

BYTE

THE SMALL SYSTEMS JOURNAL

NOVEMBER 1985 VOL. 10, NO. 12

IN UNITED STATES
\$4.25 IN CANADA / £2.10 IN U.K.
A MCGRAW-HILL PUBLICATION
0360-5280

GRAPHICS HARDWARE

FEATURES:

Circuit Cellar: 1200-bps
MOSART Chip
Two Programming Projects

REVIEWS:

Data General/One
C Compilers for Macintosh

KERNEL:

Pournelle
Webster



TURBO "NEW" PACK \$95.00

You get both our terrific new Turbos, and pay only \$47.50 each. Sold separately, they're \$69.95 each.

- Turbo GameWorks™
- Turbo Editor Toolbox™

NEW!

TURBO HOLIDAY PACK \$125.00

At about a 50% savings, you get our standard holiday special.

- Turbo Pascal® 3.0
- Turbo Tutor®
- Turbo DataBase Toolbox™

All this for only \$125.00. See the order form at right.

Turbo Pascal and Turbo Tutor are registered trademarks and Turbo Database Toolbox, Turbo Tutor, Turbo Tutor Toolbox, Turbo GameWorks, and Windows are trademarks of Borland International, Inc. WordStar is a trademark of WordStar International Corp. MultiMate is a trademark of MultiMate International Corp. Microsoft is a registered trademark and Word is a trademark of Microsoft Corp. Windows is a trademark of Seattle Software Corporation.

SAVE OVER 30% ON OUR GIFT PACKS!

Announcing Borland's New Turbo Editor Toolbox™ \$69.95

IT'S ALL YOU NEED TO BUILD YOUR OWN WORD PROCESSOR FOR ONLY \$69.95!

You get all the modules you need to build your own word processor.

- You get ready-to-compile source code.
- You get a full-featured word processor that looks and acts like WordStar™; we call it MicroStar™
- You get a 200-page manual that tells you how to integrate the editor procedures and functions into your programs.

You can use Turbo Editor Toolbox "as is" or modify it any way you want.

And you don't get a bill for Royalties.

Because Borland doesn't believe you should pay for something more than once.

All this and more for only \$69.95.

And until March 1, 1986 you can get Borland's new Turbo Editor Toolbox for even less! (Only \$47.50 when you buy the special Turbo New Pack.)

YOU CAN HAVE MANY WINDOWS ON THE WORLD. The new Turbo Editor Toolbox features windowing, a technique that lets you see several documents—or several parts of the same document—at once. You know best what your needs are. Turbo Editor Toolbox lets you open the windows you want. And to make those windows part of your program.

WITH TURBO EDITOR TOOLBOX YOU CAN HAVE THE BEST OF ALL WORD PROCESSORS IN YOUR WORD PROCESSOR. You can make WordStar behave like Multi-Mate. Support windows just like Microsoft's® Word™. And do it as fast as WordPerfect does it. Incorporate your new "hybrids" into your programs to achieve incredible control and power.

Turbo Editor Toolbox. It's the kind of tool that almost everyone needs—and we're the kind of company to give it to you at a reasonable price, without any compromise on quality. (We're so sure you'll be satisfied that we offer a 60-day money-back guarantee—something no one else does.)

THE CRITICS' CHOICE

"Turbo Pascal has got to be the best value in languages on the market today—and Borland International, by delivering excellent products at reasonable costs, is leading the software industry where it has to go. Turbo Pascal is more than just a good program at a low cost. It's also a low-cost, well-conceived programming language making it possible for lots of people to produce good programs."

Jerry Pournelle, BYTE

"This compiler, produced by Borland International, is one of the best programming tools presently available for the PC."

Michael Covington, PC Tech Journal

"Language deal of the century...Turbo Pascal."
Jeff Duntemann, PC Magazine

BORLAND
INTERNATIONAL

**Three
Special
Gift Packs**



60-DAY MONEY-BACK GUARANTEE

Introducing Borland's New Turbo GameWorks™ \$69.95

THE GAMES YOU CAN PLAY, REPLAY, REVISE AND REWRITE BUT CANNOT RESIST.
(Turbo Pascal Source Code included!)

We give you the source code, the manual, the diskettes, the 60-day guarantee and the competitive edge. Let the games begin. Chess. Bridge. Go-Moku.

State-of-the-art games that let you be player, referee, and rules committee—because you have the Turbo Pascal source code. Which means that you can play a game or create a game, any time and any way you want.

Borland's new Turbo GameWorks lets you combine gamesmanship with craftsmanship. Discover the secret techniques and moves used by the Old Masters. Learn exactly how state-of-the-art computer games are made—so you can go off and make your own. Since you have the source code, you can always change the game. Or rig the game, if no one's looking. Pure Magic. That's Turbo GameWorks. And part of the "sourcery"—Turbo GameWorks is only \$69.95. When combined with our new Turbo Editor Toolbox in the Turbo New Pack, it's only \$47.50.

SHORT CUTS, SECRETS AND STRATEGIES. The Turbo GameWorks manual takes you step-by-step through all the games. How to play them. How to modify them. How to use the power of Turbo Pascal to write new games.

You'll learn general problem analysis, how to identify all possible moves, "rule of thumb" strategies, procedures for testing strategies, and ways to rate options. You'll also be introduced to "top down" program design, the development of basic algorithms, the use of constants and data structures and ways to design short cuts with incremental updating.

On top of all that, you'll have a lot of fun (if you want to).

So go to play (and work) with Borland's new Turbo GameWorks. It's unique. It's fascinating. And it's brand-new. Be first with the latest and greatest—order your Turbo GameWorks today.

BORLAND'S TURBO GAMEWORKS AND SOME OF ITS MASTER PIECES

Chess, the ultimate strategic game. A game so old that no one knows its exact origins. Turbo GameWorks lets you play chess at six different levels from the beginner to the sophisticated user. And you have many ways of playing with your Turbo GameWorks. Let the computer solve checkmate problems. Set the time limit for each game. And there's more.

Decide whether you or the computer "goes first." Trade places with the computer at any point in the game. It's all possible with GameWorks.

Go-Moku, also known as "Five-in-Line," is a very old Japanese game played on a board of squares. The first player to get five game pieces in a row—either horizontally, vertically, or diagonally—wins the game.

It's an intriguing game. But you're not limited to playing it one way. With Turbo GameWorks, you can modify it your way.

Bridge. Play bridge with a friend or team up against the program—you decide which hands the computer plays. You can even decide to let the program cheat! The program automatically bids and plays its own hands. And, since you can tinker with the source code, you can make "your" Bridge unlike any other.

TURBO HOLIDAY JUMBO PACK

\$245.00

Now you get the whole Turbo Pascal family including its newest members at an incredible price.

- Turbo Pascal 3.0 combines an integrated programming environment with the latest Pascal compiler in the galaxy
- Turbo Tutor teaches you step by step how to use the Turbo Pascal development environment. With commented source code for all program examples on diskette
- Turbo DataBase Toolbox gives you all the tools you need to sort and search your data and build powerful database applications
- Turbo Graphix Toolbox™ gives you a complete library of Pascal procedures to build applications using high resolution graphics and graphics window management
- Turbo GameWorks—Chess, Bridge, Go-Moku. Secrets and strategies of state-of-the-art computer games are revealed with complete source code
- Turbo Editor Toolbox—the Pascal modules that let you build your own word processor. A full featured WordStar-like program, MicroStar™, is included on your disk

You're getting everything at only \$40 each. And if you already own one or several members of the Turbo family, be creative—nothing can stop you from buying the Jumbo Pack, picking out the ones you already have and giving them as holiday gifts to family or friends. At these prices you can afford to give to others and to yourself!

NEW!

NEW!

Holiday Gift Packs, Turbo GameWorks™ & Turbo Editor Toolbox™

NOT COPY-PROTECTED

Available at better dealers nationwide. Call (800) 556-2283 for the dealer nearest you. To order by Credit Card call (800) 255-8008, CA (800) 742-1133.

The holiday packs include an upgrade coupon for both options so you get BCD and 8087 support for \$39.95 (regularly \$55.00)

Carefully describe your computer system!

Mine is 8-bit 16-bit
I use PC-DOS MS-DOS
 CP/M-80 CP/M-86
My computer's name and model is _____

The disk size I use is: 3 1/2" 5 1/4" 8"

Name _____
Shipping Address: _____
City _____ State _____ Zip _____
Telephone _____

NOTE: Turbo Editor Toolbox and Turbo GameWorks are available for the IBM PC and true-compatibles using Turbo Pascal 3.0 ONLY

Gift Pack Offers Last Until March 31, 1986

	Quantity
* Turbo Holiday Jumbo Pack	\$245.00
* Turbo Holiday Pack	\$125.00
* Turbo New Pack	\$95.00
Pascal	\$69.95
Pascal w/8087	\$109.90
Pascal w/BCD	\$109.90
Pascal w/8087 and BCD	\$124.95
Turbo DataBase	\$54.95
Turbo Graphix	\$54.95
Turbo Tutor	\$34.95
Turbo Editor	\$69.95
Turbo GameWorks	\$69.95

These prices include shipping to all U.S. cities. All foreign orders add \$10 per product ordered.

Amount (CA add 6% tax) _____
Payment VISA MC Check Bank Draft
Credit Card Expiration Date: _____
Card # _____

COD's and Purchase Orders will not be accepted by Borland International. California residents, add 6% sales tax. Outside USA, add \$10 and make payment by bank draft, payable in U.S. dollars drawn on a U.S. bank. H15

With Dazzling Discounts!

C·O·N·T·E·N·T·S



86



166

FEATURES

INTRODUCTION	86
CIARCIA'S CIRCUIT CELLAR: THE WORLD'S SMALLEST 1200-BPS MODEM <i>by Steve Ciarcia</i>	89
This flexible device has many applications, three of which Steve describes.	
PROGRAMMING PROJECT: AN ASSEMBLER FOR VM2 <i>by Jonathan Amsterdam</i>	112
This assembler will let you write programs using instruction mnemonics and symbolic names for data.	
PROGRAMMING PROJECT: EXTENDING TURBO PASCAL <i>by Bruce Webster</i>	123
Bruce looks at five small libraries he created for Turbo Pascal under MS-DOS.	
CD-ROMS AND THEIR KIN <i>by Richard S. Shuford</i>	137
Optical storage devices, featuring storage capacities in the hundreds of megabytes, claim several advantages over traditional magnetic media.	
HIGHS AND LOWS OF PARAMETER PASSING <i>by Michael Kilian</i>	151
Interface low-level languages to high-level languages for more speed and flexibility.	
PROGRAMMING INSIGHT: GAME-PADDLE CONTROL LINEARITY TEST <i>by Marvin L. De Jong</i>	161
Use the game-paddle inputs on the Apple II to measure physical properties.	

THEMES

INTRODUCTION	166
THE AMIGA'S CUSTOM GRAPHICS CHIPS <i>conducted by Phillip Robinson</i>	169
BYTE interviews chip designer Jay Miner.	
RASTER OPERATIONS <i>by John Bennett</i>	187
BitBlt operations integrate text and graphics in high-performance systems.	
MOVING PICTURES <i>by Stefan Demetrescu</i>	207
The developer of the SLAM graphics chip discusses real-time graphics system design.	
HIGH-RESOLUTION PRINTER GRAPHICS <i>by Mark Bridger and Mark Goresky</i>	219
You can address the individual dots used to generate dot-matrix characters.	
THE μPD7281 PROCESSOR <i>by Tom Jeffery</i>	237
This non-von Neumann chip is designed for high-speed parallel processing of images.	

REVIEWS

INTRODUCTION	250
REVIEWER'S NOTEBOOK <i>by Glenn Hartwig</i>	253
THE DATA GENERAL/ONE <i>by Wayne Rash Jr.</i>	254
An 11-pound portable computer with a liquid-crystal display.	
SANYO MBC-775 <i>by Bruce Roberts</i>	266
A portable IBM PC-compatible with a built-in color monitor.	

BYTE (ISSN 0360-5280) is published monthly with one extra issue per year by McGraw-Hill Inc. Founder: James H. McGraw (1860-1948). Executive editorial circulation, and advertising offices: 70 Main St., Peterborough, NH 03458, phone (603) 924-9281. Office hours: Mon-Thur 8:30 AM - 4:30 PM, Friday 8:30 AM - 1:00 PM, Eastern Time. Address subscriptions to BYTE Subscriptions, POB 590, Martinsville, NJ 08836. Postmaster: send address changes, USPS Form 3579, undeliverable copies, and fulfillment questions to BYTE Subscriptions, POB 596, Martinsville, NJ 08836. Second-class postage paid at Peterborough, NH 03458 and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9321. Subscriptions are \$21 for one year, \$38 for two years, and \$55 for three years in the USA and its possessions. In Canada and Mexico, \$23 for one year, \$42 for two years, \$61 for three years. \$69 for one year air delivery to Europe, 17,100 yen for one year surface delivery to Japan, \$37 surface delivery elsewhere. Air delivery to selected areas at additional rates upon request. Single copy price is \$3.50 in the USA and its possessions, \$3.95 in Canada and Mexico, \$4.50 in Europe, and \$5 elsewhere. Foreign subscriptions and sales should be remitted in United States funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue. Printed in the United States of America.

BYTE November

VOLUME 10, NUMBER 12, 1985

FIVE C COMPILERS FOR THE MACINTOSH by Tim Field	275
Aztec C, Hippo-C, Mac C, Megamax C, and Softworks Macintosh C.	
MAGIC/L by Michael W. Gilbert and Albert S. Woodhull	337
Loki Engineering's FORTH descendant moves to 8-bit machines.	
IBM'S PROFESSIONAL GRAPHICS SYSTEM by Rik Jadrnicek	355
A high-resolution color monitor paired with a graphics-controller board.	
JUKI'S 6300 DAISY-WHEEL PRINTER by Wayne Rash Jr.	361
A letter-quality printer featuring Diablo compatibility.	
REVIEW FEEDBACK	367
Readers respond to previous reviews.	

KERNEL

INTRODUCTION	370
COMPUTING AT CHAOS MANOR: OLD FAVORITES AND NEW ONES by Jerry Pournelle	373
The subject of computer conferencing finds Jerry discussing the old ARPANET and the new BIX.	
CHAOS MANOR MAIL conducted by Jerry Pournelle	399
Jerry's readers write, and he replies.	
ACCORDING TO WEBSTER: MEMORIES by Bruce Webster	401
Because of a memory upgrade from Levco, Bruce begins to use his Macintosh for major word processing.	
BYTE U.K.: LIVING C-PERSONAL by Dick Pountain	419
Living C-Personal is a new product from the U.K. that offers an editor, interpreter, animator, and tracer/debugger all rolled into one menu-driven windowing environment.	
MATHEMATICAL RECREATIONS: REPEATING DECIMALS by Robert T. Kurosaka	433
Learn some of their properties and a few possible uses.	
BYTE JAPAN: COMPARING FUJITSUS by William M. Raike	445
Bill describes his latest computer purchase—the Fujitsu FM-16β.	
CIRCUIT CELLAR FEEDBACK conducted by Steve Ciarcia	450
Steve answers project-related queries from readers.	

EDITORIAL:	
A TALE OF FOUR COVERS	6
MICROBYTES	9
LETTERS	14
FIXES AND UPDATES	33
WHAT'S NEW	37, 452
ASK BYTE	44

CLUBS AND NEWSLETTERS	54
BOOK REVIEWS	57
EVENT QUEUE	82
UNCLASSIFIED ADS	509
BYTE'S ONGOING MONITOR BOX, BOMB RESULTS	510
READER SERVICE	511



250



Address all editorial correspondence to the Editor, BYTE, POB 372, Hancock, NH 03449. Unacceptable manuscripts will be returned if accompanied by sufficient first-class postage. Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE. Copyright © 1985 by McGraw-Hill Inc. All rights reserved. Trademark registered in the United States Patent and Trademark Office. Where necessary, permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center (CCC) to photocopy any article herein for the flat fee of \$1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 29 Congress St., Salem, MA 01970. Specify ISSN 0360-5280/85 \$1.50. Copying done for other than personal or internal reference use without the permission of McGraw-Hill Inc. is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106 or 18 Bedford Row, Dept. PR, London WC1R 4EJ England.



Subscription questions or problems should be addressed to: BYTE Subscriber Service, POB 328, Hancock, NH 03449

370

PRINTERS ONLY

UNBELIEVABLE SAVINGS!

Our 6 year industry reputation guarantees you:

1. Immediate delivery
2. Mail-order with confidence
3. Lowest prices
4. Professional expertise

EPSON® LX80



SAVE, SAVE, SAVE!

Fast, economic printing. Let the LX80 print your next business letter or report.

- Complete Epson Line 10-40% off
- LX80 (100cps, NLQ, 80 col) \$CALL\$
- FX85+ (160cps, NLQ, 8K buf) SAVE 20%+
- FX185+ (160cps, NLQ, 132 col) \$CALL\$
- LQ1500 (200cps, NLQ, 18 pin) SAVE 25%+
- Sheet feeders, Tractors, Interfaces 10-40% off

brother HR15XL



Daisy Wheel Printer Plus. Two color and Shadow Printing.

- Economically priced and superior quality.
- Complete Brother Line Save 10-35%
 - HR15XL (17cps, 3K buffer, 13.5" carriage) \$CALL\$
 - HR15 & 15XL Keyboard attachment SAVE 15%+
 - HR25(23cps, 16.5" carriage, 3K buffer) \$SAVES
 - HR35 (32cps, 16.5" carriage, 7K buffer) SAVE 20%+
 - M1059 (180cps, serial/parallel std., NLQ) \$CALL\$
 - Twinwriter 5 (Dots & Daisies, 140cps, 40 LQ) SAVE 20%+



Canon PC PERSONAL COPIERS

Ideal for Home or Office. Personal copying at its finest.

Entire copying process in the convenient disposable cartridge. Virtually service free.

- Complete Canon Line
- PC10 Single sheet feed \$599
- PC14 Multiple copies, NEW \$CALL\$
- PC25 Reduce, Enlarge, Legal size \$SAVES

AND MORE PRINTERS!

- Complete Smith Corona Line 10-40% off
- Complete Dataproducts Line up to 35% off
- Complete Okidata Line 15-30% off
- Complete Hewlett Packard Line \$CALL\$
- Panasonic 1091 (120cps, NLQ, 1K buffer) \$CALL\$
- Anadex 8625B (240cps, 3.5K buffer, Commercial) \$CALL\$
- Anadex DP6500 (500cps, Corresp. Quality) \$CALL\$
- Amdek 5055 (55cps, LQ, Quiet) \$CALL\$



★ FREE CATALOG ★

CALL TODAY!

- Anaheim, CA (714) 630-3622
- San Diego, CA (619) 278-2560
- San Francisco, CA (415) 673-0170
- Sherman Oaks, CA (818) 501-3486
- Santa Clara, CA (408) 980-1213
- Houston, TX (713) 789-1014
- Dallas, TX (214) 239-4300
- Seattle, WA (206) 453-0151
- Denver, CO (303) 750-5900

© Orange Micro, Inc., 1985

Orange Micro
PRINTER STORE
"Computer Printer Specialists"

BYTE

EDITOR IN CHIEF
PHILIP LEMMONS
MANAGING EDITOR, PRINT
GENE SMARTE

MANAGING EDITOR, ELECTRONIC PUBLISHING AND COMMUNICATIONS
GEORGE BOND
CONSULTING EDITORS
STEVE CIARCIA

JERRY POURNELLE
BRUCE WEBSTER

SENIOR TECHNICAL EDITORS
G. MICHAEL VOSE, *Themes*
GREGG WILLIAMS

TECHNICAL EDITORS
THOMAS R. CLUNE
JON R. EDWARDS
RICHARD GREHAN
GLENN HARTWIG, *Reviews*
KEN SHELDON
JANE MORRILL TAZELAAR
TOM THOMPSON
CHARLES D. WESTON
EVA WHITE
STANLEY WSZOLA
MARGARET COOK GURNEY, *Associate*
DONNA OSGOOD, *Associate, San Francisco*
ALAN EASTON, *Drafting*

NEWS AND TECHNOLOGY
EZRA SHAPIRO, *Bureau Chief, San Francisco*
RICH MALLOY, *Senior Technical Editor, New York*
PHILLIP ROBINSON, *Senior Technical Editor, Palo Alto*
TONY LOCKWOOD, *Senior News Editor, Peterborough*
ASSOCIATE NEWS EDITORS
DENNIS BARKER, *Peterborough*
BRENDA MCCLAUGHLIN, *San Francisco*
LYNNE M. NADEAU, *Peterborough*
MARK WELCH, *San Francisco*

CONTRIBUTING EDITORS
JONATHAN AMSTERDAM, *programming projects*
MARK DAHMKE, *video, operating systems*
MARK HAAS, *at large*
RIK JADRNICKE, *CAD, graphics, spreadsheets*
MARK KLEIN, *communications*
ALASTAIR J. W. MAYER, *software*
ALAN MILLER, *languages and engineering*
JOHN C. NASH, *scientific computing*
DICK POUNTAIN, *U.K.*
WILLIAM M. RAIKE, *Japan*
PERRY SAIDMAN, *computers and law*
ROBERT STERNE, *computers and law*

COPY EDITORS
BUD SADLER, *Chief*
DENNIS BARKER
ELIZABETH COOPER
ANNE L. FISCHER
NANCY HAYES
LYNNE M. NADEAU
PAULA NOONAN
JOAN VIGNEAU ROY
WARREN WILLIAMSON

ASSISTANTS
PEGGY DUNHAM, *Office Manager*
MARTHA HICKS
CATHY KINGERY
JUNE N. SHELDON

ART
ROSSLYN A. FRICK, *Art Director*
NANCY RICE, *Associate Art Director*

PRODUCTION
DAVID R. ANDERSON, *Production Director*
DENISE CHARTRAND
MICHAEL J. LONSKY
JAN MULLER

Editorial and Business Office: 70 Main Street, Peterborough, New Hampshire 03458, (603) 924-9281
West Coast Offices: McGraw-Hill, 425 Battery St. San Francisco, CA 94111, (415) 362-4600
McGraw-Hill, 1000 Elwell Court, Palo Alto, CA 94303, (415) 964-0624.
New York Office: 1221 Avenue of the Americas, New York, NY 10020, (212) 512-2000

Officers of McGraw-Hill Information Systems Company: President, Richard B. Miller. Executive Vice Presidents, Fredenck P. Jannott, Construction Information Group; Russell C. White, Computers and Communications Information Group; J. Thomas Ryan, Marketing and International Senior Vice Presidents; Francis A. Shinal, Controller; Robert C. Violette, Manufacturing and Technology; Senior Vice Presidents and Publishers, Laurence Altman, Electronics Week; Harry L. Brown, BYTE and Popular Computing; David J. McGrath, Construction Publications Group Vice President; Peter B. McCuen, Communications Information; Vice President, Fred O. Jensen, Planning and Development Officers of McGraw-Hill, Inc.: Harold W. McGraw, Jr., Chairman; Joseph L. Dionne, President and Chief Executive Officer; Robert N. Landes, Executive Vice President and Secretary; Walter D. Serwatka, Executive Vice President, Publishing Services; Ralph R. Schulz, Senior Vice President, Editorial, Shel F. Asen, Vice President, Manufacturing; George R. Elsinger, Vice President, Circulation; Ralph J. Webb, Vice President and Treasurer

SENIOR VICE PRESIDENT/PUBLISHER
HARRY L. BROWN
PUBLISHER'S ASSISTANT
BEVERLY JACKSON

PERSONNEL
CHERYL HURD, *Office Manager*
PATRICIA BURKE, *Personnel Coordinator*

TYPOGRAPHY
SHERRY MCCARTHY, *Chief Typographer*
LEN LORETTE
DONNA SWEENEY

ADVERTISING SALES
DENNIS J. RILEY, *Director of Sales and Marketing*
SANDRA FOSTER, *Administrative Assistant*
ADVERTISING/PRODUCTION (603-924-6448)
LISA WOZMAK, *Supervisor*
ROBERT D. HANNINGS, *Senior Account Coordinator*
MARION CARLSON
KAREN CILLEY
LYDA CLARK
MICHELE GILMORE
DENISE PROCTOR
WAI CHIU LI, *Quality Control Manager*
JULIE NELSON, *Advertising/Production Coordinator*

CIRCULATION (800-258-5485)
GREGORY SPITZFADEN, *Director*
ANDREW JACKSON, *Subscriptions Manager*
CATHY A. RUTHERFORD, *Assistant Manager*
LAURIE SEAMANS, *Assistant Manager*
SUSAN BOYD
PHIL DECHERT
MARY EMERSON
LOUISE MENEZES
AGNES E. PERRY
JENNIFER PRICE
JAMES BINGHAM, *Single-Copy Sales Manager*
LINDA RUTH, *Assistant Manager*
CAROL AHO
CLAUDETTE CARSWELL
KAREN DESROCHES

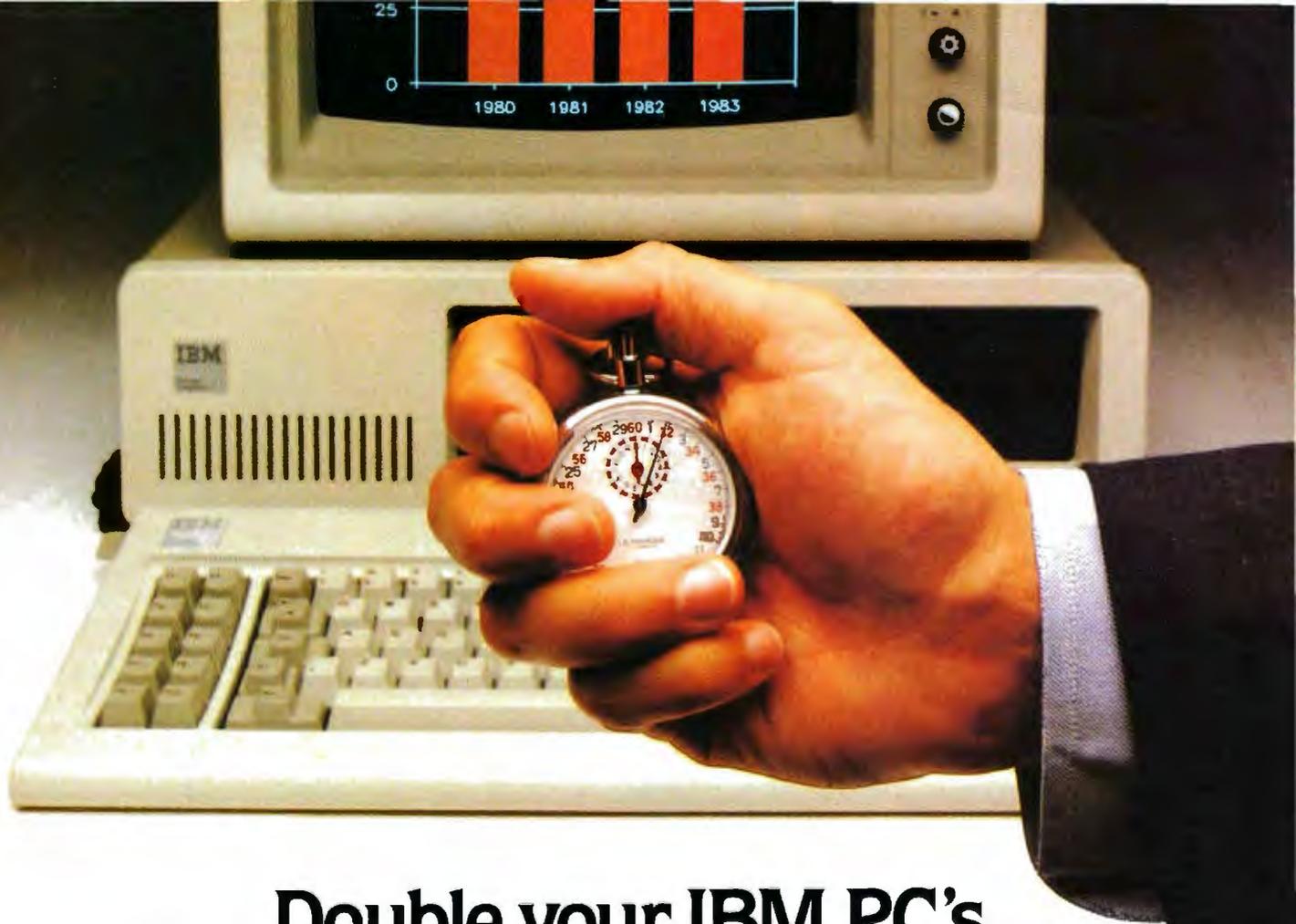
MARKETING COMMUNICATIONS
HORACE T. HOWLAND, *Director (603-924-3424)*
VICKI REYNOLDS, *Marketing Production Manager*
STEPHANIE WARNESEY, *Marketing Art Director*
SHARON PRICE, *Assistant Art Director*
DOUG WEBSTER, *Director of Public Relations (603-924-9027)*
WILBUR S. WATSON, *Operations Manager, Exhibits*

PLANNING AND DEVELOPMENT
MICHELE P. VERVILLE, *Manager*
PATRICIA AKERLEY, *Research Manager*
CYNTHIA DAMATO SANDS, *Reader Service Coordinator*
FAITH KLUNTZ, *Copyrights Coordinator*

ACCOUNTING
KENNETH A. KING, *Assistant Controller*
VICKI WESTON, *Accounting Manager*
LINDA SHORT, *D/P Manager*
EDSON WARE, *Credit*
MARIE CAGGIANI
MARILYN HAIGH
DIANE HENRY
VERN ROCKWELL
JOANN WALTER

BUILDING SERVICES/TRAFFIC
ANTHONY BENNETT, *Building Services Manager*
BRIAN HIGGINS
MARK MONKTON

RECEPTIONISTS
L. RYAN MCCOMBS
CHERYL CASTRO, *Assistant*



Double your IBM PC's processing speed for under \$650.

AT speed for your IBM PC, with QuadSprint by Quadram.

Quadram introduces a rapid advancement in IBM PC performance. QuadSprint. The innovative expansion board that doubles the processing speed of your personal computer. Just plug the totally transparent QuadSprint into your system and watch **all** your PC programs (Lotus 1-2-3, dBASE III, Wordstar, and more*) run faster and more efficiently than ever before... without special commands or interface software.

But best of all, you can pick up QuadSprint without running up a huge bill. At less than \$650, QuadSprint is about half the price of other accelerator (turbo) cards and turns your PC into a machine that's virtually as fast as the new PC AT.

So make your own rapid advancement. To the Quadram dealer closest to you. And see how to double the processing speed of your IBM PC. With QuadSprint by Quadram.

QUAD*Sprint*TM



QUADRAMTM
An Intelligent Systems Company

4355 International Blvd./Norcross, Ga. 30093
(404) 923-6668/TWX 810-766-4915 (QUADRAM NCRS)

Inquiry 403

A TALE OF FOUR COVERS

Since "Graphics Hardware" is the theme of this issue of BYTE, Phil Lemmons suggested that it would be only fitting if the cover were—what else?—computer-generated! Although I have experimented briefly with graphics packages in the past, this was to be my first serious attempt at a finished computer painting (pixeling?). In mid-August I received, on loan, the following: (1) ZSoft Corporation's PC Paintbrush, a graphics program for the IBM PC and compatibles marketed by IMSI, (2) Sigma Designs' Color 400 graphics board, which yields 16 colors at a resolution of 640 by 400, (3) a Princeton Graphic Systems SR-12 RGB high-resolution monitor, and (4) a Summagraphics SummaSketch digitizing tablet and pen. These were driven by an Eagle Turbo PC with a hard disk. Now, my background is art, not computers. So it was with some concern that I faced my assignment: familiarize myself with the system and produce sketches and a BYTE cover . . . in three weeks.

GETTING STARTED

I began with an exploration of PC Paintbrush's features. This required only occasional reference to the manual, since the program's basic functions are quite intuitive. After only several minutes, I began to form my first impression of what it's like to use computer graphics—a sense of power.

Take a simple operation, one an artist performs repeatedly: changing paint color and brush size. Traditionally, this involves, at the very least, cleaning one brush and finding another; quite possibly it will require finding and opening another tube or bottle of paint. Big deal, you say. But to change brush color and size on the computer took only two whisks of the wrist across the digitizing tablet (to move the cursor and click on the appropriate menus) and only about 4 seconds to complete. Compared to this, the old-fashioned way is pure drudgery.

The same can be said of all the various functions of the PC Paintbrush program, such as cut-and-paste routines, erasing, color fills, "spray-painting," enlarging/rotating/reducing, and zooming in. It wasn't long before these functions were becoming second nature to me. Manipulating an

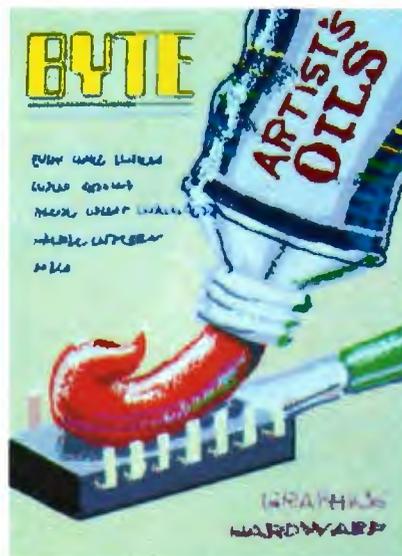
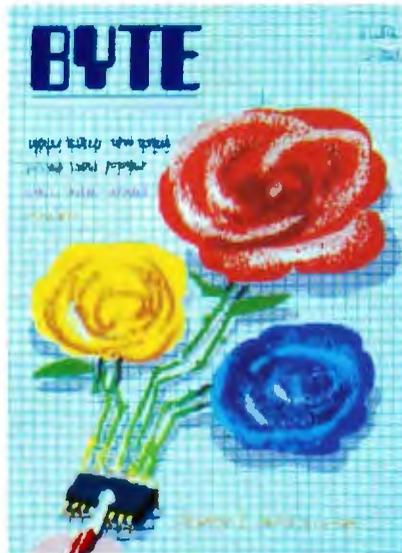
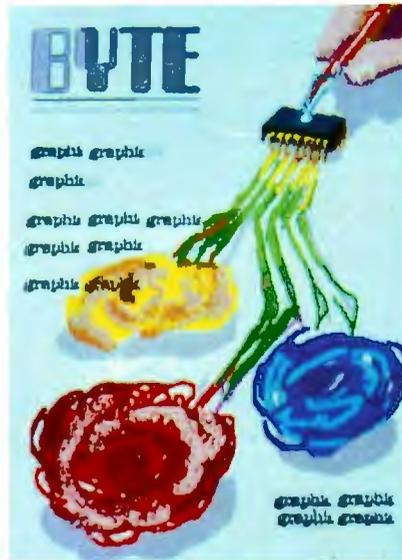


image on the screen was virtually effortless—and fast.

THE SKETCHES

After only a few hours, I began working on the three sketches you see reproduced here. This was a breeze. First, I drew and saved to disk a blank BYTE cover in the correct proportions; whenever I wanted to try out another idea, I simply called up this file and started a new sketch with the BYTE logo already in place. Conversely, when any sketch reached an interesting stage, I simply saved that version to disk and then continued from that point with further experimenting. Most of my work in the program was done in the freehand drawing mode.

THE COVER

The cover wasn't exactly planned. After I had finished three sketches, I wanted to experiment with a finished image so that I could show Phil and Ross [Rosslyn Frick, BYTE's art director] what the final cover would be like. Since two sketches contained flowers, I decided to paint a rose. With a handful of sentimental greeting cards for references, I started in.

This was great fun! I started with a solid red area shaped like a rose. Then I began refining the image with different shades and hues created by mixing patterns of the 16 basic colors. The zoom feature came into its own for touching up edges and close-up work on the computer chip. Highlights? A flick of the wrist sends a "spray" of white onto a petal. A background? Create your own pattern; one touch of a button sends it cascading over the screen. Want to see what another looks like? Save the old version, fill in a new background, save this version, and compare the two back and forth. In about three hours I had a finished painting, background, shadows, and all.

Ross and Phil liked what I had done so far on the system. In fact, Ross was so pleased with the image of the rose that she was in favor of putting it on the cover. And, of course, that's exactly what we did. After making one 20-minute alteration (enlarging the chip and putting it on a more prominent petal), the image was ready to be photographed for final layout and color separations.

—Robert Tinney

Maxell Corp. of America, 60 Oxford Drive, Moonachie, NJ 07074



maxell[®]
FLOPPY DISKS
THE GOLD STANDARD
Inquiry 238

SmarTerm 220 software makes DEC terminals obsolete!

You don't need a DEC terminal to access DEC's new generation host software. Now you can use your IBM PC and SmarTerm 220 terminal emulation software to access All in One, A to Z, and other popular mainframe software. SmarTerm 220 gives you sophisticated, accurate DEC VT220, VT100, VT102 and VT52 emulation, and includes TTY mode to link you to popular services like The Source, CompuServe, Dow Jones, EASYLINK, and Tymnet.

As you've learned to expect from Persoft, the industry leader in software terminal emulation, SmarTerm 220 continues the tradition of offering "smart" software solutions where IBM PC hardware limitations prevent exact duplication of DEC terminal features. For example, we give you horizontal scrolling for 132-column text display, and also support popular 132-column

video display boards. And we provide "convenience" features not found in other terminal emulation packages like: "Branch to DOS" hot key, automatic installation, color support, multiple setups, "smart" softkeys, remappable keyboard layouts, and online help screens detailing PC and AT keyboard mappings. Our unique support for DEC's popular EDT editor includes convenient keyboard mapping of the "GOLD" and PF function keys, as well as an EDT specific on-line help screen, and keytop chart.

International business people take note: SmarTerm 220 fully supports European versions of the DOS operating system, 8 bit mode, the VT220 multinational character sets, and the compose key.

SmarTerm 220 is a powerful communications package as well, allowing text and binary file transfer at speeds up to 19,200 baud. In addition to the



popular XMODEM "error-free" protocol, we include our own PDIP protocol and supply you with free BASIC and FORTRAN programs which implement the protocol on VAX/VMS systems.

So "farm out" your obsolete DEC terminal, and join more than 35,000 satisfied users who "reap" the benefits of SmarTerm!

The SmarTerm family:

SmarTerm 220—DEC VT220
SmarTerm 100—DEC VT100
SmarTerm 125—DEC VT125
SmarTerm 400—Data General Dasher D400
SmarTerm 4014—Tektronix 4014

PUT YOUR DEC TERMINAL OUT TO PASTURE!



After SmarTerm, what do you do with your obsolete terminal?

IDEA CREDIT: Ann Garner Riddle of Winston-Salem, N.C.

*SmarTerm is a registered trademark of Persoft, Inc. *PDIP is a trademark of Persoft, Inc. *DEC, VT, REGIS, A to Z and All in One are trademarks of Digital Equipment Corp. *DASHER is a registered trademark of Data General Corp. *Tektronix is a registered trademark of Tektronix, Inc. © Persoft, Inc. 1985. All rights reserved.

**Persoft, Inc. — 2740 Ski Lane — Madison, WI 53713
(608) 273-6000 — Telex 759491**

persoft

Apple Introduces Add-ons for II, Macintosh

Apple Computer Inc. unveiled several new and enhanced peripherals for Apple II and Macintosh computers.

The Apple II RAM Expansion Card is a standard-slot card for the II, II+, and IIe. In its standard form, it holds 256K bytes of RAM but has sockets for up to 1 megabyte (using 256K by 1-bit chips). It also contains a 32K-byte ROM and a CMOS gate array interface to the I/O bus. Under ProDOS, DOS 3.3, and Pascal, the expansion memory can act as a RAM disk or as direct-access memory (built-in firmware handles memory moves for assembly-language programs). Information about pricing and availability of the card could not be obtained before we went to press.

The UniDisk 3.5 (\$499) is a 3½-inch disk drive that interfaces directly to Apple IIc computers; other Apple II models must contain the IIc upgrade ROM to use the UniDisk. The 800K-byte 135-tpi drive works with ProDOS, DOS 3.3, and Pascal. Apple said it runs approximately 30 percent faster than previous Apple II drives.

Third-party products supporting both the UniDisk 3.5 and the memory card include Quark's Catalyst 3.0 (a Macintosh-style "desktop" for the Apple II) and Virtual Combinatics' Pinpoint (desk accessories for Appleworks).

The \$595 Imagewriter II adds four-color printing capabilities, increased speed, and an expansion slot to Apple's standard dot-matrix impact printer. The Imagewriter II can print at 250 characters per second in draft mode, 180 cps in correspondence mode, and 25 cps in near-letter-quality mode. It can also handle graphics from 72 to 160 dots per inch, can print on paper from 3 to 10 inches wide, and can accept Apple's new \$225 cut-sheet feeder. The printer uses a fabric continuous-loop ribbon that is available in black or in a four-color style (black, magenta, cyan, and yellow). An RS-232C serial connection links the printer to either the Macintosh or the Apple II. A single expansion slot can be used to expand the Imagewriter II's 1K-byte buffer to 32K bytes with a \$99 card. Or the slot can be used for an Appletalk card that is scheduled to be released early next year. Apple said that Sorcim's SuperCalc 3a, Software Publishing's pfs:Graph, and Broderbund's Dazzle Draw will support the Imagewriter II's color capability.

Apple's Hard Disk 20, which is scheduled to be available this month and sell for less than \$2000, attaches to the serial port of a Macintosh external disk drive. The disk has a formatted storage capacity of 20.77 megabytes, a transfer rate of 500 kbits/second, and an average seek time of 85 milliseconds. The drive, designed to fit beneath the Macintosh, includes a second port for daisy-chaining devices. Systems that use the Hard Disk 20 will still have to boot from a floppy disk. Third-party developers will be supplied information on the drive's new hierarchical file structure.

The Apple Personal Modem (\$399) is a Hayes-compatible 300/1200-bps modem that attaches to the RS-232C port of the Macintosh or Apple II. Apple's new \$399 Color Monitor IIe and Color Monitor IIc are electrically identical but have different cases. The IIe model has an optional stand (\$25). Both are 13-inch composite (NTSC) video monitors.

In other Apple news, the company has clarified its policy on the Switcher program, which allows concurrent RAM residency of several Macintosh programs. While Switcher will be licensed to third parties for bundling with other software and also be sold by Apple dealers for about \$20, it will still be available for free on services such as CompuServe. Although Apple doesn't encourage this practice, it will be allowed because the company had earlier advocated it.

Intel Sampling 80386 Microprocessor

Intel is now selling samples of its CMOS 32-bit 80386 microprocessor and related CPU boards and software tools. The company claims a sustained performance of 3 to 4 million instructions per second for the chip. The 80386 has a direct address space of 4 gigabytes and virtual memory capacity of 64 trillion bytes. It contains on-chip hardware for memory

(continued)

management, multitasking, four-level software protection, and self-testing. A pipelined architecture lets the 80386 fetch, decode, execute, and memory-manage instructions all at the same time. The chip supports both segmentation (with segments up to 4 gigabytes) and paging. It was designed to be fully compatible with all software written for Intel's earlier iAPX 86 microprocessors (the 8086, 8088, 80186, 80188, and 80286).

The 80386 can run applications concurrently under several different operating systems. The chip has 32-bit registers and data paths and demultiplexed 32-bit address and data buses. The 32-megabytes/second local bus allows access to an off-chip cache of any size in two clock cycles.

The 80386 will be available in a 132-lead pin-grid array package in both 12- and 16-MHz versions. In sample quantities, it will cost \$299. Full-production quantities won't be available until late 1986. Although the 80287 can work as a numeric coprocessor for the 80386, a faster 80387 coprocessor is being planned.

Intel is also selling Multibus I and II single-board computers using the 386 for \$3860 each. PL/M and C compilers and an assembler are also available. The UNIX System V and iRMX operating systems are planned for 1986 release.

AT&T Will Sell Alloy MS-DOS Emulator for UNIX PC

An add-in board allowing AT&T's UNIX PC to run PC-DOS programs should be available from AT&T this month. The DOS-73 board is made by Alloy Computer Systems, which granted AT&T exclusive marketing rights earlier this year.

The DOS-73 card, which might be named something else by AT&T, includes an 8-MHz 8086, 512K bytes of RAM, and a serial port. Software included with the card emulates some IBM PC functions while redirecting many MS-DOS function calls to comparable UNIX operations to be executed by the UNIX PC's faster 68010 processor. The DOS emulation can be accessed from the console or from either remote terminal. A PC-DOS application can operate concurrently with other UNIX programs in separate windows, but only one PC-DOS program can run at a time on the system. The card is capable of emulating the Hercules graphics card for the IBM PC.

At press time, AT&T would not disclose pricing or availability for the card. However, Alloy said that AT&T would receive shipments in October at prices that would let it sell the card for about \$1000.

Northwest Instruments Unveils Hardware-based Software Analyzer

Northwest Instruments Systems took the wraps off its SoftAnalyst, a hardware system for the IBM PC and PC AT that lets programmers nonintrusively analyze high-level software written in Pascal, C, FORTRAN, and Ada. The product uses a microprocessor probe that fits in the PC's CPU socket. The SoftAnalyst, priced from \$9955, can report on program flow, execution time, response time, and execution bottlenecks.

Nanobytes

Alsys Inc., Waltham, MA, the company founded by Jean Ichbiah, principal designer of the Defense Department's Ada language, plans to release a validated Ada compiler for IBM's PC AT in December. . . . **Boston Software Publishers** released MacIndex, a \$50 program that prepares indexes from MacWrite documents. . . . **AT&T** began shipping samples of its 1-megabit memory chip during the summer. It will grind into full production in early 1986. . . . **LeBlond Software**, Indianapolis, IN, has released Concerto, a \$99 enhancement for Lotus Development Corp.'s Symphony. It lets developers design Symphony add-in modules in BASIC instead of assembly language. . . . Meanwhile in Lotusland, Lotus said future versions of its business software, including 1-2-3 release 2 and Symphony 1.1, will accommodate installation upon and booting from a hard disk. . . . **Alpha Microsystems**, Santa Ana, CA, has been granted a patent for its VCR Backup Controller System, which allows IBM PC hard disks to be backed up on standard VCRs. . . . **Lattice** announced dbc III, a \$250 set of C library functions that can access dBASE III data files. . . . **Motorola** introduced the MC68605 X.25 Protocol Controller (XPC), which fully implements the physical and data-link layers of the 1984 CCITT X.25 recommendation. The XPC generates the X.25 link-level commands and responses. At 12.5 MHz, the chip can handle serial communications at 10 megabits per second. In quantities of 100, it will sell for \$50. . . . **Adaptex** brought out a 24-MHz version of its AIC-010 storage controller chip. . . . **Checkmate Technology**, Tempe, AZ, has redesigned its MultiRam memory-expansion cards. Apple IIe and IIc owners can now add a 65816 processor. Checkmate will bundle Micro Magic's operating system with the 65816 enhancement.



We make it simple.

An Interface disk or tape subsystem is simple to install and simple to use for IBM PC, XT, AT, and most PC-compatibles

For the PC and compatibles we give you:

- External DiskSystems[®] from 10 to 119MB.
- Internal with 10 to 55MB.
- 10MB removable cartridge Winchester.
- 10MB TapeSystem[®].
- DualStor[®] with 10, 22, or 33MB of fixed storage plus 10MB tape or 10MB removable Winchester.



DualStor with combination disk and tape

For the PC-XT, we give you:

- Internal 10 to 55MB.
- DoubleBarrel[®] is an internal combination with 10, 22, or 33MB fixed storage combined with 10MB of tape back-up.
- External 10MB tape cartridge drive.
- External ExtraDrive[®] is a 10MB removable cartridge Winchester.
- External DiskSystem with 10 to 55MB of additional storage.



10-megabyte TapeSystem

For the PC-AT, we give you:

- Internally mounted hard disk drives with 21 to 117MB.
- Internal 10MB removable cartridge Winchester.



AT up-grade kit

Since 1978, Interface has been providing quality storage subsystems at affordable prices for the personal computer market.

DiskSystems, TapeSystems, DualStor, DoubleBarrel and ExtraDrive are copyrights of Interface, Inc. IBM is a registered trademark of IBM Corporation.

Inquiry 197 for End-Users.
Inquiry 198 for DEALERS ONLY.



Interface, Inc.

**SEE US AT COMDEX
BOOTH #H 8042**

21101 Osborne Street,
Canoga Park, CA 91304
Or call (818) 341-7914

Canada: Santronic Sales, Ltd.
(604) 522-1658

In 1876 Alexander Graham Bell gave people an easier way to stay in touch. Today, we're doing the same for computers.

At Kyocera, we think it's about time computers had an easier way of staying in touch. That's why we're introducing a telecommunications package featuring our 1200 bps modem and Microsoft's Access software for IBM-PC, XT, AT and all compatibles.

It's the most advanced bundled system on the market. But you don't need an advanced degree in computer science to use it.

We designed our 1200 bps modem with a mind of its own. It can answer automatically, distinguish busy and dial-tones, even handle voice and data communications at the same time. And you won't

Kyocera's intelligent stand alone modem with Microsoft Access software.



have to work overtime memorizing mind boggling command sequences, because we've also given our modem built-in help menus.

Of course, any businessperson worth his weight in data knows the best hardware needs the best software.

That's why we teamed up with the most advanced telecommunications program available, Microsoft's new Access.

Only Access features X.PC protocol which lets you simultaneously monitor up to 15 live connections through separate "windows" on your screen. For instance, as one window displays stock market returns, another can provide market analysis. Through a third window, you can book an airline flight via OAG (Official Airline Guide). All the while, X.PC checks data transmissions for errors.

Access also lets you compose, send and receive letters through electronic mail services. The Kyocera 1200 bps modem with Microsoft Access is available in stand alone or

For the Kyocera dealer nearest you, call toll-free (800) 235-1222 or (408) 257-8000.

*IBM, IBM-PC and IBM-XT are trademarks of International Business Machines Corporation. Microsoft is a registered trademark of Microsoft Corporation. OAG is a registered trademark of Official Airline Guide Inc.

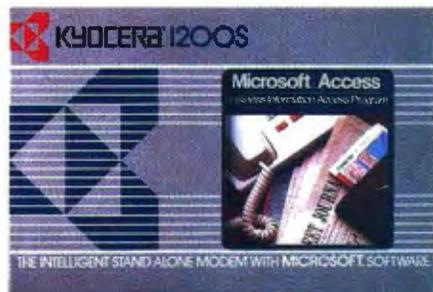


The 1876 liquid telephone.
With it Bell made the world's first phone call:
"Mr. Watson, come here. I want you."

direct card. The bundled package contains all necessary accessories, including an RS-232C cable (for IBM-PC, XT* and compatibles). And because it's bundled, you'll save a bundle.

The Kyocera 1200 modem with Microsoft Access software. If Alexander Graham Bell were around today, he'd wish it was his idea.

 **KYOCERA Modems**
A tradition of innovation.



CALCULATING PROBABILITIES

"The Technology of Expert Systems" by Robert Michaelsen, Donald Michie, and Albert Boulanger (April, page 303) mentioned a method of calculating probability used by some expert systems such as TAXADVISOR and MYCIN, in which the probability of one conditional AND another is taken as the minimum of their individual probabilities, and the probability of one conditional OR a second is taken as the maximum of their probabilities.

If a group goes to all the trouble to make an expert system, it really should take the time to calculate its probabilities correctly. The correct procedure for finding the probability in the case of an AND is to multiply the individual fractional probabilities. For an OR, one should calculate the probability of all of the conditionals' evaluating to "false," which is an AND operation, and then subtract the result from 1. As an example, the first of the two trees [see figure 1] is traversed from left to right using the first method of calculating probability; the second, using the correct method. The numbers at each branch are the probabilities of the tree so far evaluating to "true."

Multiplication and subtraction routines

are fast compared to artificial-intelligence constructs. I do not believe that the time saved is worth the accuracy lost. What if a program given the above data had a threshold value of 0.5?

PHILIP GOETZ
Ellicott City, MD

Robert Michaelsen replies:

In response to Mr. Goetz's letter, I have the following comments. The people who built MYCIN were aware that they were not using "probabilities." Instead, they created their own calculations for dealing with uncertainty, based on confirmation theory, and called them "certainty factors."

They rejected the use of probabilities in their expert system because the system violated the assumptions about statistical independence and prior probabilities that are necessary with Bayes' rule. While it is true that certainty factors are subject to problems of interpretation not found with probabilities, they judged the interpretation problems to be less severe than those with statistical assumptions. (Other expert systems, e.g., PROSPECTOR, have used Bayesian revision to handle uncertainty.)

For a complete discussion of certainty factors and the reasons for their use, see E. H. Shortliffe and B. G. Buchanan's "A Model of Inexact Reasoning in Medicine," Mathematical Biosciences, vol. 23, 1975, page 351.

DECLARATIVE PROGRAMMING AND PARALLEL COMPUTING

I found your August issue very interesting and informative. I particularly appreciated the articles on declarative programming.

However, I believe I detected some myopia in the thinking of the authors. Several of the authors argued that declarative programming will be needed to make parallel computing work. However, their vision of parallel computing is an array of identical processors, all of which simultaneously make similar computations on arrays of numbers.

Very few people actually need this kind of numerical parallelism. Weather forecasters, seismologists, numerical aerodynamicists, and perhaps a few others do. For most people, even those facing massive number-crunching problems, the nature of the problems is different. They don't lend themselves to simultaneous computations on number arrays. The greatest use of declarative programming will probably have nothing to do with parallel computing.

In the meantime, parallel computing seems to be sneaking in the back door, in a guise completely different from the array computers most people seem to be thinking about. For instance, in the very same issue there were articles on the Commodore Amiga and the DSI-32 copro-

(continued)

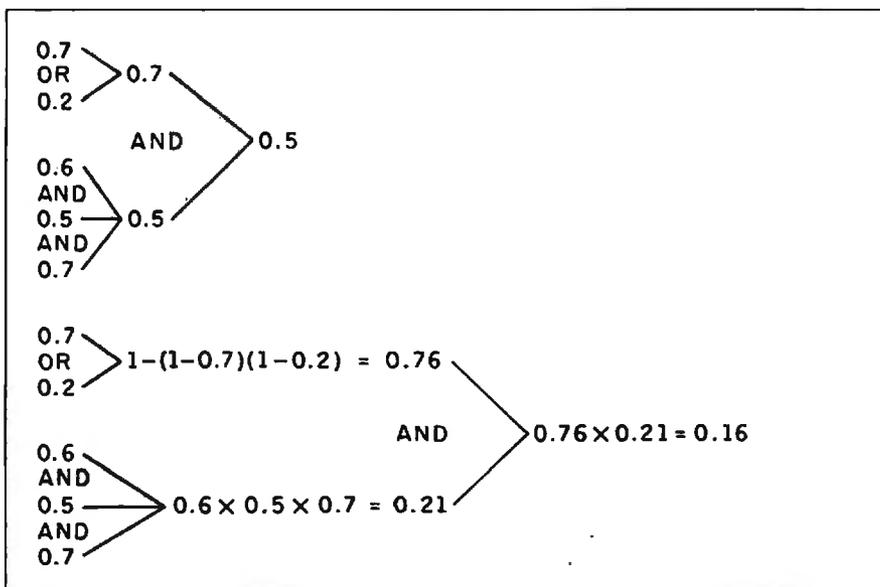


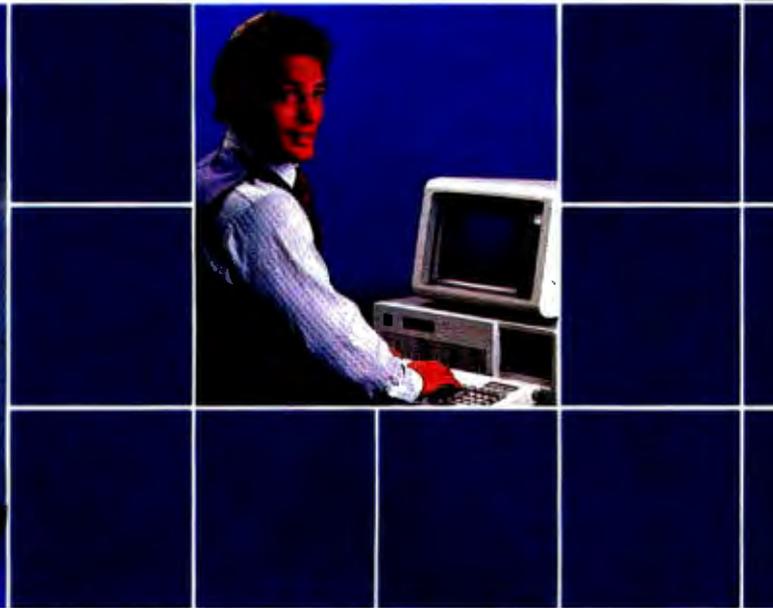
Figure 1: Probability calculations using AND and OR.

LETTERS POLICY: To be considered for publication, a letter must be typed double-spaced on one side of the paper and must include your name and address. Comments and ideas should be expressed as clearly and concisely as possible. Listings and tables may be printed along with a letter if they are short and legible.

Because BYTE receives hundreds of letters each month, not all of them can be published. Letters will not be returned to authors. Generally, it takes four months from the time BYTE receives a letter until it is published.

Hard Drives

You Can Forget About.



The nicest thing about Maynard's hard drives is their humility. They never draw attention to themselves. They simply do what you tell them to do, so you can keep your mind on your work, not your hardware. Unsurpassed performance. Versatile design. Superb reliability. We give you an awful lot to forget about.



*Internal, external, or portable
hard drives from 10 to 30MB.*



 **Maynard Electronics**

430 E. SEMORAN BLVD., CASSELBERRY, FL 32707

305/331-6402

Inquiry 239

Why you should ignore 95% of the news

Because NewsNet automatically finds the 5% you need. From our database of authoritative, up-to-date business news, you get just the stories you want, delivered instantly to your microcomputer. You choose your own, unique keywords, and NewsNet saves—just for you—every new article containing those words. Or, you can find that critical 5% on your own, with NewsNet's powerful keyword searching and text scanning.

Just what's in NewsNet's database? The full text of over 300 valuable business newsletters. In-depth news, written by experts, filled with analysis and interpretation. News from 34 different industries and professions—everything from Computers to Investments, from Management to Telecommunications. Plus extras such as wire services, online stock quotes, air fares, and business credit reports.

Computer News:

Your Specialty is our Specialty. Here are just a few of the 25 Electronics and Computers newsletters on NewsNet:

The Artificial Intelligence Report
The Business Computer
The Computer Cookbook
Consumer Electronics Data Base Informer
Electronic Mail News
Outlook on IBM
Japan High Tech Review
Micro Moonlighter

Mini/Micro Bulletin
Personal Computers Today
Robotronics Age Newsletter
Semiconductor Industry & Business Survey
The Seybold Report on Professional Computing
Stanley Klein Newsletter on Computer Graphics

**ONLINE
BUSINESS
NEWS**

NewsNet

Call Today!
We'll send all you need to subscribe.

**(800)
345-1301**

(in PA 215-527-8030)

NewsNet Inc. 945 Haverford Road, Bryn Mawr, PA 19010

cessor board, both of which allow dissimilar kinds of processes to go on in parallel, simply to unload the main CPU. The greatest use of parallel computing will probably have nothing to do with enormous arrays of identical processors doing similar computations on number arrays.

JOSEPH P. MARTINO
Sidney, OH

STAR MAPS

In the July BYTE, Bruce Webster describes a program that displays nearby star positions on a Macintosh ("New Perspectives on Nearby Stars," page 107). Programs like these are long overdue. In the pre-micro age I had to solve the same problems while researching exploratory routes among the stars (published in the October 1979 issue of *Spaceflight*), but the only maps that could be drawn on an available mainframe were on a line printer, with 132 horizontal "pixels"!

It may interest your readers to know that the Cartesian coordinate system used by Webster may be adapted to give coordinates referenced to the plane of the galaxy rather than that of the earth's equator. If X_G , Y_G , and Z_G are galactic coordinates, they may be calculated by:

$$\begin{aligned} X_G &= -0.0672 \cdot X - 0.8727 \cdot Y - 0.4835 \cdot Z \\ Y_G &= 0.4927 \cdot X - 0.4504 \cdot Y + 0.7445 \cdot Z \\ Z_G &= -0.8676 \cdot X - 0.1884 \cdot Y + 0.4602 \cdot Z \end{aligned}$$

with X , Y , and Z as used by Webster. The galactic plane is then the X_G - Y_G plane, and the galactic center is 10 kiloparsecs along the positive X_G axis.

Lastly, I wish to bemoan the lack of an up-to-date collection of nearby star information. The list by Allen (1973) that was referenced by Webster in fact relies on a 1969 catalog (by Gliese). With the recent tremendous expansion in astronomical knowledge, there would be a lot known about nearby stars—but the information is uncollated, unpublished, and inaccessible. It would be a public service if an astronomer were to collect and publish the data—preferably in some machine form such as the Harvard catalog of bright stars, available to CP/M users.

TONY ORME
Aldershot, England

SWITCHING TO DVORAK

As a professional systems analyst for a large manufacturing company, it is my responsibility to estimate cost and return on investment for computer-oriented projects. Most of the time I have been able to rely on past experience and/or local

(continued)

Introducing In·a·Vision

Complex Drawing Made Easy

We created In·a·Vision just for you. The engineer who needs more productive drafting support. The designer who needs versatility for alternate ideas or quick revisions. The architect who needs to manage a variety of working drawings. And the businessman who needs first-class presentation materials as well as detailed flow charts and organization charts.

Point. Click. Draw.

Now all you do to create complex technical drawings, systems designs, blueprints, diagrams, illustrations, and proposals is point,

click and draw. With In·a·Vision's mouse support, windowing, icons, and pull-down menus, you produce drawings more quickly, accurately and efficiently than ever before.

In·a·Vision's advanced technology includes many features not found on comparable systems costing thousands more. For example,

you can pan around in a user-definable drawing space up to 68" x 68" and zoom in on specific areas for greater detail. Scale, rotate and dimension symbols, fill an area with your choices of predefined colors and patterns, as well as draw lines with multiple styles and widths. Other features include overlays, predefined and user-definable page sizes, rulers, grids, and symbol libraries.

Multi-tasking in a PC-based CAD system.

In·a·Vision uses multi-tasking to enable you to continue drawing while printing hard copies as well as edit multiple drawings simultaneously.

Unlike more expensive CAD systems, In·a·Vision is easy to install and use. Even the computer novice can be productive in less than a day. And In·a·Vision is not copy-protected.

Ten Day Trial Period.

We're so sure In·a·Vision will

make you more productive, we'll give you ten days to prove it to yourself. If In·a·Vision doesn't improve your productivity, return it within ten days for a full refund.

In·a·Vision will make your complex drawing tasks simple and make you more productive. Satisfaction guaranteed. Dial 800-272-3729 to order or for a free

brochure. In Texas

or for customer support, call (214) 234-1769. MICROGRAFX, Inc., 1820 North Greenville Avenue, Richardson, Texas 75081.

MICROGRAFX™
The Picture of Success.

(Most popular graphics cards, plotters and printers supported.)
Microsoft Windows compatible. Call for specific operating environment requirements.

Inquiry 256

In·a·Vision and MICROGRAFX are trademarks of MICROGRAFX, Inc.
Windows and Microsoft are trademarks of Microsoft, Inc.

OUR PLUG-IN CARD GIVES YOU PLUG-IN CONTROL.

PC \leftrightarrow 488 allows your IBM PC/XT/AT or compatible to control IEEE-488 instruments.

With **PC \leftrightarrow 488**, you can:

- Plug-in to BASIC, C, FORTRAN, or Turbo Pascal.[™]
- Emulate hp controllers,
- Use Tek Standard Codes and Formats,
- Run IBM's IEEE-488 software, and much more.

Just \$395 for the complete hardware and software interface.



Capital Equipment Corporation
10 Evergreen Avenue
Burlington, MA 01803
Call today (617) 273-1818



Turbo Pascal is a trademark of Borland International



LETTERS

sources to help with my estimates, until now. It seems that upper management is interested in the Dvorak keyboard for all computer-related hardware. This interest has come from hearing and reading about how efficient the Dvorak keyboard is over the QWERTY. Now management would like me to come up with some sort of estimate to switch over.

We have about 100 computer terminals in our plant and office used by various users (from factory workers to the president). In addition, we have 10 keypunchers who use either an IBM keypunch (remember the 80-column card—ugh!) or a key-to-disk system by Sperry. Also, we have five computer operators, and let's not forget the diehards in the programming department (of which I am a member).

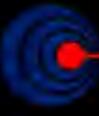
I have to plead ignorance of this subject, so I am asking if you or any of your readers have heard of any company that has switched over to the Dvorak keyboard. If so, what benefits and heartaches were involved?

FRANCO ARDITO
Systems Analyst
Executive Offices
Buffalo Forge Company
490 Broadway
Buffalo, NY 14204

DataSaver⁴⁰⁰

Standby UPS

Power protection for high-level microcomputers with peripherals, multi-tasking systems, and communication networks is here, now, with the 400 Watt DataSaver. Placed between the desktop computer and system monitor, the DataSaver 400 features a master power switch directing four power outlets, 2-stages of overvoltage transient suppression and built-in, automatically recharged batteries stand by to assure clean, uninterrupted power for the five minutes you might need to shut down before the power shuts off. 90 and 200 Watt models available.



Cuesta Systems Corporation

3440 Roberto Court
San Luis Obispo, CA 93401

©1985, Made in U.S.A.

Write or call 805/541-4160
Dealer, O.E.M. Inquiries invited

"A NEW LEVEL OF COMPUTING POWER"

Wow! Congratulations on a comprehensive look at state-of-the-art systems' capacity in your August BYTE. A new level of computing power is about to appear on our desktops, from high-powered personal audio/graphics in an innovative package ("The Amiga Personal Computer"), to 32-bit computational power ("The DSI-32 Coprocessor Board" and "BYTE West Coast: New Microprocessor Chips"), to new high-level languages ("Declarative Languages: An Overview"). BYTE has evolved considerably from the days when 8-bit controller/processors were being first assembled into general-purpose computers by "hobbyists."

Twenty years ago I was fortunate to be a member of a high school computer club whose members were permitted access to a local university's IBM System/360 during "idle time." One member of our group was programming in LISP, and we used to joke about the parenthetic delimiters as "impediments." I was chided for my tendency to use FORTRAN. I loved PL/I, but the problems I wanted to work on were heavily computational, and FORTRAN provided easy links to assembly-

(continued)



Super Subsystem

AST's Colossus™—The Complete Data Storage Solution For Unparalleled Performance, Expandability and Reliability

Unmatched Performance. Offering the industry's fastest disk access time and disk-to-tape data transfer rate, this 74Mb hard-disk subsystem—expandable to 370Mb—with 60Mb streaming tape backup is perfect for your large single-user data bases, as well as multi-user and local area network applications.



Rugged, Front to Back. SCSI Expansion Port ensures easy connection to more storage or other SCSI peripheral devices.

Advanced Architecture. Colossus uses state-of-the-art SCSI (Small Computer Systems Interface) architecture and high-performance intelligent peripheral controllers. This means you get automatic media defect management, extensive error identification and recovery, and power-on self-test for total hassle-free operation at all times. With Colossus, "bad sectors" are a thing of the past.

Features A Future. Colossus is easily upgraded as your needs increase.

Its SCSI expansion port lets you connect Colossus Expansion Units and other peripheral devices.

Complete Compatibility. Colossus is specially designed to be compatible with local area networks, including the latest from AST and IBM® XT/AT compatibility means you can boot directly off Colossus and run PC-DOS and other operating systems. And its exclusive DMA/8/16 AT Interface maximizes performance in multi-user applications.

Rapid Backup. Colossus' tape backup allows streaming image or file-by-file backup operations with a choice of menu or command driven software operation. And it's fast—up to 5Mb per minute. Industry standard tape format means media is transportable for access on other systems. Of course, Colossus also provides backup for the XT and AT internal drives.

Modular Construction. Pop-in sub-assemblies make enhancement and maintenance literally a snap. We start out with the finest quality components available. Extensive testing and comprehensive burn-in procedures ensure that every completed subsystem will provide you with totally trouble-free performance, no matter what your application.

Your data deserves the best storage system available. For the name of your nearest dealer call our Customer Information Center (714) 863-1333. Or write, AST Research, Inc., 2121 Alton Avenue, Irvine, California 92714 TWX: 753699 ASTR UR.

Colossus Disk Subsystem Features

- 74Mb Formatted Disk Capacity—Base Unit
- Expands Up to 370Mb Using Expansion Unit(s)
- 30 Millisecond Average Disk Access Time
- Optional Xenix™ Driver (QA '85)
- 32-Bit Error Checking and Correction (ECC)
- 60Mb Tape Cartridge Backup—5Mb per Minute Backup/Restore
- Backup/Restore By Drive, Volume, Directory or File
- Local Area Network Compatible
- Boots Off Disk

AST
RESEARCH INC.

Colossus trademark of AST Research, Inc. IBM registered trademark of International Business Machines Corp. Xenix is a trademark of Microsoft Inc.



Inquiry 3 for End-Users. Inquiry 4 for DEALERS ONLY.

P ERFECT FIT

THE NEW VECTRA PERSONAL COMPUTER FROM HEWLETT-PACKARD.

In today's fast-moving business environment, you need a personal computer that has the flexibility to fit perfectly with changing business needs and opportunities. The new Hewlett-Packard Vectra PC is just such a computer: flexible and versatile.

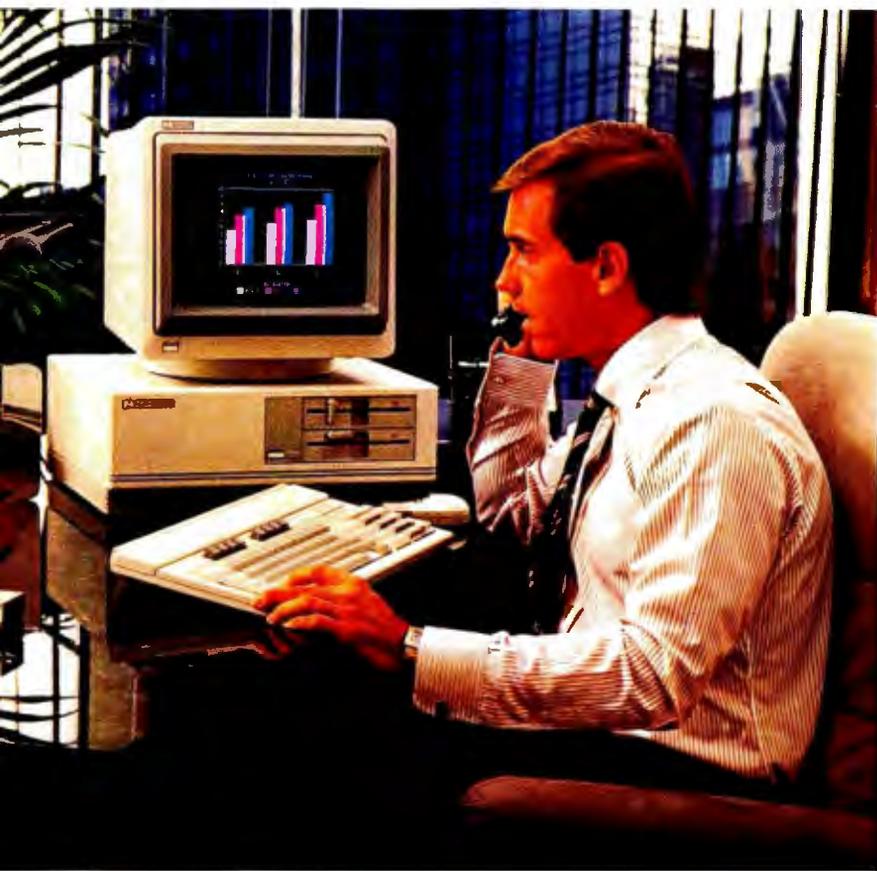
You get the *performance* you need, because you can select the power, speed and memory capabilities that suit you best; the *software*

you need, because it's compatible with the IBM PC/AT; and the *hardware flexibility* you need, because it's designed to access a full range of accessories and peripherals.

The HP Vectra PC is a high performance computer. It's 30% faster than the IBM PC/AT. And with the addition of the optional co-processor, it can run even faster.

And since the Vectra PC is compatible with the IBM PC/AT, it runs PC-DOS 3.1 programs—without alteration. Like Lotus® 1-2-3®, MultiMate™, and R:BASE™ 5000, plus HP's new AdvanceWrite word processing series, TextCharts presentation graphics, and more.

There are several internal and external memory storage



HP Vectra Specs:

MEMORY

256K expandable to 3.64MB

MICROPROCESSOR

Intel 80286; runs at 8MHz

Optional: Intel 80287; co-processor runs at 5.33 MHz

OPERATING SYSTEM

MS-DOS 3.1 (compatible with PC-DOS 3.1)

DATA STORAGE

5¼" internal flexible discs (360K or 1.2MB capacity)

20MB internal hard discs

3½" stand-alone flexible discs; 20MB stand-alone hard disc.

options, as well. So you can choose the storage you need now. Or expand as your needs change.

The Vectra PC has high resolution text and graphics capabilities. Color or monochrome displays. And seven expansion slots to add accessories, extra memory, data communications, video options, plus a host of peripherals. Like the popular HP graphics plotters, ThinkJet and LaserJet printers, to name a few.

In all, the Hewlett-Packard Vectra PC is superbly flexible. As a stand-alone, or as an easily integrated addition with HP, IBM and other computer environments.

And, because it comes from Hewlett-Packard, you know you're getting a quality product.

Find out how the Vectra PC can fit your needs—whether technical, professional or secretarial. Call 1-800-FOR-HPPC, Dept. 276Z, for the name of your local authorized Hewlett-Packard dealer, or Hewlett-Packard sales representative. In Canada, call 1-800-387-3867. *Vectra*



 **HEWLETT
PACKARD**
Business Computing Systems

How to go from UNIX to DOS without compromising your standards.

It's easy. Just get an industry standard file access method that works on both.

C-ISAM™ from RDS.

It's been the UNIX™ standard for years (used in more UNIX languages and programs than any other access method), and it's fast becoming the standard for DOS. Why?

Because of the way it works. Its B+ Tree indexing structure offers unlimited indexes. There's also automatic or manual record locking and optional transaction audit trails. Plus index compression to save disk space and cut access times.

How can we be so sure C-ISAM works so well?

We use it ourselves. It's a part of INFORMIX®, INFORMIX-SQL and File-it!™, our best selling database management programs.

For an information packet, call (415) 322-4100. Or write RDS, 4100 Bohannon Drive, Menlo Park, CA 94025.

You'll see why anything less than C-ISAM is just a compromise.



RELATIONAL DATABASE SYSTEMS, INC.

© 1985, Relational Database Systems, Inc. UNIX is a trademark of AT&T. INFORMIX is a registered trademark and RDS, C-ISAM and File-it! are trademarks of Relational Database Systems, Inc.

LETTERS

language-coded routines as well as plotter library routines. Over the years, my programs have become strongly hierarchical, with multiple levels of function calls and constant evocation of external routines from my personal library.

I believe that for a computational language to survive, it must eventually evolve into a hierarchical functional language. Therefore, I applaud Dr. Peter Harrison for his work on FP and his intent to make FP available on VAX and PC systems in the near future ("Functional Programming Using FP," page 219). FP is a step *beyond* the level of block-structured languages, such as PL/I, and languages with symbolic array operators, such as APL. Welcome to a world where man speaks to machine with the logic of mathematics!

GARY R. CONRAD, M.D.
Iowa City, IA

COMPUTER-ACCESS INEQUITIES

The July Editorial ("Equal Access to Computers: Scruples or Rubles" by Phil Lemmons, page 6) seems to have been written with Jersey City State College in mind. JCSC is an urban college that largely serves a nontraditional, minority population. We are seeking funding to establish a Social Science Computer Resource Center to fulfill the following objectives:

1. The development of a consortium of social science faculty and students to transform every social science course into a computer-aided-instruction (CAI) offering.
2. The establishment of a research service for local businesses, government and social agencies and the development of a social science team method of doing research on the impact of the computer on human behavior.
3. The development of electronic communication systems to link JCSC social science faculty and students with other colleges, universities, and organizations.

Any suggestions? Thank you.

PHILIP A. RAGONE
Professor of Sociology
Jersey City State College
Jersey City, NJ
(201) 547-3261

Phil Lemmons's editorial correctly identifies "computer inequity" as a problem for disadvantaged schoolchildren. I would go further and suggest that the long-term effect of computer inequity, whether in the

(continued)

BE UNPRODUCTIVE FOR A WEEK.



WIN THE ACCO PRODUCTIVITY SWEEPSTAKES.

Week in, week out, you're busy being productive. So we at ACCO hope you win a week away from work. On the island of Aruba, the crown jewel of the Caribbean.

It's the first prize in our Office Productivity Sweepstakes.

On Aruba, you'll do anything but work. Like snorkeling, sailing, dining, golfing and trying your luck in the casinos.

But if you don't win a week in Aruba, you could still win one of 24 Casio Card radios. Or one of 36 Pocket Trivia games.

And if you don't win one of those, you'll definitely win at being more productive around the office.

All it takes are ACCO

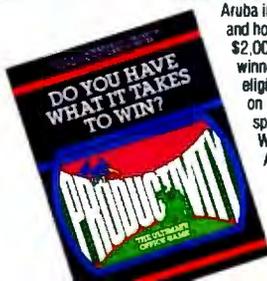
anti-glare CRT filters, desk top printer stands, surge protectors, data binders and diskette trays.

Because ACCO computer products all work hard at helping people get more work done. People like you who deserve to do nothing for a week.

Enter now, and receive a brochure of ACCO products at special prices.

No purchase necessary. Entrants must be 18 years and older. All entries must be received by March 28, 1986. One entry per person. No facsimiles or mechanical reproductions will be accepted. Each entry must be mailed separately. Entries are the sole property of the sponsor. Sponsor is not responsible for lost, misdirected, or mutilated entries. The prize winners will be drawn from entries received with all questions answered. Drawings for all prizes to occur April 12, 1986. Winners will be notified by registered mail. Prizes are non-transferable. First prize will be a trip for two to

Aruba including air transportation, from a major airport, and hotel for 7 nights. Trip value is approximately \$2,000.00. Taxes are the sole responsibility of the winners. Winners are required to sign an affidavit of eligibility and liability. Winners names will be available on request. Decision of the judges is final. Sole sponsor is ACCO International, 770 South Acco Plaza, Wheeling, IL 60090. Employees and families of ACCO, ACCO distributors, and associated agencies are not eligible. Sweepstakes open only to U.S. residents. Void where prohibited.



Inquiry 6

B11 **Send in today**

Signature _____ Date _____

Name (Please print or type) _____

Title _____ Phone _____

Company Name _____

Address _____

City _____ State _____ Zip _____

Where do you buy supplies? _____

About how many computer work stations are in your office? _____

About how many employees are in your office? _____

This entry form must be completed to qualify for Sweepstakes. Mail to:

ACCO

ACCO International, Inc.
Attn. Marketing Dept.
770 S. ACCO Plaza
Wheeling, IL 60090



schools or in adult life, will be "information inequity." As computers blur the line between knowledge and information, those who have little or no access to information may become the underclass of the future.

While the price of declining hardware promises greater availability of computers to all, continuing restrictive software license agreements—"one user, one ma-

chine"—theoretically perpetuate inequality.

ELLEN MOSS POLER
New York, NY

LOGO DIALECT DIFFERENCES

I was glad to see the Logo program in "The Expert Mechanic" by Michael Fichtelman (June, page 205). I typed it in, but I found that IBM Logo "doesn't know how to WORD?" in the procedures

Search, Change, and Disp.

Am I the victim of differences between Logo dialects, or was something left out of the program listing?

TERRY R. GRANT
Manchester, MO

Michael Fichtelman replies:

I'm afraid Mr. Grant is the victim of the difference between Logo dialects. Expert Mechanic is written in Terrapin Logo, but I don't think the difference is insurmountable. In Terrapin Logo, the predicate WORD? returns TRUE if its input is a word, while the predicate LIST? returns TRUE if its input is a list. This is similar to the operation of the ATOM and LISTP predicates in Common LISP. If IBM Logo has an equivalent predicate, the translation should not be difficult.

MAKING DO WITHOUT COMMUNICATIONS SOFTWARE

I read with interest Monsieur Desjardins's description of the "Morocco Principle" for unidirectional "ASCII Transfer" (Letters, August, page 24) between computers that require communications software only on the receiving hardware. Without realizing it, two years ago I discovered a similar "Mt. Pleasant Principle" for transferring ASCII files between CPM machines without any communications software. To do this, the receiving machine is first readied with the following instruction:

A>PIP MYFILE.TXT = RDR:

The ASCII file is then sent from the other machine using

A>PIP PUN: = MYFILE.TXT

PUNCH and READER send data to, or receive data from, the serial communications port.

With the serial ports set to the same baud rate, etc., I have transferred files between a Radio Shack Model II and my trusty Kaypro 2 by simply modifying an RS-232C cable so that pins 2 and 3 are twisted (2 on one end connected to 3 on the other, etc.).

My Kaypro 2 is so old that it came with only a "dumb" terminal program. I could still transfer data files to the mainframe here at Central Michigan University by readying our CDC to receive using the "dumb" terminal, exiting to CPM, typing the instruction

A>PIP PUN: = MYFILE.DAT

and then recalling the terminal program
(continued)

THE SHUTTLE-AT BOARD
DELIVERS MAX IBM AT COMPATIBILITY

5.8 Mhz

AT MASS PRODUCTION COST

SHUTTLE-286

- 80286 Processor
- System BIOS
- 1 MByte RAM Capacity on board
- Plug Compatible to IBM Parts and accessories
- Provision for Low Cost I/O Ports
- 8 Expansion Slots Upgradable to 11
- On Board Battery

TURBO SHUTTLE-286

- 8 Mhz Turbo (Switchable to 6 Mhz)
- Build-in Multi-Function Card

IBM is a trademark of IBM Corp.

OPERATION MANUAL CONTRACT
AT BIOS CONTRACT
PC/XT BIOS CONTRACT AVAILABLE

IBS Corporation
2700 E. Imperial Hwy. Bldg. A Brea, Ca.92621
(714) 579-0680, 579-0691
579-0692, 579-0693

LARGE OEM QUANTITIES \$ 595

We've been accused of breaking the speed limit.



You Be The Judge.



Until now, if you wanted true letter quality printing, you needed a daisywheel printer. Then you waited and waited while it plugged along at speeds of about 55 cps.

Now the waiting is over. Because the Genicom 3320 dot

matrix printer offers true letter quality printing at an incredible 180 cps. It's the fastest impact letter quality printer available.

And the Genicom 3320 offers full graphics capability...impossible with a daisywheel.

It also features up to 300 cps data processing, high throughput, heavy duty cycle printing, quiet operation, and Hex dump diagnostics.

Plus the 3320 comes standard with Diablo® 630 and IBM® PC Graphics protocols and works

with most major PC software packages such as Lotus®, Wordstar 2000® and Multimate®.

Call our Toll Free number for all the evidence. You'll find Genicom has five other 3000 models for everything from color printing and bar codes to speeds up to 400 cps.



GENICOM

The Printers That Mean Business.

Genicom Corporation, Dept. 315J, Waynesboro, VA 22980. TOLL FREE 1-800-437-7468. In Virginia, call 1-703-949-1170.

Diablo® is a registered trademark of Xerox Corporation. IBM® is a registered trademark of International Business Machines. Lotus® is a registered trademark of Lotus Development. Wordstar 2000® is a registered trademark of Micropro International Corporation. Multimate® is a registered trademark of Multimate International Corporation.

LETTERS

to terminate the input mode, save the file, and sign off the mainframe.

We do what we can to maximize utility (and make dol), don't we?

RODNEY C. KIRK
Mt. Pleasant, MI

THE AMIGA'S RAM LAYOUT

The collaboration of Gregg Williams, Jon Edwards, and Phillip Robinson resulted in an essentially excellent preview of the Amiga computer (August, page 83). But if anyone had scrutinized the hardware coldly, the RAM layout might have received the assessment it deserves.

How can a true 16-bit computer possibly have just 256K bytes of dynamic RAM in this day and age?

With the eight dynamic RAM chips in your fine photograph of the main circuit board, it would make electronic sense only if these chips were 64K by 4-bit dynamic RAMs. With the 16 chips in another magazine's corresponding (but lesser) photograph, it would make electronic sense only if those chips were 128K by 1 bit. Neither of these schemes makes

production sense.

If the other magazine's 16 chips were 256K by 1 bit, that would make production sense. But then the standard on-board memory would be 512K bytes, not 256K, and the optional (extra cost) memory-expansion cartridge would raise the total to 1 megabyte, not 512K. This would make a great deal of production sense. And assuming the boards, main and expansion, were wired in a sensible manner, simply replacing those hypothetical 256K by 1-bit chips with next year's 1M by 1-bit chips would bring total expanded in-box RAM to 4 megabytes. All very straightforward, no particular problems, but that's not how the Amiga is set up!

Why, logically, will an expensive external expansion cabinet be necessary to get that kind of RAM capacity for the Amiga? Why is an optional cartridge necessary just to get 512K in the first place? Is it possible that the Amiga's makers deliberately crippled the machine's memory scheme in order to squeeze some extra pesos out of its sales?

Had you all not been quite so dazzled

by the Amiga's clearly great features, you might have noticed this not-so-great feature. It's really a dog. But then, no one else noticed it, either.

I appreciate the Amiga for what it does in its price range, even if the range seems just a trifle steeper than it needs to be; and I appreciate the way it does it, thanks to BYTE's analytic preview. But I resent a RAM implementation that needlessly cheats its customers.

JIM HOWARD
Project City, CA

Gregg Williams replies:

Mr. Howard caught one point that I had entirely overlooked, but I must add that I find his opinions to be rather extreme. I, for one, am glad to be offered a machine with color, greater speed, and twice the memory and disk storage of the Macintosh, all for considerably less (\$900 less, if you use an existing television set) than the Macintosh itself. I applaud Commodore's decision to use 256K bytes in its basic machine (the company had orig-

(continued)

DREAMER

Inquiry 357

Make 1-2-3™, WordStar™, VisiCalc™, easier!

NO MORE MEMORIZING AND TRAINING

- Are you always forgetting those keystroke sequences required for your sophisticated business software?
- Wouldn't it be easier to press a key labelled "Format Right" instead of typing "/ R L R" to right-justify a cell in Lotus 1-2-3? or a key labelled "Save File" instead of typing "Ctrl K S" in WordStar?
- Now, with the help of Dreamer's descriptive keys, you can execute oddly-constructed commands with no more memorization, no more flipping through instruction manuals.
- Cut training time and costs for yourself and your staff to a minimum by putting a Dreamer next to your system. The Dreamer will make your computer a dream to use.
- The Dreamer is available for the IBM PC or XT and the Apple //e or][Plus.

DREAMER FEATURES:

- 20-key numeric pad with separate cursor controls
- IBM version:
 - 70 Lotus 1-2-3 commands
 - 30 WordStar commands
- Apple version:
 - 60 WordStar commands
 - 40 VisiCalc commands
- Templates included for alternate command pages
- Easy selection between command pages
- Easy installation
- Full 90-day warranty

T. S. MICROTECH INC.

(213) 644-0859
12565 Crenshaw Blvd.
Hawthorne, CA 90250

\$259

A few smart reasons to buy our smart modem:

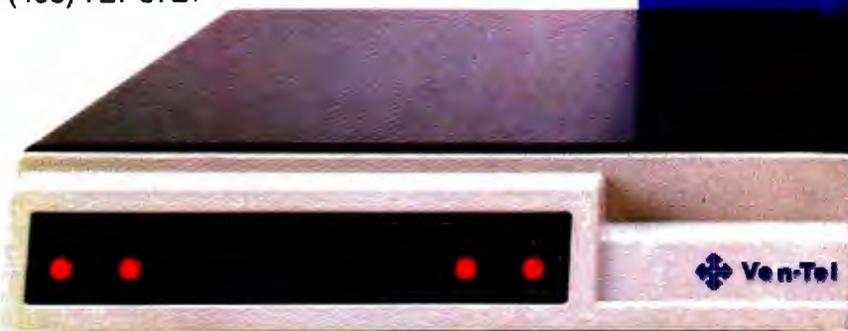
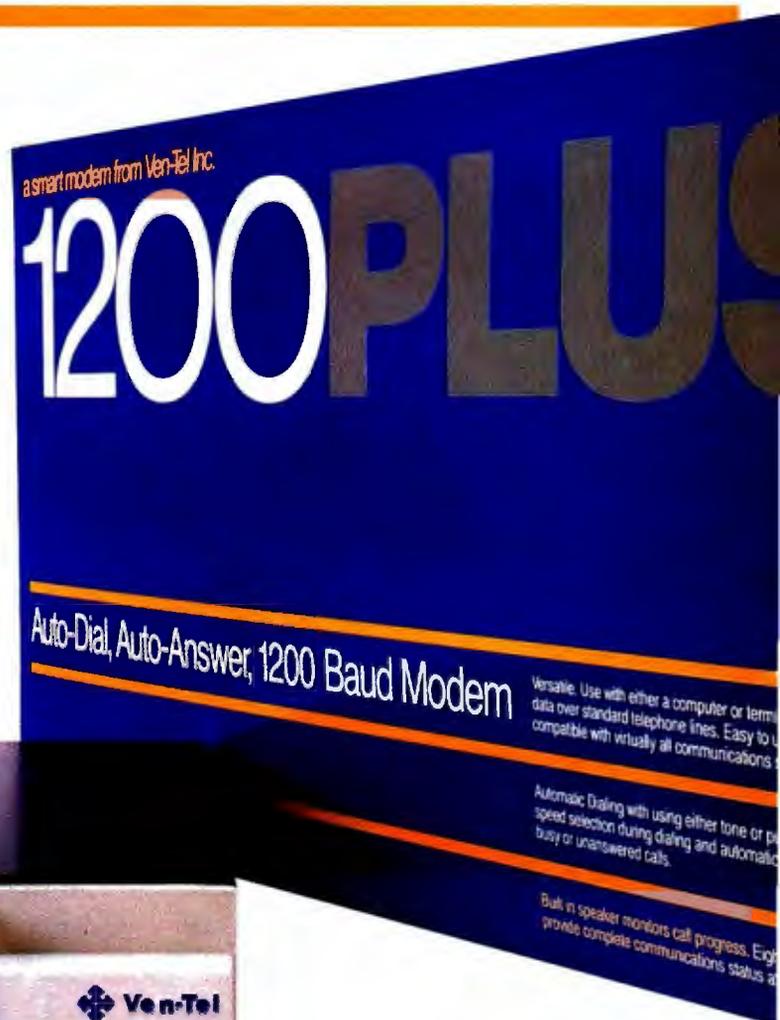
Features	Ven-Tel 1200 PLUS	Hayes
1200 and 300 baud, auto-dial, auto-answer	Yes	Yes
Compatible with "AT" command set	Yes	Yes
Can be used with CROSSTALK-XVI or Smartcom II software	Yes	Yes
Regulated DC power pack for cool, reliable operation	Yes	No
Eight indicator lights to display modem status	Yes	Yes
Speaker to monitor call progress	Yes	Yes
Attractive, compact aluminum case	Yes	Yes
Two built-in phone connectors	Yes	No
Compatible with The Source and Dow Jones News Retrieval	Yes	Yes
Unattended remote test capability	Yes	No
Phone cable included	Yes	Yes
Availability	Now	
Price	\$499	\$599

The Ven-Tel 1200 PLUS offers high speed, reliable telecommunications for your personal computer or terminal. Whether you use information services or transfer data from computer to computer, the Ven-Tel 1200 PLUS is the best product around. Available at leading computer dealers and distributors nationwide.

Also from Ven-Tel: internal modems for the IBM and HP-150 Personal Computers with all of the features of the 1200 PLUS.

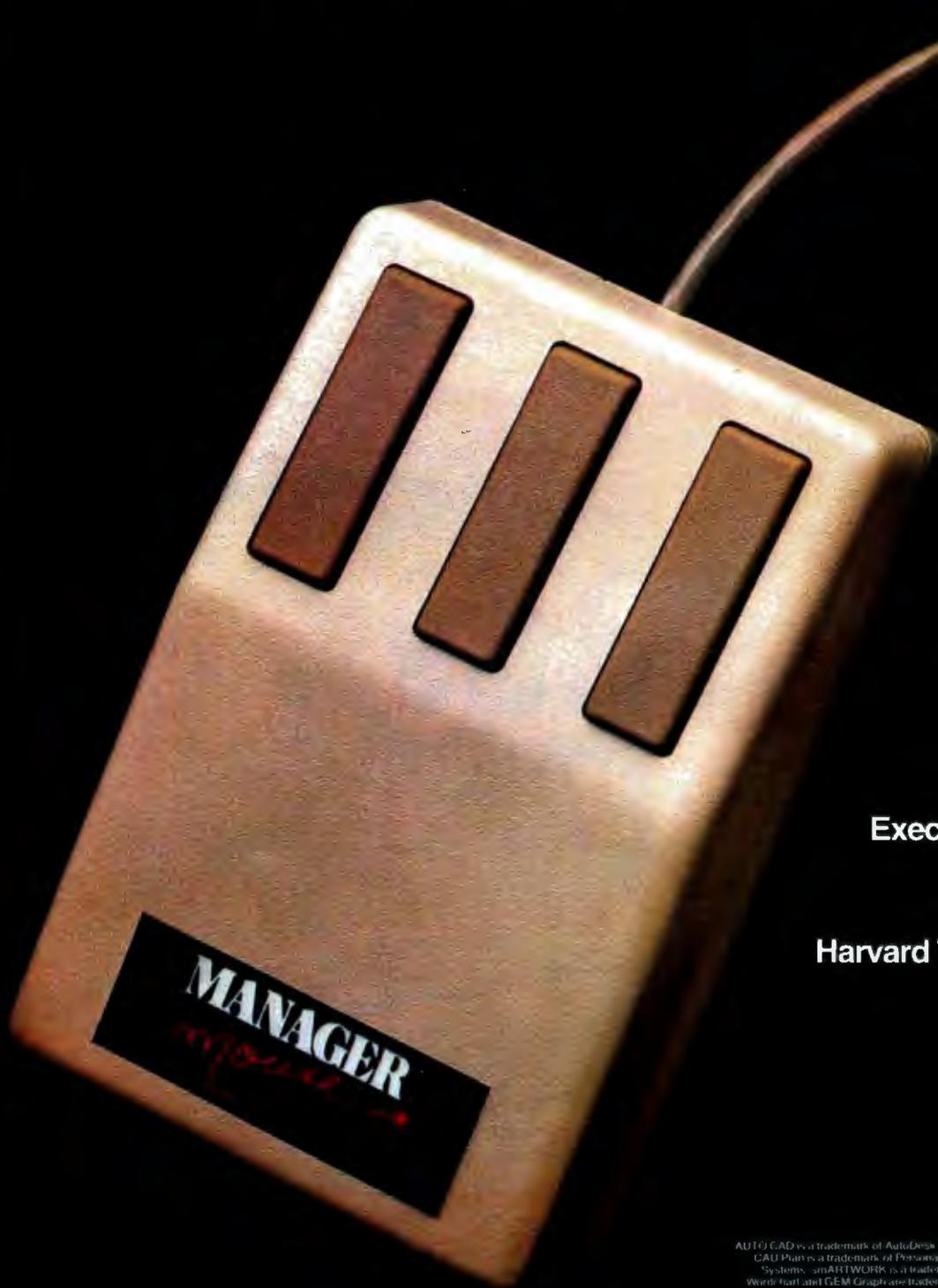
You choose. The Ven-Tel 1200 PLUS—the smartest choice in modems.

Ven-Tel Inc.
 2342 Walsh Avenue
 Santa Clara, CA 95051
 (408) 727-5721



Crosstalk is a trademark of Microstuf; Hayes and Smartcom II are trademarks of Hayes Microcomputer Products.

There are 25 you should buy



AUTO CAD™
CAD key™
CAD Plan™
CAD Master™
smARTWORK™
GEM™
GEM Desktop™
GEM Draw™
GEM Wordchart™
GEM Graph™
TopView™
IBM Assistant Series™
DESQ™
FRAMEWORK™
Telepaint™
PC Illustrator™
Art Studio™
Executive Presentation Kit™
PC Paintbrush™
DR Halo™
Harvard Total Project Manager™
Microsoft WORD™
Microsoft Project™
Network™
Quicknet™

Manager Mouse™ and T Mouse™
are registered trademarks of the
Forretington Company

AUTO CAD is a trademark of AutoDesk, Inc. CAD Key is a trademark of Micro Graphical Systems, Inc. CAD Plans is a trademark of Personal CAD Systems. CAD Master is a trademark of Data Graphics Systems. smARTWORK is a trademark of Wintek Corp. GEM, GEM Desktop, GEM Draw, GEM Wordchart and GEM Graph are trademarks of Digital Research. TopView and IBM Assistant Series are trademarks of International Business Machines. DESQ is a trademark of Quantitative Office Systems. FRAMEWORK is a trademark of Ashton-Tate, Inc. Telepaint is a trademark of LCS Telegraphics. PC Illustrator is a trademark of Computer Graphics Group. Art Studio is a trademark of MICRAF. Executive Presentation Kit is a trademark of Koala Technology. PC Paintbrush is a trademark of BRSI. DR Halo is a trademark of Media Cybernetics. Harvard Total Project Manager is a trademark of Harvard Software. Microsoft WORD and Microsoft Project are trademarks of Microsoft Corp. Network is a trademark of Solut Corp. Quicknet is a trademark of PSC.

good reasons Manager Mouse™

Manager Mouse is an innovation in Mouse technology.

It is indispensable to many windowing, computer aided design, graphics, project management and word processing programs. Its unique independent suspension* system delivers smooth, skip-free performance on any surface, at any angle with precise control. It plugs directly into your computer without any external power supply and requires no special tablets or pads. It's totally portable. Take it with you in its travel pouch anywhere in the world.

Manager Mouse's enclosed drive mechanism makes for carefree maintenance as well. Manager Mouse is designed for use with IBM PC,™ XT,™ AT™ and a growing number of compatible personal computers, as well as an ever increasing list of software. It comes with its own TMouse™ software, a comprehensive user's manual and technical reference data, a six month limited warranty, and a protective travel pouch.

*Patent Pending

MANAGER™

mouse →

Call 1-800-982-0030 for your nearest dealer.

IBM PC, PC-XT, PC-AT and PC Portable are trademarks of International Business Machines. COMPAQ Portable, Plus, 286 and DeskPro are trademarks of Compaq Computer Corp. ATT 6300 is a trademark of AT&T Information Systems. Eagle PC, PC Plus and Spirit are trademarks of Eagle Computers, Inc. Ericsson is a trademark of Ericsson Information Systems. Columbia is a trademark of Columbia Data Products, Inc. Coplus is a trademark of Corvus Data Systems, Inc. TI Professional is a trademark of Texas Instruments, Inc. DEC Rainbow 100 is a trademark of Digital Equipment Corp. ITT Extra is a trademark of ITT Business Communications Corp. Datavue Plus is a trademark of Dittman Kemp Sperry PC is a trademark of Sperry Corp. Leading Edge, Model D and Model M are trademarks of Leading Edge Products, Inc. Morrow Plus is a trademark of Morrow Designs, Inc. Tandy 1605 is a trademark of Televideo Systems, Inc. Tandy 1000, Tandy 1200 HD and Tandy 288B are trademarks of Radio Shack. Panasonic, Senior Partner and Executive Partner are trademarks of Panasonic Consumer Products. Burroughs ET-2000 is a trademark of Burroughs Corp. Kaypro is a trademark of Kaypro Corp.

A standard RS-232-C interface* makes Manager Mouse compatible with these computers.

IBM PC,™ PC-XT,™
PC-AT™ and PC Portable™
COMPAQ Portable,™
Plus,™ 286™ and
DeskPro™
ATT 6300™
Eagle PC,™ PC Plus,™
Spirit™
Ericsson™
Columbia™
Corona™
TI Professional™
DEC Rainbow 100™
ITT Extra™
Datavue 25™
Sperry PC™
Leading Edge Model D,™
Model M™
Morrow Pivot™
Televideo 1605™
Tandy 1000,™ Tandy 1200 HD,™
Tandy 2000™
Panasonic Senior Partner,™
Executive Partner™
Burroughs ET-2000™
Kaypro™

*Please check the type of connector on your computer's serial card to be sure to buy the right Manager Mouse for your computer.

TORRINGTON

Part of worldwide Ingersoll-Rand

59 Field Street
Torrington, CT 06790
Inquiry 366



The Masters of Software Engineering

At Wang Institute, you'll find a community of professionals working toward a common goal: leadership positions in software engineering and project management.

Our MSE program gives you a practical foundation in the technology, methodology and management of software development. An integrated core curriculum consists of Formal Methods, Programming Methods, Software Engineering Methods, Computing Systems Architecture, Management Concepts and Software Project management. A variety of elective courses are offered each semester, and two project courses precede the degree.

This outstanding curriculum is complemented by a dedicated faculty, a sophisticated computing facility and a country setting outside of Boston. It's an excellent educational environment for developing the skills to specify, design and implement cost-effective software systems.

Wang Institute OF Graduate Studies

Name _____ Business Address _____

Business Phone _____

Home Phone _____

Years of Software
Development
Experience: _____
BYT-11/85



Your current status:
 Software Professional
 student other

TYNG ROAD, TYNGSBORO, MA 01879 617-649-9731

inally designed a 128K-byte machine with a 128K-byte add-on cartridge) and to have an expansion bus (Jay Miner, who designed the custom chips, said he had to fight very hard to keep the bus in the design). You do not need an "external expansion cabinet" to get to 512K of memory—the 256K cartridge plugs into the front of the machine, replacing a hollow panel.

Mr. Howard's objections, though, draw attention to a fact of life that keeps showing up in the microcomputer industry: the effect of marketplace constraints on the engineering design of products. It's true that it would have been nice to have put more memory on the Amiga motherboard, but that would have caused the price of the basic unit to increase by, say, \$300. The key fact is this: It's entirely possible that, in the same market, a \$1295 computer would be successful, while a \$1595 computer would sell too few units to survive at all. Because of this admittedly illogical impulse that makes people buy a product at \$9.95 more often than they would at \$10.00, manufacturers tend to design products to sell at the lowest possible "basic" price. This practice, called unbundling, has been around as long as people have had products to sell, and it shows no signs of disappearing now.

Getting on to answering some of Mr. Howard's questions, the eight memory chips on the Amiga motherboard (see page 83 of the August issue) are, in fact, 64K by 4-bit RAM chips; four of these in a row allows the Amiga's memory bus to be a full 16 bits wide (unlike the IBM PC, which is slower than an equivalent 16-bit data bus design because of its 8-bit data bus). The 16-chip design he saw on a motherboard in another magazine was a 128K-byte Amiga prototype that used sixteen 64K by 1-bit RAM chips.

I'll conclude by adding three pieces of information that were left out of the motherboard photo in the August article. The edge connector at the bottom of the photo is for the 256K-byte expansion cartridge (this connects to the front of the Amiga), and the connector on the right is the Amiga's expansion bus.

Also, the first Amigas to be shipped (which hasn't yet happened at the time I am writing this) are to have 192K bytes of write-protected RAM instead of ROM; users will start these Amigas with a special "kick-start" disk that loads a copy of the ROM software into the 192K of RAM. This will give Commodore more

(continued)

Make Stat Magic

**MORE! Stats, Power
IMPROVED! File Handling, Reporting**

Statistics, reports and plots happen magically with SPSS/PC+™ —the enhanced and expanded Statistical Package for IBM PC/XT/AT's*

SPSS/PC+ is the most comprehensive statistical program for performing simple or complex tasks. For nearly 20 years, SPSS Inc.'s reputation and reliability as the leading producer of mainframe statistical and reporting software is unsurpassed. SPSS/PC+ carries this reputation into the PC environment.

SPSS/PC+ — Fully integrated: report writing, plotting, file management, communications with mainframes. **Statistics:** descriptives, crosstabulation, multiple regression, ANOVA. Simple facilities allow transfer of files between SPSS/PC+ and programs like Lotus 1-2-3, dBASE III, and SAS.†

SPSS/PC+ Advanced Statistics™ — Factor, cluster, discriminant analyses, MANOVA.

SPSS/PC+ Tables™ — Presentation-quality tabular reporting. Produce stub and banner tables. Handle multiple response survey data. Control content and layout completely.

SPSS/PC+ documentation is rated Number One by both novices and experienced analysts. SPSS Inc. also offers a full training schedule and a customer support hot-line.

Contact our Marketing Department today.

SPSS Inc., 444 N. Michigan Avenue,
Chicago, IL 60611, 312/329-3500.

In Europe: SPSS Europe B.V., 4200 AC
Gorinchem, The Netherlands.

Phone: +31183036711

TWX: 21019.



SPSS inc. PRODUCTIVITY RAISED TO THE HIGHEST POWER™

*SPSS/PC+ runs on the IBM PC/XT/AT with hard disk. Contact SPSS Inc. for compatible microcomputers.

IBM PC/XT and PC/AT are trademarks of International Business Machines Corporation. dBASE III is a trademark of Ashton-Tate. 1-2-3 is a trademark of Lotus Development Corporation. SAS is a registered trademark of SAS Institute, Inc. SPSS, SPSS/PC+, SPSS/PC+ Tables, and SPSS/PC+ Advanced Statistics are trademarks of SPSS Inc. for its proprietary computer software.

time to find and correct bugs before it creates the final version of the Amiga ROMs.

Given Mr. Howard's feelings about the Amiga, I'll be the first to come to his rescue if someone forces him to buy one.

THE getNum FUNCTION

"Context-Free Parsing of Arithmetic Expressions" by Jonathan Amsterdam

(August, page 138) was clear and informative. There are, however, two points of further interest to the reader. They both concern the function getNum. First: By making this integer-valued, you are necessarily limited to numbers not exceeding MAXINT (32767 on most machines). This can create problems since, in some Pascals, entering a larger number will result in getNum producing either a nega-

tive value (because of two's complementing) or even a nonsense result. What is even worse, if this parser is extended to deal with real-number entries by having it parse the digits before and after the decimal point separately, then even an innocent number such as 3.45670 will have "3" and "45670" both subjected to the tender mercies of getNum—the result will be ridiculous!

Which brings me to the second point. Several years ago I wrote a parser very similar to the one in this article except that it parses any algebraic expression: It will accept real numbers and transcendental functions (e.g., sine, log, etc.). I placed this parser in the public domain and it is available on a disk from the Boston Computer Society's PC User Group. Unfortunately, it too contains a GetInteger function that has the same limitations as Mr. Amsterdam's! The problem is easily corrected, in either case, by simply changing the value of the function from Integer to Real.

MARK BRIDGER
Newton Upper Falls, MA

INSIDE MAC

In response to the letter from Mr. Singer in the September issue ("Paying Extra for Manuals," page 428), I must say that I agree that Apple should have made errors more clear to the user. However, I disagree that *Inside Mac* was overpriced or, for that matter, that it would have been of use to anyone but a serious programmer. I have read *Inside Mac* and found it to be a treasure chest for the serious Mac programmer, but I am relatively sure that it would have been 90 percent incomprehensible to the average user. I paid \$25 for my copy, which is still the going rate, I believe, and it would have been worth far more than four times that amount.

I agree that the end user should not have to figure out what ERROR#10 means. Instead, Apple should have had some generic "A serious problem has developed. . ." type of message. I guarantee you that the real meaning of error #10 would not be very enlightening to most users—it is "F emulator" trap, also known as DSIineFErr. I hope that helps Mr. Singer, but I doubt it will.

I would like to point out in closing that the Mac is far more complex to "hack" than the IBM because of the immense power of the toolbox. Comparing the relative merits of *Inside Mac* to the IBM technical manual is comparing apples to dinosaurs.

SCOTT BERFIELD
Northbrook, IL ■

THE BYTEK SYSTEM 125

PROGRAMS A WORLD OF TECHNOLOGIES

BYTEK Corporation, Instrument Systems Division, introduces the most complete software-oriented calculator in the world. It's a great reality calculator. The BYTEK MultiProgrammer is a high technology calculator that's been designed to be used in the field. This state of the art instrument is packed with features:

- Supports all common technologies: EPROMs including CMOS and Flash Erasable devices, EEPROMs, Masked PROMs, Microcomputer chips, PALs, MPLs, and HPLs.
- Internal RAM starts at 6K bytes and is expandable to 2 megabytes (10 megabyte).
- Integrated EPROM Programming: No modules or personality adapters are required to program most popular EPROMs and EEPROMs.
- Integrated Data Programming capable of programming 8 EPROMs simultaneously, 8, 16, 32 and 64 bit words.
- Optional Data Expansion Module doubles the going programming capacity.
- 28 key full-sized integral keyboard.
- 16 Character X 7 Line LCD display.
- Intelligent Algorithms automatically identify the type of EPROM in the socket.
- Two Serial RS232C Ports and a Parallel Printer Port provide maximum communication flexibility.
- Advanced Technology Module Port supports present and future programming technologies.
- 16 Bit in Circuit Emulation Capable.
- Completely software controlled (programming).
- Power up in BASIC.
- Delivered in one 32 bit module.

BYTEK CORPORATION
INSTRUMENT SYSTEMS DIVISION

1001 South Rogers Circle, South Miami, FL 33156
(305) 254-4100, Telex 470070 BYTEKPC

PC NETWORK IS PROUD TO ANNOUNCE...

WE'RE #1

In Less Than 2 Years You've Made Us The World's Largest Mail-Order Supplier Of Personal Computer Products.

Here's Why We're The World's Best...

Some say that being the biggest and being the best are qualities that often have little impact on each other. We believe otherwise. In a marketplace as crowded as ours, PC Network has excelled by making your needs and your budget our prime considerations. To accomplish this, we merge 2 powerful but underused concepts ... We give you more. We charge you less. *PC Network is the "Value Added" Mail Order Firm.* We think that's good business. And so do you, as you've proven with an *astounding 90% repeat-buy rate!*

How does your Network membership give you the advantage? Read on.

#1 in Speed

We ship almost all of our orders *complete within 48 hours*. Additionally we maintain a special RUSH stock of many important products to fill your emergency needs *overnight!*

#1 in Support

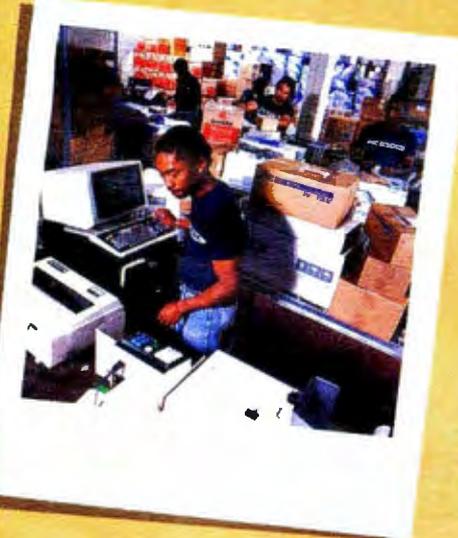
We are over 100 strong, all working to serve you. Our sales people are consultants, not order takers. Our technical support staff are factory-trained and degreed engineers. *Excellence and a concern for your needs are stressed in every department of the Network ... and it pays off.*

#1 in Satisfaction

You know, only too well, the risks of products not turning out to be what they seemed in ads or show demonstrations. To insure your satisfaction, we offer a *10 day, money back, no-questions-asked, guarantee on all hardware ... combined with our unique "Try-Before-You-Buy" software rental program.* Get only what you want, without risk or hassle.

#1 in Stability

This is a time of industry ups and downs. Imitators and basement/garage operations abound. It seems as if a typical mail-order firm has the life expectancy of a match. Not so with the Network. We maintain the financial strength, supplier relations and industry savvy to insure that *we'll be here when you need us.*

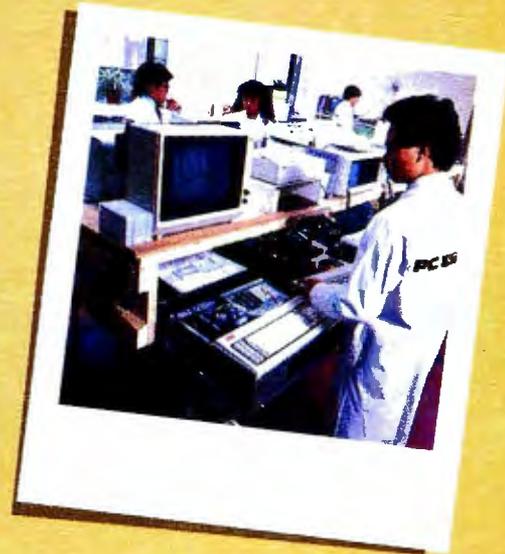
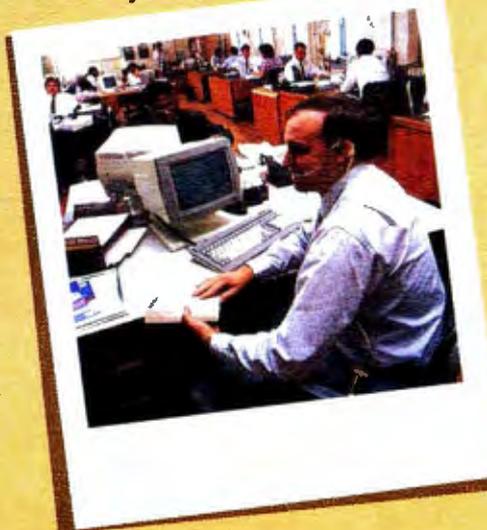


#1 in Selection

We sell more computer products than any other firm in the business. We have over *35,000 square feet of inventory valued at over \$5,000,000.* The Network offers over *30,000 different products* for virtually any personal computer on the market.

#1 in Savings

Our huge volume has enabled us to lead the way in providing the lowest prices on the largest selection in the industry. We offer our unique *"Cost + 8%" formula on everything ... not just the popular "grabber" products.*



#1 in Even More

But to truly excel, PC Network must do even more for our members.

- You'll get the *Printout*, our quarterly newsletter, giving you fantastic specials and an unbiased analysis of new products and trends.
- You'll get our *600 page wholesale catalog*, the largest compilation of computer products anywhere ... plus quarterly updates.
- You'll get the *Network's On-Line Bulletin Board ... a 24-hour-a-day, 7-day-a-week computer service with access to product updates, tech support, download free demo software, public domain software and much, much more.*

The Challenge of Being #1

Above all, you'll receive our pledge to keep constant watch on all facets of this ever-changing industry, seeking new ways to reward your commitment to PC Network.

As for *our* commitment? With your satisfaction, we'll stay the biggest *and* the best.

CALL TOLL-FREE 1-800-621-S-A-V-E
In Illinois Call (312) 280-0002

PC NETWORK

GET THE NETWORK ADVANTAGE!!!

BUY HARDWARE AND SOFTWARE AT WHOLESALE + 8%, AND GET 14-30 DAY SOFTWARE RENTALS*...

Listed below are just a few of the over 20,000 products available at our EVERYDAY LOW PRICES! The Network carries products for Apple, IBM, CP/M and most other popular computer families.

GAMES & EDUCATIONAL SOFTWARE FOR YOUR APPLE II & MACINTOSH

(Please add \$1 shipping and handling for each title ordered from below.)

Wholesale		Wholesale	
Arrows Home Accountant-Mac Only	\$65.00*	Miles Computing Mac Attack-Mac Only	\$23.00*
Aston Art Portfolio & Travel Shoppe	31.00*	Palair Mac Type-Mac Only	24.50*
Bluechip Baron/Millionaire/Tycoon	28.25*	Penguin Graphics Magician	28.37*
Broderbund Loadrunner	18.75*	Penguin Pensate or Kyphus	20.50*
Broderbund Chopfiter	19.00*	Penguin Transylvania-Mac Only	20.37*
Broderbund Print Shop	28.75*	Professional Software Trivia Fever	22.00*
Broderbund Dazzle Draw	31.97*	Priority Software Forbidden Quest	22.00*
CBS Mastering the GRE	47.00*	Scarborough Master Type	25.50*
CBS Murder by the Dozen	20.37*	Scarborough Run for the Money	27.00*
CBS Goren Bridge Made Easy	45.00*	Simon & Schuster Typing Tutor III	28.25*
Counterpoint The News Room	26.37*	Sir-Tech Wizardy	26.37*
Davidson Speed Reader II	37.97*	Sir-Tech Knight of Diamonds	18.97*
Davidson Math Blaster	29.57*	Sir-Tech Rescue Raiders	18.87*
Davidson Word Attack	39.97*	Sublogic Night Mission Pinball	20.00*
Tel Byte Smooth Talker-Mac Only	47.00*	Sublogic Flight Simulator II	27.25*
Hayden DaVinci-House/Intensors/Landscape	24.75*	Spinmaker Alphabet Zoo Face Maker	15.97*
Hayden Sargon III	25.75*	Kinder Comp. Hey Diddle Diddle	
Infocom Deadline or Suspended	24.00*	Rhymes & Riddles. Story Machine	
Infocom Enchanter Palace/Hall	20.00*	Spinmaker The Most Amazing Thing	20.77*
Infocom Cutthroats: Witness or Look I		Spinmaker Delta Drawing	24.97*
Infocom Antihiker's Guide or Seastalker	20.00*	T/Maker Click Art-Mac Only	26.00*
Infocom Suspect Sorcerer or Intidel	22.00*	Writer Desk Organizer	65.00*
Infocom Zork II or III	22.00*	Videos Fun Pack-Mac Only	19.77*
Layered Front Desk-Mac Only	65.00*	Vindex Mac Checkers & Reversi	25.17*
Mirage Concepts Trivia	24.00*	Virtual Combinatics Micro Cookbook	21.00*

BUSINESS SOFTWARE FOR YOUR APPLE II & MACINTOSH

(Please add \$2.50 shipping and handling for each title ordered from below.)

Apple Apple Works	\$165.00*	Microsoft Word for Macintosh	\$102.00*
Borland International Turbo Pascal	30.00*	Microsoft File for Macintosh	102.00*
BPI GL, AP, AR, PR, or INV	205.50*	Microsoft Multiplan for Macintosh	102.00*
Broderbund Bank Street Writer	40.00*	Microsoft Basic for Macintosh	79.00*
Central Point Copy II or Copy II Mac	20.00*	Microsoft Project for Macintosh	66.00*
FunSoft Sideways	34.00*	Monogram Dollars & Sense for Apple II	55.00*
FunSoft Maccasm	60.00*	Monogram Dollars & Sense for Macintosh	70.00*
Haba Habadex	40.00*	Odessa Helix for Macintosh Req's 512K	200.00*
Haba Quartet	101.95*	Provue Overview-Mac Only	135.00*
Harvard Mac Manager	29.95*	Sensible Software Sensible Speller IV	67.50*
Human Edge Mega Prober	15.50*	Softart Fancy Fonts	125.00*
Human Edge Sales Edge	110.00*	Softch Microsystems UCSD Pascal	140.00*
Human Edge Communication Edge	98.00*	Software Arts TK Solver for Mac	134.00*
Living Videotext Think-Thank-Mac Tool	70.00*	Software Publishing PFS File Write or Graph	68.00*
Main Street Filer-Mac Only	85.00*	Stoneware DB Master-Mac Tool	95.00*
MECA Managing your Money	105.50*	Telex Fileviewer for Mac	87.50*

HARDWARE FOR YOUR APPLE II & MACINTOSH

(Please add shipping and handling charges found in italics next to price.)

DISK DRIVES		MODEMS	
Alps AP-100A Dual Apple Drives in One Case	\$309.00* (7.00)	Hayes Micromodem 1200 Baud	\$125.00* (2.50)
Apple MAC 400KB External Drive	349.95* (7.50)	Novation Apple Cat II	174.45* (3.50)
Corvus 5.5MB Hard Drive	939.00* (20.28)	Prometheus 1200 A	276.00* (6.00)
Omega Macconuli 5MG Removable Drive for A2	1,250.00* (27.00)	Low Cost 1200 Baud Internal Modem for Apple II	299.00* (6.00)
Micro Sci A2 145KB Drive	185.00* (5.00)	w/MAC Pack	
Micro Sci A2 145KB Drive	20.00*	Zoom Zoom/Modem Ite	90.00* (2.50)
Micro Sci Floppy Controller	55.00* (2.50)	Microcom Compatible-Free Dow Jones	
PC Network 140K External Drive for Apple II	95.00* (2.50)		
Rana Elite 1.63M Drive	225.00* (5.00)		
Rana Elite II 3.2M Drive	320.00* (7.00)		
Rana Elite III 6.52K Drive	399.95* (10.00)		
Tecmar 5MB Removable Drive for MAC	999.00* (21.58)		
Tecmar 10MB MAC Drive	999.00* (21.58)		
Tecmar 5MB MAC Drive Upgrade	1,235.00* (26.68)		

BOARDS AND BUFFERS

ALS Z-Engine	\$129.00* (2.50)	Apple Macintosh Carrying Case	\$74.00* (1.50)
AST Multi-IO-2 serial/Color	155.00* (3.00)	Apple Macintosh Security Kit	37.00* (1.50)
AST Promote Promisc Software Ite	243.67* (2.50)	Apple Macintosh Numeric Keypad	74.00* (2.50)
Microtek Dumping/IX	55.00* (2.50)	Hayes Match II Joystick w/ Fire Button	31.00* (1.50)
Orange Micro Grappler I	96.90* (2.50)	Kennington Dust Cover for MAC or imagewriter	8.25* (1.50)
Orange Micro Serial Grappler	78.00* (2.50)	Kennington Starter Pack	54.00* (3.00)
PC Network 280 Card	35.00* (2.50)	Kennington Surge Protector	33.47* (2.50)
Quadram APC/IG Graphics Interface	42.00* (2.50)	Kennington System Saver Fan	56.97* (1.50)
Quadram RAM-80	88.00* (5.00)	Kosala MacVision	158.00* (3.00)
Quadram Multicolor-1 Parallel/1 Serial/ Clock Expandable to 256K	140.00* (2.50)	Kosala MacVision Touch Tablet	78.00* (1.50)
Thunderbolt Thunderclock	104.00* (2.50)	M&R Sup-R-Mod RF Modulation	44.00* (1.50)

MEMORY CHIPS

(All Memory Chips Guaranteed for Life!)

Wholesale		Wholesale	
64K Memory Upgrade Kits (9 Chips)	\$6.40* (1.00)	Amdek Video 300G Composite Green	\$110.00* (3.00)
Dynamic Discounts Available!		Amdek Video 300A Composite Amber	120.00* (3.00)
64K Dynamic Ram Chips (Each)	60* (1.00)	Amdek Video 310A IBM Type Amber	130.00* (3.00)
256K Dynamic Ram Chips (Each)	3.00* (1.00)	Amdek Color 300-Composite	215.00* (4.64)
128K IBM AT Pluggyback Chips (Each)	5.00* (1.00)	Amdek Color 600-High Res RGB	365.00* (7.89)
		Amdek Color 700-Ultra High Res	455.00* (9.83)
		Amdek Color 710-1700 w/Non Glare Long Phosphor	475.99* (10.48)

EXTERNAL MODEMS

Anchor Signalman Express	\$205.00* (5.00)	Princeton HK-12 RGB Monitor	CALL
Hayes Smartmodem 300	125.00* (5.00)	Princeton MAX-12e	CALL
Hayes Smartmodem 1200B Alone	265.00* (5.00)	Quadram Quadchrome II New! 640X200 RGB w/4 Screens/Black Phosphor Mask/IBM Case	370.00* (8.21)
Hayes Smartmodem 2400	535.00* (5.00)	Samsung 12" TTL IBM Type Amber	85.00* (5.00)
Prometheus Promodem 1200	276.00* (6.00)	A great looking/performing monochrome from the manufacturer of IBM's own color monitor	
External 100% Hayes Compatible		Taxan 440 Super Hi Res RGB	495.00* (10.69)
U.S. Robotics Courier 2400BPS Modem	450.00* (5.00)	Zenith ZVM 12.1 Green High res	76.00* (2.50)
U.S. Robotics Passport	199.00* (4.00)		

LOWEST PRICE 1200BPS Modem!

MONITORS

Wholesale		Wholesale	
Amdek Video 300G Composite Green	\$110.00* (3.00)	Princeton HK-12 RGB Monitor	CALL
Amdek Video 300A Composite Amber	120.00* (3.00)	Princeton MAX-12e	CALL
Amdek Video 310A IBM Type Amber	130.00* (3.00)	Quadram Quadchrome II New! 640X200 RGB w/4 Screens/Black Phosphor Mask/IBM Case	370.00* (8.21)
Amdek Color 300-Composite	215.00* (4.64)	Samsung 12" TTL IBM Type Amber	85.00* (5.00)
Amdek Color 600-High Res RGB	365.00* (7.89)	A great looking/performing monochrome from the manufacturer of IBM's own color monitor	
Amdek Color 700-Ultra High Res	455.00* (9.83)	Taxan 440 Super Hi Res RGB	495.00* (10.69)
Amdek Color 710-1700 w/Non Glare Long Phosphor	475.99* (10.48)	Zenith ZVM 12.1 Green High res	76.00* (2.50)

TERMS & CONDITIONS

*PC Network-Members pay just 8% above the wholesale price, plus shipping. All prices reflect a 3% cash discount. Minimum shipping \$2.50 per order. International orders call for shipping & handling charges. Personal checks please allow 10 working days to clear.

†RENT BEFORE YOU BUY-Members are eligible to join the NETWORK'S Business and Game software Rental Libraries and evaluate products for a full 14 (Regular) or 30 (VIP) days to see if it meets your needs. AND THE NETWORK'S rental charges are far less than other software rental services-Just 20% OF THE MEMBER WHOLESALÉ PRICE. Rental titles available in IBM/Apple/Mac and CP/M Formats. Hardware prices highlighted by * reflect recent major price reductions.

GAMES & EDUCATIONAL SOFTWARE FOR YOUR IBM

(Please add \$1 shipping and handling for each title ordered from below.)

Wholesale		Wholesale	
ATI Intro to PC DOS Vol 1 & II	\$23.00*	Infocom Deadline or Suspended	\$24.00*
ATI Intro to BASIC	23.00*	Microsoft Flight Simulator	27.00*
Bluebus Chess: Your Toughest Opponent!	34.00*	Mouse Systems PC Paint Turn your PC	59.95*
Bluechip Millionaire/Oli Baron or Tycoon	28.25*	into A Color Macintosh!	
Broderbund Load Runner	19.75*	Scarborough MasterType	27.00*
CBS Goren Bridge Made Easy	45.00*	Sierra On-Line King's Quest	27.00*
CBS Mastering the SAT	81.00*	Sierra On-Line Crossfire	18.00*
CDEX Training for Word Star	37.25*	Sublogic Night Mission Pinball	20.00*
Comprehensive Intro to Personal Computing	32.00*	Spinmaker Alphabet Zoo, Kinder Comp, Story Machine, Face Maker, Hey Diddle Diddle, Rhymes & Riddles	15.37*
Davidson Math Blaster Wora Attack!	26.50*	Spinmaker Delta Drawing	24.97*
Davidson Speed Reader II	36.50*	Spinmaker Most Amazing Thing	20.77*
Hayden Sargon III	25.75*	Spinmaker Most Amazing Thing	20.77*
Individual Professor DOS	32.50*	Virtual Combinatics Micro Cookbook	21.00*
Individual The Instructor	24.50*		
Infocom Zork for Windows	20.00*		

BUSINESS SOFTWARE FOR YOUR IBM

(Please add \$2.50 shipping and handling for each title ordered from below.)

Ashton-Tate DBase III	\$365.00*	Micro Pro Wordstar 2000	\$262.00*
Ashton-Tate Framework	365.00*	MicroRM Finance 5000	200.00*
Borland Turbo Pascal	25.75*	Microsoft C Compiler	320.00*
Borland Sidekick (Protected)	26.00*	Microsoft Word-Latest Version 2.0	205.00*
Borland Superkey	34.75*	Microsoft Multiplan	85.00*
BPI GL, A-R or A/P	305.00*	Microsoft Word	107.00*
BPI Aura	265.00*	Monogram Dollars & Sense	95.00*
BPI Personal Accounting	48.00*	Multimate Multimate (Latest Version)	190.00*
Central Point Copy II PC	20.00*	Norton Norton Utilities 3.0	46.00*
Conceptual Instruments Desk Organizer	157.00*	Oasis The Word Plus	75.00*
Digital Research DR Logo	75.00*	Open Systems P/D Sales A/R INV G/L A/P Team Mgt	ea. 310.00*
Digital Research Corp Desktop	25.00*	Power Base Power Base	197.00*
Digital Research Gem Draw	73.00*	Real World G/L A/R A/P or OE/INV	ea. 325.00*
Enertronics Energraphics with Plotter Option	190.00*	Resoft Prokey Version 3	70.00*
FunSoft Software Showways	34.00*	Ryan Macintosh RM COBOL (Dev. System)	520.00*
Harvard Harvard Project Manager	175.00*	Sarnna Sarnna III Word Processor	227.00*
Harvard Total Project Manager	225.00*	Sarnna Word II	320.00*
Hayes Smartwriter II-New VT100 Emulator	68.00*	Salesite Software Word Perfect	190.00*
Human Edge The Management Edge	137.50*	Softcraft Fancy Fonts	125.00*
Human Edge The Sales Edge	110.00*	Software Arts TK Solver	60.00*
Human Edge Mind Prober	26.50*	Software Publishing PFS File Write, Graph	200.00*
Lifetime Unkissable Delta	135.00*	Software Publishing PFS Report	64.00*
Lotus Development Lotus 1-2-3	265.00*	Sonnet Superscript III	189.00*
MDBS Knowledgebase	225.00*	Xanero Ability	252.50*
Micro Pro Wordstar 2000	219.00*		

HARDWARE FOR YOUR IBM

(Please add shipping and handling charges found in italics next to price.)

DISK DRIVES		MODEMS	
Omega Bermuda Box Dual 10MB Drives	\$2,200.00* (47.52)	AST Reach/Short Slot 1200 Baud Internal Modem	\$345.00* (2.50)
Maynard WS-1 10MB Internal Hard Disk	730.00* (15.77)	Hayes Smartmodem 1200B with New Smartcom II/VT100 Emulator	317.00* (2.50)
Maynard WS-2 same as WS-1 but with Sandstar/Floppy Controller (uses 1 slot)	930.00* (20.30)	Hayes Smartmodem 1200B Alone	265.00* (2.50)
PC Network 10MB INTERNAL Height Autoload Drive New lower price	\$30.00* (7.13)	Prometheus Promodem II 1200B Internal Quadram Quadromem II 1200B Baud Hard w/Crossstalk XV	225.00* (2.50)
PC Network 10MB External Hard Drive by Shugart or Tandem	495.00* (10.69)		
PC Network 10MB Backup Same unit used in Compaq's DeskPro	495.00* (10.69)		
PC Network Half Height DS/DD Drives	58.00* (1.27)		
Tandem 100-2 Full Height DS/DD Drives	93.00* (2.20)		
Talgrissa 25MB External Hard Disk with 60MB Tape Backup	2,375.00* (51.30)		
Teac 1.7MB Half Height DS/DD Drive for AT	90.00* (1.94)		
Teac 1.7MB Half Height DS/DD Drive for AT	110.00* (2.40)		

MULTIFUNCTION CARDS

Apparat AT Ram Expansion card	\$210.00* (2.50)	Hercules Color Card w/Parallel/Port	\$142.00* (2.50)
AST Six-Pack Plus With 54K	199.00* (2.50)	Hercules Monochrome Graphics Card	263.00* (2.50)
AST i10 Plus II	120.00* (2.50)	Paradise Modular Graphics Card	235.00* (2.50)
AST Advantage for AT	355.00* (2.50)	PC Network Hercules Mono Card Clone 100% Hercules Compatible!	105.00* (2.50)
Everex Magic Card-NTK	160.00* (2.50)	PC Network Color Card	80.00* (2.50)
PC Network 512K Memory Board w/OK	69.00* (2.50)	Persyst Rib Card Ultra High Res. Color	299.00* (2.50)
PC Network Six-Pack Clone w/OK Full Six-Pack Features-Game Port Standard Direct Input from Taiwan at a Fabulous price!	69.00* (2.50)	STB Grapha Plus II	199.00* (2.50)
1 year Warranty-Money back Guarantee		Simultaneous Mono Graphics & Color!	
PC Network i10 Plus II Clone Ser/Par/Genie/Clock standard	69.00* (2.50)		
Quadram Improved Quadram w/OK	170.00* (2.50)		
Tecmar Captain Multifunction Card w/OK	146.00* (2.50)		

VIDEO CARDS

Hercules Color Card w/Parallel/Port	\$142.00* (2.50)		
Hercules Monochrome Graphics Card	263.00* (2.50)		
Paradise Modular Graphics Card	235.00* (2.50)		
PC Network Hercules Mono Card Clone 100% Hercules Compatible!	105.00* (2.50)		
PC Network Color Card	80.00* (2.50)		
Persyst Rib Card Ultra High Res. Color	299.00* (2.50)		
STB Grapha Plus II	199.00* (2.50)		

ACCESSORIES

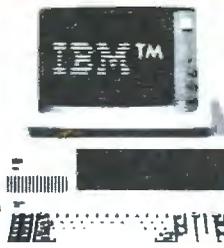
Brand Name DS/DD Disks	\$8.95* (11.00)		
Guaranteed for Life! No Genie's!			
DS/DD Bulk Reel Special	79* ea.		
Packaged in 54 with sleeves and labels			
Guaranteed for Life!			
PC Network Replacement 130 Watt	82.00* (2.70)		
IBM PC Power Supply-Gives your PC the same Capacity as an XT Good for add in Tape Drives (without need for a playback unit) and large capacity disk drives.			
SM-AT PC Document Keyboard Templates	9.99* (11.00)		
1/2 inch DBase/Multimate and others (Each)			

COMPLETE SYSTEMS

Wholesale		Wholesale	
Apple Macintosh Base System	CALL	COMPAQ Hard Disk Portable 10MB Hard Disk/Floppy/256K	\$2,235.00* (48.28)
AT&T 6300 PC CPU2	\$1,595.00* (14.02)	IBM PC Base System 2SDDD/FDC/256K	1,495.00* (32.55)
128K-2 Floppy 1 Serial/1 Parallel		IBM PC Professional Hard Disk	1,749.00* (37.78)
AT&T 7300 Univ PC	3,699.00* (19.90)	IBM PC/AT Base System-2 1MB Floppy/256K	2,795.00* (60.37)
10MB Hard Disk/1 Floppy/512K			

IBM PC BASE SYSTEM

IBM PC w/256K
 Floppy Drive Controller
 2 Double Sided Double
 Density Disk Drives
 Mix and Match with
 your favorite Monitor
 and Printer!

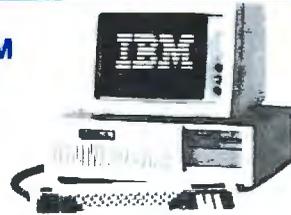


\$1,495.02*

IBM PC HARD DISK SYSTEM

IBM PC w/256K
 Floppy Drive Controller
 1 Double Sided Double
 Density Disk Drive
 Half Height 10MB
 Disk Subsystem

\$1,749.00*



IBM PC/AT SYSTEM

Available NOW!!
 Call for the
 Configuration
 of your choice

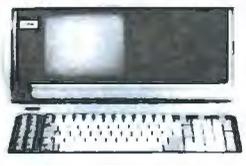
CALL FOR
 LATEST IBM
 ANNOUNCEMENTS

CUSTOM
 CONFIGURATIONS
 WELCOME

COMPAQ™

PORTABLE HARD DISK SYSTEM

w256K/1 Floppy/10MB Hard Disk



\$2,235.00* w/10MB
\$2,369.00* w/20MB

DESKPRO SYSTEM WITH TAPE BACKUP

640K CPU/1 Floppy/10MB Hard Disk
 10MB Tape Drive/Monitor

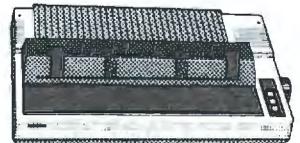


\$2,951.94* w/10MB
\$3,151.94* w/20MB

EPSON® PRINTERS

Unbelievable Low Prices!!!

NEW MODELS
 NOW AVAILABLE!!



LX-80 80COL/100CPS . . . \$199.00*
 FX-85 80COL/160CPS . . . 299.00*
 FX-185 132COL/160CPS . . . 429.00*
 LQ-1500 132COL/200CPS . . . 799.00*

APPLE IIc

APPLE IIe

MACINTOSH SYSTEMS

NEW HOLIDAY HOURS
 M-F 7:30 AM-9:00 PM CST
 SAT 9:00 AM-7:00 PM CST



CALL TOLL FREE
1-800-621-S-A-V-E

In Illinois call (312) 280-0002
 Your Membership Validation Number B3Y5

You can validate your membership number and, if you wish, place your first money-saving order over the phone by using your VISA, MASTERCARD or AMERICAN EXPRESS. Our knowledgeable service consultants are on duty Mon.-Fri 7:30 AM to 9 PM, SAT. 9 AM to 7 PM CST.

PERSONAL COMPUTER NETWORK
 320 West Ohio
 Chicago, Illinois 60610



Call now...Join the PC NETWORK and start saving today!

64K IBM PC MEMORY EXPANSION KITS

Quantity Discounts Available.
 Guaranteed for Life!



Quantity of 100 Sets
\$3.96* per set

Set of 9 Chips
\$5.40*

1/2 HEIGHT DS/DD DISK DRIVES



The Network buys direct and makes fantastic deals with manufacturers like Tandon/CDC/Shugart/Gume/TEAC/Hi-Tech and others to bring you fantastic prices on Name Brand drives for your PC/AT/XT/1 or Compatible

\$59.00*

Quantity Discounts Available

INTERNAL PC HARD DISK

Low Power/Automatic Boot Works on standard PCs and Compatibles. Includes drive/controller/cables/mounting hardware and instructions



Full one year warranty!

10MB
\$330.00*

20MB
\$420.00*

Quantity Discounts Available

OMEGA®

TALLGRASS®
 TG-5025

Bernoulli Box
 Dual 10MB Drives

\$2,200.00*

25MB Hard Disk with
 60MB Tape Backup

\$2,375.00*

BRAND NAME DISKETTES Guaranteed for Life!

Quantity Discounts Available.

SS/DD For APPLE II & III Box of 10. **\$7.95***

DS/DD Box of 10. **8.95***

MACINTOSH Box of 10 Includes free Flip & File Case. **21.95***

BULK DISK SPECIAL Guaranteed for Life!

DS/DD. Each .79*

SS/DD. Each .69*

Packaged in 50 Includes Sleeves & Labels

INFOCOM®



\$20.00*



\$20.00*



\$22.00*



\$22.00*

Available for IBM, APPLE & MACINTOSH

Lotus™
\$265.00*

WordPerfect
 or
 MultiMate™
 Each Only
\$199.00*

MICROSOFT
 Flight Simulator
 The World's most realistic computer game with life-like graphics and 100% realistic simulation.
\$27.00*

GATO
 APPLE & IBM
 Captain Your own WWII submarine
 Great graphics!

\$18.00*

*Members pay 8% above this wholesale price plus shipping.

PRICING MADNESS

Once again, as Federal Express picks up our ad at the very last millisecond before this issue's advertising deadline, ***here we sit with dozens of price reductions and new product announcements which have arrived too late for us to let you know.***

Why, our ad manager asks, do we always go through a last minute price update frenzy, just seconds before our ad is due at the publisher, when we know that despite our heroic effort, ***many of these products will cost even less by the time you read this ad.***

How, she asks, can we get a crystal ball to forecast what fantastic promotions and specials our suppliers are going to offer from now to the date ***this ad gets to the newsstand over two months from today?***

Well, we decided that she has a good point. While we'll still keep getting our grey hairs and ulcers from last minute revisions, we will start publishing this notice and ask our readers to make a simple check. Look at any four back issues of this magazine (***yes we're in every one***) and track the prices on the most popular products. ***You will see that many drop with every issue.*** Most of these price changes were instituted well before the issue was printed and ***our members always pay the lower price.*** This should prove that this notice is much more than hype.

Given the current madness in the PC industry with its spur of the moment pricing and instant product introductions, ***you will find it always pays to call for our latest prices.*** You will be glad you did.



BUSINESS REPLY CARD

First Class

Permit No. 14823

Chicago, IL

POSTAGE WILL BE PAID BY ADDRESSEE

PC NETWORK
320 West Ohio
Chicago, Illinois 60610

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



PC NETWORK GOES TO THE

ORIENT DIRECT

How do you suppose most manufacturers of personal computer products get started?

They go to the Orient... taking either their designs or simply their ideas to one or more of the major electronics manufacturing concerns, getting bids for making these devices under contract to the creators. Multifunction Cards, Video Cards, Disk Controllers, Modems and I/O Boards all begin their life in this way.

This relationship between the manufacturing capabilities of the East and the design and marketing talents of the U.S. has resulted in the incredible selection of enhancement products for the IBM and Apple computer markets.

Well, with 100,000 members and growing strong, The Network sent its buyers east to visit some of these manufacturing

concerns to check out the feasibility of directly importing these products in the necessary volumes to *save our members money!* What they came back with was astounding.

Now, we always figured that there were some pretty substantial markups as these boards came into the country and got fancy boxes and marketing promotions under any one of a number of well known brand names in the peripheral add-on markets *but we had no idea they were so large!*

To prove our point, consider what they brought back. Each board is constructed to the same precise specifications, on exactly the same machinery as their name-brand duplicates. The difference? *As a Network member, you pay only 8% over our unusually low wholesale price... and you get our full 1 year warranty!*

Hercules' Smarter Brother

A Monochrome Graphics Card with Printer Port... 100% compatible with Hercules product...



Wholesale price
\$99.00*

Graphics Printer Interface

If all you want is a printer, this is the card for you. Supports all text and graphics printer features.

Wholesale price... **\$29.00***



The "9" Pack Plus

Multifunction like the AST "6" Pack... up to 384Kb of expansion memory, 1 serial, 1 parallel, and 1 game port, a clock/calendar and 3 software packages standard.



With 0 K...
\$89.00*
Wholesale

IBM Color Card

100% compatible with the IBM offering. The wholesale price?

A mere **\$69.00***



The I/O Double Plus

If you don't need memory—just ports, identical I/O board to the AST I/O + with 2 serial, (1 standard) 1 parallel, 1 game port and clock/calendar with software.

Wholesale price
\$69.00*



512 K Memory

The least expensive way to add memory to your current system. With 0 K installed.

Wholesale priced at only...
\$69.00*



Watch our Network ONLINE listings for new products in this ORIENT DIRECT line for the Apple II and IBM AT computer families.

*PC NETWORK Members pay just 8% above this wholesale price, plus shipping. All prices reflect a 3% cash discount. Minimum shipping \$2.50 per order. International orders call for shipping & handling charges. Personal checks, please allow 10 working days to clear.

CALL TOLL-FREE 1-800-621-SAVE In Illinois Call (312) 280-0002

PC NETWORK

GET THE NETWORK ADVANTAGE!!!

F·I·X·E·S A·N·D U·P·D·A·T·E·S

BYTE'S BUGS

RAMDISC Corrections

A "What's New" writeup supplied an incorrect price for Beck-Tech's RAMDISC software. (See July, page 408.) The RAMDISC software alone is \$49.95. With your purchase of a MacMegabytes memory-expansion board, Beck-Tech provides you

with the RAMDISC package. A MacMegabytes memory-expansion board gives your 128K- or 512K-byte Macintosh more than 1 megabyte of internal memory.

In addition, RAMDISC does not have a slide-show utility. However, a demon-

stration of Beck-Tech's animation software package, MacMovie, is provided with each disk.

Beck-Tech Company is headquartered at 41 Tunnel Rd., Berkeley, CA 94705, (415) 548-4054. We apologize for the error.

BYTE'S BITS

Writing for BYTE Available

Interested in writing for BYTE but don't know how? The answers to your questions lie in *Writing for BYTE*, a free four-page brochure that addresses the questions most often asked by potential BYTE authors.

Writing for BYTE explains the kinds of articles that are most applauded by BYTE readers, and it tells you what you need to know about acceptance and publication fees. The brochure has tips on what to expect from the editing process, and your

rights as an author are spelled out.

For your copy of *Writing for BYTE*, send a self-addressed stamped business-size envelope to BYTE Author's Guide, BYTE/McGraw-Hill, POB 372, Hancock, NH 03449.

New Number for BYTEnet Listings

BYTEnet Listings has a new telephone number. Call (617) 861-9764. When you receive a carrier tone, enter three or four carriage returns so that our software can determine your operating parameters. Op-

timal parameters are 8 bits, 1 stop bit, no parity, full duplex, and either 300 or 1200 bps. You can download programs with the following protocols: ASCII, XMODEM, XMODEM with error checking, TeleLink,

TeleLink with error checking, MiniTel, MODEM7, and MODEM7 with error checking. BYTEnet Listings does not support 2400-bps transmissions at the present time.

BYTEnet Listings Goes On Line in the United Kingdom

BYTE readers in the United Kingdom can now download the programs mentioned in BYTE from the Compulink Fido bulletin-board system in Woking Ferry, Surrey, England.

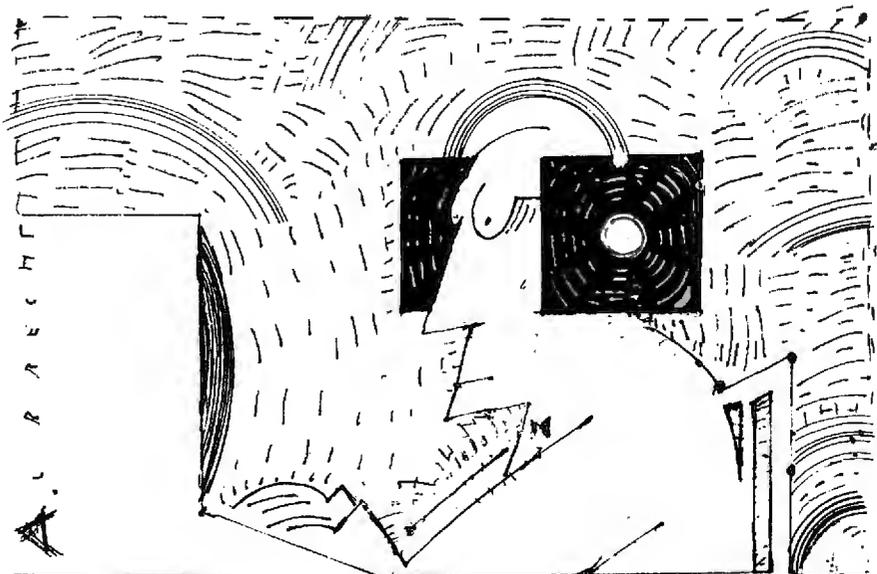
Compulink is a public-access bulletin-board system featuring a variety of public-domain software. It is independent of BYTE magazine, and BYTE listings are provided through the volunteer services of Compulink.

The BYTEnet Listings library comprises more than 140 programs from the September 1984 BYTE to the issue you're reading now. Bug reports, program enhancements, and all questions related to the listings in BYTE magazine should be directed to BYTE's offices in the United States and not to Compulink. The proper address for inquiries about BYTEnet Listings is BYTE/McGraw-Hill, POB 372, Hancock, NH 03449, U.S.A., Attn: BYTEnet Listings.

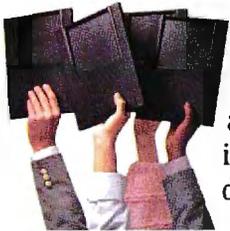
Frank Thornley, the Compulink sysop,

reports that the system is up and running 24 hours a day at 300, 1200, and 2400

bps. CCITT protocols are the norm. In the United Kingdom, call 04867 6535.



DATA INDEPENDENCE MUCH SMALLER



The Age of Data Independence™ dawned about two years ago when IOMEGA introduced a revolutionary mass storage device called The Bernoulli Box®. Featuring a unique technology that uses rugged, removable 10-megabyte cartridges, it freed companies to work more productively and economically—and was soon recognized as the decade's biggest step forward in business data storage.

Today, IOMEGA has taken another giant step. With the addition of the compact 20-megabyte-per-cartridge Bernoulli Boxes, in single- and dual-drive versions, the Data Independence family gets simultaneously bigger and smaller. The new Bernoulli Boxes double on-line capacity to up to 40 megabytes and cut the space required to carry and store data cartridges. They also boast a footprint that is literally half that of the previous version, freeing just that much more valuable desk space.

But what makes the new Bernoulli Box so exciting are the same features that made it the new standard in data management to begin with.



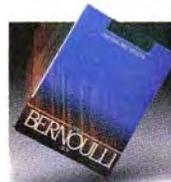
TRANSPORTABILITY.

The Bernoulli Box cartridges are completely interchangeable. You're free to take the cartridge from one and use it in another with complete confidence. Take it across the hall or mail it across the continent.



EXPANDABILITY.

Free yourself from the limitations of system capacity. If you need more, you expand by buying slim, inexpensive cartridges, not bulky and costly hardware.



RELIABILITY.

Incredible resistance to shock and vibration combined with a rugged cartridge format frees you from concerns about equipment failure, head crash, or data loss.

THE BERNOULLI BOX

™ : MORE GIANT STEPS. ER FOOTPRINTS.



PERFORMANCE.

The amazing speed of The Bernoulli Box—with access times and transfer rates that rival and often surpass the best hard disk drives—translates into the best freedom of all: the freedom of time. And now The Bernoulli Box offers users the option of booting from The Bernoulli Box cartridge with any of the IBM PC or compatible computers.



SECURITY.

Free your sensitive files, such as payroll and personnel, from unauthorized scrutiny and free yourself from unnecessary anxiety. Put them on a Bernoulli Box cartridge, and put the cartridge where you *know* it will be safe.



Check out the latest Bernoulli Box family members today. More giant steps towards the complete data independence of businesses using the IBM PC, XT, AT, most compatibles, and the Macintosh*™ Giant steps with very small footprints.

For the dealer nearest you, call 1-800-556-1234, ext. 215. In California, call 1-800-441-2345, ext. 215.



*The Bernoulli Box for Macintosh is available in a 5-megabyte single-drive version and a 20-megabyte dual-drive version for AppleTalk.™

The Bernoulli Box is a registered trademark of IOMEGA Corporation. Data Independence is a trademark of IOMEGA Corporation. Macintosh is a trademark licensed to Apple Computer, Inc. AppleTalk is a trademark of Apple Computer, Inc.

THE BERNOULLI BOX®

IOMEGA®

IOMEGA Corporation
1821 West 4000 South
Roy, Utah 84067

Inquiry 199

We've Earned The Right To Be #1 By Being First So Often

When it comes to being FIRST with technology-leading products **Advanced Digital** wears its #1 button with pride. We were **FIRST** to introduce an 8-Bit, single board S-100 computer... We were **FIRST** to introduce a 6MHz, 128KByte single board computer... We were **FIRST** to introduce a 6MHz, 128KByte Slave Processor board. Our record of **FIRSTS** continues with...

- The introduction of **MULTI SLAVE** - a 3 USER, 8MHz SLAVE card for the S-100 Bus systems running Turbo-Dos™ or NETWORK/OS.™
- The introduction of **HDC-2001**, the all new hard disk controller for the S-100 BUS.
- The introduction of **SUPER 16**, a 16-Bit, S-100 Slave card for use with Turbo-Dos or NETWORK O/S.
- The introduction of our new **SUPER 186** - the **FIRST** 16-Bit, single board S-100 computer that performs at twice the speed of older technologies. Loaded with features such as on-board floppy disk controller and up to 1MByte of RAM, the SUPER 186 is designed to function as a bus Slave or Master. Advanced Digital's SUPER 186 permits you to take advantage of vast libraries of sophisticated applications software.

Again, we were #1 with...

- The introduction of **PC-SLAVE**, an IBM PC Multiuser card with 8088 (8MHz) CPU and 256-768K RAM on board.

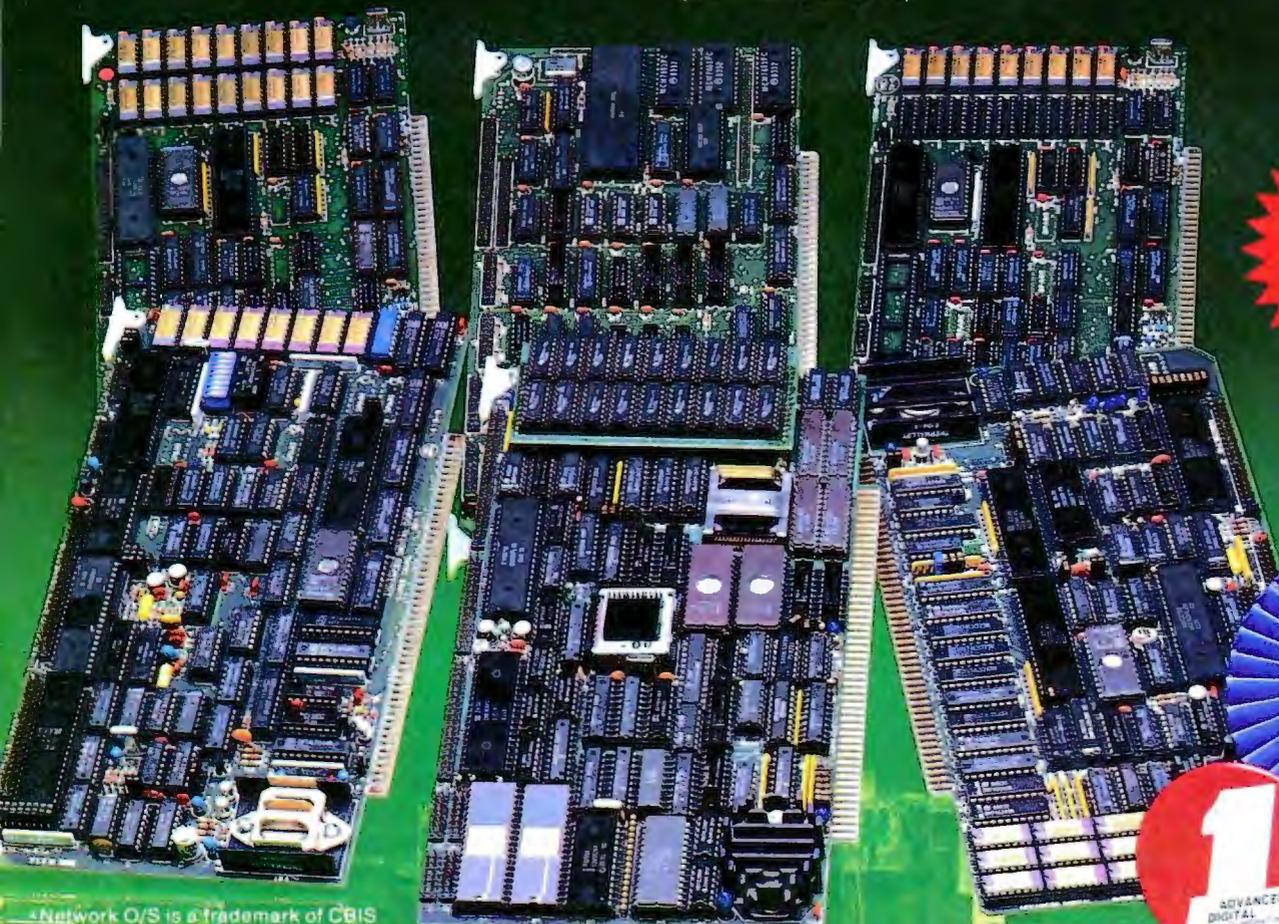


When it comes to selecting your S-100 boards, go with Advanced Digital - the recognized industry leader.

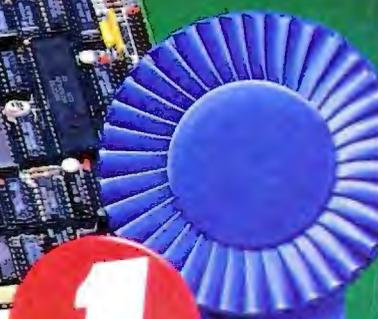
See your local computer dealer or contact Advanced Digital today for more information on the new PC-SLAVE, and the complete line of S-100 single board computers and multiuser systems.

ADVANCED DIGITAL CORPORATION *Leading the Microcomputer Technology*

Advanced Digital • 5432 Production Drive, Huntington Beach, CA 92649 • Tel. (714) 891-4004 • Telex 183210 ADVANCED HTBH
Advanced Digital U.K. Ltd. • 27 Princes St., Hanover Square • London W1R8NQ • United Kingdom • (01) 409-0077 • (01) 409-3351 • Telex 265840 FINEST
Toll Free (1-800) 251-1801
(Outside California)



SEE US AT
LAS VEGAS
COMDEX
'85



*Network O/S is a trademark of CBIS
*CP/M is a trademark of Digital Research
*TurboDOS is a trademark of Software 2000

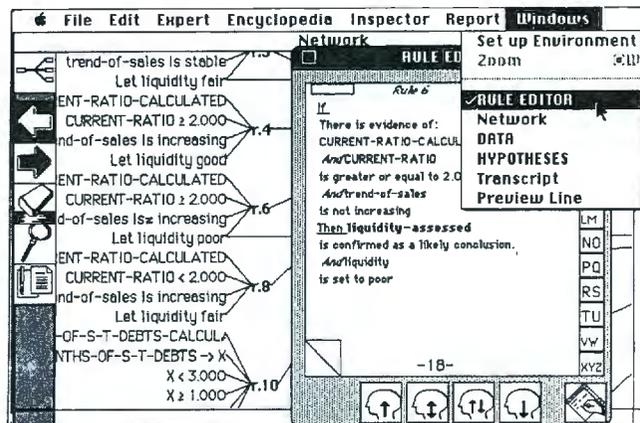
Three Expert-System Generators

Neuron Data's Nexpert is a software package that lets Macintosh users build rule-based expert systems. It conforms to the Macintosh user interface by employing multiple windows and a series of pull-down menus.

Nexpert uses an interpreted Knowledge Editor that consists of a Rule Editor, a Category Editor, and a Text Editor. Because it is interpreted, the system can rapidly integrate new or changed knowledge into the stored body of rules. You can link knowledge that Nexpert has stored to either text or graphics images.

The rule-editing screen has a form with spaces so that you can fill in the components of an IF...THEN rule. Pull-down menus note the options available at any given time. You can either type in a response or click on the option you would like to choose. If you would like to use a variable that has already been entered, you don't need to retype it; you can use the mouse to copy the entry instead. This reduces the chances of semantic or syntactic errors by cutting down the amount of typing necessary.

Once you enter rules, you can retrieve them through Nexpert's Encyclopedia or Network. The Encyclopedia catalogs the rules in alphabetic order, so you can find them by scrolling through an organized listing. The Network is an interactive



Sample screen from Neuron Data's Nexpert package for the Macintosh.



Sample screen from Radian's RuleMaster programming tool.

graphics representation of the knowledge base, much like a block diagram or flowchart. You can visually track which decisions lead to which conclusions and which rules played a role. Modifications made to the Network chart will be reflected in the structure of the expert system.

Nexpert's inference engine, Knowcess, combines backward- and forward-chaining

search strategies. You can specify the reasoning path the program is to follow or let it determine the most efficient strategy. You can change data, enter new data, or suggest a new hypothesis at any time. You can run "what if" simulations at the end of a session; cases can be recorded and rerun.

Nexpert requires a 512K-byte Macintosh and costs \$5000. Contact Neuron Data Inc., 444 High St., Palo Alto, CA 94301, (415) 321-4488. Inquiry 600.

RuleMaster from Radian Corporation is a programming tool for building and running expert systems on the IBM PC XT or AT and the AT&T UNIX PC. On the IBM machines, it requires either XENIX or DOS 3.0.

RuleMaster has two parts: RuleMaker is a facility for inducing rules from examples and Radial is a high-level language for expressing rules. You enter a series of examples in any order on a spreadsheet-like table, from which RuleMaker induces rules and generates Radial code.

You can write expert systems directly in the Radial language or edit Radial code into a program generated by RuleMaker. Radial is a structured language with only 14 keywords. It provides both forward and backward chaining as well as a combination of the two.

When responding to an inquiry, RuleMaker might ask for more information. Because the program organizes the rules in what it has determined to be the most efficient order, the first questions asked are those that yield the most information.

An explanation facility within RuleMaster lets you type WHY at any point to get either an explanation of a response or a justification of a question.

(continued)

For the IBM PC AT and the AT&T UNIX PC, Rule-Master costs \$5000. A less powerful subset of Rule-Master for the IBM PC XT is \$995. A four-day training session is available at Radian for an additional \$500. Contact Radian Corp., 8501 Mo-Pac Blvd., POB 9948, Austin, TX 78766, (512) 454-4797. **Inquiry 601.**

Aion Corporation is offering the Aion Development System/PC for constructing and using rule-based expert systems on the IBM PC, XT, and AT. The program uses a series of interactive editors and a multiwindow interface to provide a structured programming environment.

The first editor you encounter is the state editor, which works much like an outline processor. It lets you outline your problem, inserting and deleting headings as desired. You can expand or compress the outline or selected portions of it at any time.

When a portion of the outline is fully expanded, you can enter rules relating to it by using the rule editor. The rule-editing screen prompts you for relevant information about the rule. It also finds semantic and syntactic errors.

Although the outline helps you organize a problem, it has no bearing on the order in which the inference engine processes the rules. The program chooses its own path by using a combination of backward and forward chaining, unless you control it by using the step editor to declare sequences. You can also give rules entry conditions to ensure which rule is fired first.

An options window is

always available for querying the system. Through this window you can ask why a question is being asked, how a value was determined, or what the implications of an answer will be. You can also back up and change answers, and you can save sessions and begin them again later where you left off.

The Aion software allows direct access to DOS commands and includes graphics features for custom-designing screens.

The Aion Development System/PC requires an IBM PC, XT, AT, or compatible with 512K bytes of RAM, two disk drives (a hard disk is recommended), and PC-DOS 2.0 or higher. The execution system requires only 320K bytes of RAM. The development and execution software, documentation, and a two-day instruction course for two people costs \$7000. Contact Aion Corp., 101 University Ave., Palo Alto, CA 94301, (415) 328-9595. **Inquiry 602.**

—Brenda McLaughlin

FORTH Development System for Atari's 520ST

The Dragon Group's 4xFORTH is a series of 32-bit FORTH development systems for Atari's 520ST computer. The compiler also includes an assembler and editor and provides full support for multitasking, multi-user access, and file-system access, as well as for RAM disks, serial disks, and printer drivers. Two versions of the compiler are planned. Level 1, available since August at a price of \$99.95, supports Atari's A-line graphics; Level 2, planned for October release at \$149.95, provides support

for the GEM user interface. A \$75 accelerator package enhances the execution speed of code generated by either level compiler.

A complete Developer's System, which includes the Level 2 compiler, accelerator, targetter, and a royalty-free license to distribute programs written with 4xFORTH, is priced at \$500. Complete source code for 4xFORTH is also available for \$2500. You can upgrade any version of 4xFORTH to another by paying the retail price difference plus \$10.

Contact the Dragon Group, 148 Poca Fork Rd., Elkview, WV 25071, (304) 965-5517. **Inquiry 603.**

Ansa's Paradox Database

Ansa Software has introduced its first product, Paradox, a relational database-management program for the IBM PC and 100-percent compatibles. Paradox incorporates some algorithms from the field of artificial intelligence for speed and ease of use.

You pose questions to Paradox by typing an example of the information you want; this is the QBE (query by example) method. Then the two artificial-intelligence concepts—program synthesis and heuristic query optimization—enter the picture. Paradox writes a program (program synthesis) that will produce the answer in the least time (heuristic query optimization). You don't need to know anything

about the data's organization or about the best structure for algorithms.

PAL (Paradox Application Language) comes with the program. This language allows development of applications based on Paradox. Another Paradox function called "scripts" records the series of operations that you perform. You can then play back scripts so they can fulfill much of the use of macros.

Ansa has built Paradox around a rows-and-columns user interface that resembles that of Lotus 1-2-3. Paradox can import or export 1-2-3, Symphony, dBASE II, dBASE III, pfs:File, ASCII, or DIF files.

Paradox works with tables, forms, queries, and reports. Tables can contain up to 260 million characters consisting of 65,000 rows (records), 255 columns (fields), 4000 characters per row, and 255 characters per column. Forms display information about a single record and can be custom-designed. Any change in a form is immediately reflected in the related table. Queries are used to retrieve, select, or perform calculations on the information in tables. The report generator lets you print (to screen or paper) the results of Paradox questions and answers. It can work with both standard and custom-designed report formats.

Paradox requires an IBM or compatible, two floppy-disk drives or one hard disk and one floppy disk, 512K bytes of RAM, and MS-DOS 2.0 or above. Its suggested list price is \$695.

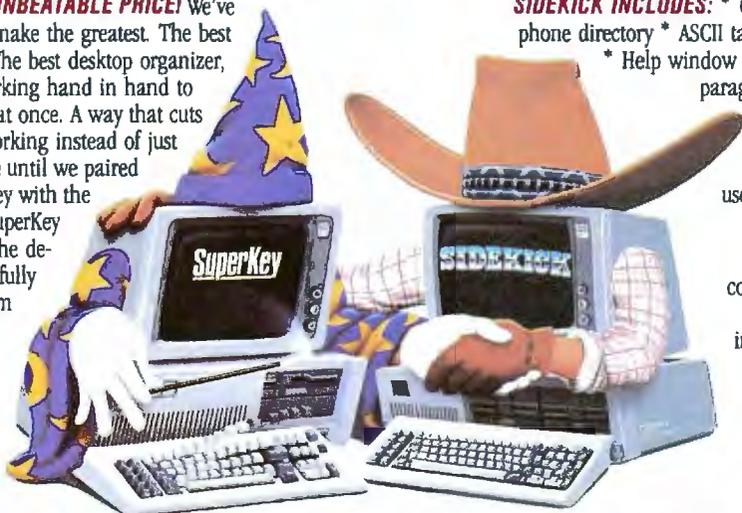
Contact Ansa Software, 1301 Shoreway Rd., Belmont, CA 94022, (415) 595-4469. **Inquiry 604.**

(continued)

Borland's SuperKey And SideKick Work So Well Together, You'll Hardly Work At All.

AN UNBEATABLE TEAM AT AN UNBEATABLE PRICE! We've teamed the best with the best to make the greatest. The best keyboard enhancer, SuperKey®. The best desktop organizer, SideKick®. The dynamic duo working hand in hand to let you do many different things at once. A way that cuts down the keystrokes, so you're working instead of just typing. A way that wasn't possible until we paired the electronic wizardry of SuperKey with the practical efficiency of SideKick. SuperKey brings the magic. SideKick does the details. The "S-Team" works beautifully together because we designed them that way.

GET SUPERKEY AND SIDEKICK TODAY and you'll have an unbeatable team at an unbeatable price — and a \$15 rebate back in the mail.



SIDEKICK INCLUDES: * Calculator * Notepad * Auto dialer & phone directory * ASCII table * Perpetual calendar & datebook * Help window * Full-screen editor with word-wrap, paragraph editing and much much more.

(Chances are that once you have SuperKey and SideKick working together for you, you'll never need to use a word-processing program again).

SUPERKEY INCLUDES:

* Encryption to keep confidential files confidential * Programmable keys that let you turn a thousand keystrokes into one * Keyboard lock * Automatic turn-off of your screen after a pre-set time so the expensive phosphorus in your monitor's screen isn't etched or ruined * Secret Password protection and more.

IF YOU USE SIDEKICK, YOU NEED SUPERKEY. BECAUSE SUPERKEY AND SIDEKICK CAN MAKE YOUR DAY GO SOMETHING LIKE THIS:

8:00 am. You got to work on time, despite the 44-mph turkey ahead of you in the fast lane. It's spreadsheet time. You hit one key. Lotus 1-2-3 (or whatever) is up and running. (One key, because SuperKey has recorded all the CD\123 <ENTER> 123<ENTER> <ENTER>/ F <ENTER> R <ENTER> SALES <ENTER> <PgDn>) foolishness and your one keystroke played all that back instantly. One keystroke instead of a minutet).

8:03 am. You're into the spreadsheet. Phone rings. You kick in SideKick's Notepad—without leaving your spreadsheet. You talk. You listen to Frank. You make notes that tell you that Frank is upping the numbers from yesterday's order and he needs a new price and delivery date. He wants a meeting. Fast, but when? You have SideKick fire up your Calendar. Time agreed and noted—in SideKick's NotePad. Conversation ends. Your spreadsheet is still there.

8:07 am. You're watching the spreadsheet but you're thinking about the new bid you have to figure out. So you have SideKick's Calculator pulled up on the screen—over a small piece of the spreadsheet—which doesn't go away.

8:08 am. SideKick is coming up with new numbers. SuperKey keeps the spreadsheet on a roll. Satisfied with the numbers, you have SideKick auto-dial Frank's number. Talk. Talk. Hang up.

8:09 am. Spreadsheet about done. You're watching it, but thinking about what Frank just said on the phone. He liked your numbers. He ordered. He said, "That was fast. We won't need that meeting. (SideKick cancels it from your Calendar). And he also said, "How did you get all that done so quickly?" And you said, "I've got a couple of new guys working for me."

IF YOU DON'T USE SIDEKICK YET, YOU GET THEM BOTH AND FOR A LIMITED TIME, A \$15.00 CASH-BACK! Because SuperKey and SideKick are so compatible, we let them move in together. Into their own blister-pack. With the \$15.00 cash-back coupon and the manuals. Which is what you get for \$139.90 instead of the usual \$154.90. You need to fill-in the cash-back coupon, along with your registration cards and proof of purchase, and mail it back. We'll rush you your \$15.00 rebate right away. Rebate offer ends March 31, 1986. (PS: You can still buy SuperKey and SideKick separately. SuperKey **\$69.95**. SideKick **\$84.95**. Not copy-protected.)

THE CRITIC'S CHOICE

"If you want the ultimate in sophistication, you won't find anything finer on the battlefield right now than Borland's SuperKey and SideKick combo." **LEON A. WORTMAN, InfoWorld**



4585 Scotts Valley Drive, Scotts Valley CA 95066
Phone (408) 438-8400 Telex 172373

SuperKey SIDEKICK

SuperKey and SideKick require DOS version 2.0 or later. Software for your IBM®PC, XT, AT, 3270, PCjr and true compatibles.

Available at better dealers nationwide. Call (800) 556-2283 for the dealer nearest you. To order by Credit Card call (800) 255-8008, CA (800) 742-1133.

Yes, I want the Best!

The SideKick-SuperKey Team	Quantity
Team \$154.90	
\$15 cash-back ONLY when purchased together Both come not copy protected	
SuperKey \$69.95	
SideKick \$84.95 (copy protected)	
SideKick \$84.95 (not copy-protected)	
Subtotal	
(CA res add 6% tax)	
Amount Enclosed	
Payment VISA MC BankDraft Check	
Credit Card Exp Date	
Card #	

**\$15.00
Cash
Back**

SuperKey only—Outside USA and Canada: Due to US Governmental restrictions of export of technology, purchase of SuperKey (without DES) can only be made through authorized distributors.

SideKick only: PCjr requires the not copy-protected version.

\$15 cash-back rebate upon receipt of signed license agreement and cash-back coupon. Your \$15 cash-back rebate includes tax when applicable. These prices include shipping to all U.S. cities. All foreign orders add \$10 per product ordered.

Name _____

Shipping Address _____

City _____ State _____ Zip _____

Telephone _____

COD's and Purchase Orders WILL NOT be accepted by Borland. California residents add 6% sales tax. Outside USA add \$10 and make payment by bank draft payable in US dollars drawn on a US bank.

Copyright 1985 Borland International BI-1014

SuperKey and SideKick are registered trademarks of Borland International, Inc. 1-2-3 is a trademark of Lotus Development Corp. IBM is a registered trademark of International Business Machines Corp.

Inquiry 44 for End-Users, Inquiry 45 for DEALERS ONLY.

Banker Board Gives Color Computer 256K Bytes

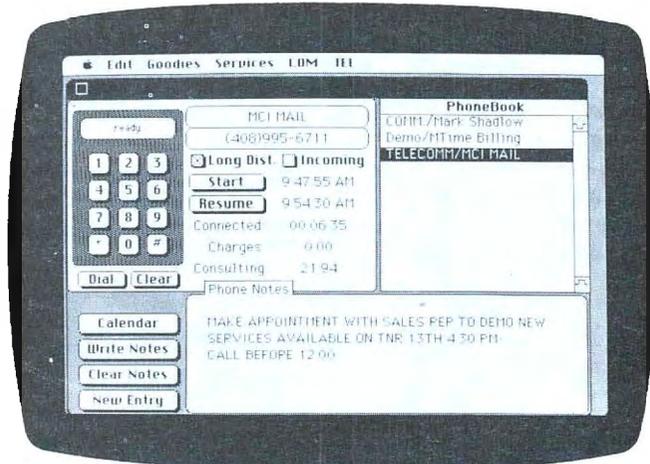
The Banker is a 256K-byte memory expansion for the TRS-80 Color Computer. Available in assembled or kit forms, the Banker board is installed in the Color Computer's SAM socket. In addition to installing the Banker board, you must replace the 64K-byte chips with eight 41256 (256K by 1-bit) chips and a jumper attached to pin 1 of each of the 41256 chips.

The Banker is designed to be compatible with other software and hardware, but you can add a switch to make it emulate the 64K-byte system. Included with the Banker board is software (on disk or cassette) to use the extra memory for a RAM disk, fast disk copying, and print spooling. Patches are also provided to access the extended memory from Telewriter-64, BASIC, and OS-9.

A number of versions of the Banker are available. A bare board with software and documentation is \$29.95; the same package with all necessary parts except memory is \$54.95. An assembled and tested board is \$69.95, or \$99.95 with the 256K bytes of RAM. A new \$24.95 SAM chip might also be necessary for some versions of the Color Computer; you might need an adapter to use the Banker with newer Korean-made Color Computers.

Contact J&R Electronics, POB 2572, Columbia, MD 21045, (301) 987-0578 or 788-6540.

Inquiry 605.



An example of SideKick running on the Macintosh.

SideKick for the Macintosh

Borland International has enhanced SideKick, its desktop organizer, to run on the Macintosh computer. Dubbed the Macintosh Office Manager, the package contains the usual SideKick accessories and features concurrent capabilities.

You can run your preferred word processor, spreadsheet, or graphics program in the background and bring up SideKick's notepad to jot a reminder. At the same time, you can use the program's telecommunications utility; a phone dialer logs your calls and tracks the length of the call in order to calculate the charges.

As a desktop organizer, SideKick for the Mac has a calendar, notepad, print spooler, and calculator. For information management, the package offers a filing system that maintains data in index-card fashion; all files are integrated with other accessories at all times. Background communications features include a phone log and area-code lookup. An add-on called PhoneLink provides automatic telephone dialing; it

plugs into the Mac's sound port.

The Macintosh version of SideKick runs on either the 128K- or 512K-byte machine. It works with Macmodem or Hayes-compatible modems. The package costs \$84.95. PhoneLink is \$45. Contact Borland International Inc., 4585 Scotts Valley Dr., Scotts Valley, CA 95066, (408) 438-8400. Inquiry 606.

Bubble-Memory Subsystem from Intel

Intel's BPK 70AZ-6C bubble-memory component kit with bias compensation provides an operating temperature range of -40 to +85° Celsius. The kit contains a 1-megabit bubble-memory component (the 7110AZ with an internally packaged Z-coil) and five ICs.

An important feature of the BPK 70AZ-6C kit is the Z-coil, which allows instantaneous erasure of the bubble memory's contents. Intel supplies you with complete

instructions and applications support.

The BPK 70AZ-6C is a modular building block for designing bubble-memory systems. In a complete system, a 7220 BMC (bubble-memory controller) interfaces the BPK 70AZ-6C subsystem to the host processor. One 7220 BMC can interface up to four 1-megabit subsystems to create a ½-megabyte system.

The BPK 70AZ-6C sells for \$955 in quantities of 100. Contact Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95051, (408) 987-8080. Inquiry 607.

Multitasking Operating System Toolbox for IBM PC

Three operating-system products from Wendin let IBM PC users add custom operating-system features to MS-DOS or emulate the UNIX and VMS mainframe operating systems.

The Operating System Toolbox provides a number of tools to enhance or rewrite MS-/PC-DOS. The Toolbox kernel traps and executes MS-DOS calls directly. Four process privilege levels exist, with low-privilege processes requesting services from the kernel or Record Management System. Multitasking capabilities and paged memory-management features are also included. The C source code and user-interface examples in C, Pascal, and assembly language are provided.

Wendin also announced two operating-system shells for MS-DOS developed using the Operating System Toolbox (which is not required to run them). PC-UNIX emulates many of the

(continued)

IT EXPECTS YOU TO GROW.

INTRODUCING THE NCR PC6.

If you don't want your business to stay small, why get a computer that does? No personal computer gives you more growing room than the new NCR PC6.

The PC6 is upgradable to 40 megabytes—room for 7,575 pages of charts, inventory lists or business letters.

As your business takes off, you'll take on more jobs, more responsibilities, and have less time for them. So the PC6 runs the estimated 10,000 IBM-compatible programs at 8MHz processing speed. (Almost *twice* as fast as the IBM PC/XT.) And for low speed programs, a switch downshifts the PC6 to 4.77 MHz.

When you're ready for multitasking, more memory, and new applications, so is the PC6.

There are four integral drive positions for hard and floppy disks plus a tape backup. Mix and match to suit your needs. And no PC offers more expansion slots (eight in all).

Expand your staff and the PC6 extends your authority. It's the perfect nucleus for a computer network.

And no matter how big you get, you'll never outgrow NCR's support. We're big in 120 countries, with 1,200 service support offices.

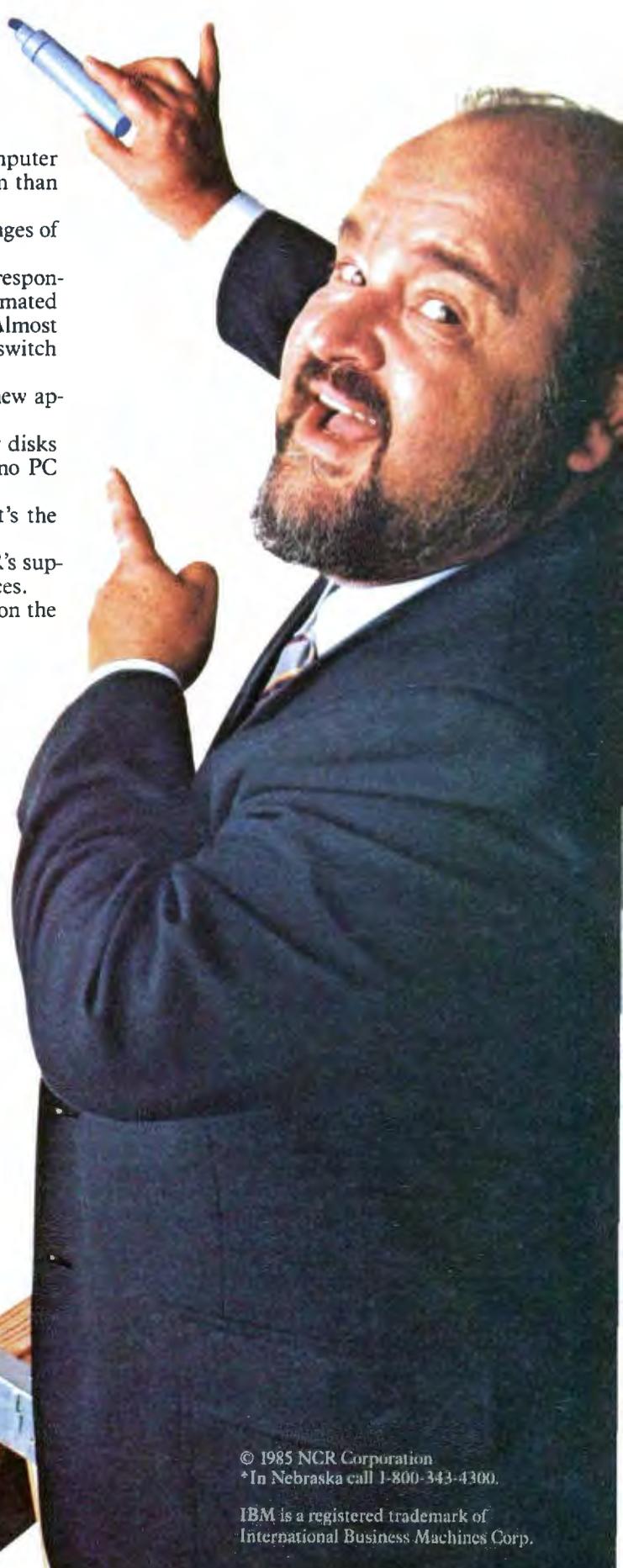
So if you're a small businessman with big ambitions, take on the new NCR PC6. It's as anxious to grow as you are.

For the nearest NCR dealer, call toll-free 1-800-544-3333*

A BETTER PERSONAL COMPUTER. IT'S EXACTLY WHAT YOU'D EXPECT FROM NCR.

The NCR logo consists of the letters 'N', 'C', and 'R' in white, each enclosed in a red square, which are then arranged horizontally.

Inquiry 278



© 1985 NCR Corporation
*In Nebraska call 1-800-343-4300.

IBM is a registered trademark of
International Business Machines Corp.

functions and utilities found in AT&T's UNIX operating system. PCUNIX uses about 20K bytes of RAM and its utilities take about 100K bytes on disk. PCVMS emulates Digital Equipment Corporation's VAX/VMS operating system.

The Operating System Toolbox is priced at \$99. PCUNIX and PCVMS are \$49 each. All three products include complete C source code. For more information, contact Wendin, Box 266, Cheney, WA 99004, (509) 235-8088. Inquiry 608.

Hewlett-Packard's LaserJet Plus

HP's LaserJet Plus is an enhanced version of the popular LaserJet laser printer. Enhancements include a new formatter board (that has more memory and new firmware) and a Centronics parallel interface option.

The improved formatting board gives the LaserJet Plus more flexibility in fonts. The printer can download fonts from 6 to 30 points, store up to 32 fonts, and employ up to 16 fonts per page. Cartridge fonts are still an option and the user can choose either portrait- or landscape-printing orientation.

The board contains 512K bytes of RAM that yields 395K bytes of user memory for improving the printer's graphics capability. The LaserJet could print a full page of 75-dpi graphics, a half-page at 150 dpi, and approximately a sixth-page at 300 dpi. The LaserJet Plus can print a full page of 150-dpi graphics and a half-



GP Industrial Electronics' XM512 EPROM Emulator.

page of 300-dpi graphics. The formatter board also allows downloadable forms and letterheads; rules, patterns, and shading for forms creation; and storage of up to 32 forms in the printer's memory.

The LaserJet Plus is priced at \$3995 and is 100 percent compatible with the LaserJet (both use HP's PCL printer command language). The formatter is available as an upgrade for LaserJet owners at a price of \$1495 until December 31, 1985, and for \$1995 after that. The parallel interface option is not available as an upgrade.

Contact Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303. Inquiry 609.

EPROM Emulator

GP Industrial Electronics has introduced the XM512 EPROM Emulator, which is capable of emulating all EPROMs in current use. It is intended to help microsystem designers and development engineers speed up the process of

combining software and hardware. Typical address access time for writing data to or reading it from the XM512 is 200 nanoseconds.

This emulator connects to the target system via supplied 24-/28-pin cables. An LED provides status and error information. If you wish, you can emulate 16-bit systems by connecting two units.

Pricing for the XM512 EPROM Emulator is set at £795. Contact GP Industrial Electronics Ltd., Unit E, Huxley Close, Newnham Industrial Estate, Plymouth PL7 4JN, England, tel: (752) 342961; Telex: 42513. Inquiry 610.

Fast 20-megabyte Backup Tape

Genoa Systems Corporation is offering the Galaxy Models 3120 (internal) and 3220 (external) 20-megabyte, half-height,

streaming, digital, cassette-tape drives. The 3120 and 3220 are fully IBM-compatible, run under DOS 2.x and 3.x using the standard QIC-02 interface, and require an IBM PC, XT, AT, or compatible with 256K bytes of RAM, one floppy-disk drive (to install the backup software), and two expansion-card slots. The drives transfer data at 86.3K bytes per second (at a 90-inches-per-second tape speed) and can back up a full 20-megabyte disk in 4.3 minutes.

The 3120 and 3220 use the same software as the Galaxy Model 3160 (internal) and 3260 (external) 60-megabyte, half-height, streaming-cartridge drives. The Genoa software has a multiple-window interface, menus, a batch option, and on-line help. A time/percentage bar chart shows the time left to execute a backup function.

The software offers full restoration or file-by-file backup. File-by-file can be organized by directory or subdirectory; by time, date, and last-modified files; or by file appending and exclusion. Reports of backup activity and directories are automatically saved and can be printed.

A DOS toggle lets you run other applications or DOS commands without terminating any backup program. You can also employ the drives as a system resource: They are compatible with 3Com, PCnet, and Novell networks.

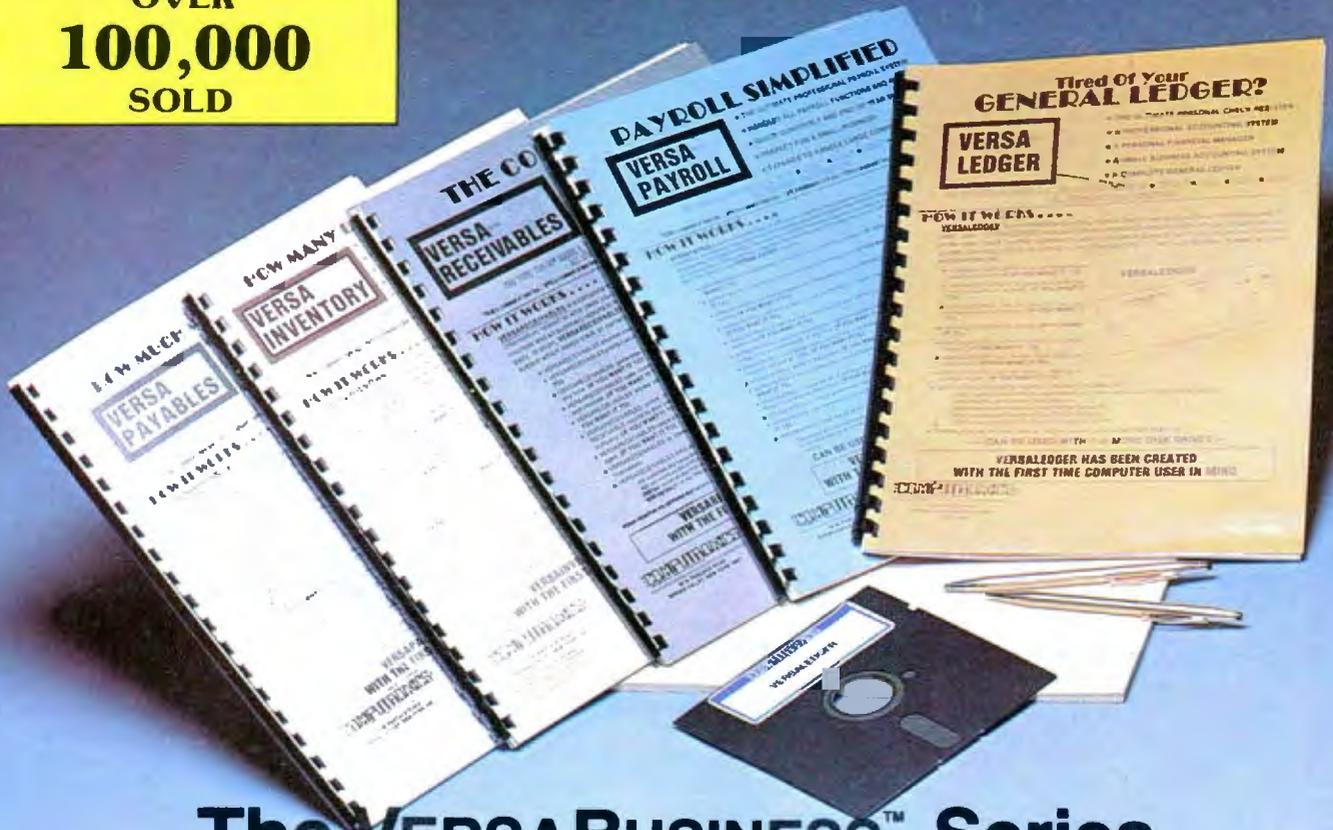
Suggested prices are \$995 for the Model 3120 and \$1145 for the Model 3220. Contact Genoa Systems Corp., 73 East Trimble Rd., San Jose, CA 95131, (408) 945-9720. Inquiry 611.

continued on page 452

Introducing the Most Powerful Business Software Ever!

FOR YOUR IBM • APPLE • MAC • TRS-80 • KAYPRO • COMMODORE • MSDOS OR CP/M COMPUTER*

OVER
100,000
SOLD



The VERSABUSINESS™ Series

Each VERSABUSINESS module can be purchased and used independently, or can be linked in any combination to form a complete, coordinated business system.

VERSARECEIVABLES™

\$99.95

VERSARECEIVABLES™ is a complete menu-driven accounts receivable, invoicing, and monthly statement-generating system. It keeps track of all information related to who owes you or your company money, and can provide automatic billing for past due accounts. VERSARECEIVABLES™ prints all necessary statements, invoices, and summary reports and can be linked with VERSALEDGER II™ and VERSAINVENTORY™.

VERSAPAYABLES™

\$99.95

VERSAPAYABLES™ is designed to keep track of current and aged payables, keeping you in touch with all information regarding how much money your company owes, and to whom. VERSAPAYABLES™ maintains a complete record on each vendor, prints checks, check registers, vouchers, transaction reports, aged payables reports, vendor reports, and more. With VERSAPAYABLES™, you can even let your computer automatically select which vouchers are to be paid.

VERSAPAYROLL™

\$99.95

VERSAPAYROLL™ is a powerful and sophisticated, but easy to use payroll system that keeps track of all government-required payroll information. Complete employee records are maintained, and all necessary payroll calculations are performed automatically, with totals displayed on screen for operator approval. A payroll can be run totally, automatically, or the operator can intervene to prevent a check from being printed, or to alter information on it. If desired, totals may be posted to the VERSALEDGER II™ system.

VERSAINVENTORY™

\$99.95

VERSAINVENTORY™ is a complete inventory control system that gives you instant access to data on any item. VERSAINVENTORY™ keeps track of all information related to what items are in stock, out of stock, on backorder, etc., stores sales and pricing data, alerts you when an item falls below a preset reorder point, and allows you to enter and print invoices directly or to link with the VERSARECEIVABLES™ system. VERSAINVENTORY™ prints all needed inventory listings, reports of items below reorder point, inventory value reports, period and year-to-date sales reports, price lists, inventory checklists, etc.

VERSALEDGER II™

\$149.95

VERSALEDGER II™ is a complete accounting system that grows as your business grows. VERSALEDGER II™ can be used as a simple personal checkbook register, expanded to a small business bookkeeping system or developed into a large corporate general ledger system **without any additional software.**

- VERSALEDGER II™ gives you almost unlimited storage capacity (300 to 10,000 entries per month, depending on the system),
- stores all check and general ledger information forever,
- prints tractor-feed checks,
- handles multiple checkbooks and general ledgers,
- prints 17 customized accounting reports including check registers, balance sheets, income statements, transaction reports, account listings, etc.

VERSALEDGER II™ comes with a professionally-written 160 page manual designed for first-time users. The VERSALEDGER II™ manual will help you become quickly familiar with VERSALEDGER II™, using complete sample data files supplied on diskette and more than 50 pages of sample printouts.

SATISFACTION GUARANTEED!

Every VERSABUSINESS™ module is guaranteed to outperform all other competitive systems, and at a fraction of their cost. If you are not satisfied with any VERSABUSINESS™ module, you may return it within 30 days for a refund. Manuals for any VERSABUSINESS™ module may be purchased for \$25 each, credited toward a later purchase of that module. All CP/M-based Computers must be equipped with Microsoft BASIC (MBASIC or BASIC-80)

To Order:

Write or call Toll-free (800) 431-2818
(N.Y.S. residents call 914-425-1535)

- * add \$3 for shipping in UPS areas
 - * add \$4 for C.O.D. or non-UPS areas
- Inquiry 174

- * add \$5 to CANADA or MEXICO
- * add proper postage elsewhere

DEALER INQUIRIES WELCOME

All prices and specifications subject to change | Delivery subject to availability.

COMPUTRONICS!

50 N. PASCACK ROAD, SPRING VALLEY, N.Y. 10977

Conducted by Steve Ciarcia

BUSINESS HARDWARE

Dear Steve,

I am a university student majoring in management information systems. Most of the concepts are software-oriented, but I would like to enhance my knowledge by learning about computer hardware, especially systems used in business. Could you recommend a few books?

ZAAHIR SALAAMAH
Saint Laurent, Quebec, Canada

A good reference book that lists and rates other books about microcomputers is Reader's Guide to Microcomputer Books by Michael Nicita and Ronald Petruska (Golden Lee, 1984). It includes sections on all the popular microcomputers, microprocessors, and operating systems.

You should probably concentrate on books about MS-DOS, UNIX, and the 8086 family of microprocessors. I suggest the following books: From Chips to Systems: An Introduction to Microprocessors by Rodney Zaks (Sybex, 1981), Modern Computer Concepts by Joseph Giarratano (Howard W. Sams & Co., 1983), Microprocessor Operating Systems, Vol. 2, edited by John Zarrella (Microcomputer Applications, 1982), and 8086/8088 16-Bit Microprocessor Primer by Christopher Morgan and Mitchell Waite (BYTE Books, 1982).—Steve

GOOD-BYE MONITOR

Dear Steve,

Is it possible for software to produce unwanted effects on hardware? I have an IBM PC on which I run Symphony and a few other programs. One day, I received an evaluation copy of an educational program that I decided to try. Three seconds after I booted the disk, my monochrome monitor gave the visual equivalent of the big bang. It was blown. My serviceman estimates the cost of fixing it will be about \$115.

I did notice after the damage was done that the program was to be run only on the PCjr. It would appear to me almost impossible for the incompatibility of the two systems to have such a dramatic effect. Or is it?

I have a dual floppy-disk system and a

Paradise modular graphics card driving the monochrome monitor. Is it an overly sensitive monitor, the graphics card, the software, some combination of these, or a coincidental event that caused my problem?

DON BERLINER
Lansdale, PA

Without knowing the actual code in the program or your precise configuration, it's hard to say what actually did happen. Nevertheless, as many others with similar experiences will testify, it is possible to "blow up" hardware with software. In particular, many people have had their monochrome monitors go up in smoke as yours did. "Safe" software should never make any assumptions about equipment. A public-domain program called SCRNSAVE caused similar problems in earlier versions.

The video-display controller chip in the PC is programmable for a variety of modes. For example, you can actually have an 80-character by 50-line display on a PC, though it is tough to read. Also, a program can send out instructions to reprogram the chip in such a way as to blow out a monitor that is expecting signals that are quite different. At this point I feel like saying, "Believe it . . . or not!"—Steve

ZENITH AND PC-DOS

Dear Steve,

I have a Zenith Z-150 with which I am pleased. I want to run a few application programs that were written for the IBM PC, but they cause problems on my machine. The trouble lies, I believe, with the differences in the DOS, but I don't know enough to tell for sure. I have Zenith's MS-DOS 1.25 and 2.11 and IBM's PC-DOS 2.0 and 2.1.

If I format a disk in any DOS that is 2.0 or higher, will a disk made under another DOS copy to my disk? An attempt to copy (under MS-DOS 2.11) a program written for PC-DOS 2.1 netted me extensive damage to the data on both disks. However, I have Word for the Zenith, and it seems to run fine under PC-DOS 2.0 and 2.1. When I asked Zenith about the problem, I got the stock company answer: "PC-DOS has not

been tested, and the results are unpredictable."

Can you shed a little unbiased light on the possible pitfalls of using PC-DOS on the Z-150?

ROBERT HAWKINS
Greenville, MS

Even without the details of your one file-copying problem between MS-DOS 2.11 and PC-DOS 2.1, I would suspect a factor other than potential incompatibility between operating systems; it was probably a onetime occurrence. I have been using a Z-150 with a hard disk running under PC-DOS 2.1 for two months with absolutely no problems using both copy-protected software and software that isn't copy-protected. Files have been exchanged between IBM PCs, Micromint MPXs, the Z-150, and a Chameleon running PC-DOS 2.0, 2.1, and MS-DOS 2.11 with nary a problem. However, you could run into a problem trying to mix MS-DOS 1.25 and DOS 2.xx disks; avoid this combination if you can.

There may be a small number of programs (particularly games) that will not run properly on the Z-150, but I am not aware of any in particular. The Z-150 seems to be a very compatible PC clone, and PC-DOS 2.1 should run fine.

One word of caution. A problem may exist if you boot your system with one operating system and switch disks to the other operating system that uses a different version of COMMAND.COM. It is best to try to standardize on one version.—Steve

PC PROBLEMS

Dear Steve,

How can I upgrade my IBM PC to XT compatibility? I went through a year's worth of "Ask BYTE" and didn't find anything on the subject.

As hard-disk prices come down, I'd like to install one in my PC. Which one do you recommend? Do you recommend an internal or an external drive, and should I get a 130-watt power supply? Also, do you know which hard disks have tape-drive backup capability that I can add later?

With so many advertisements, I believe

(continued)



Clipper gives dBASE III™ users more time to do more. Or less.

Clipper™ allows you to run all dBASE III™ programs 2 to 20 times faster than they do with the standard dBASE interpreter.

That frees up extra time you're wasting if you're running dBASE III programs without Clipper.

Extra time to think. To create. To produce. To use as you choose.

You see, Clipper is the first true compiler for dBASE III. Clipper eliminates the time-consuming translation which the dBASE interpreter performs line after line whenever a program is run.

With Clipper, once you've debugged your source code, it's compiled into more efficient machine code.

And Clipper compiles all your dBASE III programs. The ones you have today. The ones you'll have tomorrow. But don't wait until tomorrow to order Clipper.

Today, Clipper has already been purchased to speed up dBASE run time at 3M and Touche Ross. At Exxon and NASA. In

the Harvard Physics Department. For the State of Arizona and TRW.

And that's just a few of the installations worldwide. From Greece to Venezuela to Canada to Europe.

So stop wasting time. Call our toll-free 800 number and get Clipper.

You'll spend less time running dBASE III and more time running the rest of your life.

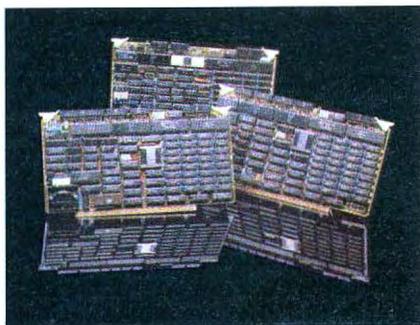
 **nantucket™**

Inquiry 273 for End-Users. Inquiry 274 for DEALERS ONLY.

5995 S. Sepulveda Blvd., Culver City, CA 90230 (800) 556-1234 ext. 225 In California (800) 441-2345 ext. 225

dBASE III is a registered trademark of Ashton-Tate.

16-Bit Networks To Go



Intercontinental Micro is shipping solutions today for all your S-100 BUS 16-bit and PC network needs.

Our products have always featured Direct Memory Access, Memory Management and Vectored Priority Interrupts to give you the fastest networks possible, bar none.

Of course, we also offer a complete line of 8-bit and interface/controller products as well as the sophisticated TurboDOS™ multiuser operating system.

For complete networking solutions and years of experience call Intercontinental Micro today.

CPZ-186-

8MHZ 80186, 2 sync or async serial I/O channels, 20 parallel I/O lines, 256K RAM expandable to 1 megabyte, onboard floppy disk controller.

CPS-186-

10MHZ 80186, 4 sync or async serial I/O channels, 20 parallel I/O lines, 256K RAM expandable to 1 megabyte.

CPS-16-

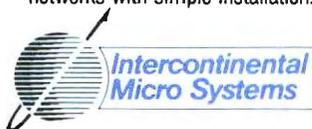
8MHZ 8086, 256K RAM expandable to 1 Megabyte, 2 sync or async serial I/O channels, 20 parallel I/O lines.

LANPC-

Allows IBM PC/XTs,™ PCs or compatibles to integrate into TurboLAN,™ ARCnet™ and S-100 BUS networks.

LANS 100-

Build Zenith Z100,™ PC and S100 networks with simple installation.



4015 Leaverton Ct., Anaheim, Ca 92807.
(714) 630-0964, TELEX: 821375 SUPPORT UD

TurboDOS is a trademark of Software 2000
IBM PC, and XT are trademarks of International Business Machines, TurboLAN is a trademark of Intercontinental Micro Systems. ARCnet is a trademark of the Datapoint Corporation, Zenith Z100 is a trademark of the Zenith Corporation.

ASK BYTE

the consumer is lost in this sea of information.

GLENN DAIL
Annapolis, MD

I can appreciate your confusion about upgrading to a hard disk. Although BYTE has not published an article specifically on this topic, a few other publications have. [Editor's note: See "Four Hard Disks for Under \$1000" by Richard Grehan in the Fall 1985 BYTE special issue Inside the IBM PCs.]

The September 18, 1984, issue of PC magazine has several articles reviewing hard disks, tape backup units, and about installing your own hard disk.

The November 1984 PC Tech Journal reviews 10 hard disks for the PC and also addresses the problem of power supplies.

The March 1985 PC Tech Journal has an article that shows how to convert a PC into an XT.

Unfortunately, I have not evaluated any of the hard disks, so I can't make any specific recommendations. My own preference is for an external unit with its own power supply, unless you upgrade your regular PC power supply to 130 watts.

Most tape units have their own interface cards, although a few will operate from the floppy-disk controller. Again, with no direct experience, I can't make any recommendations.—Steve

MAC UPGRADE

Dear Steve,

I am a recently graduated civil engineer. Although I don't know much about electronic design, I am an avid reader of your projects.

I bought a Macintosh in March because I needed it for writing my thesis, but I have since come to regret the hasty purchase. I'm very upset that Apple demanded \$995 for the 512K-byte upgrade.

It is my opinion that quite a number of Mac owners would like to have the option of upgrading the RAM chips to the 256K-bit versions on their own. I would be grateful if you would show the necessary modifications for the RAM multiplexers and any other rewiring.

VINCENT CHEW
Bellmore, NY

"Fatten Your Mac" by Tom Laflaur and Susan Raab in the January 1985 issue of Dr. Dobb's Journal gives step-by-step instructions on removing the 64K-bit chips and replacing them with new 256K-bit chips. Be sure to check the addendum

on page 4 of the same issue, which discusses differences between early- and late-model Macs. An erratum in the March 1985 issue mentions an error in the text that refers to pin 7 of the memory-select IC being soldered, while the figure shows pin 8. Pin 8 is the correct one.

Back issues of Dr. Dobb's Journal can be obtained by writing to 2464 Embarcadero Way, Palo Alto, CA 94303. They are \$3.50 each. The one you need is #99.—Steve

BUBBLES

Dear Steve,

The January and February 1984 issues of BYTE featured the two-part article "Bubbles on the S-100 Bus" by Louis Wheeler. It was an interesting project and I hoped to see more on the subject of bubble memory, particularly if someone had adapted it to something other than the S-100 bus (I have an Osborne).

I would like to build this project as a separate unit with its own power supply to interface with my Osborne through the RS-232C port. Would this be reasonable? One of the really critical parts of the project is the wiring. Has anyone come up with a PC board to simplify this problem?

JOHN T. COUGHLIN II
Westlake, OH

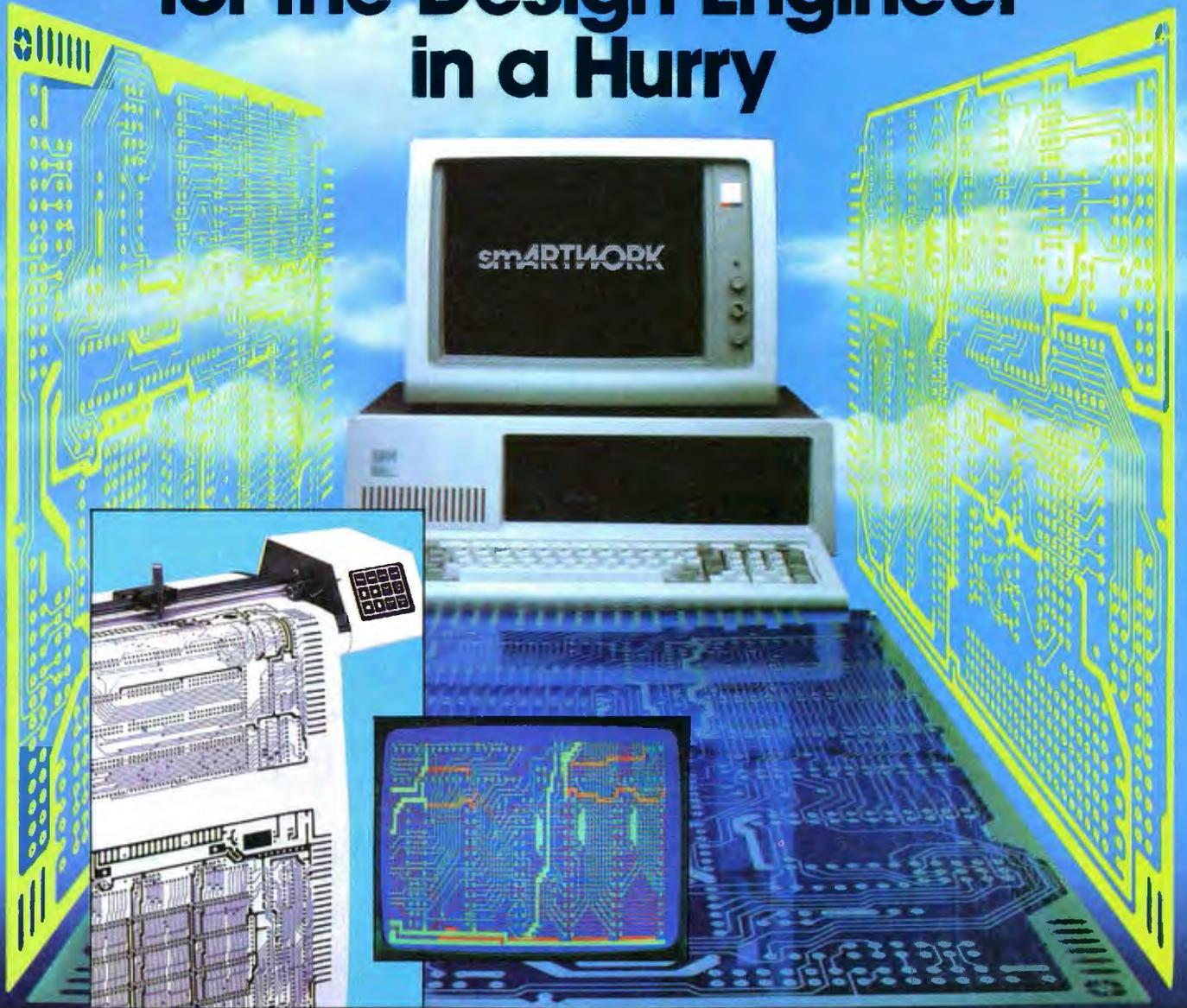
Building a bubble-memory board to interface with an RS-232C serial port is not out of the question but could wind up being quite expensive. The reason is that the bubble-memory devices themselves are relatively expensive and do not lend themselves to homebrew construction techniques. This means that you will have to purchase a prefabricated bubble-memory board, like the one described in the article. These boards take care of all the critical wiring and let you supply the interface circuitry. Again, these boards are usually relatively expensive.

There is no technical reason why you cannot build a bubble-memory device to interface to your serial port. In fact, Fujitsu America Inc. offers just such a device, an RS-232C interface that lets you use Fujitsu's bubble-memory plug-in cassettes. You can get more information about these devices from

Fujitsu America Inc.
Component Sales Division
910 Sherwood Drive-23
Lake Bluff, IL 60044
(312) 295-2610

(continued)

Circuit-Board-Artwork Software for the Design Engineer in a Hurry



For only \$895, smARTWORK® lets the design engineer create and revise printed-circuit-board artwork on the IBM Personal Computer. You keep complete control over your circuit-board artwork — from start to finish.

Forget the tedium of taping it yourself or waiting for a technician, draftsman, or the CAD department to get to your project.

smARTWORK® is the only low-cost printed-circuit-board artwork editor with all these advantages:

- Complete interactive control over placement and routing
- Quick correction and revision
- Production-quality 2X artwork from a pen-and-ink plotter
- Prototype-quality 2X artwork from a dot-matrix printer

- Easy to learn and operate, yet capable of sophisticated layouts
- Single-sided and double-sided printed circuit boards up to 10 x 16 inches
- Multicolor or black-and-white display

System Requirements:

- IBM Personal Computer, XT, or AT with 256K RAM, 2 disk drives, and DOS Version 2.0 or later
- IBM Color/Graphics Adapter with RGB color or black-and-white monitor
- IBM Graphics Printer or Epson FX/MX/RX series dot-matrix printer
- Houston Instrument DMP-41 pen-and-ink plotter
- Optional Microsoft Mouse

The Smart Buy

At \$895, smARTWORK® is proven, convenient, fast, and a sound value. Call us today. And put it to work for yourself next week.



Wintek Corporation Inquiry 387
1801 South Street
Lafayette, IN 47904-2993
Telephone: (317) 742-8428
Telex: 70-9079 WINTEK CORP UD

In Europe contact: RIVA Terminals Limited,
Woking, Surrey GU21 5JY ENGLAND,
Telephone: 04862-71001, Telex: 859502

"smARTWORK," "Wintek" and the Wintek logo are registered trademarks of Wintek Corporation.

The design criteria for building your own RS-232C bubble-memory interface go beyond what I could describe here. But the project will, in general, involve an intelligent microcontroller to receive instructions from the RS-232C port, process the instructions to determine the direction of data transfer, and perform the actual transfer.—Steve

ASCII CODES

Dear Steve,
I am using a daisy-wheel typewriter as a printer for my Kaypro 10. It is the Brother

Model CE 50, and it has bidirectional printing capabilities and a Centronics interface with a buffer.

I have a problem that I need some help on. I would like to use more ASCII codes with WordStar than were foreseen with the version 3.3 I am running.

First, my printer has special characters like the German umlaut, the English pound sign, the sign for Dutch guilders, and some special accent symbols. I can print these from a BASIC program using a CHR\$() function (ASCII 14 to 22). I would like to be able to print them from WordStar.

Second, I would like to be able to type Arabic on my printer. Using WordStar, I could enter the Arabic in the phonetic transcription standardized by the United States Foreign Service Institute of the Department of State. Then I could run a BASIC program that would translate the data to Arabic characters to print on my printer (the Arabic daisy wheel fits in my printer).

You may remember that Arabic is written from right to left. This is no problem for my printer since I can change the print
(continued)

A PROTOTYPE FOR YOUR PROTOTYPES



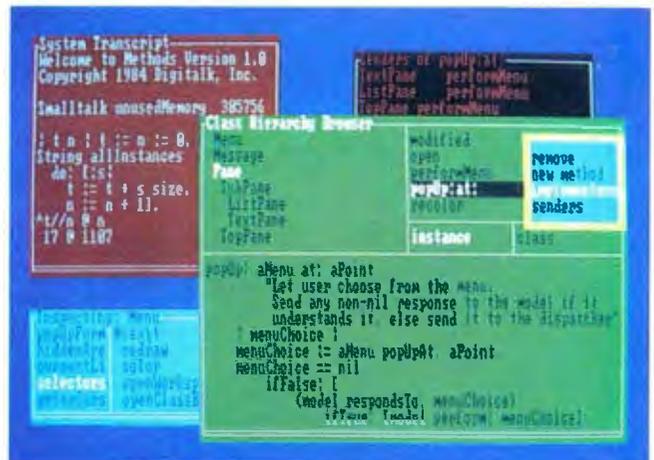
METHODS BY DIGITALK. A SMALLTALK PROGRAM DEVELOPMENT ENVIRONMENT FOR THE IBM PC. AN OBJECT-ORIENTED SPEED DEMON. AN EXCITING WAY TO PROGRAM.

Think about your problem. Browse the Methods Smalltalk source code. Select some building blocks like pop-up menus, windows, text-editors and dictionaries. Put them together. Try it. Oops, Methods tells you something is missing. No problem. Continue thinking, changing and trying. Now you're prototyping! Try out new ideas. Redefine your problem. And you don't have to throw this prototype away. Refine it until you like the finished product.

Methods by Digitalk. A new way to develop software for the PC. Use it for windowing, simulation and artificial intelligence applications. Use it by prototyping.

Methods is Smalltalk-80™ language compatible. It includes its own Smalltalk source code. You can extend it in Smalltalk and assembly language.

Methods operates on IBM PCs with 512K bytes RAM using MS-DOS or PC-DOS. Color and monochrome monitors are supported. No mouse is required. A Smalltalk language manual and an environment guide are included.



Available from Digitalk for \$250. Outside U.S. add \$15.00 for shipping and handling. California residents add 6% sales tax. Visa and MasterCard accepted. Educational and Dealer Discounts Available.

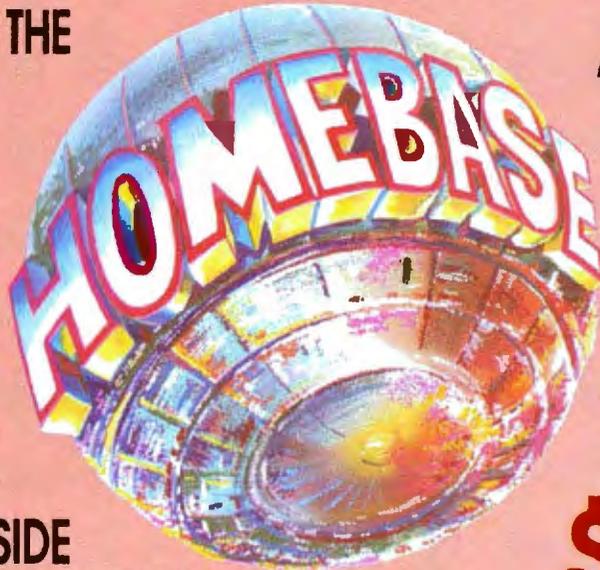
DIGITALK, INC.

5200 West Century Boulevard
Los Angeles, California 90045
(213) 645-1082

Smalltalk-80™ is a trademark of Xerox Corporation. IBM is a registered trademark of International Business Machines Corporation. MS is a trademark of Microsoft Corporation.

NEXT GENERATION

HOMEbase™ BREAKS THE SOFTWARE BARRIER BY COMBINING ALL THE RESIDENT PROGRAMS YOU'VE ALWAYS WANTED ... INTO ONE SOLID PIECE OF SOFTWARE THAT LIVES IN YOUR COMPUTER ALONGSIDE WORDSTAR, LOTUS OR WHATEVER ELSE YOU HAPPEN TO BE RUNNING.



"We like HomeBase. It comes from the next generation of resident utilities."

**Paul Freiberger
& Phillip Robinson**
Software Review
San Jose Mercury News
7/21/85

\$49.95
(not copy protected)

FEATURES

- **Notepads**—you can have a single, simple notepad, or use HOMEbase's full power to have a series of notepads; indexed, cross-referenced and fully searchable and sortable.
- **Calculator**—designed for simple calculations and complex formulaic work as well.
- **DOS Services**—you can open multiple directories onscreen, move copy, view and even edit files from this powerful feature. And you can get a beginner up and running with MSDOS in just minutes.
- **Instant Databases**—just hit the hotkey to freeze whatever software you're working in, and you're ready to find, insert or manipulate data. Hit it again, and you're back working in your original software without skipping a beat.
- **Auto Dialer**—stores configuration data for each name... even the window size you choose for that particular communication.
- **Alarm**—a window opens containing your appointment information, and the alarm first ticks, then rings.
- **Multiple Phone/Address Directories**—create as many as you like.
- **Rolodex™ Card Printer**—prints your HOMEbase address book directly onto continuous form Rolodex cards.
- **Template Maker**—create instant entry forms for your HOMEbase Databases.
- **Cut & Paste**—from anywhere to anywhere! You can even cut columns of numbers and paste them directly into your HOMEbase Calculator for instant addition!
- **Programmable Hotkeys**—you can choose the hotkeys you want to take you into HOMEbase's features.
- **Multiple Phone Message Pads**—a secretary can keep a separate message pad system for each of a number of people. Fully searchable and sortable, too!
- **Time & Expense Diary**—the easy way to keep out of trouble with the IRS.
- **To-do List**—with roll forward.
- **Background Electronic Mail**—your electronic mail arrives and files itself while you're working in another piece of software!
- **Quickdem Terminal**—instant communications, available at the touch of a hotkey.
- **Mailing Label Printer**—print labels from your address book in just seconds.
- **Screen Saver**—automatically turns off your screen when you haven't hit the keyboard for a while. To turn it back on again, just hit any key. Prevents image burn-in.
- **Type Ahead Keyboard Buffer**
- **On-screen clock**—just hit the hotkey.
- **Multiple Calendars**—HOMEbase allows the user to keep track of numerous appointment books. And to search across one or all of them. Imagine how valuable this can be for a central secretary or receptionist!
- **New Easy Installation**—NOW HOMEbase can easily be installed by everyone!

ORDER YOUR COPY OF HOMEbase TODAY!

(NOW... ALL ORDERS SHIPPED WITHIN 48 HRS.!!)

For Visa, American Express and MasterCard Orders Call Toll Free **1-800-538-8157 ext. 824** California **1-800-672-3470 ext. 824** Call Mon-Fri 6am to 12pm, Sat & Sun 6am to 8pm (PST) Or fill in this ORDER FORM enclose check, money order or Visa, American Express or MasterCard number. HOMEbase is available for the IBM PC, AT, XT and True Compatibles. Requires at least 256K (320K or more is recommended) so that it can reside in memory at the same time you're running other programs.

HOMEbase \$49.95 + \$5 for shipping and handling*

check money order VISA MasterCard American Express Card # _____ Exp. Date _____

Name _____

Title _____

Company Name _____

Address _____

City _____ State _____ Zip _____

Home Phone () _____ Work Phone () _____

*California residents add 6% sales tax. Outside U.S. please add \$15. Checks must be on a U.S. bank and in U.S. dollars. Sorry, no C.O.D. or purchase orders.

For dealer and site license information, call 408-996-1883.

8

YES! Site licenses are available for companies... large and small. For further information on site licenses call 408-996-1883.

Keypro is a trademark of Kaypro Corp. Wordstar is a trademark of MicroPro. Prokey is a trademark of RoseSoft. Rolodex is a trademark of Rolodex Corp. Lotus 1-2-3 is a trademark of Lotus Development Corp.

SEND TO:

AMBER

Amber Systems
1171 S. Saratoga-Sunnyvale Road
San Jose, CA 95129

The IBM® upgrade path.



It's still a great system—in perfect condition. But now you're ready to make a deal on your IBM PC or XT.

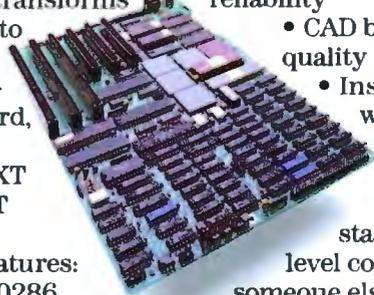
Maybe your business needs have grown, or your new application package runs too slow.

Don't dump your present IBM system. Red River Technology has a better offer—Atlas—a single-board plug-in package that transforms your IBM PC or XT into a super-AT.

Atlas isn't a semi-compatible plug-in card, but completely transforms your PC or PC XT into a 100% IBM PC AT compatible system.

Consider these features:

- 8 or 10 Mhz 80286 CPU. 50-100% more performance than IBM's PC AT (switch selectable—6, 8, or 10 Mhz)
- IEEE 802.3 standard LAN option on the base board (your choice, StarLAN or Ethernet)



- IBM compatible serial port
- IBM compatible parallel port
- 512K memory standard, expandable to 1.5 megabyte without using precious IO expansion slots
- Three 8-bit slots, use more of your existing add-in boards
- Five CMOS VLSI gate arrays eliminate over 60 chips to lower power consumption and improve reliability
- CAD based design, highest quality multi-layer board
- Installs in 10 minutes with nothing but a regular screwdriver.

Red River Technology has defined state-of-the-art in board-level computers. So don't take someone else's best offer for your IBM PC or XT. Red River Technology believes an upgrade path should not be a dead end.

For more information on the Atlas single-board computers, call us today, at 817-571-5714.

Assembled and tested board:
\$1795 (8 Mhz CPU) **\$2395** (10 Mhz CPU)
 (Specify PC or XT version)
 Kit form (includes board, 5 gate arrays, 8 Mhz 80286) **\$595** (8 Mhz CPU)

SPECIAL INTRODUCTORY OFFER: For a limited time, your choice of free case OR \$150 rebate for your old motherboard. Offer good on assembled and tested board orders only.

Quantity discounts available. Dealer and OEM inquiries welcome. Other unique 8088 and 80186 boards also available. Write for details.

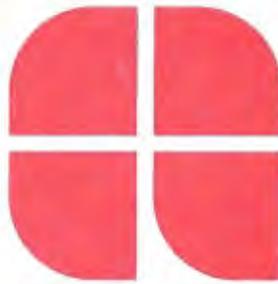
TERMS: VISA, MASTERCARD, AMERICAN EXPRESS, CHECK, MONEY ORDER. \$5 SHIPPING AND HANDLING PER ORDER. TEXAS RESIDENTS ADD 6% SALES TAX.



Red River Technology, Inc.

Red River Technology, Inc., DFW West,
 4001 W. Airport Fwy., Suite 500,
 Bedford, Texas 76021

IBM is a registered trademark of International Business Machines Corporation. Atlas is a trademark of Red River Technology, Inc.



direction with an optional switch.

I do hope that you can provide me with some useful information.

CHRIS LEISS
Hilversum, The Netherlands

You can type characters for the ASCII codes 14 to 22 in WordStar by using the keystrokes Control-O to Control-W. WordStar adds 128 to the ASCII codes for the last letter in many words, so your BASIC program will have to compensate. An easy way is to run each character through a filter to set the high bit to 0. A Microsoft BASIC statement to do this is

```
10 A$ = CHR$(ASC(A$) AND &H7F)
```

Reversing the direction on the printer motor is possible, but consider reversing the order of the characters in your translation program. This is pretty easy in BASIC, and you can shift the lines to the right margin by adding spaces to fill all lines either before or after the character order is reversed. A Microsoft BASIC program to reverse the character order is

```
9 REM Get a line of text
10 LINE INPUT B$
19 REM Find out how many characters
20 X = LEN(B$)
30 C$ = " "
40 FOR J = 1 TO X
49 REM Read last character
50 A$ = RIGHT$(B$,1)
59 REM Skip if CR
60 IF A$ = CHR$(13) GOTO 80
69 REM Add to end of new string
70 C$ = C$ + A$
79 REM Remove character from old string
80 B$ = LEFT$(B$,LEN(B$) - 1)
89 REM . . . and do it again
90 NEXT J
```

The line can then be right-justified by adding spaces to the front of the string.

—Steve ■

IN ASK BYTE, Steve Ciarcia answers questions on any area of microcomputing. The most representative questions received each month will be answered and published. Do you have a nagging problem? Send your inquiry to

Ask BYTE
c/o Steve Ciarcia
POB 582
Glastonbury, CT 06033

Due to the high volume of inquiries, personal replies cannot be given. All letters and photographs become the property of Steve Ciarcia and cannot be returned. Be sure to include "Ask BYTE" in the address.

The Ask BYTE staff includes manager Harv Weiner and researchers Larry Bregoli, Bill Curlew, Jeannette Dojan, Roger James, Frank Kuechmann, Dick Sawyer, and Robert Stek.

COMPUTERS

IBM SYSTEM SPECIALS	
PC w/256K, 2 Drives	\$1649
PC-XT w/256K, 1 Dr & 10 MB	\$2299
IBM AT All Models	\$Call
CORONA PPC-400-22	\$1239
PPC-400 w/ 10 MB	\$1899



KAYPRO All Models	\$Call
LEADING EDGE	
Model D Monochrome 2 Dr	\$1259
NCR All Models	\$Call
NEC APC-III PACKAGES	
w/2 Dr, Wordstar Pro Pk, Elf	\$1995
w/plotter, digitizer & AutoCAD	\$Call
PANASONIC Exec Partner	\$Call
WANG	
PC/APC Up to 21% off!	\$Call
Office Assistant w/printer	\$Call
ZENITH	
ZF-171-82 (80C88)	\$2030
ZF-158-42 (8088-2)	\$1750
ZF-241-82 (AT Compatible)	\$Call

FOR IBM PC/AT/JR & COMPAQ

3 COM Networking	\$Call
DCA Irmal/Imaline/IrmaKey	\$Call
NOVELL Networking	\$Call
ANCHOR Mark XII	\$239
HAYES	
Smartmodem 1200/2400	\$385/\$625
1200B w/Smartcom II	\$355
NOVATION SmartCat Plus	\$295
PRENTICE POPCOM	
C100/X100	\$249/\$265
VEN-TEL PC Modem Halfcard	\$369



AST RESEARCH INC.	
ADVANTAGE! (for AT)	\$Call
SIX PACK PLUS w/64K	\$219
FOUR PORT X/N	\$Call
HERCULES Graphics Card	\$299
Color Card (RGB/Comp/Par)	\$155
PROMETHEUS Promodem External	\$315
ORCHID PCTurbo 186 w/128K	\$655
PARADISE SYSTEMS Multi-Display	\$195
Modular Graphics Card	\$269
EVEREX Graphics Edge	\$Call
INTEL 8067/80287	\$119/\$189
ABOVE Board (PC/AT)	\$Call
QUADRAM	
EXPANDED QUADBOARD w/64K	\$195
QUADMEG AT	\$Call
SIGMA DESIGNS Color 400	
Mouse	\$499/\$575
STB SYSTEMS Graphix Plus II	
Super Rio w/64K	\$279
TALL TREE JRAM-2UJ-RAM-3	\$Call
TANDON TM-100-2	\$109
TEAC FD-55B	\$95
TECMAR Graphics Master	\$460
Captain w/0K	\$169
JrCaptain w/128K	\$299

HARD DISK

ARCHIVE 60 MB Tape Back Up	\$899
CORVUS	
11.1 MB Omnidrive Starter Kit	\$1649
45 MB Omnidrive	\$3995
Trimline Combo (TLC)	\$Call



INTERDYNE Tape Backup	\$429
IRWIN Internal Tape Backup	\$499
IOMEGA Bernoulli 20 MB	\$2399
SEAGATE 20MB Internal Kit	\$599
30 MB Internal Kit	\$999
TANDON 20MB Kit	\$589
TALLGRASS	
TG-5025 25MB/60MB Tape	\$2399
TG-6180 (80 MB w/60 MB Tape)	\$5949

DOT MATRIX PRINTERS

C-ITOH All Models	\$Call
CITIZEN	
MSP-10	\$295
MSP-15	\$435
MSP-20	\$Call
MSP-25	\$Call



EPSON JX-80 Color	\$489
LQ-1500	\$899
LX-80	\$229
FX-85	\$350
FX-185	\$479
NEC P2/P3 Pinwriters	\$525/\$735
OKIDATA	
792	\$359
Dkimate 20	\$Call
PANASONIC KX-P1091	\$249
STAR MICRONICS	
Gemini 15X	\$345
SG-10	\$229
SD-1075	\$Call
SR-15	\$619
TOSHIBA	
P1340	\$559
P351	\$1099

LETTER QUALITY

BROTHER/DYNAX	
HR-15XL/HR-35	\$359/\$729
Twinriter 5	\$Call
HEWLETT-PACKARD Laser Jet	\$Call
DIABLO 630 ECS/IBM	\$1779
EPSON DX-10/SO-2000	\$Call
JUKI 6100/6300	\$Call
NEC	
ELF 360	\$415
2050	\$669
3550	\$1029
8850	\$1449
QUME Sprint 1140/1155/1190	\$Call
SILVER REED EXP 500/550	\$250/\$419
STAR MICRONICS Power Type	\$415

PLOTTERS & DIGITIZERS

GTCO All models	\$Call
HITACHI Tiger Tablet II	\$Call
ENTER COMPUTER Six Shooter	\$759



HOUSTON INSTRUMENTS	
PC-695	\$645
DMP-41/42	\$2369
DMP-29	\$1799
DMP-51/52	\$3559
DT-11 Digitizer	\$679
TAXAN 710S	\$Call
ROLAND DX-Y-800/880	\$699/\$920
SUMMAGRAPHICS SummaSketch	\$Call

MONITORS & TERMINALS

AMDEK	
Video 300/300A/310A	\$125/130/155
Color 500/710	\$319/\$539
PRINCETON GRAPHICS Max-12E	\$175
HX-12/HX-12E/SR-12	\$469/519/599
QUME All Models	
	\$Call
ROLAND	
MB-122G	\$155
MB-142	\$Call
CB-141	\$269
CC-141	\$559
TAXAN	
115	\$115
116	\$125
420/L	\$Call
440	\$559
TELEVIDE All Models	
	\$Call
WYSE	
WY-50	\$459
WY-350	\$Call
ZENITH	
ZVM-123A	\$79
ZVM-124	\$Call
ZVM-135	\$439
ZVM-136	\$Call
Z-29A	\$Call
Z-49	\$Call

SOFTWARE, ETC.

ASHTON-TATE DBASE III	\$379
Framework	\$379
HARVARD Total Project Mgr	\$255
MICROPRO Wordstar Propak	\$265
Wordstar 2000	\$259
MICRORIM R:BASE 5000	\$Call
MICROSOFT Word	\$235
MULTIMATE	\$229
POWERBASE	\$259
SSI Wordperfect	\$235
SOFTWARE PUB PFS:Report	\$75
PFS:Write/File/Plan/Graph	\$85
GEN TECH STANDARD	
384K Multifunction board	\$169
Hercules compat. video card	\$159
Standard ASYNC/CLK	\$79

MISCELLANEOUS

RAM CHIPS	
64K SET	\$7.50
256K SET	\$37
call for quantity pricing	
DOUBLE-SIDED DISKETTES	
3M	\$27
Dysan	\$30
Maxell	\$25
Wabash	\$19
PRINT BUFFERS	
QUADRAM Microfazer	
Parallel/Parallel 16K	\$139
64K	\$185
128K	\$239
Serial/Serial, Ser/Par, Par/Ser	
8K	\$139
64K	\$159
INT. STRUCT. ShuffleBuffer 32K	\$269
ACT Printer Optimizer	\$Call
SURGE PROTECTORS	
EPD/CURTIS All models	\$Call
NETWORK Wire Tree/Plus	\$39/\$55
KENSINGTON Masterpiece	\$Call
EMERGENCY POWER SYSTEMS	
SOLA Mini UPS	\$Call
TrippLite BC425-FC (425 Watts)	\$Call
SWITCHBOXES	
DATASPEC All configurations	\$Call
COMPUTER ACCESSORIES	
Data Directors (All Models)	\$Call

CUSTOMER SERVICE

401-781-0020

ORDERS ONLY

800-843-4302

217 Broadway, Suite 515, NY, NY 10007

HOURS 9 - 8 EST, MONDAY - SATURDAY
Personal Ck (2 Weeks to Clear), Cashier's Ck.
Money Order Accepted.
APO Orders Add 6% (minimum \$7). Add 3%
For Net Terms. All Returned Non-Defective
Merchandise Are Subject To A 20% Restocking
Charge. GenTech Reserves the Right to Change
Advertised Prices.



2 MILLION PC IC CLEARANCE
CALL FOR QUANTITY DISCOUNTS

RED-HOT RAM & EPROM PRICES

NEW EEPROM

Part No.	Price	7400
SN7401N	14	29
SN7402N	14	29
SN7403N	14	29
SN7404N	14	29
SN7405N	14	29
SN7406N	14	29
SN7407N	14	29
SN7408N	14	29
SN7409N	14	29
SN7410N	14	29
SN7411N	14	29
SN7412N	14	29
SN7413N	14	29
SN7414N	14	29
SN7415N	14	29
SN7416N	14	29
SN7417N	14	29
SN7418N	14	29
SN7419N	14	29
SN7420N	14	29
SN7421N	14	29
SN7422N	14	29
SN7423N	14	29
SN7424N	14	29
SN7425N	14	29
SN7426N	14	29
SN7427N	14	29
SN7428N	14	29
SN7429N	14	29
SN7430N	14	29
SN7431N	14	29
SN7432N	14	29
SN7433N	14	29
SN7434N	14	29
SN7435N	14	29
SN7436N	14	29
SN7437N	14	29
SN7438N	14	29
SN7439N	14	29
SN7440N	14	29
SN7441N	14	29
SN7442N	14	29
SN7443N	14	29
SN7444N	14	29
SN7445N	14	29
SN7446N	14	29
SN7447N	14	29
SN7448N	14	29
SN7449N	14	29
SN7450N	14	29
SN7451N	14	29
SN7452N	14	29
SN7453N	14	29
SN7454N	14	29
SN7455N	14	29
SN7456N	14	29
SN7457N	14	29
SN7458N	14	29
SN7459N	14	29
SN7460N	14	29
SN7461N	14	29
SN7462N	14	29
SN7463N	14	29
SN7464N	14	29
SN7465N	14	29
SN7466N	14	29
SN7467N	14	29
SN7468N	14	29
SN7469N	14	29
SN7470N	14	29
SN7471N	14	29
SN7472N	14	29
SN7473N	14	29
SN7474N	14	29
SN7475N	14	29
SN7476N	14	29
SN7477N	14	29
SN7478N	14	29
SN7479N	14	29
SN7480N	14	29
SN7481N	14	29
SN7482N	14	29
SN7483N	14	29
SN7484N	14	29
SN7485N	14	29
SN7486N	14	29
SN7487N	14	29
SN7488N	14	29
SN7489N	14	29
SN7490N	14	29
SN7491N	14	29
SN7492N	14	29
SN7493N	14	29
SN7494N	14	29
SN7495N	14	29
SN7496N	14	29
SN7497N	14	29
SN7498N	14	29
SN7499N	14	29
SN7500N	14	29

Part No.	Description	Price	Part No.	Description	Price
21C14	(200ns) CMOS SRAM	9.99	6264LP-15	(150ns) LP SRAM	7.49
	CMOS USES LESS POWER		MC146818	REAL TIME CLOCK & RAM	7.95
27C16	(450ns) CMOS EPROM	9.95	27128-25	(250ns) EPROM	5.95
4164N-200	(DRAM)	9/9.95	41256-150	(150ns) DRAM	6.49
6116P-4	(200ns) SRAM	3.49	68764	(450ns) DRAM	12.95
6116LP-4	(200ns) LP SRAM	3.69	68766	(350ns) 25V EPROM	14.95

Part No.	Price	Function
2816A	24	2048x8 16K E ² PRAM 350ns... 12.95
Digitalizer™		
DT1050		—system, Teaching, Office, education, electronic Microcomputers, language, math, etc. (DT1050) with standard 160K 5.25" floppy disk, 137 words and useful words, 2 lines, and 5 different size buttons. The words and lines are arranged in a grid. Address: 10000 S. 100th St., Suite 100, Kent, WA 98148. (206) 835-1000. The DT1050 consists of a master processor (MC68010) and two 16K 5.25" floppy disks. Price: \$199.95. Shipping and handling extra.
DT1050		Digitalizer™... \$29.95 ea.
MM54104		Processor Chip... \$12.95 ea.
DT1057		—Expands the DT1050 memory from 137 to over 200 words. \$21.95 ea.
Part No. DT1057		... \$21.95 ea.

MICROPROCESSOR COMPONENTS

Part No.	Price	Part No.	Price
80C80	19.99	80C88	19.99
80C86	19.99	80C87	19.99
80C88	19.99	80C89	19.99
80C86A	19.99	80C87A	19.99
80C86B	19.99	80C87B	19.99
80C86C	19.99	80C87C	19.99
80C86D	19.99	80C87D	19.99
80C86E	19.99	80C87E	19.99
80C86F	19.99	80C87F	19.99
80C86G	19.99	80C87G	19.99
80C86H	19.99	80C87H	19.99
80C86I	19.99	80C87I	19.99
80C86J	19.99	80C87J	19.99
80C86K	19.99	80C87K	19.99
80C86L	19.99	80C87L	19.99
80C86M	19.99	80C87M	19.99
80C86N	19.99	80C87N	19.99
80C86O	19.99	80C87O	19.99
80C86P	19.99	80C87P	19.99
80C86Q	19.99	80C87Q	19.99
80C86R	19.99	80C87R	19.99
80C86S	19.99	80C87S	19.99
80C86T	19.99	80C87T	19.99
80C86U	19.99	80C87U	19.99
80C86V	19.99	80C87V	19.99
80C86W	19.99	80C87W	19.99
80C86X	19.99	80C87X	19.99
80C86Y	19.99	80C87Y	19.99
80C86Z	19.99	80C87Z	19.99

Part No.	Price	74LS
74LS01	14	29
74LS02	14	29
74LS03	14	29
74LS04	14	29
74LS05	14	29
74LS06	14	29
74LS07	14	29
74LS08	14	29
74LS09	14	29
74LS10	14	29
74LS11	14	29
74LS12	14	29
74LS13	14	29
74LS14	14	29
74LS15	14	29
74LS16	14	29
74LS17	14	29
74LS18	14	29
74LS19	14	29
74LS20	14	29
74LS21	14	29
74LS22	14	29
74LS23	14	29
74LS24	14	29
74LS25	14	29
74LS26	14	29
74LS27	14	29
74LS28	14	29
74LS29	14	29
74LS30	14	29
74LS31	14	29
74LS32	14	29
74LS33	14	29
74LS34	14	29
74LS35	14	29
74LS36	14	29
74LS37	14	29
74LS38	14	29
74LS39	14	29
74LS40	14	29
74LS41	14	29
74LS42	14	29
74LS43	14	29
74LS44	14	29
74LS45	14	29
74LS46	14	29
74LS47	14	29
74LS48	14	29
74LS49	14	29
74LS50	14	29
74LS51	14	29
74LS52	14	29
74LS53	14	29
74LS54	14	29
74LS55	14	29
74LS56	14	29
74LS57	14	29
74LS58	14	29
74LS59	14	29
74LS60	14	29
74LS61	14	29
74LS62	14	29
74LS63	14	29
74LS64	14	29
74LS65	14	29
74LS66	14	29
74LS67	14	29
74LS68	14	29
74LS69	14	29
74LS70	14	29
74LS71	14	29
74LS72	14	29
74LS73	14	29
74LS74	14	29
74LS75	14	29
74LS76	14	29
74LS77	14	29
74LS78	14	29
74LS79	14	29
74LS80	14	29
74LS81	14	29
74LS82	14	29
74LS83	14	29
74LS84	14	29
74LS85	14	29
74LS86	14	29
74LS87	14	29
74LS88	14	29
74LS89	14	29
74LS90	14	29
74LS91	14	29
74LS92	14	29
74LS93	14	29
74LS94	14	29
74LS95	14	29
74LS96	14	29
74LS97	14	29
74LS98	14	29
74LS99	14	29
74LS00	14	29

Part No.	Price	Part No.	Price
6502	10.99	6503	10.99
6504	10.99	6505	10.99
6506	10.99	6507	10.99
6508	10.99	6509	10.99
6510	10.99	6511	10.99
6512	10.99	6513	10.99
6514	10.99	6515	10.99
6516	10.99	6517	10.99
6518	10.99	6519	10.99
6520	10.99	6521	10.99
6522	10.99	6523	10.99
6524	10.99	6525	10.99
6526	10.99	6527	10.99
6528	10.99	6529	10.99
6530	10.99	6531	10.99
6532	10.99	6533	10.99
6534	10.99	6535	10.99
6536	10.99	6537	10.99
6538	10.99	6539	10.99
6540	10.99	6541	10.99
6542	10.99	6543	10.99
6544	10.99	6545	10.99
6546	10.99	6547	10.99
6548	10.99	6549	10.99
6550	10.99	6551	10.99
6552	10.99	6553	10.99
6554	10.99	6555	10.99
6556	10.99	6557	10.99
6558	10.99	6559	10.99
6560	10.99	6561	10.99
6562	10.99	6563	10.99
6564	10.99	6565	10.99
6566	10.99	6567	10.99
6568	10.99	6569	10.99
6570	10.99	6571	10.99
6572	10.99	6573	10.99
6574	10.99	6575	10.99
6576	10.99	6577	10.99
6578	10.99	6579	10.99
6580	10.99	6581	10.99
6582	10.99	6583	10.99
6584	10.99	6585	10.99
6586	10.99	6587	10.99
6588	10.99	6589	10.99
6590	10.99	6591	10.99
6592	10.99	6593	10.99
6594	10.99	6595	10.99
6596	10.99	6597	10.99
6598	10.99	6599	10.99
6600	10.99	6601	10.99
6602	10.99	6603	10.99
6604	10.99	6605	10.99
6606	10.99	6607	10.99
6608	10.99	6609	10.99
6610	10.99	6611	10.99
6612	10.99	6613	10.99
6614	10.99	6615	10.99
6616	10.99	6617	10.99
6618	10.99	6619	10.99
6620	10.99	6621	10.99
6622	10.99	6623	10.99
6624	10.99	6625	10.99
6626	10.99	6627	10.99
6628	10.99	6629	10.99
6630	10.99	6631	10.99
6632	10.99	6633	10.99

IBM SHOP

THANKSGIVING SPECIAL

PROMETHEUS PROMODEM 1200\$299.95
ANCHOR VOLKSMODEM 1200\$189.95

1-800-IBM-SHOP

ORDERS ONLY



714/840-2406



Quotes and Technical Assistance

*** SYSTEMS ***

ITT EXTRA PC-256K

Two 1.2 HT 360K Dr's, Monochrome Board, 12" Amber/Green Monochrome Monitor, Serial & Parallel Port, DOS 2.1 **\$1549.95**

IBM XT 256K

One IBM 360K Floppy Dr., one 10 Meg Hard Disk, Monochrome Board, Amber/Green Monochrome Monitor, DOS 2.1 ONLY **\$2,895.95**

IBM PC-256K

Two Teac 360K Dr's, Monochrome Graphics Board, Parallel Printer Port, Monochrome Display, DOS 2.1 ONLY **\$1,995.95**

IBM PC AT 512K

1.2 Meg Floppy, 20 Meg Hard Disk, Amber/Green Monochrome Display, Monochrome Graphics Board, including shipping UPS, DOS 3.1 ONLY **\$4,445.95**

IBM PC AT 512K

1.2 Meg Floppy, 20 Meg Hard Disk, Princeton HX-12, Color Graphics Board, AST Advantage, Anchor Volks 1200 Modem, Panasonic 1092 Printer, dBase III & Crosstalk Software, including shipping UPS, DOS 3.1, ONLY **\$5,995.95**

IBM PC AT un-enhanced **\$2,999.95**

IBM PC AT enhanced **3,695.95**

COMPAQ DESK PRO MODEL 2

256K/Dual Disk Drive **\$1,999.95**

COMPAQ DESK PRO 286 MODEL 1

256K/Single 1.2 Meg Drive **\$3,199.95**

COMPAQ PORTABLE

128K/Single Disk Drive **\$1,949.95**

*** TOP TEN SOFTWARE ***

dBASE III IBM **\$379.95**

BPI Accounting Modules **325.95**

PEACHTREE Accounting Modules **295.95**

IBM Displaywrite III **149.95**

Managing Your Money IBM/APPLE **115.95**

Dollars & Sense IBM **113.95**

Norton Utilities 3.0 IBM **59.95**

PFS Write/File/Report **85.95**

SIDEWAYS IBM/APPLE **39.95**

Multimate IBM **269.95**

Crosstalk IBM **104.95**

Microsoft Word IBM **249.95**

*** PRINTERS DOT MATRIX ***

PANASONIC 1091 120CPS **\$279.95**

PANASONIC 1092 180CPS,NLQ 33CPS **379.95**

EPSON LQ1500 200CPS/67CPS LQ **989.95**

EPSON LX80 100CPS **249.95**

OKIDATA 92P 160CPS **389.95**

BROTHER 2024L 200CPS/NLQ 96CPS **995.95**

*** PRINTERS LETTER QUALITY ***

BROTHER HR-15 17GPS **\$369.95**

BROTHER HR-25 24CPS **519.95**

BROTHER HR-35 36CPS **729.95**

DIABLO Advantage 25CPS **589.95**

JUKI 8100 20CPS **379.95**

JUKI 6300 40CPS **759.95**

*** MODEMS ***

HAYES 1200B Internal W/Smartcomm 2 **\$369.95**

HAYES Micromodem IIE **219.95**

HAYES 2400 **649.95**

U.S. ROBOTICS 2400 **475.95**

THOUSANDS OF ITEMS AVAILABLE.
CALL FOR COMPLETE PRICING.

CALIFORNIA MICRO HOUSE

16835 Algonquin St., Huntington Beach, CA 92649
TELEX # 5101011798 CAL MICRO

Corporate accounts welcomed, purchase orders accepted with net 15 day terms, subject to credit approval. To expedite shipping of purchase orders, please use telex #. Also, use telex # for price quotations. All prices represent cash, prepaid discount. All items shipped next day in factory sealed packages. We guarantee all items for 30 days. California residents please add 6% sales tax. Prices subject to change without notice.

CLUBS AND NEWSLETTERS

ASSEMBLY FOR COMPUTERS IN ENGLISH (ACE), Leni Cook, 12 Coral Tree Lane, Rolling Hills Estates, CA 90274. Outgrowth of the National Council of Teachers of English encouraging software development for language arts. Annual meeting, Annual dues: \$5.

NEWS COMPUTING JOURNAL, Department of Journalism, Central at Yale, University of New Mexico, Albuquerque, NM 87131. Quarterly journal on microcomputer use in journalism. Annual subscription: \$30.

YALE MACINTOSH USERS' GROUP (YMUG), Philip Rubin, Box 220 Yale Station, New Haven, CT 06520. Monthly meetings. *The Desktop Journal* (monthly), public-domain software library. Membership: \$20.

PORTLAND COMPUTER SOCIETY (PCS), POB 5494, Portland, OR 97208. Monthly educational meetings, SIGs, 24-hour BBS at (503) 775-4838, semimonthly newsletter. Annual dues: \$15.

SOUTH BAY APPLE III USER'S GROUP, Gary Fortune, POB 432, Redondo Beach, CA 90277, (213) 316-7738. Monthly meetings, classes, newsletter. Annual fee: \$25.

COMMODORE INVESTOR'S NEWSLETTER, Dr. Lynn Harner, 2011 Central, Dodge City, KS 67801, (316) 227-8952. Stock-market investment news for Commodore users. Free. Send SASE.

TI PROFESSIONAL COMPUTER (TI PC) USERS GROUP OF NEW MEXICO, Lawrence Langdon, (505) 298-9876. Monthly meetings in Albuquerque and newsletter.

ICS BBS, ICS, 9601 Aero Dr., San Diego, CA 92123, (800) 621-0852, ext. 303. BBS at (619) 279-0084, *The ICS Industrial IBM PC Sourcebook* (free to qualified users).

TOLEDO APPLE USERS (TAU), POB 566, Toledo, OH 43693-0566. Monthly meetings, member-aid hotline, BBS, newsletter.

MICROCLUB, 16 Stournara Str., Athens 10682, Greece; tel: 3640.676. Contact with other European clubs welcome. *Computer and Software* magazine published regularly.

OSBORNE KOMPUTER OWNERS KLUB (OKOK), Lionel Soracco, POB 40429, Pasadena, CA 91104, (818) 794-3243. Monthly meetings, hands-on sessions, SIGs, public-domain library, newsletter.

COMPUNEWS, Anthony Polifrone, Buyers Laboratory Inc., 20 Railroad Ave., Hackensack, NJ 07601, (201) 488-0404. Computer information service, buyer's guide, newsletter, hotline. Subscription: \$139.

DBASE II USERS GROUP, Federation of Computer Users and User Groups (FOCUS), Hong Kong Polytechnic, Hung Hom, Kowloon, Hong Kong; tel: 3-7396239; Telex: 38964 Polyx Hx. Monthly meetings and newsletter. Newsletter exchanges and visitors welcome.

NATIONAL NINETY-NINE'ERS, Mark Leair, 4904 Edsall Dr., Cleveland, OH 44124-2305. For TI-99/4A users. Local users groups, newsletter, BBS, public-domain library. Send SASE.

THE REST OF US (CHICAGO AREA MACINTOSH USER'S GROUP), Tom Brodersen, Suite 1100, 134 North LaSalle, Chicago, IL 60602, (312) 641-1266. Monthly meetings, newsletter, discounts, BBS, demonstrations, public-domain software library.

CLERGY KUG, Elmer Little Jr., 3868 Centorbi Court, Florissant, MO 63034. Newsletter for Kaypro users in the ministry.

SAN FRANCISCO PC USERS GROUP, Suite 33, 4444 Geary Blvd., San Francisco, CA 94118. For users of the IBM PC and compatibles. Monthly meetings, *Blue Notes*.

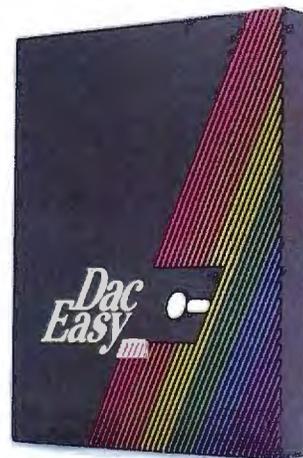
FRANKLIN USERS GROUP, Douglas Trueman, Apt. L, East Wind Rd., Tecumseh, MO 65760. Newsletter, public-domain library, technical assistance for users of the Franklin and Apple-compatibles. ■

CLUBS AND NEWSLETTERS is an acknowledgment of new clubs and newsletters received at BYTE. Please allow at least four months for your club's mention to appear. Send information to BYTE, Clubs and Newsletters, POB 372, Hancock, NH 03449.

Lots of dollars.



Lots of sense.



\$69.95

They've been doing it for years. Selling you accounting software module by module, till before you know it you've paid up to five thousand dollars for a complete system. That's a lot of dollars... which doesn't make good business sense.

Now, there's a better alternative. Dac Easy Accounting. For only \$69.95, Dac Easy is a fully integrated accounting package offering instant access to General Ledger, Accounts Receivable, Accounts Payable, Inventory, Purchase Order, Billing and Forecasting. And Dac Easy has the flexibility to manage either product or service oriented businesses.

It's not just the price that makes Dac Easy better. Only Dac Easy saves three years of history in all files, making automatic forecasting easier and more accurate. Plus, you can generate any of 300 different reports for instant access to the exact information you need.

Dac Easy is menu-driven for ease-of-use, and comes with easy-to-understand documentation inside a handsome slip-case binder. It's also non-copy-protected. Listen to what experts are saying:

"Dac Easy Accounting is remarkable, amazing, revolutionary, sensational..."
Computer Buyer's Guide & Handbook, September 1985

Find out for yourself why Dac Easy is the fastest selling accounting package in history. Compare Dac Easy's range of features against systems costing thousands more. You'll see how Dac Easy can save you lots of dollars. Which makes a lot of sense.

PARTIAL LIST OF FEATURES

General Information

- Menu driven
- Password protection
- File capacity limited only by disk space
- Support contract available

General Ledger

- Unlimited multi-level accounts
- Three-year account history for CRT inquiry
- Pencil and pen feature to correct mistakes
- Unique budgeting routine
- CRT transaction inquiry
- Activity report, trial balance, financial statements, unlimited departments and journals

Accounts Receivable

- Open invoice or balance forward
- Customized aging report
- Unlimited number of customers
- Flexible mailing labels and directories
- Supports partial payments & finance charges
- Three-year customer history for number of invoices, sales, costs, and profits
- Customized statements
- Cash flow analysis/sales analysis
- Automatic sales forecasting

Accounts Payable

- Check printing with multiple invoices and cash available routines
- Aging reports with seven customized columns
- Unlimited number of vendors
- Flexible mailing labels and directories
- Three year vendor history
- Unlimited allocations per invoice

Inventory

- Supports average, last purchase, and standard costing methods
- Powerful physical inventory routines
- Accepts any unit of measure
- Three-year product history in units, dollars, cost, and profits
- Automatic forecast of product sales
- Automatic pricing assignments
- Alert and activity reports with 11 sorts
- CRT shows on-hand/on-order/committed sales/cost/profit/turns/GROI

Purchase Order

- Inventory and non-inventory items
- Allows up to 99 lines per P.O.
- Per line discount in %
- P.O. accepts generic discounts/freight/taxes/insurance
- P.O. accepts back orders and returns
- Purchase journal

Billing

- Service or Inventory invoicing on plain or preprinted forms with remarks
- Prints sales journal
- Allows return credit memo

Forecasting

- Unique program that automatically forecasts using your three-year history:
 - Revenue and expense accounts
 - Vendor purchases
 - Customer sales, cost, and profit
 - Inventory item usage
- Forecast by same as last year, or % base from last year, or trend, or least square trend line analysis method

Dac Easy Accounting

To Order Call Toll Free

1-800-992-7779

Ask For Operator 111

For More Information Or In Texas Call

214-458-0038

☒ dac software, inc 4801 Spring Valley, Building 110-B, Dallas, TX 75244

Send in this coupon with your credit card number, money order or check for \$69.95 plus \$7.50 for postage and handling. In Texas, add 6 1/2% sales tax (\$4.28). Outside U.S., add \$17.50 for postage and handling. No C.O.D.

CHECK MONEY ORDER
 AMEX VISA MASTERCARD Expires _____

Account No. _____

Name _____

Company Name _____

Address _____

City _____ State _____ Zip _____

Phone _____

Signature _____

30-Day Money Back Guarantee: dac software, inc. provides a 30-day money back guarantee that all claims and features listed in this ad are true.

Minimum Hardware Requirements:
 IBM (PCjr, PC, XT, or AT)¹ or other compatibles, 128K memory, one 5 1/4 DSDD floppy disk, 132 column printer in compressed mode, 80X24 CRT, MS-DOS², PC DOS¹ 2.0 or later.

¹Trademarks of International Business Machines Corporation
²Trademark of Microsoft Corporation.

Dac Easy Accounting

EVEREX EVER FOR EXCELLENCE



LOTUS 1-2-3 132 COLUMNS



PC PAINT



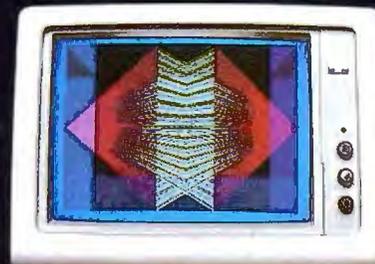
PC PAINTBRUSH 720x348



SYMPHONY HIGH RESOLUTION



PC PAINT



16 COLORS, 320x200

The Edge



The Plain Facts:

The EVEREX EDGE	The EVEREX EDGE	Paradise Modular Card	Genoa Spectrum	STB Chauffeur	Hercules Graphics Card	Tseng Labs Ultrapak
Runs an IBM or Compatible Color Monitor	✓	✓	✓			
IBM Monochrome Compatible and High Resolution, 720x348 graphics	✓		✓		✓	✓
Runs Color Software on a Monochrome Monitor, Full Screen:	✓	✓	✓	✓		
—in 16 shades of green on the IBM Monochrome monitor	✓	✓	✓	✓		
—Runs Flight Simulator, PC Paintbrush, IBM BASICA commands and more	✓	✓	✓	✓		✓
—No patches or modifications needed	✓		✓	✓		✓
—Displayed in the IBM standard 9x14 character set	✓	✓				✓
Extended Text Modes:	✓		✓			✓
—132 columns by 25 rows in monochrome	✓		✓			✓
—132 columns by 44 rows in monochrome	✓		✓			✓
—132 columns by 25 rows in color	✓		✓			✓
Runs Lotus 1-2-3™ and Symphony™ in high resolution monochrome graphics:	✓		✓		✓	✓
—in 132 columns by 25 rows	✓		1-2-3 only			✓
—in 132 columns by 44 rows	✓					✓
Runs Lotus 1-2-3™ and Symphony™ in High Resolution color:	✓		✓			
—16 colors, 320x200	✓		✓			
— 4 colors, 640x200	✓		✓			
Software switchable for all display modes and monitors	✓		✓			
Software switchable display memory, 16K, 32K and 64K	✓					
Disable Screen Memory	✓					
Printer Port (standard)	✓		✓	✓	✓	✓
Light Pen Connector (standard)	✓	✓	✓		✓	
Works in any PC-AT slot	✓			✓	✓	
List Price	\$399	\$395	\$459	\$395	\$499	\$680*

*Includes one serial port and clock/calendar

Excellence is the standard at Everex—it's in our name, our products, in everything we do. When you look for the best for your computer—you'll find Everex products.

Visit your local Everex dealer today and ask to see Everex products in action. For the name of your nearest Everex dealer, please call (415) 498-1111. TELEX: 5101000590 EVEREX FAX: 415-651-0728

Registered Trademarks: Paradise Modular Graphics Card—Paradise Systems, Inc.; Hercules Graphics Card—Hercules Computer Technology; Lotus 1-2-3—Lotus Development Corporation; PC Paint—Mouse Systems Corporation; Teemar Graphics Master—Teemar Inc.; Persys Bob—Persys Products; Ultra Pak—Taang Lab.; The Edge—Everex Systems Inc.; IBM, PC Tutorial—International Business Machines Corporation; Flight Simulator—Microsoft Corporation.

Dealer Hotline: (800) 821-0806. In CA (800) 821-0807

Imaging Engineering Ultimo, Australia TLX: 74349 IMAGIN AA

Microage Distribution Ltd. London, England TLX 881 3241 WONGS G

Feeder Paris, France TLX: 4413241 FEEDER

Automated Office Systems Hout Bay, South Africa 2721-70-8091

Survex, 1027 Speers Road, Oakville, Ontario Canada L6L-2X5, 416-842-6093

Pride Computers, 102-8167 Main Street, Vancouver,

British Columbia, V5X 3L2, 604-321-5690

Inquiry 150

EVEREX

EVER for Excellence

Address: 47777 Warm Springs Blvd. Fremont, CA 94539 (415) 498-1111

B·O·O·K R·E·V·I·E·W·S

MACINTOSH REVEALED,
VOLUME ONE:
UNLOCKING THE
TOOLBOX
Stephen Chernicoff
Hayden Book Co.
Hasbrouck Heights, NJ; 1985
516 pages, \$25.95

ADVANCED
PROGRAMMER'S GUIDE
FEATURING dBASE III
AND dBASE II
Luis Castro, Jay Hanson,
and Tom Rettig
Ashton-Tate
Culver City, CA: 1985
680 pages, \$28.95

16-BIT MODERN
MICROCOMPUTERS:
THE INTEL I8086 FAMILY
George Gorsline
Prentice-Hall
Englewood Cliffs, NJ; 1985
528 pages, \$32.95

STATISTICAL PROGRAMS
IN BASIC
Ronald D. Schwartz and
David T. Basso
Reston Publishing
Reston, VA: 1985
224 pages, \$16.95



Computer's publications department.

Importantly, *Macintosh Revealed*, like *Inside Macintosh*, assumes a knowledge of Pascal or 68000 assembly language. Although the book will be most useful to Pascal and assembly-language programmers, the Toolbox, the term for Mac's 64K bytes of ROM (read-only memory) routines, doesn't specify which language to use as long as you follow the proper rules and conventions. Thus, BASIC or C programmers can find useful information in Chernicoff's book.

As Chernicoff explains, when Apple first began developing Mac software, it used the Lisa (now known as the Macintosh XL); both the Lisa and the XL have since been discontinued. The Lisa programming environment, with its Pascal compiler and 68000 assembler, became the de facto standard for programming the Macintosh. Apple has since released a software-development system that

includes the Pascal compiler and the 68000 assembler for Macintosh developers. It is called the Macintosh 68000 Development System. Chernicoff's book, however, was completed prior to the system's release and the discontinuation of the Lisa and the Mac XL.

Volume One presents the foundations of the Toolbox. Topics include the basic conventions for calling the Toolbox from an application program, memory management, fundamental concepts behind the QuickDraw graphics routines, how to use QuickDraw, Macintosh resources, how to start programs and load code into memory for execution, and how character text is represented inside the com-

(continued)

MACINTOSH REVEALED, VOLUME ONE:
UNLOCKING THE TOOLBOX
Reviewed by Bonnie L. Walker

Volume One of Stephen Chernicoff's two-volume reference *Macintosh Revealed* offers more than an introduction to Macintosh menus and the mouse, and it is not simply a beginner's guide to Microsoft BASIC. The book is for serious programmers.

Macintosh Revealed resembles a polished-up edition of Apple's own *Inside Macintosh* documentation. This isn't surprising, since the author served as editor in chief of Apple

INTRODUCING THE *Western AT*

Newest Compatible in the Personal Computer Market!!! By the OEM Manufacturer of the Most Advanced IBM PC Compatible — The "Western PC Turbo."



Some Outstanding Features of the "Western AT":

- 6MHz or Optional 8MHz CPU
- Up to 1MB RAM on the Mother Board
- 16MB in System Protected Virtual Address Mode.
- 8 I/O Expansion Slots
- On Board Battery-Backed Clock-Calendar
- Socket for 80287 Math Co-Processor
- 20/40MB Winchester Disk Memory
- 2 Serial, 1 Parallel
- Optional 4 Serial, 1 Game Port
- 20-60MB Tape Streamer Back-Up

\$2795.



Some Outstanding Features of the "Western PC Turbo":™

- Dual Clock Speed of 8MHz-4.77MHz Giving 65% Faster Operation.
- Up to 1MB RAM on the Mother Board. Optional RAM Disk Software to Address above 640K.
- 1 Serial, 1 Parallel Port on the Mother Board.
- Optional Clock Calendar and 1 Serial Port, 1 Parallel Port on Floppy Disk Controller.
- 10, 20, 40MB Internal Winchester Disk Capability.

\$1495.

IBM PC is a registered trademark of IBM Corp.
Distributors, Dealers & OEM Welcome

Western Computer

1381 Warner Ave., Warner Corporate Park, Suite B
Tustin, CA 92680
(714) 544-4740, 544-4743 544-4746
TELEX 758731
AnswerBack Western Comp

Inquiry 385 for End-Users.
Inquiry 386 for DEALERS ONLY.

BOOK REVIEWS

puter and displayed on the screen.

The second volume, *Programming with the Toolbox*, is said to cover the parts of the Macintosh user interface such as events, overlapping windows, pull-down menus, cut-and-paste text editing, controls, alert and dialog boxes, and disk input/output (I/O). [Editor's note: A review of the second volume is forthcoming.]

STEP BY STEP

In Volume One, each chapter (except the first) consists of an overview of one feature of the Toolbox and how to use it, followed by a reference section. Although this book is not for beginners, the author makes a remarkable effort to thoroughly explain the extremely complex nature of the innards of the Toolbox, the ROM code that ensures that "all Macintosh software shares the same easy, intuitive user interface."

Chernicoff explains the trap mechanism, the stack, the Pascal interface, stack-based and register-based routines, and other topics. He gives programming examples in Pascal form with additional information on how to use them in assembly language. He compares the memory organization of the 128K-byte and the 512K-byte Mac as well as the 512K-byte and the 1-megabyte Macintosh XL. Since memory addresses in the book may differ from those in future models of the Macintosh, programmers are cautioned to address locations by name. Throughout the text, Chernicoff provides numerous charts and figures that clarify the information.

Explanations follow on the QuickDraw graphics routines, which produce everything you see on a Macintosh screen, including text, pictures, windows, and menus. QuickDraw is also used for printing on a dot-matrix printer or preparing animation frames off screen and transferring them to the screen all at once. The book also covers the underlying principles and concepts of QuickDraw and then explains how to use it.

Another feature of the Toolbox is resources, such as menus, icons, character fonts, and dialog and alert boxes. "Summoning Your Resources" presents a thorough tutorial on this subject along with the detailed reference section. Chernicoff describes a Mac program as simply "a bundle of resources." Resources let you separate the text of menus and dialogs from the rest of the program, which makes it easy to change or edit that text. They also allow descriptive information about a program's behavior to be separated into bite-size "chunks" that do not all need to be in memory at once.

Chernicoff discusses the way in which code is loaded into memory for execution. He describes this as "curriculum enrichment," since you don't need to know it in order to write short and straightforward application programs. You will need this information, however, if you plan to produce stand-alone programs that can be started directly from the Finder or to define your own icons for the Finder desktop. Application code is stored in code

(continued)

MARK WILLIAMS' C SOURCE DEBUGGER

Those who insist on C compiler performance
are very big on Mark Williams.

And the compiler is just part of our total C Programming System.

NEW 3.0 ENHANCEMENTS

These and other powerful utilities now *included* in the C Programming System:

- make: compiles only what's necessary from multiple modules, a powerful programming discipline
- diff: identifies differences between two files
- m4: macroprocessor expression editing and substitution
- egrep: extended pattern search
- MicroEMACS: full screen editor with source

COMPILER FEATURES

- Runs under MS-DOS
- Full Kernighan & Ritchie C with recent extensions including void and enum
- Register variables for fast, compact code
- Full UNIX™ compatibility and complete libraries
- Large and small memory models
- MS-DOS linker compatibility
- 8087 Support
- One-step compiling
- English error messages
- ROMable code
- Linker, assembler, archiver
- Extensive third party library support

csd C SOURCE DEBUGGER

- Debugs at C source level without assembly language
- Separate evaluation, source, program and history windows
- Can execute any C expression
- Capabilities of a C interpreter, but runs in real time
- Set trace points on any statement or variable

Mark Williams' C compiler has earned a place in some very big companies for some very good reasons: it proves the benchmarks right with the speed, code density, consistent performance and expert support required in professional development environments.

But a total development tool shouldn't stop with compiling. Or go on and on with extras that add up and up.

Only Mark Williams' C Programming Systems *includes* the csd C Source Debugger with true source level debugging to speed your programming job.

And only Mark Williams' new 3.0 version *includes* utilities like "make" to make quick work of even the largest projects.

From source code to final product, only one takes you all the way: Mark Williams' C Programming System.

All for only \$495. Ask about our 30-day money back guarantee when you call

1-800-692-1700 to order today.*

You'll be big on the total C Programming System from Mark Williams, too.



1430 West Wrightwood
Chicago, Illinois 60614

DEALERS WELCOME!! (103/212A) **ALPHA CONCORD**

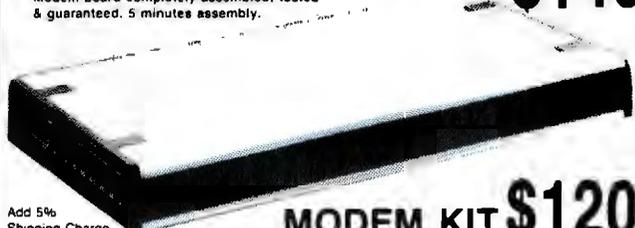
300/1200 bps
99% Hayes compatible

- Auto dial, auto answer (tone or pulse)
- 8 status indicators & switch selectable
- Auto speed selection (0-300, 1200 bps)
- Speaker with volume control
- Aluminum case, w/adaptor

6 MONTH WARRANTY. ONLY **\$179**

SEMI-ASSEMBLED MODEM *** **\$140**

Modem board completely assembled, tested & guaranteed. 5 minutes assembly.



Add 5% Shipping Charge **MODEM KIT \$120**

10 DAY MONEY BACK GUARANTEE (No refund on shipping charge)

AT COMPATIBLE

Case	\$110
Keyboard	\$110
Printer/RS232	\$120
2M expansion card	Scale

AT BAREBOARD \$CALL

AT MOTHERBOARD \$900
(without 80286 IC SETS)

XT KEYBOARD \$70.

CONCORD Technology Inc.
 Ph. (604) 879-3555 Telex: 04-503393 CONCORD
 47 W. Broadway, Van., B.C. Canada V5Y 1P1

MOTHERBOARD
 Replacement & 99% compatible

XT or APPLE IIe

\$175 ea.
(tested, guaranteed)

CASE & KEYBOARD FOR IIe \$90

BEST PRICES on IBM/APPLE CARDS
 Write for Price List.

BOOK REVIEWS

segments that are meaningful only for programs assembled or compiled directly into executable machine language. If you write a program in an interpreter system, the program has no machine code as such and therefore has no code segments.

A chapter entitled "Upstanding Characters" explains how text is represented internally and how to display it and control its appearance on the screen. The Macintosh character set is based on the 7-bit ASCII (American Standard Code for Information Interchange) code. There are a few control characters that can't be typed from the keyboard with special graphical representations on the Mac screen—the cloverleaf command symbol, the check mark for marking menu items, and the Apple symbol used for the menu title of desk accessories. The character codes for these screen-only characters are defined as Toolbox constants. For instance, you can refer to the Apple character as CHR(AppleMark).

HELPFUL APPENDICES

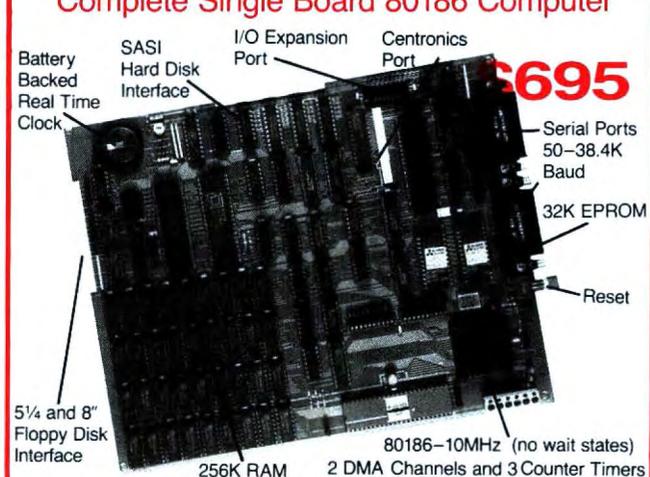
Volume One concludes with several useful appendices. The "Toolbox Summary" lists information by chapter. Appendix B, "Resource Formats," details each resource type. Appendix C is a summary of Macintosh memory layouts. Appendix D, "Key Codes and Character Codes," is a quick guide to the hexadecimal code for each character. Appendix E is a complete list of operating-system error codes, including those not covered in the main text. Also included is a list of "Dire Straits" errors that are reported directly to the user. These errors are so serious that recovery is impossible and the alert box (the one with the bomb icon) forces the user to restart the program. Appendix F is a summary of trap macros and trap words presented alphabetically by trap macro and then sorted again numerically by trap word. Appendix G summarizes assembly-language (global) variables whose addresses may be subject to change and should be referred to by name rather than by address. Further, *Macintosh Revealed* contains a useful and very detailed glossary as well as an unusually detailed index.

LEARNING TO LOVE PASCAL

As a "serious" Macintosh programmer in the midst of developing what will eventually be a stand-alone application program, I am looking forward to the second volume of this book. As a seasoned Apple II programmer accustomed to working with BASIC, I am beginning to resign myself to the fact that Mac development dictates either learning to love Pascal or switching to assembly language. Even though there are a growing number of high-level languages that are available for programming directly on the Macintosh (such as Microsoft BASIC, Apple's MacPascal, as well as Macintosh versions of FORTRAN, COBOL, C, LISP, Logo, and FORTH), the applications programmer seems to be better off working in the native language of the Macintosh just because the degree of support from

(continued)

TURBO-MEGA-BOARD
 Complete Single Board 80186 Computer



\$695

Labels on board: Battery Backed Real Time Clock, SASI Hard Disk Interface, I/O Expansion Port, Centronics Port, Serial Ports 50-38.4K Baud, 32K EPROM, Reset, 5 1/4 and 8" Floppy Disk Interface, 80186-10MHz (no wait states), 256K RAM, 2 DMA Channels and 3 Counter Timers, Expandable to 1 MB.

25% faster and **double** the RAM capacity of other 80186 boards make the **Turbo-Mega-board** the best value in single board computers at **\$695**. Fully assembled and tested, the **Turbo-Mega-Board** runs Turbo-DOS, CP/M-86 and MS-DOS. The advanced hardware and firmware features allow easy integration of a complete and powerful single or multi-user system. For more details call:

CARINT Limited
 957-R Industrial Road
 San Carlos, California 94070
 Telex: 756224 CARINT RWC

(415) 595-4333

Mark Williams

Now the biggest name
in C compilers comes in a size
everybody can afford.

Let's C.™

Introducing Mark Williams' \$75 C compiler. Want to explore C programming for the first time? Or just on your own time? Now you can do it in a big way without spending that way. With Let's C.

This is no little beginner's model. Let's C is a powerful programming tool, packed with all the essentials of the famous Mark Williams C Programming System. The one chosen by Intel, DEC, Wang and thousands of professional programmers. The one that wins the benchmarks and the reviewers' praise:

"(This compiler) has the most professional feel of any package we tested..."—BYTE
"Of all the compilers reviewed, (it) would be my first choice for product development."—David W. Smith, PC WORLD

And now for more big news. Get our revolutionary csd C Source

Debugger for just \$75, too. You can breeze through debugging at the C source level ignoring clunky assembler code.

Affordable, powerful, debuggable. Mark Williams Let's C is the big name C compiler at a price you can handle. Get your hands on it now.

Mark Williams Let's C

- For the IBM-PC and MS-DOS
- Fast compact code plus register variables
- Full Kernighan & Ritchie C and extensions
- Full UNIX™ compatibility and complete libraries
- Small memory model
- Many powerful utilities including linker, assembler, archiver, cc one-step compiling, egrep, pr, tail, wc
- MicroEMACS full screen editor with source
- Supported by dozens of third party libraries
- Upgradeable to C Programming System for large scale applications development

Let's C Benchmark Done on an IBM-PC/XT, no 8087.

Program: Floating Point from BYTE, August, 1983.

Exec Time in Seconds

Let's C	134.20
MS 3.0	347.45

Use this coupon or charge by calling toll-free:
1-800-MWC-1700. In Ill. call 312-472-6659.

Mark Williams Let's C

\$75

Please send me:

_____ copies of Let's C and _____ copies of csd (C Source Debugger) at \$75 each. (Ill. residents add 7% sales tax.)

Check Money Order Visa, MasterCard or American Express

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Card #: _____ Exp. Date: _____

Signature: _____

 **Mark Williams Company**

1430 West Wrightwood
Chicago, Illinois 60614

Inquiry 235

DESMET C \$150*

Macintosh™ Development Package

Runs on both 128K and 512K Macintosh
 Full K&R Compiler — IEEE Floating Point
 >450 Function Macintosh ROM Library
 Assembler, Linker & Librarian
 >120 Function STUDIO Library
 Machine Code Debugger
 Source Code Editor
 "Shell" interface
 300 Page manual
 RAM Disk

Published and sold direct to the end-user by:

C Ware Corporation
 P.O. Box C, Sunnyvale, CA 94087
 (408) 720-9696

*Price includes domestic shipping. Canada \$5. Europe/Asia add \$20. Call to charge by VISA, MC or AMEX. Street address: 505 W. Olive, #767, Sunnyvale, CA 94086.

Macintosh is a trademark licensed to Apple Computer, Inc.

Apple Computer will probably be greater.

Chernicoff's book is well written, nicely designed, and well organized. For the type of help it provides, it is the best book I've seen.

Bonnie L. Walker (4101 Woodhaven Lane, Bowie, MD 20715) is a systems analyst/programmer. Currently she is using a 512K Mac to develop a nutrition self-help assessment and data-analysis system on a grant from the National Institutes of Health.

ADVANCED PROGRAMMER'S GUIDE FEATURING dBASE III AND dBASE II

Reviewed by Paul W. Lowans

The combined nine years of dBASE programming and technical-support experience of authors Luis Castro, Jay Hanson, and Tom Rettig is evident in the information-packed *Advanced Programmer's Guide Featuring dBASE III and dBASE II*. Castro began with Ashton-Tate in 1982 and is currently project supervisor of the Software Support Center. Hanson is director of project support. Rettig is a project supervisor at the Software Support Center.

The authors present all versions of dBASE II and III. The purpose of this book is not proper syntax and explanations of commands; rather, it emphasizes programming design and technique. Commands and algorithms are grouped to provide the reader with an understanding of dBASE's programming capabilities.

An optional disk (\$25) containing programs and algorithms is available but does not contain any additional information. It serves as a convenience to programmers who do not want to key in the routines.

The authors discuss a variety of topics centered around setting up a complete database system. They explain the importance of security and how to provide limited access to users by setting up passwords. They stress the importance of proper documentation, both within the program and hard copy, and they make suggestions as to the best approach. Also, they emphasize preparation before writing the first code so that coding is smoother and easier. The book explains a standard for program structure by indenting lines and distinguishing memory variables from fields. This allows prompt understanding of the program by someone other than the programmer.

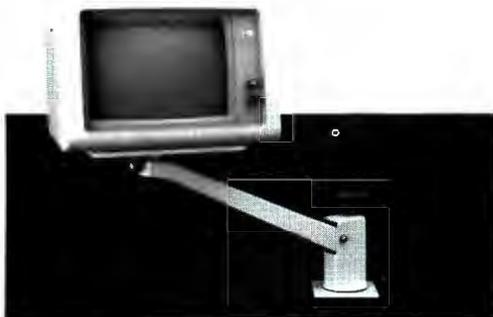
Discussions of techniques in data handling, covering all types in both database and memory-variable forms, are included. *Advanced Programmer's Guide* contains suggestions on interfacing a program with a user by setting up friendly and appealing screens. Chapters are devoted to database handling, printing and form generators, and interfacing dBASE with assembly language. The coverage of debugging and optimizing techniques is very good.

Castro, Hanson, and Rettig explain software differences and problems and give special attention to programs and algorithms that work around the problems. In most cases,

(continued)

FREE
 CATALOG

More Space Saving Products From LinTek Computer Accessories



- Monitor Mover (Adjusts 4 ways) \$149.95
- Space Saver Arm (Adjusts 3 ways) 89.00
- Dust Cover/Copy Holder (for IBM-PC) 24.95
- Keyboard Drawer (25" x 15½" x 3½") 84.95
- Medium Tilt & Turn (11" x 10" x 2½") 27.95
- Large Tilt & Turn (14" x 14" x 2½") 34.95
- PC Printer Stand (Fits all printers) 19.95
- System Floor Stand (For IBM-PC) 23.95

★ ★ ★ SEND FOR FREE CATALOG ★ ★ ★

LinTek 
 Computer Accessories

Dealer inquiries
 welcome.

P.O. Box 8056, Grand Rapids, MI 49508 (616) 241-4040

THE PROFESSIONAL'S CHOICE

Lotus
1-2-3
\$309

Lotus
Symphony
\$429

dBase III
\$369

FrameWork
\$369

MultiMate
\$239

Word
Perfect
\$209

Software

Word Processing Editors

FANCY FONT	\$139
FINAL WORD	\$189
MICROSOFT WORD	\$229
MULTIMATE	\$239
MULTIMATE ADVANTAGE	\$299
OFFICE WRITER/ SPELLER	\$249
PFS: WRITE	\$ 95
SAMMA WORD III	\$259
VOLKSWRITER DELUXE	\$159
VOLKSWRITER SCIENTIFIC	\$279
WORD PERFECT 4.0	\$209
WORDSTAR	\$189
WORDSTAR 2000	\$259
WORDSTAR 2000+	\$299
WORDSTAR PRO	\$259
XYWRITE II+	\$199

Spreadsheets/Integrated Packages

ELECTRIC DESK	\$209
ENABLE	\$359
FRAMEWORK	\$369
JAZZ	\$399
LOTUS 1-2-3	\$309
MULTIPLAN	\$135
OPEN ACCESS	\$369
SMART SYSTEM SPREADSHEET	\$559
AUDITOR	\$109
SUPERCALC 3	\$219
SYMPHONY	\$429

Accounting

BPI	\$319
GREAT PLAINS IUS EASYBUSINESS	\$479
ONE WRITE PLUS	\$319
OPEN SYSTEMS	\$179
PEACHTREE	\$369
REAL WORLD	\$299
STAR ACCOUNTING PARTNER	\$369
STAR ACCOUNTING PARTNER II	\$249
	\$549

Desktop Environments

DESK ORGANIZER	\$ 79
GEM DESKTOP	\$ 45
SIDEKICK	\$ 45

Database Systems

ALPHA DATA BASE MANAGER II	\$179
CLIPPER	\$399
CLOUD V 2.0	\$139
CONDOR III	\$329
CORNERSTONE	\$289
DBASE II	\$299
DBASE III	\$369
KNOWLEDGEMAN PC FOCUS	\$269
PFS: FILE/PFS: REPORT	\$1195
POWERBASE	\$169
QUICKCODE III	\$319
QUICKREPORT	\$169
R BASE 4000	\$249
R BASE 5000	\$379
REFLEX	\$329
REVELATION	\$729

Languages/Utilities

CONCURRENT DOS	\$189
C86 C COMPILER	\$299
DIGITAL RESEARCH C COMPILER	\$219
DR FORTRAN 77	\$219
LATTICE C COMPILER	\$299
MICROSOFT C COMPILER	\$249
MS BASIC COMPILER	\$249
MS FORTRAN	\$239
NORTON UTILITIES	\$ 69
TURBO PASCAL	\$ 59
XENIX	\$Call

Project Management

HARVARD TOTAL PROJECT MANAGER	\$259
MICROSOFT PROJECT	\$159
PROJECT SCHEDULER NETWORK	\$339
SUPERPROJECT	\$219
TIMELINE 2.0	\$299

Communications/Productivity Tools

CROSSTALK	\$105
CROSSTALK MKIV	\$149
PROKEY	\$ 89
KEYWORKS	\$ 69
REMOTE	\$119
SMARTCOM II	\$109
SUPERKEY	\$ 55

Graphics/Statistics

BPS BUSINESS GRAPHICS	\$229
CHARTMASTER	\$229
CHARTSTAR	\$169
DIAGRAM MASTER	\$229
EXECUVISION	\$259
ENERGRAPHICS	\$199
GEM DRAW	\$ 89
GRAPHWRITER	\$ 89
COMBO	\$359
INNOVISION	\$329
MS CHART	\$159
OVERHEAD EXPRESS	\$109
PC DRAW	\$249
PC PAINTBRUSH	\$ 89
PC PAINT	\$ 79
PFS: GRAPH	\$ 95
SIGNMASTER	\$165
STATGRAPHICS	\$595
STATPAK-NWA	\$329
STATPAC-WALONICK	\$349
SYSTAT	\$419

Professional Development

LIGHTYEAR	\$329
THINK TANK	\$119

Personal Finance

DOLLARS AND SENSE	\$119
HOWARD TAX PREPARER 85	\$195
MANAGING YOUR MONEY	\$119

Hardware *

Accessories

CURTIS SURGE PROTECTORS	\$Call
DATASHIELD BACKUP POWER	\$Call
GILTRONIX A/B SWITCH (64K)	\$Call
MICROBUFFER INLINE (64K)	\$Call
MICROFAZER INLINE	\$219
256K RAM SET	\$ 49
8087 MATH CHIP	\$139

Multifunction Boards

AST ADVANTAGE	\$389
AST 6 PAK PLUS (64K)	\$229
AST 6 PAK PLUS (384K)	\$269
ORCHID BLOSSOM (0K)	\$209
ORCHID BLOSSOM (384K)	\$289
ORCHID PC TURBO	\$699
PERSYST TIME SPECTRUM (0K)	\$209
PERSYST TIME SPECTRUM (384K)	\$269
QUADBOARD (0K)	\$229
QUADBOARD (384K)	\$249
TECMAR CAPTAIN (0K)	\$189
TECMAR CAPTAIN (384K)	\$229
TECMAR JR CAPTAIN (128K)	\$329
TECMAR JR WAVE (64K)	\$249
TECMAR WAVE (64K)	\$209

Display Boards

EVEREX EDGE	\$319
EVEREX GRAPHICS EDGE	\$329
HERCULES GRAPHICS CARD	\$309
HERCULES COLOR CARD	\$159
PARADISE MODULAR GRAPHICS	\$275
PARADISE MULTIDISPLAY CARD	\$295
PERSYST BOB	\$369
PRINCETON SCAN DOUBLER	\$199
SIGMA COLOR 400	\$529
STB CHAUFFER	\$279
STB GRAPHICS PLUS II	\$309
TECMAR GRAPHICS MASTER	\$459
TSENG ULTRA PAK	\$429
TSENG ULTRA PAK-S	\$369

Emulation Boards

AST	\$Call
CX1 3278/9 Plus	\$959
IRMA	\$799
IRMALINE	\$999
IRMAPRINT	\$Call

Networks

AST PC NET	\$Call
CORVUS NET	\$Call
ORCHID PC NET	\$Call
3 COM	\$Call

Displays

AMDEK 310A	\$169
PRINCETON HX-12	\$459
PRINCETON MAX-12E	\$179
PRINCETON SR-12	\$589
PRINCETON HX-12E	\$Call
PRINCETON HX-9	\$Call
QUADRAM AMBERCHROME	\$179
TAXAN 122 AMBER	\$169
TAXAN 420/440	\$399/\$599
ZENITH 124 AMBER	\$145
ZENITH 135 COLOR	\$Call

Modems

AST REACH 1200	\$389
HAYES 1200	\$389
HAYES 1200B	\$365
HAYES 2400	\$609
TRANSET 1000	\$299
VENTEL 1200 HALF CARD	\$369
WATSON	\$449

Mass Storage/Backup

ALLOY MT25 TAPE (EXT)	\$895
CORE AT PLUS	\$Call
OMEGA BERNOULLI BOX-NEW!	\$2549
IRWIN 310A 10MB TAPE (EXT)	\$850
IRWIN 110D 10MB TAPE (INT)	\$549
SYSGEN IMAGE	\$850
TALLGARSS TG5025	\$2845
TECMAR QIC-60H TAPE (EXT)	\$1499
TECMAR QIC-60AT TAPE (INT)	\$1199

Printers/Plotters

DIABLO	\$Call
EPSON FX-85	\$469
EPSON FX-185	\$489
EPSON LQ-1500	\$899
HP 7475A PLOTTER	\$Call
JUKI 6300	\$799
JUKI 6100	\$389
NEC P3	\$799
NEC 3550	\$1139
OKIDATA	\$Call
OUME SPRINT 1155	\$1589
TOSHIBA P1340	\$629
TOSHIBA P351	\$1149

Input Devices

KEYTRONIC 1561	\$179
KOALA	\$Call
MICROSOFT MOUSE	\$139
PC MOUSE W PAINTBRUSH	\$129

Harvard
HTPM
\$259

Chart-Master
\$229

Quadboard
384K
\$249

Tseng
Ultra Pak
\$429

Smartmodem
1200B
\$365

Smartmodem
2400
\$609

*CALL FOR SHIPPING COSTS



LOWEST PRICE GUARANTEE!!

We will match current nationally advertised prices on most products. Call and compare.

free!

Diskette Library Case with your order



1-800-221-1260

In New York State call (718) 438-6057

TERMS:

Checks—allow 14 days to clear. Credit processing—add 3%. COD orders—cash, M.O or certified check—add \$5.00. Shipping and handling UPS surface—add \$3.00 per item (UPS Blue \$8.00 per item). NY State Residents—add applicable sales tax. All prices subject to change.



MON.-THURS. 9:00AM-8:00 PM
SUN. & FRI. 9:00AM-4:00 PM

Softline

Softline Corporation
P.O. Box 729, Brooklyn, N.Y. 11230
TELEX: 421047 ATLN UI



TECHLAND Blue Lynx.
Complete line _____ Call!
IRMA Complete line From \$849

HARD DISCS

PEACHTREE TECHNOLOGIES
10 & 20 Meg. internal &
external _____ From \$549
IRWIN/TANDBERG Tape
back-up systems _____ From \$495
SEAGATE Fast 10, 20, 75 Meg.
for PC & AT _____ From \$495
SYSGEN Complete line _____

_____ New Low Prices. Call!

BERNOULLI TECHNOLOGY
Hard disc Subsystems _____ \$2595
PRIAM Superfast 40 & 60
Meg. for AT _____ Call!

PRINTERS & PLOTTERS

We have thousands in stock.
PRINTER SPECIAL OF THE MONTH Call for details!
HOUSTON INSTRUMENTS
Plotters and Digitizers in stock _____

DOT MATRIX

EPSON FX85/185 _____ NEW!
EPSON LX80/LQ1500 _____
COMREX 420, Epson com-
patible, 400cps _____ \$1695
OKIDATA 192 & 193, ML84,
Pacemark 2410 _____
OKIDATA Color printers,
complete line _____
TOSHIBA P-351 & 1340 _____

_____ New Low Prices!

TEXAS INSTRUMENTS 855 _____
_____ From \$799

LETTER QUALITY

NEC Spinwriters 2050, 3550,
8850 _____ New Low Prices!
COMREX CR II E, CR III & CR
IV _____ Start at \$369
We carry a full range of form
handling options.



PARADISE Multi-display
or modular graphics
cards _____ From \$199
STB Chauffeur &
Colorific _____ \$289 & \$189
SIGMA Color 400 for
PGS SR-12 New Low Price!

FLOPPY DISK DRIVES

1/2 HEIGHT Disk
Drives from Shugart,
Mitsubishi & TEAC.
PC, XT & AT Compatible
_____ From \$115



COMPUTERS

AT&T Color and Mono Systems
in stock _____ Start at \$1995
COMPUTER SPECIAL OF THE MONTH Call for details! _____

NETWORKING/ PROTOCOL CONVERSION

SNA & BISYNC 3780, 5251.
Mod 11 & 12, 3274, 3278 _____
PC TURBO 186/187 board,
128K, 8087 Serial Board
attached _____ \$875



CHIPS

All our chips are tested
and priced for quick
sale. Call us!
INTEL 8087, 80287,
high speed coproc. _____
_____ From \$125
**64K—256K
RAMCHIPS**
_____ Call for Market Price.
128K Piggy-back chips
for your AT _____
_____ Call for Market Price.



MISCELLANEOUS

MAXELL Diskettes in a
FREE flip N' file box \$25
DYSAN Diskettes at
the lowest price in the
USA _____ Call!
MOUSE SYSTEMS
PC Mouse, optical
w/software _____ \$139
MICROSOFT Mouse,
bus or serial mechanical
KEYTRONICS 5151 &
5152 keyboards _____
_____ From \$149
**KENSINGTON MICRO-
WARE** MasterPiece, \$99
CURTIS Accessories,
Pedestals, cables, etc. _____
HAYES Mach II & Mach
III Joysticks _____ \$39/\$45
QUADRAM Microfazer
print buffer 8-128K _____
_____ From \$129
TRIPPELITE ISOBAR
surge protectors, 4 & 8
plug _____ From \$49



©Copyright 1985
Micro Mart, Inc.
Technology Corporate Campus
3159 Campus Drive
Norcross, Georgia 30071

IBM is a registered trademark of
International Business Machines
Corporation.

Prices are subject to change
without notice and are similar,
but may vary at over 20 Micro
Mart Retail Stores.

Inquiry 249



Micro Mart has financing
options available. Ask for
a Micro Mart Blue Chip
Credit Card, today.





WELCOME TO THE WORLD OF MICRO MART.

A world of friendly micro-computer experts. And your window to the world of computer products, information, service and support. Or just good microcomputer advice.

Micro Mart presents the latest and best-selling PC products at some world-beating prices. And with our 15 million dollar inventory on-line to our IBM mainframe, we quickly know what's in stock. And how to get it to you fast.

You'll find Micro Mart Service to be world class, too. Highly trained technicians repair and replace any product we sell. On-site, depot and customized Micro Mart Service can fit your business needs. No question. But if you have any questions about any aspect of microcomputers, Micro Mart will give you the answers.

So for all your PC needs, call on the people at Micro Mart. They make all the difference in the world. "We're America's PC Specialists."

1-800-241-8149. ORDERS ONLY (404) 449-8089. INFORMATION

MICRO MART BT 11/1



©D. Martin 1985



MICRO MUSIC New synthesizer system for PC, incl. keyboard & digitizer \$1895
POLAROID Palette \$1195

SOFTWARE

SOFTWARE SPECIAL OF THE MONTH. Call for details!

ACCOUNTING

SORCIM/IUS Complete line including Windows. From \$289/each

SPREADSHEETS & INTEGRATED PACKAGES
SORCIM SuperCalc 3, vers. 2.0. New Low Price!

ENHANCEMENTS & UTILITIES

FOX & GELLER Complete line for dBase II/III, Rbase 4000

NORTON Utilities 3.0 \$69

ROSESOFT ProKey 3.0 \$89

CENTRAL POINT SOFTWARE Copy II PC \$35

SOFTSTYLE Set FX+ and Printworks, printer control

SIDEWAYS Inverts printout \$35

BORLAND SideKick and SuperKey From \$40

COMPILERS & LANGUAGE TOOLS

LATTICE C-Compilers \$279

MICROSOFT Complete line

BORLAND Turbo Pascal, Turbo Toolbox & more... From \$35/each

GRAPHICS

Z-SOFT PC Paintbrush, mouse graphics \$95

DECISION RESOURCES
ChartMaster Latest version \$239

MICROSOFT Chart \$169

COMMUNICATIONS

MICROSTUF Crosstalk XVI. Latest version \$99

HAYES Smartcom II \$85

WORD PROCESSORS

MULTIMATE w/spelling checker & tutorial New Low Price!

SAMNA + \$350

MICROSOFT Word. New version New Low Price!

LIFETREE Volkswriter Deluxe \$169

SSI WordPerfect, version 4.0 \$249

MICROPRO WordStar Professional series New Low Price!

OFFICE & PROJECT PLANNING

HARVARD Total Project Manager \$299

SORCIM/IUS Super Project \$199

MICROSOFT Project \$175

DATA BASE MANAGERS

Call for unadvertised Data Base Managers.

MICRORIM 4000 or 5000, Report Writer & Clout

New Low Price!

WARNER SOFTWARE The Desk Organizer \$145

MICROSTUF Infoscope \$99

MODEMS

HAYES Smartmodem 300, 1200, 1200B & 2400. We have the best stock in the USA. Call!

VEN-TEL 1200 Baud Half Card w/Crosstalk \$399

MONITORS AND CRT'S

PGS Max 12 (E) amber, HX12, HX12 (E), & SR-12 New Low Prices!

QUADRAM Quadchrome, 690 dot RGB \$449

AMDEK Color 300, 500, 600, 700, 710 Call!

AMDEK 300A/300G/310A \$129/\$119/\$165

MICRO MART IS A SERVICE MARK OF MICRO MART, INC.

Inquiry 249



EXPECT NOTHING LESS!

**GUARANTEED
100%
SOFTWARE
COMPATIBLE**

**The Match For Over 400
Software Programs . . .**

Software loves us. In fact, Peachtree, Open Systems, Great Plains™ Small Business Software, and many others recommend our computer forms. We're compatible with software programs big or small. Together we get your job done.

**We'll Match Your Special
Programming Needs with Custom
Designed Formats.**

Forms designed to your exact specifications. You can have extra graphic touches, colors, perforations, parts, and much more. Custom design and 100% software compatibility are as easy as placing a custom order. Call our Forms Consultants . . . Toll Free for assistance. **1-800-328-5727**

100% Software Compatibility
Guaranteed. Expect Nothing Less.



**FREE CATALOG and
COMPATIBILITY GUIDE**

Request your **FREE** 32 page catalog complete with a software/forms Compatibility Guide. Call Toll Free:

1-800-328-5727, Ext. 518
In Minnesota 1-800-742-5685



7765

A DIVISION OF DELUXE CHECK PRINTERS, INC

they point out which version is being used in the examples. Most of the appendix is filled with subroutines and programs of all kinds, ranging from dBASE to assembly language (in CPM and MS-DOS).

NOT JUST FOR DBASE

The authors cover the full array of programming subjects, including operating systems, languages, and programming concepts with emphasis on structured programming. Because the principles covered can be applied to all programming languages, not just dBASE, this book is of significant value as a programming guide for multilanguage programmers.

In the back of the book is a section titled "Curriculum for Educators." It provides guidelines for the book's use as a textbook for programmers.

Advanced Programmer's Guide is a top-notch dBASE text. It is written in easy-to-understand language and provides complete coverage of dBASE programming. It is a guide to be used with the dBASE manual and would be a valuable source for a serious beginner or an advanced programmer.

Paul W. Lowans (POB 357, Spencerport, NY 14559) is an electronics engineering technician at Xerox Corporation in Rochester, New York.

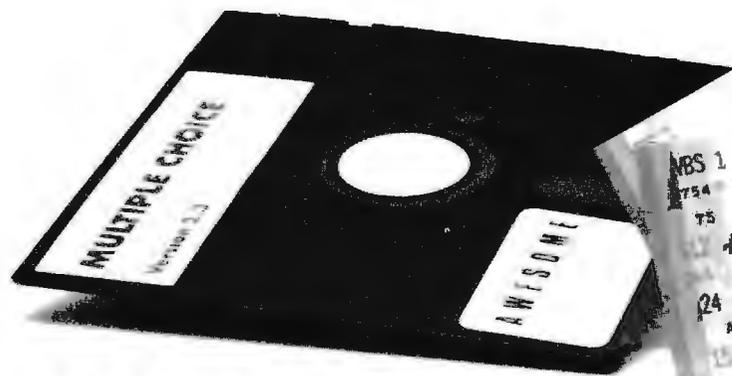
**16-BIT MODERN MICROCOMPUTERS:
THE INTEL 18086 FAMILY**
Reviewed by Alan Finger

The Intel 8086 has become the most widely written-about family of microprocessors. George Gorsline's *16-Bit Modern Microcomputers: The Intel 18086 Family* is one of the latest entries. Unlike the majority of such books that are targeted at the advanced user of the IBM Personal Computer, this text for software-oriented students is intended to provide a better understanding of the relationship between software and the underlying hardware environment. The author, a professor of computer science at Virginia Polytechnic Institute and State University at Blacksburg, presents an integrated picture of 16-bit microprocessor hardware and software.

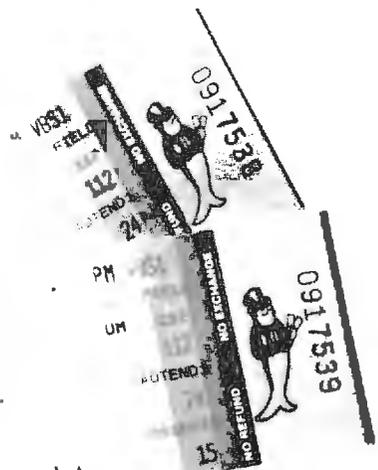
BROAD TERRITORY

The book is divided into 13 chapters jumping—perhaps more than necessary—between hardware- and software-related topics. Gorsline starts with an interesting discussion of computer history and the inverse relationship between hardware and software costs over the years. This moves into a description of classic microcomputer architecture and design with comparisons of functions of some of the more common designs. A discussion of subroutine-calling methods highlights some of the low-level diversity that is so often hidden from the program-

(continued)



MS 1
754 IELD
75 1
ADULT
ITEMD1
24 17.50
A
BOBSEP



TWO WAYS TO SET A CROWD ON FIRE

Take this ad into your office and ask: "Anybody want to see a couple of Springsteen tickets?" You'll be surprised at the amount of interest you generate. Valuable commodities tend to cause excitement. Here's another way to fire up a crowd.

HOW TO PUT ON A SPECTACULAR PC PERFORMANCE

Quietly install Multiple Choice on your PC. Then, when you sense someone looking over your shoulder, put on the following show:

As you type along on your word processor, using WordStar, Xywrite, WordPerfect, MicroSoft Word, etcetera, make one keystroke that instantly puts you into the middle of your 1-2-3, Framework or SuperCalc spreadsheet.

The rapid intake of breath, or possibly the clearing of a throat, will signal your next move. Make another keystroke to instantly put you into MS/DOS, where you casually do a directory listing.

When you're done listing the directory, one keystroke will shoot you back into the original word-processing document, with everything exactly as you left it.

By this time, you'll have a crowd that rivals the one you drew with the Springsteen-ticket ploy. If you want to guarantee an even larger crowd, try juggling eight resident applications, in addition to SideKick.

You've just experienced *Multiple Choice*, a memory-switching program from Awesome Technology.

JERRY POURNELLE RECOMMENDS IT.

Jerry Pournelle discusses *Multiple Choice* in his *Byte* column: "I've got it here at Chaos Manor (I'm running it now on the Z-160) and it works fine. With *Multiple Choice*, you can have WordStar, DOS and Lotus 1-2-3 running all at the same time (with SideKick in the background already yet). Who needs Symphony? Recommended!"

Pournelle later says: "Most of us might like to work on one thing at a time, but in the real world we tend to be interrupt-driven. Sit down to write, and the phone rings: Someone wants someone else's telephone number. Start to work on a spreadsheet, and you're sure to remember a phone call you ought to make. . . ."

"... It isn't so much that we want to be able to run more than one program at a time, but that we want to go back and forth among tasks without long waits and distractions. . . ."

IN ONLY 10K OF MEMORY, MULTIPLE CHOICE LETS YOU ADD FUNCTIONS TO SIDEKICK, OR CREATE YOUR OWN SIDELONE.

Pournelle concludes that SideKick was a good start, but: "... while SideKick's command structure is logical, it isn't necessarily related to the programs you want to use. I'd rather use SideKick, 123 or Supercalc, Xywrite, dbase II and MITE than any of the integrated programs I've tried!"

With *Multiple Choice*, then, you can have the best of all possible worlds. Add your favorite programs to SideKick, or create your own integrated *SideClone* altogether.

WHY NOT GO WITH IBM'S TOP VIEW AND MULTIPROCESSING?

Don't purchase a multiprocessing operating system like Top View. There are a bunch of reasons.

Windowing ignores the reality of most software designs: *You need more space, not less.* Top View wallows in about 170K of resident memory (*Multiple Choice* takes 10K). TopView doesn't give you the full range of MS/DOS commands (you can't even format a disk). Without special hardware, most of today's applications, running concurrently, will foul up your screen. And finally, you don't need multiprocessing because word processing and spreadsheets run slowly enough as it is.

WP and spreads *can't afford* to share background-processing cycles. WordStar can barely keep up with the cursor now. And when you hit your spreadsheet's "calc" key, you want answers, not a blinking thinking-indicator.

MEET THE SPRINGSTEEN OF SILICON-BRAIN SURGEONS.

Seeing this ad is about as close as most people will ever get to a pair of Springsteen tickets, a much sought after and valuable commodity.

Springsteen is *The Boss*. It's only right that a performer who gives the audience more than any other entertainer should be on top. His four-hour performance completely redefines the word *value*.

Each industry has such superstars. Once upon a time, Jason "*Born-to-code*" Loveman joined Digital Research as a wizard. Jason regarded his officially assigned project as a dead-end. So, during breaks, evenings and weekends, he created an MS/

DOS work-alike for the 68000. He told DR of it about the time his buddies were showing it to Atari (also about that time, a news leak in *Infoworld* mentioned the codename *Jason-DOS*). Atari bought it, as did several other companies.

Thus, a guy named Loveman, out to do an encore, formed Awesome Technology (no brag, just fact). Awesome's first product: *Multiple Choice*, in its own way, the same kind of value represented by Springsteen tickets.

Yes, there are other switcher programs. But, they lack the compactness and the reliability of *Multiple Choice*. Their authors haven't "paid the price." *Good luck, goodbye* competition.

FOR ONLY \$99, DON'T LET THE GLORY DAYS PASS YOU BY.

If you want extra time to go *dancing in the dark*, set your PC *on fire* with an Awesome concert. It will do wonders for not only your *showbusiness* career, but your *business-business* career. Isn't that why you got your PC in the first place?

Multiple Choice takes less than 10K of resident memory (one-seventeenth that of Top View and a fraction of that taken by full-blown SideKick). It's not copy protected, because Jason isn't paranoid (*Multiple Choice* will even run, speaking about paranoid copy protection, Framework and 1-2-3). And you may return it for any reason within 30 days for a full refund.

Go to your nearest dealer and demand *Multiple Choice* today! You can start *blasting through the bedrock* of PC delays tomorrow. You can also put on one heck of a career-enhancing show.

A W E S O M E TECHNOLOGY INC

177 Webster St., Suite A-416, Monterey, CA 93940
For information, call 408/646-1384

Order TOLL FREE (VISA/MC/no CODs,POs)
800/548-2255 x803 or in CA 800/624-2644 x803
Price: \$99 (CA residents include sales tax.)

Current customers can trade up to *Multiple Choice* version 2.3 by returning their diskette with \$25.

Dealers please contact Awesome's master distributor:

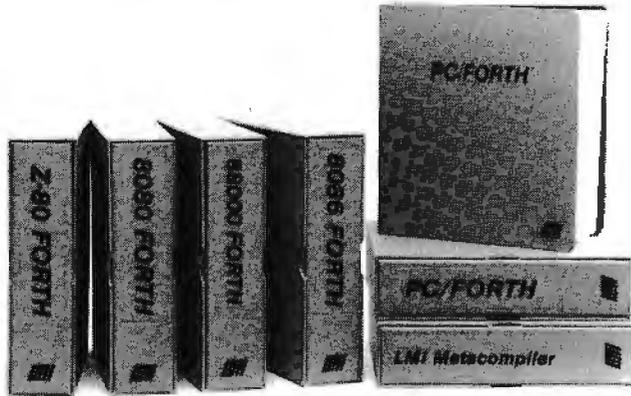


Secure Systems Technology, Inc.
1966 E. 66th St., Cleveland, OH 44103
800/647-5580 or in OHIO 216/361-3304

*Multiple Choice works with MS/DOS 2.0 and later, on all IBM PC/XT/AT/compatibles, and comes with a money-back guarantee. In addition to the August *BYTE*, Multiple choice was reviewed in the 7/15/85 *Los Angeles Times* by Lawrence J. Magid, and in the 6/18/85 *Bay Area Computer Currents* by Steve Rosenthal. © 1985 by Awesome Technology, Inc. Products referenced are trademarks of somebody or other. Metaphors by Bruce Springsteen. Advertising by TRBA. 408/258-2708.

TOTAL CONTROL

with **LMI FORTH™**



For Programming Professionals: an expanding family of compatible, high-performance, Forth-83 Standard compilers for microcomputers

For Development:

Interactive Forth-83 Interpreter/Compilers

- 16-bit and 32-bit implementations
- Full screen editor and assembler
- Uses standard operating system files
- 400 page manual written in plain English
- Options include software floating point, arithmetic coprocessor support, symbolic debugger, native code compilers, and graphics support

For Applications: Forth-83 Metacompiler

- Unique table-driven multi-pass Forth compiler
- Compiles compact ROMable or disk-based applications
- Excellent error handling
- Produces headerless code, compiles from intermediate states, and performs conditional compilation
- Cross-compiles to 8080, Z-80, 8086, 68000, and 6502
- No license fee or royalty for compiled applications

Support Services for registered users:

- Technical Assistance Hotline
- Periodic newsletters and low-cost updates
- Bulletin Board System

Call or write for detailed product information and prices. Consulting and Educational Services available by special arrangement.



Laboratory Microsystems Incorporated
Post Office Box 10430, Marina del Rey, CA 90295
Phone credit card orders to: (213) 306-7412

Overseas Distributors.

Germany: Forth-Systeme Angelika Flesch, D-7820 Titisee-Neustadt
UK: System Science Ltd., London EC1A 9JX
France: Micro-Sigma S.A.R.L., 75008 Paris
Japan: Southern Pacific Ltd., Yokohama 220
Australia: Wave-onic Associates, 6107 Wilson, W.A.

BOOK REVIEWS

mer of high-level languages. Likewise, the explanation of memory-addressing modes clearly illustrates the underlying relationship between software and hardware behavior.

THE 8086

The book then zeroes in on a description of the 8086's internal architecture, applying the concepts developed in a preceding chapter. This actually is the shortest portion of the book; Gorsline conveys a very concise view of the 8086.

As we begin to delve into the 8086 instruction set, the author's computer science orientation begins to show. He presents the various comparison, jump, and call instructions first, with the emphasis on implementation of proper flow of control constructs. Even their symbolic representations are included. Although the intent is laudable, I found a few missing elements in the discussion of long conditional jumps (greater than +/- 128 bytes) and the use of register and indirect jumps and calls to implement multiway, or case, transfers. A separate chapter covers various data-movement and manipulation instructions.

Gorsline covers most hardware-related topics in a single long chapter. Here we are treated to an introduction to 8086 system design detailing the bus timing and the various "glue" components required to turn an 8086 processor into a working computer. If the reader is not well versed in computer design, the timing diagrams and schematics may prove intimidating. Fortunately, a thorough understanding is not critical to the remaining material, which is devoted to the problems of moving data in and out of a computer. Intel's 8251 Programmable Communications Controller is described thoroughly, as are the principles of writing device-driver software.

Since one of the first steps in "bringing up" a microcomputer system is to establish terminal communications with it, the discussion is very appropriate. Gorsline then examines the 8086 interrupt-and-trap mechanism as a necessary component of a practical system, and for those readers not familiar with the technologies of the various peripherals used in microcomputer systems, he provides a general dissertation on various types of devices such as serial terminals, rotating storage (disks), and bubble memories.

One of the more difficult yet powerful components in the 8086 family is the 8087 Numeric Data Processor. It receives excellent treatment at the hands of Gorsline. Starting with the need for utilizing floating-point arithmetic, he provides one of the more readable explanations of the 8087 architecture and instruction set that I have seen. Some of the more esoteric but critical details, such as rounding and infinity interpretation, are also presented clearly.

It is not until we are fairly well along that the book actually deals with the 8086 assembly language itself. What the author presents serves as a good, albeit incomplete, reference to the subject. Although there are several 8086

(continued)

FORTRAN, C, and BASIC Programmers...

Programming just got easier with Scientific Subroutine Libraries from Wiley Professional Software.

You need to quickly generate dependable, accurate and error-free code. Whatever language you use, Wiley Professional Software has a powerful Scientific Subroutine Library that can save you considerable programming time and development money.

Each library consists of more than 100 pretested and precompiled mathematical and statistical subroutines, supplied on disk as a linkable library and as source code. Each package includes 400-plus pages of documentation, providing you with extensive reference material, a listing of the subroutine's source code, complete test programs and the results of running each test. The Subroutines cover formulas for:

- ◆ General statistics
- ◆ Probability
- ◆ Analysis of variance
- ◆ Regressions
- ◆ Matrices
- ◆ Interpolations
- ◆ Fourier analysis
- ◆ Cross tabulations
- ◆ Differential equations
- ◆ Roots of biquadratic equations
- ◆ Function evaluations
- ◆ Systems of equations
- ◆ Solution of equations
- ◆ Times series analysis
- ◆ and more

Just out, Professional FORTRAN! Coming Soon, MORE FORTRAN!

And now all the subroutines are available to those of you programming in Professional FORTRAN. All that's required is IBM Professional FORTRAN or Ryan McFarland FORTRAN.

On the way is MORE FORTRAN, which includes subroutines covering such areas as:

Analytical Geometry ◆ Vector Algebra ◆ Utility (including complex matrix manipulation) ◆ Numerical Analysis (including fast Fourier transforms, and solution to systems of non-linear equations) ◆ Assembler Service Routines—FORTRAN CALLS

LIBRARY	PRICE	REQUIREMENTS
FORTRAN Library	\$175	Microsoft FORTRAN ver. 3.13 or later, or IBM 2.0
C Language Library	\$175	Lattice C Compiler ver. 2.12 or later
BASICA Library	\$125	BASICA
Professional FORTRAN Library	\$175	IBM Professional FORTRAN; Ryan McFarland FORTRAN
MORE FORTRAN Library	Call for Price	Microsoft FORTRAN ver. 3.2 or later; IBM Professional FORTRAN; PC DOS 2.0 or better

Developed by Peerless Engineering Service

To order, or for free literature, call: 212-850-6788

Or write: Wiley Professional Software
John Wiley & Sons, Inc.
Leslie Bixel,
605 Third Avenue, New York, NY 10158



Dealer Inquiries Invited.
Educational site licenses available.

wiley[™]
PROFESSIONAL
SOFTWARE

THE TECHNICAL SOFTWARE SOURCE

BANC \$AFE

FREE Shipping on all software. Thousands of available items — Call for complete pricing.

IBM PC AT \$4299 20MB Hard Drive 512K Ram 1.2 MB floppy Monitor	IBM Compatible PC Clone \$899 CALL IBM PC	IBM PC Compatible COMPAQ \$2759 10 MB, 640K Clock, Monitor, SER
--	---	---

\$ HARD DISK DRIVES	10 meg 414/395	20 meg 565/539	Quantity 1/10	\$ HARD DISK DRIVES
----------------------------	-------------------	-------------------	------------------	----------------------------

IBM SOFTWARE		MONITORS	
LOTUS 123	CALL	AMDEK 300A	145.00
SYMPHONY	CALL	310R Hi-Res Amber	155.00
ENABLE	CALL	COLOR 600 HI-RES RGB	433.00
ASHTON TATE Framework	389.00	PRINCETON GRAPHICS HX-12	469.00
aBRSE II	389.00	SA-12	685.00
aBRSE III	389.00	MAX-12	179.00
MULTIMATE	249.00	TAXAN 121/122	149.00
MICROSOFT Multiplan	123.00	420 (RGB)	439.00
Word	229.00	415 (RGB)	489.00
Project	159.00	440 (RGB) High Res	559.00
FOX & GELLER Quickcode	139.00	PANASONIC DT-S101 Color	149.00
ASCII PRO Comm Software	99.00	DT-H103 10" High Res RGB	369.00
Word Perfect	285.00	DT-D1300D 13" RGB Color	249.00
MICROPRO WordStar	249.00	DT-M140 14" RGB Color	319.00
WordStar 8000	285.00		
SMART WCRD III	279.00		
ALSO HAYDEN, MONOGRAM, SPI, MICROCRIM, NORTON AND MORE			

IBM HARDWARE	
AST Six Pack Plus 64K	225.00
Advantage	429.00
HERCULES Mono Graphics	319.00
Color Card	159.00
OACHID Turbo 186	599.00
Pc Net Starter Kit	CALL
QUADRAM Quadboard O-K	198.00
QuadPort for AT ser & par	115.00
TECHMAR Graphics Master	469.00
STB Rio plus 64K 5 Function	189.00
Rio Grande 3 function for AT	210.00
Graphix II	369.00
High Res 400	234.00
Choffeur monographics NEW	234.00
SIGMA High Res Color 400	CALL
Multifunction Card 384k s.p., clk	169.00
Multifunction Card OK-1, 2mb	179.00
Compatible Mono Card w/par	129.00
5151 Compatible Keyboard	129.00
TTL Monitor Rmb or Grn	100.00
TALORASS W/Tape	CALL
IRWIN TAPE DRIVE	499.00
EVEREX TAPE R-XL/AT	CALL
ADWINE 20MB DRIVE	CALL
TEAC 55B	95.00
IBM 1.2MB FLOPPY	CALL
360K Floppy for AT	115.00
Compatible Color Card (par)	119.00
MOUSE SYSTEMS Mouse	169.00
MICROSOFT Mouse	117.00
DISKETTES 25 DD	15.00
ALSO — PERYSVT, PARADISE, TECHMAR, EVEREX AND OTHERS	

MODEMS	
ANCHOR Express 300/1200	249.00
Volsmodem 1200 (5 yr wrnty)	169.00
HAYES 1200	395.00
1200B	349.00
9400	CALL
Micromodem //e	219.00
Transet 1000	CALL
PROMETHEUS 1200	293.00
Promodem 1200B	229.99
Promodem 1200A	229.00
Promodem Mac Pac Kit	329.00

APPLE PRODUCTS	
BROTHER NEW 1509 DOT MATRIX	CALL
HA-10	239.00
HA-15, HA-25, HA-35	CALL
Twinwriter	819.00
EPSON LX-80 F/T	349.00
FX-85	349.00
FX-185	505.00
OKIDATA all models	CALL
PANASONIC 1091	229.00
TOSHIBA P351 w/tractor	1279.00
STAR MICRONICS SG-10	219.00
CITIZEN	CALL
CANNON Laser Printer	2499.00
HOUSTON INSTRUMENTS Plotter	CALL
APPLIED ENG. Ramworks 64K	149.00
AST Multi I/O	CALL
MICRO SCI R2 Drive Iie	169.00
llc drive	159.00
APPLE Compatible Drive	129.00
HABA Mac drive	CALL
MRC Compatible 3 1/2 drive	249.00
BEANQUILLI 5MB MAC drive	CALL
MACINTOSH Harddrive	CALL
MACINTOSH Software Jazz	CALL
MICROSOFT Macenhancer	175.00
Softcard II	259.00
Multi-plan //e & Mac	129.00
Basic (Mac)	99.00
ASCII XPRESS (communications)	69.00
THE DESK ORGANIZER (Mac)	133.00
APPLE MOUSE II	129.00
APPLEWORKS	215.00
HAYES Moch III Joystick	39.00
SYSTEM Saver Fan	69.00
VIDEO 7 V-color 7	105.00
V-color I/c (RGB)	105.00
Titon Accelerator	229.00
VIDEX Ultratrem	169.00
APRICOIN (Lifetime Warranty)	
Super Serial Imager	79.00
Graphics Interface	69.00
80 Column/64K	69.00
Extend It 64K	59.00
DISKETTES APPLE/MAC	12.00/24.00
WE SUPPORT THESE FINE SYSTEMS:	
APPLE, IBM, COMPAQ, ITT, AND MANY MORE	
No Charge for Credit Cards	

TELEX #550757/ANSWER BACK—COMPUTERBANK UD

Orders Only
800/332-BANC
OUTSIDE CALIFORNIA
COMPUTERBANC
 16783 Beach Blvd., Huntington Beach, CA 92647
 714/841-6160

Cash prices indicated. All products are in factory sealed packages. We guarantee all items for 30 days. Within this period, defective merchandise returns must be accompanied by RMA number. All other returns will be subject to a 10% restocking fee. For prepaid orders, there will be a 3% shipping charge; 5% for UPS Blue Label; \$5.00 minimum, all orders outside U.S.A. at 15% shipping. California residents add 6% sales tax. Prices subject to change without notice.

Copyright 1985 COMPUTERBANC. All Rights Reserved

BOOK REVIEWS

assembler dialects in use today. Gorsline chose to use Intel's version; while not the most widely used, it represents the language "standard" upon which Microsoft's MASM assembler is based.

At this point, I was beginning to get the impression that Gorsline wrote much of the material more than a few months before publication. Reading on, this suspicion was confirmed as the author takes us back to hardware again with a complete examination of the Intel's 8089 I/O coprocessor. The 8089 is a powerful but expensive and difficult-to-use device that combines a microprocessor and a DMA (direct memory access) controller into a single integrated circuit. It never became widely used, and anything more than a passing reference to it seems superfluous. An accompanying section on DMA technique is vital, however, and contains a significant error: Although the author says otherwise, Intel's 8257 DMA controller does *not* directly support 16-bit data transfers.

Rather abruptly, Gorsline returns to the world of software with three chapters devoted to the fundamental elements of system software design: operating systems, assemblers, and compilers. He includes a brief history of operating systems and their basic functions, with a look at three 8086-based operating systems in use today: CP/M-86, iRMX86, and UNIX. Of these three, only the last is a major player in today's 16-bit market.

Gorsline introduces assembler and linker design concepts with a series of flow diagrams. A section on the use of macros and conditional assembly for the purpose of creating structured programs is probably one of the most valuable discussions for assembly-language programmers, regardless of the processor they may be working with.

The text then moves from assemblers to high-level languages with a brief but illuminating look at language theory. As earlier, the material seems somewhat dated with its concentration on older languages such as FORTRAN and COBOL. In one of the few references to the C language, Gorsline erroneously states that it does not support dynamic strings.

So as not to overlook the more advanced processors in the 8086 family, the author takes us back again to practical matters with a somewhat sketchy description of Intel's 80186 and a more detailed description of the 80286 processor architectures and enhancements.

The final chapter, while not really coherent with earlier sections, is certainly one of the most interesting. It is devoted to communications and networking, and it is here that Gorsline truly displays his knowledge. From network topologies and the ISO Model to local-area networks, the author manages to pack a comprehensive yet readable survey into 35 pages.

SPEAKING FROM EXPERIENCE?

I found *16-Bit Modern Microcomputers* to be a good book, but not on the strength of its 8086 material. It is true that a writer will be best writing from his experience. While

(continued)



The C for Microcomputers

PC-DOS, MS-DOS, CP/M-86, Macintosh, Amiga, Apple II, CP/M-80, Radio Shack, Commodore, XENIX, ROM, and Cross Development systems

MS-DOS, PC-DOS, CP/M-86, XENIX, 8086/80x86 ROM

Manx Aztec C86

"A compiler that has many strengths ... quite valuable for serious work"

Computer Language review, February 1985

Great Code: Manx Aztec C86 generates fast executing compact code. The benchmark results below are from a study conducted by Manx. The Dhystone benchmark (CACM 10/84 27:10 p1018) measures performance for a systems software instruction mix. The results are without register variables. With register variables, Manx, Microsoft, and Mark Williams run proportionately faster. Lattice and Computer Innovations show no improvement.

	Execution Time	Code Size	Compile/Link Time
Dhystone Benchmark			
Manx Aztec C86 3.3	34 secs	5,760	93 secs
Microsoft C 3.0	34 secs	7,146	119 secs
Optimized C86 2.20J	53 secs	11,009	172 secs
Mark Williams 2.0	56 secs	12,980	113 secs
Lattice 2.14	89 secs	20,404	117 secs

Great Features: Manx Aztec C86 is bundled with a powerful array of well documented productivity tools, library routines and features.

Optimized C compiler	Symbolic Debugger
AS86 Macro Assembler	LN86 Overlay Linker
80186/80286 Support	Librarian
8087/80287 Sensing Lib	Profiler
Extensive UNIX Library	DOS, Screen, & Graphics Lib
Large Memory Model	Intel Object Option
Z (v) Source Editor -c	CP/M-86 Library -c
ROM Support Package -c	INTEL HEX Utility -c
Library Source Code -c	Mixed memory models -c
MAKE, DIFF, and GREP -c	Source Debugger -c
One year of updates -c	CP/M-86 Library -c

Manx offers two commercial development systems, Aztec C86-c and Aztec C86-d. Items marked -c are special features of the Aztec C86-c system.

Aztec C86-c Commercial System	\$499
Aztec C86-d Developer's System	\$299
Aztec C86-p Personal System	\$199
Aztec C86-a Apprentice System	\$49

All systems are upgradable by paying the difference in price plus \$10.

Third Party Software: There are a number of high quality support packages for Manx Aztec C86 for screen management, graphics, database management, and software development.

C-tree \$395	Greenleaf \$185
PHACT \$250	PC-lint \$98
HALO \$250	Amber Windows \$59
PRE-C \$395	Windows for C \$195
WindScreen \$149	FirstTime \$295
SunScreen \$99	C Util Lib \$185
PANEL \$295	Plink-86 \$395

MACINTOSH, AMIGA, XENIX, CP/M-68K, 68k ROM

Manx Aztec C68k

"Library handling is very flexible... documentation is excellent... the shell a pleasure to work in... blows away the competition for pure compile speed... an excellent effort."

Computer Language review, April 1985

Aztec C68k is the most widely used commercial C compiler for the Macintosh. Its quality, performance, and completeness place Manx Aztec C68k in a position beyond comparison. It is available in several upgradable versions.

Optimized C Macro Assembler Overlay Linker Resource Compiler Debuggers Librarian Source Editor MacRam Disk -c Library Source -c	Creates Clickable Applications Mouse Enhanced SHELL Easy Access to Mac Toolbox UNIX Library Functions Terminal Emulator (Source) Clear Detailed Documentation C-Stuff Library UniTools (vi,make,diff,grep) -c One Year of Updates -c
---	--

Items marked -c are available only in the Manx Aztec C86-c system. Other features are in both the Aztec C86-d and Aztec C86-c systems.

Aztec C68k-c Commercial System	\$499
Aztec C68d-d Developer's System	\$299
Aztec C68k-p Personal System	\$199
C-tree database (source)	\$399

AMIGA, CP/M-68k, 68k UNIX call

Apple II, Commodore, 65xx, 65C02 ROM

Manx Aztec C65

"The AZTEC C system is one of the finest software packages I have seen"

NIBBLE review, July 1984

A vast amount of business, consumer, and educational software is implemented in Manx Aztec C65. The quality and comprehensiveness of this system is competitive with 16 bit C systems. The system includes a full optimized C compiler, 6502 assembler, linkage editor, UNIX library, screen and graphics libraries, shell, and much more. The Apple II version runs under DOS 3.3, and ProDOS. Cross versions are available.

The Aztec C65-c/128 Commodore system runs under the C128 CP/M environment and generates programs for the C64, C128, and CP/M environments. Call for prices and availability of Apprentice, Personal and Developer versions for the Commodore 64 and 128 machines.

Aztec C65-c ProDOS & DOS 3.3	\$399
Aztec C65-d Apple DOS 3.3	\$199
Aztec C65-p Apple Personal system	\$99
Aztec C65-a for learning C	\$49
Aztec C65-c/128 C64, C128, CP/M	\$399

Distribution of Manx Aztec C

In the USA, Manx Software Systems is the sole and exclusive distributor of Aztec C. Any telephone or mail order sales other than through Manx are unauthorized.

Manx Cross Development Systems

Cross developed programs are edited, compiled, assembled, and linked on one machine (the HOST) and transferred to another machine (the TARGET) for execution. This method is useful where the target machine is slower or more limited than the HOST, Manx cross compilers are used heavily to develop software for business, consumer, scientific, industrial, research, and educational applications.

HOSTS: VAX UNIX (\$3000), PDP-11 UNIX (\$2000), MS-DOS (\$750), CP/M (\$750), MACINTOSH (\$750), CP/M-68k (\$750), XENIX (\$750).

TARGETS: MS-DOS, CP/M-86, Macintosh, CP/M-68k, CP/M-80, TRS-80 3 & 4, Apple II, Commodore C64, 8086/80x86 ROM, 68xxx ROM, 8080/8085/Z80 ROM, 65xx ROM.

The first TARGET is included in the price of the HOST system. Additional TARGETS are \$300 to \$500 (non VAX) or \$1000 (VAX).

Call Manx for information on cross development to the 68000, 65816, Amiga, C128, CP/M-68k, VRTX, and others.

CP/M, Radio Shack, 8080/8085/Z80 ROM

Manx Aztec CII

"I've had a lot of experience with different C compilers, but the Aztec C80 Compiler and Professional Development System is the best I've seen."

80-Micro, December, 1984, John B. Harrell III

Aztec C II-c (CP/M & ROM)	\$349
Aztec C II-d (CP/M)	\$199
C-tree database (source)	\$399
Aztec C80-c (TRS-80 3 & 4)	\$299
Aztec C80-d (TRS-80 3 & 4)	\$199

How To Become an Aztec C User

To become an Aztec C user call 1-800-221-0440 or call 1-800-832-9273 (800-TEC WARE). In NJ or outside the USA call 201-530-7997. Orders can also be telexed to 4995812.

Payment can be by check, COD, American Express, VISA, Master Card, or Net 30 to qualified customers.

Orders can also be mailed to Manx Software Systems, Box 55, Shrewsbury, NJ 07701.

How To Get More Information

To get more information on Manx Aztec C and related products, call 1-800-221-0440, or 201-530-7997, or write to Manx Software Systems.

30 Day Guarantee

Any Manx Aztec C development system can be returned within 30 days for a refund if it fails to meet your needs. The only restrictions are that the original purchase must be directly from Manx, shipped within the USA, and the package must be in resalable condition. Returned items must be received by Manx within 30 days. A small restocking fee may be required.

Discounts

There are special discounts available to professors, students, and consultants. A discount is also available on a "trade in" basis for users of competing systems. Call for information.

Inquiry 231

MANX

To order or for information call:

800-221-0440

Discover the most powerful

The IBM Personal Computer AT.

Hold on to your hat.

The IBM Personal Computer AT (for Advanced Technology) is based on the advanced 80286 16-bit microprocessor. This remarkable computer will run many of the programs written for the IBM PC, up to three times faster. You'll be able to recalculate large spreadsheets in seconds and retrieve files in a flash. And it's ideal for IBM TopView, the new kind of software program that lets you run and "window" several other programs at once.

The IBM Personal Computer AT has got the power (and price) to surprise you. In many ways.

Compatibility, expandability, networking too.

With the IBM Disk Operating System, the IBM Personal Computer AT can use many programs from the fastest-growing library in the personal computer software industry.

The IBM Personal Computer AT is also available with up to 3 million bytes of user memory to run multiuser, multitasking operating systems such as XENIX™. Volume upon volume of information is available at your fingertips. You can customize your system to store up to 20,000 pages of information at one time. And its keyboard helps you use all of this computing power more easily.

This member of the IBM PC Family is a powerful stand-alone computer that can also be both the

primary file server and a station on your network. With the IBM PC Network (which is so easy to

IBM Personal Computer AT Specifications

User Memory 256KB-3MB*	Diagnostics Power-on self-testing* Parity checking* CMOS configuration table with battery backup*
Microprocessor 16/24-bit 80286* Real and protected modes*	Languages BASIC, Pascal, FORTRAN, APL, Macro Assembler, COBOL
Auxiliary Memory 1.2MB and 360KB diskette drives* 20MB fixed disk drive* 41.2MB maximum auxiliary memory*	Printers Supports attachment of serial and parallel devices
Keyboard Enlarged enter and shift keys 84 keys 10-foot cord* Caps lock, num lock and scroll lock indicators	Permanent Memory (ROM) 64KB Clock/calendar with battery*
Display Screen IBM Monochrome and Color Displays	Color/Graphics Text Mode Graphics Mode
Operating Systems DOS 3.0, XENIX,* PC/IX 1.1	Communications RS-232-C interface
	Networking High-performance, high-capacity station on the IBM PC Network*

*Advanced Features for Personal Computers

connect you can do it yourself), the IBM Personal Computer AT can share information with IBM PCs, PC/XTs and IBM *Portable* PCs.

Get a hands-on, hats-off demonstration.

The IBM Personal Computer AT has the power, compatibility and expandability many PC users need, at a very appealing price.

For more information contact your authorized IBM PC dealer, IBM Product Center or IBM marketing representative. For a store near you call 1-800-447-4700. In Alaska or Hawaii call 1-800-447-0890.

IBM[®]



personal computer IBM has ever made.



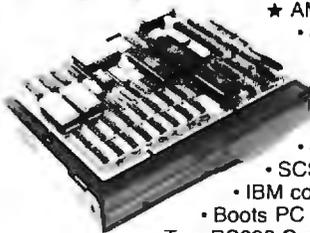
Little Tramp character licensed by Bubbles Inc., s.a.
XENIX™ is a registered trademark of Microsoft Corporation
UNIX is a trademark of AT&T Bell Laboratories. PC/IX is based on UNIX System III, which is licensed to IBM by AT&T Technologies, Inc. Developed for IBM by INTERACTIVE Systems Corp.

You Better Believe It!



For more information, call or write:
GRAFFPOINT
 4340 Stevens Creek Blvd. Suite 280
 San Jose, CA 95129 (408) 249-7951

IBM PC AT performance! PCjr price!



- ★ AMPRO Little Board/186 \$479
 - 8 Mhz 16 Bit 80186 CPU
 - 128/512K RAM; 1 MB w/add-on board
 - 128K EPROM – 2 Byte Wide sockets
 - 4 Drive floppy disk controller
 - SCSI (SASI) hard disk interface
 - IBM compatible ROM-BIOS
 - Boots PC DOS 2.x, 3.x
 - Two RS232 C serial ports
- Parallel printer port
- Expansion board w/512K RAM, 8087-2, Clock, 2 serial ports, RS422 port
- ★ AMPRO Little Board/Plus \$329
 - Same as Little Board/186 except 4 Mhz Z80A (8 Bit) CPU, 64K RAM, 4 – 16K EPROM; w/ CP/M 2.2, ZCPR3
- ★ AMPRO Little Board (the original) \$269
 - Same as Little Board/Plus except no SCSI, 4K EPROM; w/ CP/M 2.2, ZCPR3
 - ☆ 25 different enclosures w/power supplies, cables, etc. from \$99
 - ☆ Floppy/Winchester drives from \$89
 - ☆ XEBEC 4000 OWL 1/2 Ht 10Mb drive w/ integral controller \$595
 - ☆ Terminals: Wyse, Qume, Kimtron from \$395
 - ☆ Power supplies, cables, connectors in stock

Complete technical support. Assembled systems available. Write or call for free catalog. Most orders shipped same day.

VISA, MasterCard, Money Order, C.O.D. Checks allow two weeks. Purchase orders and bids welcome. Prices F.O.B. Prairie View, IL.

IBM PC AT, PCjr, PC-DOS are trademarks of International Business Machines Corporation. XEBEC OWL is a trademark of XEBEC, Inc.

DISKS PLUS 15945 West Pope Blvd.
 PRAIRIE VIEW, IL 60069
 (312) 537-7888

BOOK REVIEWS

Statistical software seems to hold a fascination that is out of proportion to the number of people who need to use it.

Gorsline writes very well about general computer science subjects, he seems much less comfortable with the 8086-specific topics. I came away with the distinct feeling that his knowledge of the device is limited.

I found two errors that, although minor, reappeared throughout the book. Gorsline consistently refers to members of the Intel processor family with the prefix "i" as in i8086. This designation is reserved for Intel's industrial temperature range parts and is distinct from the marketing department's affectation of "iAPX286," which is sometimes seen. The second error is in referring to Texas Instruments' 16-bit microprocessor, the TMS9900, as the TI-99/4; the ill-fated home computer that happened to contain one.

The author made a very serious omission from a book intended as a text. Student exercises are nowhere to be seen. This will leave either the instructor with a major task or the students with no way of reinforcing the material presented.

All in all, *16-Bit Modern Microcomputers* is a very good intermediate textbook for computer science students. Would-be hackers will have to look elsewhere.

Alan Finger is president of Cytek Inc. (805 Turnpike St., Unit 202, North Andover, MA 01845), a consulting company specializing in personal computer technology.

STATISTICAL PROGRAMS IN BASIC Reviewed by David W. Hopper

Statistics and statistical software seem to hold a fascination for computer users that is out of proportion to the number of people who actually need to use these tools on a regular basis. The fascination seems to be greatest when the source code for the statistical operations is available, particularly when it is in BASIC.

The stated purpose of *Statistical Programs in BASIC* is "to provide an innovative approach to the traditional lecture method of statistics instruction." Ronald D. Schwartz and David T. Basso present short and easily understood programs to take the place of "canned statistical programs." These short programs allow students to follow the programming logic, to understand the computational formulas used, and to see how problems are set up for computer solution.

The programs are highly commented. For example, the

(continued)

WE WILL NOT BE UNDERSOLD, WE BEAT ANY ADVERTISED PRICE

FREE

OVERNIGHT DELIVERY ON ALL ORDERS

*

HARDWARE

AST

SIX PACK PLUS \$227.00
 AT ADVANTAGE \$359.00
 5251 EMULATION BD \$543.50

QUADRAM

MICROFAZER PAR \$204.00
 QUADBOAI64K \$225.00
 QUADMEG-AT \$305.00

KEYTRONIC

5151 KEYBOARD \$149.00
 AT PROM KIT \$14.95

COMPUTER ACC.

POWER DIRECTOR \$79.00

MOUSE SYS

MOUSE SYS W/ PAINT \$138.00

PRINTERS

EPSON

FX-185 \$475.00
 FX-85 \$269.00
 LQ-1500 \$899.00

STAR MICRONICS

NLQ30 \$193.00
 NLQ40 \$261.00
 NLQ50 \$369.00

BROTHER

HR-25 \$519.00
 HR-35 \$892.00
 TWINWRITER \$913.00

HEWLETT PACKARD

LASERJET \$2175.00
 6 PEN PLOTTER \$1375.00
 THINKJET \$369.00

CALL FOR PRICES ON C.ITOH
 DIABLO, NEC, APPLE, IBM.

MODEMS

HAYES

SMARTMODEM 300 \$129.00
 SMARTMODEM 2400 \$379.00
 SMARTMODEM 1200 \$614.00

CALL FOR PRICES ON
 NOVATION, RACAL-VADIC

VEN-TEL AND OTHERS

GRAPHICS BDS

HERCULES

GRAPHICS CARD \$289.00
 COLOR CARD \$145.00

PARADISE

GRAPHICS CARD \$272.00
 MULTIDISPLAY CD \$197.00

PERSYST

COLOR CD/RGB COMP \$199.00
 BOB SUPER HI-RES \$389.00

TECMAR

GRAPHICS MSTR BD \$445.00

MONITORS

PRINCETON GRAPHICS

HX-12 HI RES \$543.00
 SR-12 W/DOUBLER \$714.00

ZENITH

AMBER 12" \$99.00
 GREEN 12" \$99.00

AMDEK

COLOR 300 \$269.00
 COLOR 500 RGB \$359.00
 COLOR 710 HI-RES \$579.00

DISKS

MAXELL HI-DEN \$42.95
 MAXELL DS-DD \$19.95
 VERRATIM \$21.95

SOFTWARE

WORD PROCESSING

WORDSTAR 2000 \$249.00
 WORDSTAR 2000 PLUS \$298.00
 WORDSTAR EASY \$87.00
 SAMNA PLUS \$299.00
 SAMNA III \$239.00
 PFS. WRITE \$78.00
 PFS.REPORT \$69.00

DATABASES & SPREADSHEETS

LOTUS 1-2-3 \$299.00
 SYMPHONY \$430.00
 SPELLING CHECKER \$87.95
 TEXT OUTLINER \$87.95
 SPOTLIGHT \$44.95
 DBASE 111 \$334.00
 FRAMEWORK \$334.00
 SUPERCALC 3 \$197.00
 REFLEX \$249.00

S.A.T. & EDUCATION

BARRON'S S.A.T. \$49.95
 HARDCOURT BRACE \$44.95

ACCOUNTING

BPI GENERAL ACC \$297.50
 BPI INV. OR JOB CST \$471.00
 BPI A/P, OR A/R \$297.50
 FIS-2001 ACC.SYSTEM \$4000.00

IBM SPECIAL #1
 IBM, 1-320K DS, DD DRIVE
 10 MEG. HARD DRIVE, AMBER
 OR GREEN MONITOR, &
 256K, PAR PORT
 PFS. WRITE AND FILE

\$2350.00

IBM SPECIAL # 2
 IBM AT- 1/20 MEG HARD
 DISK, 1.2 MEG FLOPPY, MONO
 MONITOR CARD, PAR PORT
 512K, WITH AMBER OR GREEN
 MONITOR
 ONLY

CALL \$\$\$

**256K CHIPS
 SET OF 9
 \$69.95**

**64K CHIPS
 SET OF 9
 \$5.95**

**COMPAQ
 286
 CALL \$\$\$\$**

**XIDEX DS-DD DISKS
 \$9.95 BOX OF 10**

**ORDER LINE
 1-800-334-8989**

Price-Line Computers, Inc
 9710 Topanga Cyn. Place
 Chatsworth, Calif. 91311

CALIF. RESIDENTS 1-818-341-9193

* NO SURCHARGE FOR CREDIT CARDS. FREE OVERNIGHT SHIPPING ON ORDERS OVER \$100.00. COD'S ACCEPTED. 3% ADDED FOR INS. NO MONITORS, PRINTERS, PAPER COMPUTERS INCLUDED IN OVERNIGHT SHIPPING. PRICES SUBJECT TO CHANGE W/OUT NOTICE. VISA, M/C, A/X ACCEPTED. COMP. PO'S ACCEPTED. IBM IS A REG TRADE MARK

E-Z-DOS-IT

Processing Power of

4 Computers For **\$59.95!**

**No Copy
Protect**

With E-Z-DOS-IT™ Concurrent Processing, your PC, PC/XT, or PC/AT can process up to four programs simultaneously. For example, communicate in the background while you are working at the screen. Ideal for PCs with 256K or 320K of memory. And E-Z-DOS-IT is compatible with the most popular software on the market, and it only takes 8K of RAM!



To Order Call:

USA 1-800-228-9602

CA 1-800-423-5592

Ask for Operator #24



HAMMER
Redefining Your PC Productivity.
Hammer Computer Systems, Inc.
900 Larkspur Landing Circle, Suite 250
Larkspur, CA 94939.

SEND ME E-Z-DOS-IT

Name _____

Company Name _____

Address _____

City _____

State _____ Zip _____

For DOS 2.0/2.1 @ 59.95 _____

For DOS 3.1 @ 79.95 _____

Subtotal: _____

California Residents add 6% _____

Shipping @ \$6.00/copy _____

Total _____

Method of payment: VISA MC BANK DRAFT CHECK

Account # _____ Exp. Date _____

Signature _____

(COD's & purchase orders will not be accepted). Allow up to 6 wks. for Delivery

HAMMER COMPUTER SYSTEMS, INC.,
900 LARKSPUR LANDING CIRCLE, #250
LARKSPUR, CA 94939

OP 24

BOOK REVIEWS

first one is 70 statements long, 10 of which are executable. This ratio seems to hold throughout the book. In my opinion, this is excessive commenting, particularly for such simple code. The authors use a very plain BASIC that should execute with just about any BASIC compiler or interpreter. The problem with this approach is that the code is restricted to the very simple forms of the available BASIC dialects. Thus, we are left with such things as two-character variable names, INPUT statements without explanatory prompts, and very simple PRINT statements. These factors reduce the readability of the code and hamper the user interaction and quality of the output, but they do not affect the mathematical calculations carried out by the code.

The book is organized into nine major chapters concerned with progressively more difficult topics. The beginning chapters are very simple, as befits a book designed to complement a first course in statistics.

The first sections deal with basic concepts such as summation notation and simple averaging routines. The text includes routines to sum a group of numbers, to sum a group of numbers using subscripted variables, and to sum a group of squared numbers.

A section entitled "The Analysis of Data" deals with the calculation of various means, standard deviations, and variances. The calculation of the arithmetic mean is straightforward. However, to calculate the median of a data set, the data set must be sorted to start with. If the data is already sorted, then determining the median is a trivial exercise. The standard deviation and variance are calculated using a two-pass procedure, thereby reducing potential errors associated with arithmetic round-off. The geometric mean calculation uses the obvious product of a data-point method, which will seriously limit the range and quantity of data that can be processed.

The sections covering the calculation of factorials, permutations, combinations, and five probability distributions provide straightforward algorithms for these calculations. The use of simple algorithms makes the calculations easier to understand but limits their usefulness because of overflow problems.

Simple routines are interspersed in the sections dealing with estimation theory and hypothesis testing. In the programs presented, the reader is prompted for all the required information (sample mean, standard deviation, number of data points, confidence level, and corresponding values of the standard normal variables); the program carries out the relatively trivial math. The programs for small sample sizes (less than 30 data points) prompt for the data one point at a time and calculate the mean and standard deviation on the fly. In the interest of simplicity in these calculations, the authors fall into the trap of using the sum-of-squares procedure for calculating the standard deviation rather than the more accurate updating method. This has been repeatedly shown to be a source of numerical precision errors. (See Peter A. Lachenbruch's

(continued)

Right Now, The Best Things Online Are Free.

For A Limited Time, There's No Registration Fee To Join The Source.

A special offer for BYTE readers. Now through November 30, become a member of America's preferred online information network for free.



In order to introduce you to The Source's newest online attractions, we're briefly waiving our \$49.95 registration fee.

New attractions like an Investor Services package with automated portfolio management. Grolier's full-text, online encyclopedia. The chance to join stimulating Special Interest Groups. Plus, services like electronic mail, comprehensive news and travel services.

All at very competitive online charges.*

There's even a *tutorial that's free-of-online-charges* so you'll have unlimited time to master the system. On us.

But you have to act now. To take advantage of our free membership offer, call **1-800-336-3366**** and give our representative this

*Online rates as low as 10¢/minute. \$10 monthly minimum applies.** In Virginia, call 703-821-6666.

claim number, _____ . Or mail the coupon today.

Because joining The Source is smart. But joining The Source for free is ingenious.

The SourceSM INFORMATION NETWORK

The most powerful resource any personal computer can have.

Send no money. To sign up, just mail this coupon. Or call The Source toll-free at 1-800-336-3366 and give our representative this claim number,

- YES. I want to join The Source and take advantage of your free membership offer.
- Send my new SourcePak Manual (shown) for the reduced rate of \$9.95 plus postage and handling, charged to credit card below. (\$10 off retail price)

Please bill my future online charges to:

Visa Master Card American Express

Credit card # _____
(must be provided)

Expiration date _____

Name _____

Address _____

City _____ State _____ Zip _____

Signature _____

Mother's maiden name
(for online password verification) _____

PC type _____

Phone (day) _____ (evening) _____

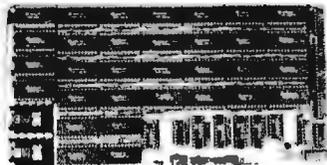
Offer expires November 30, 1985.

MAIL TO: The Source, PO Box 1305, McLean, VA 22102

The Source is a service mark of Source Telecomputing Corp.
© 1985 Source Telecomputing Corp.

64K S100 STATIC RAM

\$119⁰⁰
KIT



LOW POWER!

150 NS ADD \$10

BLANK PC BOARD
WITH DOCUMENTATION
\$49.95

SUPPORT ICs + CAPS
\$17.50

FULL SOCKET SET
\$14.50

FULLY SUPPORTS THE
NEW IEEE 696 S100
STANDARD
(AS PROPOSED)

FOR 56K KIT \$105

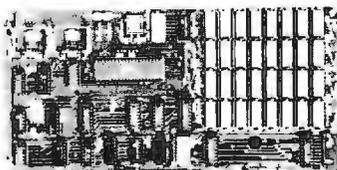
ASSEMBLED AND
TESTED ADD \$50

FEATURES: **PRICE CUT!**

- Uses new 2K x 8 (TMM 2015 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 2016a 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.

256K S-100 SOLID STATE DISK SIMULATOR!
WE CALL THIS BOARD THE "LIGHT-SPEED-100" BECAUSE IT OFFERS AN ASTOUNDING INCREASE IN YOUR COMPUTER'S PERFORMANCE WHEN COMPARED TO A MECHANICAL FLOPPY DISK DRIVE.

PRICE CUT!



BLANK PCB
(WITH CP M* 2.2
PATCHES AND INSTALL
PROGRAM ON DISKETTE)
\$69.95
*8203 *INTEL \$29.95;

- FEATURES:
- 256K on board, using + 5V 64K DRAMS.
 - Uses new Intel 8203-1 LSI Memory Controller.
 - Requires only 4 Dip Switch Selectable I/O Ports.
 - Runs on 8080 or Z80 S100 machines.
 - Up to 8 LS-100 boards can be run together for 2 Meg. of On Line Solid State Disk Storage.
 - Provisions for Battery back-up.
 - Software to mate the LS-100 to your CP-M* 2.2 DOS is supplied.
 - The LS-100 provides an increase in speed of up to 7 to 10 times on Disk Intensive Software.
 - Compare our price! You could pay up to 3 times as much for similar boards.

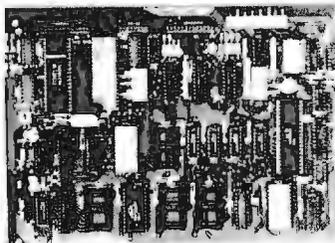
#LS-100 **\$149⁰⁰**
(FULL 256K KIT)
(ADD \$50 FOR A&T)

THE NEW ZRT-80

CRT TERMINAL BOARD!

A LOW COST Z-80 BASED SINGLE BOARD THAT ONLY NEEDS AN ASCII KEYBOARD, POWER SUPPLY, AND VIDEO MONITOR TO MAKE A COMPLETE CRT TERMINAL. USE AS A COMPUTER CONSOLE, OR WITH A MODEM FOR USE WITH ANY OF THE PHONE-LINE COMPUTER SERVICES.

- FEATURES:
- Uses a Z80A and 6845 CRT Controller for powerful video capabilities.
 - RS232 at 16 BAUD Rates from 75 to 19,200.
 - 24 x 80 standard format (60 Hz).
 - Optional formats from 24 x 80 (50 Hz) to 64 lines x 96 characters (60 Hz).
 - Higher density formats require up to 3 additional 2K x 8 6116 RAMS.
 - Uses N.S. INS 8250 BAUD Rate Gen and USART combo IC.
 - 3 Terminal Emulation Modes which are Dip Switch selectable. These include the LSI-ADM3A, the Heath H-19, and the Beehive.
 - Composite or Split Video.
 - Any polarity of video or sync.
 - Inverse Video Capability.
 - Small Size: 6.5 x 9 inches.
 - Upper & lower case with descenders
 - 7 x 9 Character Matrix.
 - Requires Par. ASCII keyboard.



\$89⁹⁵

#ZRT-80
(COMPLETE KIT, 2K VIDEO RAM)

BLANK PCB WITH 2716
CHAR. ROM, 2732 MON. ROM

\$49⁹⁵

SOURCE DISKETTE - ADD \$10
SET OF 2 CRYSTALS - ADD \$7.50

FOR 8 IN.
SOURCE DISK
(CP/M COMPATIBLE)
ADD \$10

Digital Research Computers

P.O. BOX 381450 • DUNCANVILLE, TX 75138 • (214) 225-2309

Call or write for a free catalog on Z-80 or 6809 Single Board Computers, SS-50 Boards, and other S-100 products.

TERMS: Add \$3.00 postage. Orders under \$15 add 75¢ handling. No C.O.D. We accept Visa and MasterCard. Tex. Res. add 5-1 8% Tax. Foreign orders (except Canada) add 20% P & H. Orders over \$50 add 85¢ for insurance.

BOOK REVIEWS

article "Statistical Programs for Microcomputers" in the November 1983 BYTE, page 560.) The other problem with this section is that the reader is required to input the values of the Z score or T or F statistic. This would be acceptable if tables of these statistics were included in an appendix, but they are not. It would be much better if a simple subroutine to calculate these numbers were included. Later sections deal with the acceptance or rejection of the assumption of independence for (RxC) and (2x2) contingency tables. As before, the reader is required to input the test statistics.

REGRESSION AND CORRELATION

Regression and correlation seem to hold a great deal of fascination, as evidenced by the prevalence of these functions on scientific and business calculators. Schwartz and Basso provide simple linear and exponential regression programs that use the sum-of-squares expansions to calculate the parameters of the equations. They also include elementary routines to calculate Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient. The Pearson calculation uses the sum-of-squares expansion; the Spearman calculation assumes that the paired data sets are in ranked order. There's also a short program to evaluate the significance of the calculated correlation coefficients.

The book contains a series of short programs to carry out analyses of variance programs. As with all the programs in this book, they are heavily commented, and the program structures and calculation procedures used are straightforward and easy to follow. A series of short routines to aid in the evaluation of nonparametric statistics completes the book. The Runs test, the Mann-Whitney U test, the Kruskal-Wallis test, and the Friedman test are featured.

In general, *Statistical Programs in BASIC* deals with very elementary statistical procedures in a very elementary manner. The authors use a version of BASIC that should be very easy to transport to any computer system. However, the procedures are so simple that a reader with a good statistics text and a decent calculator would not need a computer.

The major flaws in the programs are the lack of subroutines to calculate Z, F, or T statistics and the lack of even a simple sorting subroutine. Schwartz and Basso make no mention of the problems of numerical accuracy and precision and, in many cases, do not use robust routines even when simple versions of such exist. Overall, *Statistical Programs in BASIC* is a good introductory text, but not one on which to base any sort of analysis dealing with difficult or large data sets. ■

David W. Hopper (109-896 Eglinton Ave. E, Toronto, Ontario M4G 2L2, Canada) is associate editor of the newsletter of the Personal Computer Club of Toronto and a member of the board of referees for Dr. Dobb's Journal. He has published work on atmospheric turbulence and diffusion.

ALL SALES SUBJECT TO THE TERMS OF OUR 90 DAY LIMITED WARRANTY. FREE COPY UPON REQUEST.

The future... a little sooner than you expected.™



**ACHIEVE THE POWER
AND SPEED OF TOMORROW'S
TECHNOLOGY. TODAY.**

**INTRODUCING
THE EXEC. PARTNER™ FROM
PANASONIC®.**

The Panasonic Exec. Partner. What makes it an executive? The 7.16 MHz 8086-2 microprocessor for high-speed processing. So you can do more in less time.

What makes it your partner? Like all ambitious achievers the Panasonic Exec. Partner gets along with others. Namely, IBM hardware and software.

You'll also accomplish more with the new high-resolution plasma display. It lasts four times longer, offers clearer definition and is easier to read than an ordinary screen.

The Exec. Partner's built-in dual mode printer will help

you make a good impression. From silent, draft-quality mode to correspondence quality.

The 256K internal memory has built-in expandability to 640K. So the Exec. Partner will run the most sophisticated data base management programs. And its expansion slot allows you to fulfill the needs of specific applications like telecommunications and Local Area Networks.

Tomorrow's technology for today's executives. The new Panasonic Exec. Partner. **Panasonic Industrial Company**

Get a carrying case (model FXZC751) at no charge with any Exec. Partner purchased through 12/31/85. For the location of your nearest participating dealer, call 1-800-PIC-8086.

IBM is the registered trademark of International Business Machines, Inc.



CONROY

TELEX 910 380 3980

(ALL MAIL: 12060 SW Garden Place, Portland, OR 97223)

FOR YOUR APPLE

MACINTOSH



	LIST	CONROY
AEGIS, Challenger or Pyramid, ea.	\$ 50	\$ 33
ASSIMILATION, Numeric Turbo	\$ 149	\$ 109
Mac Port Adaptor	\$ 79	\$ 59
BLUECHIP, Millionaire, Barron, Tycoon, ea.	\$ 60	\$ 38
BORLAND, Sidkick (copiable)	\$ 85	\$ 45
CENTRAL POINT, Copy II Mac	\$ 40	\$ 22
CONROY-LA POINTE, Diskettes	SEE BELOW	
CONTINENTAL, Home Accountant	\$ 100	\$ 65
CREIGHTON, Home Pak or Mac Office, ea.	\$ 39	\$ 26
Mac Spell +	\$ 99	\$ 61
DOW JONES, Market Manager Plus	\$ 249	\$ 159
EXPERTELLIGENCE, ExperLogo	\$ 150	\$ 95
FIRST BYTE, Smooth Talker	\$ 100	\$ 63
FORETHOUGHT, Fact Finder	\$ 150	\$ 95
HABA, Ext. Disk Drive, 400K	\$ 449	\$ 339
DS/DD Ext. Drive, 800K	\$ 599	\$ 489
HAYDEN, Sargon III	\$ 50	\$ 31
HIPPOTAMUS, Hippo C, Level I	\$ 150	\$ 99
HUMAN EDGE, Mind Prober	\$ 50	\$ 29
INFOCOM, Hitchhiker's Guide	\$ 40	\$ 25
KOALA, Mac Vision	\$ 400	\$ 229
LIVING VIDEOTEXT, Think Tank	\$ 145	\$ 92
LOTUS, Jazz	\$ 595	\$ 389
MANHATTAN, ReadySetGo	\$ 125	\$ 69
MEGAHAUS, Megalorm	\$ 285	\$ 189
MICROSOFT, Business Pak	\$ 595	\$ 395
Excel	\$ 395	\$ 259
Multiplan, Word, or File, each	\$ 195	\$ 125
MILES, Mac the Knife, v. 1	\$ 39	\$ 25
MONOGRAM, Dollars & Sense	\$ 150	\$ 89
NOVATION, Simulac Plus Modem w/Software	\$ 499	\$ 349
ODESTA, Helix	\$ 395	\$ 249
PROVUE, Overvue	\$ 295	\$ 185
SIMON & SCHUSTER, Typing Tutor III	\$ 60	\$ 37
SOFTWARE ARTS, T/K Solver	\$ 249	\$ 159
SOFTW. PUBL., PFS, File & Report Combo	\$ 175	\$ 105
STATE OF THE ART, Electronic Checkbook	\$ 80	\$ 50
STONEWARE, DB Master	\$ 195	\$ 125
TELOS, File Vision	\$ 195	\$ 119
VIDEX, MacCalendar	\$ 89	\$ 49
WARNER, Desk Organizer	\$ 149	\$ 99

COMPUTERS

Apple

IIe, IIc, Mac

FLOPPY DISK DRIVES

	LIST	CONROY
MICRO-SCI, A2 Disk Drive, 143K	\$ 289	\$ 159
A2 Controller Card	\$ 100	\$ 59
Half Height Drive for II+ /IIe	\$ 209	\$ 159
Half Height Drive for IIc	\$ 209	\$ 159
TEAC, T40 Half Ht, 163K, Direct Controller Card for T40 by ComX	\$ 249	\$ 149

HARD DISKS

	LIST	CONROY
IOMEGA, 5 meg Bernoulli Box I/Mac	\$1995	\$1595
QUARK, QC10 for IIc/IIe/IIIMAC	\$1995	\$1095

OTHER HARDWARE

	LIST	CONROY
APPLE, Mouse for IIe	\$ 150	CALL
CCS, 7711 or 7710-A Interface, ea.	\$ 115	\$ 95
CPSE/EASTSIDE, Wild Card II (cooper. +) 1/2	\$ 140	\$ 79
COMX, 16K RAM Card (II+), 1 yr ltd wty	\$ 119	\$ 39
HAYES, Mach II, III Joysticks (II+ /IIe)	CALL	
KENSINGTON, System Saver Fan	\$ 90	\$ 65
KEY TRONIC, KB200 Keyboard (+)	\$ 298	\$ 179
KOALA, Muppet Keys	\$ 80	\$ 44
Touch Tablet w/Micro Illustrator (+) 1/2	\$ 130	\$ 75
KRAFT, Joystick (IIe/IIc)	\$ 50	\$ 25
MICRO-SCI, 80 Col. Card + 64K RAM Card (IIe)	\$ 179	\$ 89
MICROSOFT, Premium Softcard (IIe)	\$ 395	\$ 275
Z80 Softcard II, 64K	\$ 425	\$ 295
ORANGE MICRO, Buffered Grappler Plus, 16K	\$ 209	\$ 145
16K Buffer Board for Grappler Plus	\$ 99	\$ 59
Hot Link, S-P cable for IIc	\$ 70	\$ 44
TITAN, Accelerator IIa	\$ 319	\$ 229
128K RAM Card (II+)	\$ 329	\$ 149
TRACKHOUSE, Numeric Key Pad (IIe)	\$ 100	\$ 79
VIDEO 7, V Color 7 RGB Card	\$ 150	\$ 129
V Color IIc	\$ 130	\$ 89
V Color IIe	\$ 250	\$ 169
VIDEX, UltraTerm (II+ /IIe)	\$ 299	\$ 189
VideoTerm 80 Col. Card (II+ /IIe)	\$ 279	\$ 175
WICO, Smartcard (spec. I/II+ /IIe)	\$ 199	\$ 159

BUSINESS SOFTWARE

	LIST	CONROY
ALS, Word or List Handler, ea.	\$ 80	\$ 36
Handler Pak (Word/List/Spell)	\$ 170	\$ 73
APPLE, Appletworks	\$ 250	\$ 225
ASHTON-TATE, dBase II (Req CP/M 80)	\$ 495	\$ 289
BPI, AR, AP, PR or INV, each	\$ 395	\$ 240
BRODERBUND, Print Shop	\$ 50	\$ 31
Print Shop & Refill	\$ 65	\$ 39
Bank St. Mailer or Filer, ea. NEW	\$ 70	\$ 45
Bank St. Writer or Speller, ea.	\$ 70	\$ 45
Bank St. Combo (Writer & Speller)	\$ 140	\$ 85
DATA TRANS, Fontrix	\$ 95	\$ 63
DOW JONES, Market Manager	\$ 249	\$ 159
Market Analyzer	\$ 349	\$ 219
HOWARD SOFT, Tax Preparer '85	\$ 250	\$ 159
HUMAN EDGE, Sales or Mgmt Edge, ea.	\$ 250	\$ 139
LIVING VIDEOTEXT, Think Tank	\$ 145	\$ 89
MEGAHAUS, Megaworks	\$ 125	\$ 79
MICRO PRO, WordStar (req. CPM)	\$ 350	\$ 189
StarStar w/ Starcard	\$ 495	\$ 265
WordStar Professional, 4 Pak	\$ 495	\$ 265
MailMerge, SpellStar, or StarIndex, ea.	\$ 99	\$ 54
InfoStar and StarCard Combo	\$ 595	\$ 295
MICROSOFT, Multi-Plan (Ap DOS)	\$ 95	\$ 62
QUARK, Word Juggler & Lexicheck (IIe/IIc)	\$ 189	\$ 129
SENSIBLE, Sensible Speller	\$ 125	\$ 79
SIERRA/ON-LINE, Screen Writer II	\$ 130	\$ 89
SOFTWARE PUBL., PFS:File or Write, each	\$ 125	\$ 79
PFS:Graph or Report, each	\$ 125	\$ 79
PFS:Access	\$ 70	\$ 43
SPRINGBOARD, Newsroom	\$ 50	\$ 32
STONEWARE, DB Master, v. 4 +	\$ 350	\$ 189

UTILITIES SOFTWARE

	LIST	CONROY
EPSON, Graphics Dump	\$ 15	\$ 7
FUNK, Sidelways	\$ 80	\$ 37
HAYES, Terminal Prog. for Smartmodem	\$ 99	\$ 65
MICROSOFT, Full Line IN STOCK	CALL	
MICROSTUF, Crosstalk	\$ 185	\$ 109
OMEGA, Locksmith	\$ 100	\$ 73
PENQUIN, Complete Graphics System II	\$ 80	\$ 49
Graphics Magician	\$ 60	\$ 41
QUALITY, Bag of Tricks	\$ 40	\$ 29
UNITED SWI, ASCII Express-Pro DOS	\$ 130	\$ 82
UTILICO, Essential Data Duplicator III	\$ 80	\$ 49

HOME & EDUCATIONAL

	LIST	CONROY
BEAGLE BROS., Full Line IN STOCK	CALL	
BRODERBUND, Print Shop	\$ 50	\$ 29
CONTINENTAL, Home Accountant	\$ 75	\$ 43
KOALA, Full Line IN STOCK	CALL	
MICROSOFT, Typing Tutor II	\$ 25	\$ 17
MONOGRAM, Dollars & Sense (II+ /IIe)	\$ 100	\$ 59
Dollars & Sense (IIc/IIe 128K)	\$ 120	\$ 69
Forecast	\$ 60	\$ 38
SCARBOROUGH, Mastertype	\$ 40	\$ 25
Build-A-Book	\$ 40	\$ 25
Your Personal Net Worth	\$ 80	\$ 50
SIERRA/ON-LINE, Homework	\$ 70	\$ 45
SIMON & SCHUSTER, Typing Tutor III	\$ 50	\$ 33
PLUS: BARRONS, CBS, DAVIDSON, EDU-WARE, HARCOURT, LEARNING CO., TERRAPIN		

RECREATIONAL SOFTWARE

	LIST	CONROY
BLUECHIP, Millionaire or Barron, ea.	\$ 50	\$ 35
DATASOFT, Aztec or Zaxxon, each	\$ 40	\$ 27
ELECTRON, ARTS, Sky Fox & others, ea.	\$ 40	\$ 29
HAYDEN, Sargon III (Chase)	\$ 50	\$ 30
INFOCOM, Zork II, or III, ea.	\$ 40	\$ 29
MICROPROSE, Strike Eagle	\$ 35	\$ 23
ORIGIN, Ultima III	\$ 80	\$ 39
PENQUIN, Transylvania	\$ 35	\$ 24
SPECTRUM HOLOBYTE, Gato (28K)	\$ 40	\$ 25
SPINNAKER, Full Line IN STOCK	CALL	
SUB LOGIC, Flight Simulator II	\$ 50	\$ 30
PLUS: BRODERBUND, DATAMOST, MUSE, SIR-TECH		

DISKETTES

★ CONROY-LAPOINTE™ DISKETTES ★

We guarantee these top quality products with our name. 5 YEAR LIMITED WARRANTY.

10 ea. SS/SD, (Apple, etc) 35 Trk, W/FLP BOX	\$ 13
100 ea. SS/SD, (Apple, etc) 35 Trk	\$ 99
1000 ea. SS/SD, (Apple, etc) 35 Trk	\$ 669
10 ea. DS/DD, (IBM, H/P) 40 Trk, W/FLP BOX	\$ 16
100 ea. DS/DD, (IBM, H/P) 40 Trk	\$ 119
1000 ea. DS/DD, (IBM, H/P) 40 Trk	\$ 799
10 ea. SS/DD, 3 1/4" (MAC, H/P), W/FLP BOX	\$ 25
50 ea. SS/DD, 3 1/4" (MAC, H/P)	\$ 115
100 ea. SS/DD, 3 1/4" (MAC, H/P)	\$ 235
CONROY-LAPOINTE™ IBM PRE-FORMATTED	
10 ea. DS/DD, 40 Trk W/FLP BOX	\$ 20
100 ea. DS/DD, 40 Trk	\$ 149
1000 ea. DS/DD, 40 Trk	\$ 959

SINGLE-SIDED, DOUBLE DENSITY

	LIST	CONROY
CDC, 10 ea. SS/DD, 40 Trk (Apple, etc)	\$ 45	\$ 19
DYSAN, 10 ea. SS/DD, (Apple, etc)	\$ 40	\$ 27
MAXELL, 10 ea. SS/DD, MD1 (Apple)	\$ 47	\$ 19
VERBATIM, 10 ea. SS/DD, MD515-01, (Apple)	\$ 49	\$ 17
DOUBLE-SIDED, DOUBLE DENSITY		
CDC, 10 ea. DS/DD, 40 Trk (IBM, H/P)	\$ 59	\$ 23
DYSAN, 10 ea. DS/DD, (IBM, H/P)	\$ 69	\$ 35
MAXELL, 10 ea. DS/DD, MD2 (IBM)	\$ 65	\$ 21
VERBATIM, 10 ea. DS/DD, MD34 (IBM)	\$ 75	\$ 20

3 1/4" MICRO DISKETTES

MAXELL, 10 ea. SS/DD (MAC, H/P)	\$ 55	\$ 35
MEMOREX, 10 ea. SS/DD (MAC, H/P)	\$ 60	\$ 33
VERBATIM, 10 ea. SS/DD (MAC, H/P)	\$ 65	\$ 32

HIGH DENSITY DISKETTES FOR IBM-AT

MAXELL, 10 ea. DS/HD (IBM-AT)	\$ 75	\$ 49
MEMOREX, 10 ea. DS/HD (IBM-AT)	\$ 84	\$ 49

★ GENERIK DISKETTES ★

Top quality, w/jackets, no labels. Quantity discounts. 90 day "No hassle, money back guarantee."

100 ea. SS/SD, 35 Track (Apple, etc)	\$ 75
100 ea. DS/DD, 40 Track, (IBM, H/P)	\$ 79

MODEMS

	LIST	CONROY
ANCHOR, Signalman Mark XII	\$ 399	\$ 269
HAYES, 2400 External Modem	\$ 899	\$ 619
Smartmodem 1200B (IBM)	\$ 549	\$ 379
Smartcom II Software (IBM or MAC)	\$ 149	\$ 107
Smartmodem 1200 (External)	\$ 599	\$ 419
Micromodem IIe w/Smartcom (AP)	\$ 199	\$ 139
Transet 1000 - 128K	\$ 399	\$ 300
NOVATION, Apple Cat II 300 Baud (AP)	\$ 389	\$ 219
2400 External	\$ 795	\$ 549
212 Apple Cat, 1200 Baud (AP)	\$ 595	\$ 409
SmartCat Plus w/software (MAC)	\$ 499	\$ 349
ACCESS I-2-1 2808 Modem + Crosstalk (IBM)	\$ 595	\$ 369
PROMETHEUS, 1200 Standalone Modem	\$ 495	\$ 349
ProModem 1200 w/software (MAC)	\$ 549	\$ 399
ProModem 1200A (AP)	\$ 449	\$ 329
ProModem 300C (AP IIc)	\$ 199	\$ 149
ProModem 1200B (IBM)	\$ 399	\$ 289
VENTEL, PC Halfcard (IBM)	\$ 549	\$ 389

MONITORS

AMDEK, Color 300 - Comp/Audio	\$ 349	\$ 239
Color 500 - Comp/VCR/RGB/Audio	\$ 525	\$ 319
Color 600 - Comp/RGB/Audio	\$ 595	\$ 399
300A - 12" Amber/Comp	\$ 199	\$ 129
300G, 12" Green/Comp	\$ 179	\$ 119
310A, 12" Amber (IBM)	\$ 230	\$ 159
PRINCETON, HX-12 - Hi Res/RGB	\$ 795	\$ 445
HX-12e - Hi Res/RGB/for IBM-EGA	\$ 785	\$ 559
SR-12 - Hi Res/RGB	\$ 799	\$ 599
MAX-12 - Amber (IBM)	\$ 249	\$ 179
QUADRAM, Amberchrome, 12"	\$ 259	\$ 149
ZENITH, ZVM-1230 - 12" Amber/Comp	\$ 159	\$ 109
ZVM-1230 - 12" Green/Comp	\$ 159	\$ 109
ZVM-124 & ZVM-135	15-25% OFF	

CABLES

ARBO, IBM-PC to Modem Cable	\$ 31	\$ 19
ASTAR, RF Modulator for T.V. (Apple)	\$ 35	\$ 20
COMPUABLE, Mac/Hayes Smartmodem Cable	\$ 32	\$ 18
CURTIS, Monitor Extension Cable (IBM)	\$ 50	\$ 32
3'9" Keyboard Extension Cable (IBM)	\$ 40	\$ 26
RCA, Monitor Cable	\$ 15	\$ 9

PRINTERS

DOT MATRIX:

	LIST	CONROY
APPLE, Laserwriter	\$6995	\$6500
EPSON, FX85 - 160 cps DQ/32 cps NLQ/10"	\$ 499	\$ 389
FX185 - 160 cps DQ/32 cps NLQ/15"	\$ 699	\$ 539
LX80 - 100 cps DQ/16 cps NLO	\$ 299	\$ 249
LQ1500 - 200 cps DQ/67 cps LQ	\$1295	\$ 995
HEWLETT-PACKARD, LaserJet	\$3495	CALL
Thinkjet - 150 cps Inkjet	\$ 495	CALL
OKIDATA, Okimate 20 - Color, Hi Res	\$ 268	CALL
182 - 120 cps/80 col	\$ 299	CALL
192 - 160 cps/80 col/para.	\$ 499	CALL
193 - 180 cps/132 col	\$ 699	CALL
93 - 160 cps/136 col/para.	\$ 799	CALL
2410 Picemark - 350 cps/para.	\$2895	CALL
PANASONIC, P1090 - 60 cps/10"	\$ 349	\$ 249
P1092 - 180 cps/10"	\$ 599	\$ 459
QUADRAM, Quadjet - Inkjet Color	\$ 895	\$ 395
STAR MICRO, SG10 - 120 cps DQ/20 cps NLQ	\$ 299	\$ 249
SD10 - 160 cps DQ, 40 cps NLQ	\$ 449	\$ 379
SR15 - 200 cps DQ, 50 cps NLQ, 16K	\$ 799	\$ 679
TEXAS INSTRUMENTS, 855 - 150 cps	\$ 995	\$ 795
TOSHIBA, 351 - 288 cps	\$1695	\$1195

LETTER-QUALITY:

JUKI, 8300 - 40cps/para.	\$ 895	\$ 699
8100 - 18 cps/para/3 pitch	\$ 695	\$ 409
Sheet Feeder for 8300 (single)	\$ 275	\$ 225
PANASONIC, P3151 - 22 cps/15 1/2"	\$ 659	\$ 425
TOSHIBA, Pro. spacing & hi-res graphics:		
1340 - 144 cps DQ & 54 cps LQ	\$ 799	\$ 619
Bi-direction Tractor Feeder	\$ 195	\$ 175

PLOT

-LA POINTE INC.

© 1984 by Conroy-LaPointe, Inc. All Rights Reserved. All Rights Reserved

LOW PRICES TO PROFESSIONALS WHO KNOW WHAT THEY WANT AND KNOW HOW TO USE IT!

(TO ORDER, CALL (800) 547-1289)

FOR YOUR IBM-PC, XT, AT or JR

COMPUTER SYSTEMS	OTHER HARDWARE	OTHER HARDWARE	MEMORY																																																																																																																										
 <p>MAGNUM PC/XT \$995</p> <p>640K, Two 360K Drives</p> <p>Plus: MS-DOS 2.11, Parallel Port, 2 Serial Ports (RS 232C), Clock/Calendar, Floppy Drive & Tape Backup Controller, 5 slots, 135 Watt Power Supply, 8087 optional, Selectric PC/AT Style Keyboard.</p> <p>w/1 Floppy & 10 meg Hard Drive \$1595</p> <p>Please call for other configurations Above prices do not include video card or monitor</p> <p>IBM-PC 256K, 2 360K Disk Drives</p>	<table border="1"> <thead> <tr> <th>LIST PRICE</th> <th>CONROY PRICE</th> </tr> </thead> <tbody> <tr><td>Ast, SixPak Plus, 64K</td><td>\$ 395 \$ 239</td></tr> <tr><td>SixPak Plus, 256K, S/P/CC + S/W</td><td>\$ 665 \$ 259</td></tr> <tr><td>SixPak Plus, 384K, S/P/CC + S/W</td><td>\$ 895 \$ 269</td></tr> <tr><td>Preview Graphics Card w/para, 64K</td><td>\$ 399 \$ 289</td></tr> <tr><td>Advantage Multi. Bd. for AT, 128K</td><td>\$ 595 \$ 445</td></tr> <tr><td>I/O Plus II, S/P/CC</td><td>\$ 215 \$ 189</td></tr> <tr><td>I/O Plus II, S/P/CC/G</td><td>\$ 265 \$ 225</td></tr> <tr><td>Port Kits - ser, para, or game, ea.</td><td>\$ 50 \$ 35</td></tr> <tr><td>CENTRAL POINT, PC Option Board</td><td>\$ 95 \$ 81</td></tr> <tr><td>COMX, 130 Watt Power Supply</td><td>\$ 179 \$ 93</td></tr> <tr><td>CURTIS, Command Center</td><td>\$ 180 \$ 119</td></tr> <tr><td>EVEREX, The Edge, Color/Mono Bnd</td><td>\$ 399 \$ 309</td></tr> <tr><td>HAUPPAGE (HCW), 8087 Chip</td><td>\$ 175 \$ 125</td></tr> <tr><td>8087 Math Pak (Chip & softw.)</td><td>\$ 295 \$ 219</td></tr> <tr><td>HAYES, Mach II Joystick</td><td>\$ 45 \$ 29</td></tr> <tr><td>Mach III (PC or Jr.)</td><td>\$ 55 \$ 35</td></tr> <tr><td>HERCULES, Color Card w/para.</td><td>\$ 245 \$ 159</td></tr> <tr><td>Mono Graphics Card</td><td>\$ 499 \$ 309</td></tr> <tr><td>Graphics Pak</td><td>\$ 744 \$ 449</td></tr> <tr><td>KENSINGTON, Masterpiece*</td><td>\$ 140 \$ 92</td></tr> <tr><td>Masterpiece Plus</td><td>\$ 180 \$ 137</td></tr> <tr><td>KEY TRONIC, KB5151, Std. Keyboard</td><td>\$ 255 \$ 189</td></tr> <tr><td>KB 5153 Keyboard w/Touch Tab</td><td>\$ 400 \$ 325</td></tr> <tr><td>KOALA, Speed Key Software</td><td>\$ 100 \$ 83</td></tr> <tr><td>Speed Key System (Tab w/ softw)</td><td>\$ 200 \$ 115</td></tr> <tr><td>Koala Pad w/PC Design</td><td>\$ 150 \$ 85</td></tr> </tbody> </table>	LIST PRICE	CONROY PRICE	Ast, SixPak Plus, 64K	\$ 395 \$ 239	SixPak Plus, 256K, S/P/CC + S/W	\$ 665 \$ 259	SixPak Plus, 384K, S/P/CC + S/W	\$ 895 \$ 269	Preview Graphics Card w/para, 64K	\$ 399 \$ 289	Advantage Multi. Bd. for AT, 128K	\$ 595 \$ 445	I/O Plus II, S/P/CC	\$ 215 \$ 189	I/O Plus II, S/P/CC/G	\$ 265 \$ 225	Port Kits - ser, para, or game, ea.	\$ 50 \$ 35	CENTRAL POINT, PC Option Board	\$ 95 \$ 81	COMX, 130 Watt Power Supply	\$ 179 \$ 93	CURTIS, Command Center	\$ 180 \$ 119	EVEREX, The Edge, Color/Mono Bnd	\$ 399 \$ 309	HAUPPAGE (HCW), 8087 Chip	\$ 175 \$ 125	8087 Math Pak (Chip & softw.)	\$ 295 \$ 219	HAYES, Mach II Joystick	\$ 45 \$ 29	Mach III (PC or Jr.)	\$ 55 \$ 35	HERCULES, Color Card w/para.	\$ 245 \$ 159	Mono Graphics Card	\$ 499 \$ 309	Graphics Pak	\$ 744 \$ 449	KENSINGTON, Masterpiece*	\$ 140 \$ 92	Masterpiece Plus	\$ 180 \$ 137	KEY TRONIC, KB5151, Std. Keyboard	\$ 255 \$ 189	KB 5153 Keyboard w/Touch Tab	\$ 400 \$ 325	KOALA, Speed Key Software	\$ 100 \$ 83	Speed Key System (Tab w/ softw)	\$ 200 \$ 115	Koala Pad w/PC Design	\$ 150 \$ 85	<table border="1"> <thead> <tr> <th>LIST PRICE</th> <th>CONROY PRICE</th> </tr> </thead> <tbody> <tr><td>MAYNARD, SAND STAR SERIES IN STOCK</td><td></td></tr> <tr><td>MultiFunction (6) Card</td><td>\$ 89 \$ 79</td></tr> <tr><td>Memory Card no RAM</td><td>\$ 199 \$ 139</td></tr> <tr><td>Floppy Cont. Card (accepts 3 modules)</td><td>\$ 265 \$ 195</td></tr> <tr><td>Hard Disk I/F Module</td><td>\$ 495 \$ 359</td></tr> <tr><td>Serial Port Module</td><td>\$ 95 \$ 79</td></tr> <tr><td>Para or Clock Cal. Module, ea.</td><td>\$ 59 \$ 49</td></tr> <tr><td>MICROSOFT, Mouse (for PC)</td><td>\$ 195 \$ 129</td></tr> <tr><td>Serial Mouse</td><td>\$ 195 \$ 145</td></tr> <tr><td>MOUSE SYSTEMS, PC Mouse & Paint</td><td>\$ 220 \$ 145</td></tr> <tr><td>PARADISE, Modular Graphics Card</td><td>\$ 395 \$ 279</td></tr> <tr><td>Parallel or Serial Port, ea.</td><td>\$ 95 \$ 66</td></tr> <tr><td>256K Module w/clock</td><td>\$ 195 \$ 150</td></tr> <tr><td>PERSYST, PC/Mono Board, w/para</td><td>\$ 250 \$ 159</td></tr> <tr><td>PC/Color Graphics Board</td><td>\$ 244 \$ 176</td></tr> <tr><td>QUADRAM, Quadboard, no RAM, to 384K</td><td>\$ 295 \$ 195</td></tr> <tr><td>Quadboard 64K, to 384K, S/P/CC/G</td><td>\$ 395 \$ 239</td></tr> <tr><td>Quadboard 256K, to 384K, S/P/CC</td><td>\$ 675 \$ 269</td></tr> <tr><td>Quadboard 384K (full), S/P/CC/G</td><td>\$ 785 \$ 279</td></tr> <tr><td>Quadboard II, no RAM, to 256K</td><td>\$ 295 \$ 215</td></tr> <tr><td>Quadboard II, 64K, to 256K, 2S/CC</td><td>\$ 395 \$ 265</td></tr> <tr><td>Quadboard II, 256K, 2S/CC</td><td>\$ 595 \$ 395</td></tr> <tr><td>Quad 512 + 64K w/serial port</td><td>\$ 325 \$ 245</td></tr> <tr><td>Quadcolor I, board, 4 colors</td><td>\$ 295 \$ 175</td></tr> <tr><td>Upgrade Quadcolor I to II kit</td><td>\$ 275 \$ 149</td></tr> <tr><td>Quadnet VI</td><td>\$1995 \$1045</td></tr> <tr><td>Quadlink</td><td>\$ 495 \$ 375</td></tr> <tr><td>Quadsprint</td><td>\$ 645 \$ 495</td></tr> <tr><td>TALLTREE, J RAM II Board</td><td>\$ 219 \$ 159</td></tr> <tr><td>JRAM III, 256K Board</td><td>\$ 399 \$ 319</td></tr> <tr><td>TECMAR, Maestro, 128K to 3MB, S/P for AT</td><td>\$ 589 \$ 459</td></tr> <tr><td>TITAN, 128K PC Accelerator</td><td>\$ 795 \$ 595</td></tr> <tr><td>WICO, Smartboard Keyboard</td><td>\$ 400 \$ 279</td></tr> </tbody> </table>	LIST PRICE	CONROY PRICE	MAYNARD, SAND STAR SERIES IN STOCK		MultiFunction (6) Card	\$ 89 \$ 79	Memory Card no RAM	\$ 199 \$ 139	Floppy Cont. Card (accepts 3 modules)	\$ 265 \$ 195	Hard Disk I/F Module	\$ 495 \$ 359	Serial Port Module	\$ 95 \$ 79	Para or Clock Cal. Module, ea.	\$ 59 \$ 49	MICROSOFT, Mouse (for PC)	\$ 195 \$ 129	Serial Mouse	\$ 195 \$ 145	MOUSE SYSTEMS, PC Mouse & Paint	\$ 220 \$ 145	PARADISE, Modular Graphics Card	\$ 395 \$ 279	Parallel or Serial Port, ea.	\$ 95 \$ 66	256K Module w/clock	\$ 195 \$ 150	PERSYST, PC/Mono Board, w/para	\$ 250 \$ 159	PC/Color Graphics Board	\$ 244 \$ 176	QUADRAM, Quadboard, no RAM, to 384K	\$ 295 \$ 195	Quadboard 64K, to 384K, S/P/CC/G	\$ 395 \$ 239	Quadboard 256K, to 384K, S/P/CC	\$ 675 \$ 269	Quadboard 384K (full), S/P/CC/G	\$ 785 \$ 279	Quadboard II, no RAM, to 256K	\$ 295 \$ 215	Quadboard II, 64K, to 256K, 2S/CC	\$ 395 \$ 265	Quadboard II, 256K, 2S/CC	\$ 595 \$ 395	Quad 512 + 64K w/serial port	\$ 325 \$ 245	Quadcolor I, board, 4 colors	\$ 295 \$ 175	Upgrade Quadcolor I to II kit	\$ 275 \$ 149	Quadnet VI	\$1995 \$1045	Quadlink	\$ 495 \$ 375	Quadsprint	\$ 645 \$ 495	TALLTREE, J RAM II Board	\$ 219 \$ 159	JRAM III, 256K Board	\$ 399 \$ 319	TECMAR, Maestro, 128K to 3MB, S/P for AT	\$ 589 \$ 459	TITAN, 128K PC Accelerator	\$ 795 \$ 595	WICO, Smartboard Keyboard	\$ 400 \$ 279	<p>256K CHIP KIT \$34</p> <p>64K CHIP KIT \$6</p> <p>128K CHIP KIT \$75</p> <p>90 Day Warranty by us</p> <p>CALL FOR QUANTITY PRICES</p> <p>Magnum EconoRAM Plus™ LIST \$199 \$179</p> <p>384K Multifunction RAM Board Works like AST SixPak Plus™ with game port Fastrak™ RAM Disk and Spooler Software S/P/CC/G, 1 Year Limited Warranty. (Fastrak for up to 384K).</p> <p>EconoRAM™ 384K Single Function Board LIST \$99 \$99</p> <p>With Fastrak™, Fully Compatible Works on DOS 1.1, 2.0 or 2.1 Prices and availability subject to change Call.</p>
LIST PRICE	CONROY PRICE																																																																																																																												
Ast, SixPak Plus, 64K	\$ 395 \$ 239																																																																																																																												
SixPak Plus, 256K, S/P/CC + S/W	\$ 665 \$ 259																																																																																																																												
SixPak Plus, 384K, S/P/CC + S/W	\$ 895 \$ 269																																																																																																																												
Preview Graphics Card w/para, 64K	\$ 399 \$ 289																																																																																																																												
Advantage Multi. Bd. for AT, 128K	\$ 595 \$ 445																																																																																																																												
I/O Plus II, S/P/CC	\$ 215 \$ 189																																																																																																																												
I/O Plus II, S/P/CC/G	\$ 265 \$ 225																																																																																																																												
Port Kits - ser, para, or game, ea.	\$ 50 \$ 35																																																																																																																												
CENTRAL POINT, PC Option Board	\$ 95 \$ 81																																																																																																																												
COMX, 130 Watt Power Supply	\$ 179 \$ 93																																																																																																																												
CURTIS, Command Center	\$ 180 \$ 119																																																																																																																												
EVEREX, The Edge, Color/Mono Bnd	\$ 399 \$ 309																																																																																																																												
HAUPPAGE (HCW), 8087 Chip	\$ 175 \$ 125																																																																																																																												
8087 Math Pak (Chip & softw.)	\$ 295 \$ 219																																																																																																																												
HAYES, Mach II Joystick	\$ 45 \$ 29																																																																																																																												
Mach III (PC or Jr.)	\$ 55 \$ 35																																																																																																																												
HERCULES, Color Card w/para.	\$ 245 \$ 159																																																																																																																												
Mono Graphics Card	\$ 499 \$ 309																																																																																																																												
Graphics Pak	\$ 744 \$ 449																																																																																																																												
KENSINGTON, Masterpiece*	\$ 140 \$ 92																																																																																																																												
Masterpiece Plus	\$ 180 \$ 137																																																																																																																												
KEY TRONIC, KB5151, Std. Keyboard	\$ 255 \$ 189																																																																																																																												
KB 5153 Keyboard w/Touch Tab	\$ 400 \$ 325																																																																																																																												
KOALA, Speed Key Software	\$ 100 \$ 83																																																																																																																												
Speed Key System (Tab w/ softw)	\$ 200 \$ 115																																																																																																																												
Koala Pad w/PC Design	\$ 150 \$ 85																																																																																																																												
LIST PRICE	CONROY PRICE																																																																																																																												
MAYNARD, SAND STAR SERIES IN STOCK																																																																																																																													
MultiFunction (6) Card	\$ 89 \$ 79																																																																																																																												
Memory Card no RAM	\$ 199 \$ 139																																																																																																																												
Floppy Cont. Card (accepts 3 modules)	\$ 265 \$ 195																																																																																																																												
Hard Disk I/F Module	\$ 495 \$ 359																																																																																																																												
Serial Port Module	\$ 95 \$ 79																																																																																																																												
Para or Clock Cal. Module, ea.	\$ 59 \$ 49																																																																																																																												
MICROSOFT, Mouse (for PC)	\$ 195 \$ 129																																																																																																																												
Serial Mouse	\$ 195 \$ 145																																																																																																																												
MOUSE SYSTEMS, PC Mouse & Paint	\$ 220 \$ 145																																																																																																																												
PARADISE, Modular Graphics Card	\$ 395 \$ 279																																																																																																																												
Parallel or Serial Port, ea.	\$ 95 \$ 66																																																																																																																												
256K Module w/clock	\$ 195 \$ 150																																																																																																																												
PERSYST, PC/Mono Board, w/para	\$ 250 \$ 159																																																																																																																												
PC/Color Graphics Board	\$ 244 \$ 176																																																																																																																												
QUADRAM, Quadboard, no RAM, to 384K	\$ 295 \$ 195																																																																																																																												
Quadboard 64K, to 384K, S/P/CC/G	\$ 395 \$ 239																																																																																																																												
Quadboard 256K, to 384K, S/P/CC	\$ 675 \$ 269																																																																																																																												
Quadboard 384K (full), S/P/CC/G	\$ 785 \$ 279																																																																																																																												
Quadboard II, no RAM, to 256K	\$ 295 \$ 215																																																																																																																												
Quadboard II, 64K, to 256K, 2S/CC	\$ 395 \$ 265																																																																																																																												
Quadboard II, 256K, 2S/CC	\$ 595 \$ 395																																																																																																																												
Quad 512 + 64K w/serial port	\$ 325 \$ 245																																																																																																																												
Quadcolor I, board, 4 colors	\$ 295 \$ 175																																																																																																																												
Upgrade Quadcolor I to II kit	\$ 275 \$ 149																																																																																																																												
Quadnet VI	\$1995 \$1045																																																																																																																												
Quadlink	\$ 495 \$ 375																																																																																																																												
Quadsprint	\$ 645 \$ 495																																																																																																																												
TALLTREE, J RAM II Board	\$ 219 \$ 159																																																																																																																												
JRAM III, 256K Board	\$ 399 \$ 319																																																																																																																												
TECMAR, Maestro, 128K to 3MB, S/P for AT	\$ 589 \$ 459																																																																																																																												
TITAN, 128K PC Accelerator	\$ 795 \$ 595																																																																																																																												
WICO, Smartboard Keyboard	\$ 400 \$ 279																																																																																																																												
<p>FLOPPY & HARD DRIVES</p> <table border="1"> <thead> <tr> <th>LIST PRICE</th> <th>CONROY PRICE</th> </tr> </thead> <tbody> <tr><td>IRWIN, 10 meg tape backup system</td><td>\$ 795 \$ 449</td></tr> <tr><td>10 meg tape cartridges (by 3M)</td><td>\$ 25 \$ 19</td></tr> <tr><td>KAMERMAN, 10 meg kit w/controller</td><td>\$ 895 \$ 579</td></tr> <tr><td>20 meg kit w/controller</td><td>\$ 995 \$ 695</td></tr> <tr><td>Masterlight 10 meg w/tape</td><td>\$2295 \$1795</td></tr> <tr><td>SEAGATE, 10 meg w/controller</td><td>\$ 745 \$ 459</td></tr> <tr><td>20 meg w/controller</td><td>\$ 895 \$ 619</td></tr> <tr><td>TALLGRASS, 24 meg disk, 10 meg tape</td><td>\$3495 \$2490</td></tr> </tbody> </table>				LIST PRICE	CONROY PRICE	IRWIN, 10 meg tape backup system	\$ 795 \$ 449	10 meg tape cartridges (by 3M)	\$ 25 \$ 19	KAMERMAN, 10 meg kit w/controller	\$ 895 \$ 579	20 meg kit w/controller	\$ 995 \$ 695	Masterlight 10 meg w/tape	\$2295 \$1795	SEAGATE, 10 meg w/controller	\$ 745 \$ 459	20 meg w/controller	\$ 895 \$ 619	TALLGRASS, 24 meg disk, 10 meg tape	\$3495 \$2490																																																																																																								
LIST PRICE	CONROY PRICE																																																																																																																												
IRWIN, 10 meg tape backup system	\$ 795 \$ 449																																																																																																																												
10 meg tape cartridges (by 3M)	\$ 25 \$ 19																																																																																																																												
KAMERMAN, 10 meg kit w/controller	\$ 895 \$ 579																																																																																																																												
20 meg kit w/controller	\$ 995 \$ 695																																																																																																																												
Masterlight 10 meg w/tape	\$2295 \$1795																																																																																																																												
SEAGATE, 10 meg w/controller	\$ 745 \$ 459																																																																																																																												
20 meg w/controller	\$ 895 \$ 619																																																																																																																												
TALLGRASS, 24 meg disk, 10 meg tape	\$3495 \$2490																																																																																																																												
<p>CDC, 360K DS/DD DISK DRIVE Limited 30 day warranty Call for quantity prices</p> <p>Full Height \$119 Half Height \$ 89</p>																																																																																																																													
<p>CDC, Internal 20 meg kit FOR AT \$1695 \$1195</p> <p>CORE INTL., (30 msec. access time) ATplus 20 meg kit FOR AT \$1595 \$1195 ATplus 30 meg kit FOR AT \$2495 \$1875</p>																																																																																																																													

SOFTWARE FOR YOUR IBM-PC, XT, AT or JR

BUSINESS	BUSINESS	BUSINESS	UTILITIES																																																																																																																																																																
<table border="1"> <thead> <tr> <th>LIST PRICE</th> <th>CONROY PRICE</th> </tr> </thead> <tbody> <tr><td>ANALYTICA, Reflex</td><td>\$ 495 \$ 335</td></tr> <tr><td>ASHTON-TATE, Framework</td><td>\$ 695 \$ 379</td></tr> <tr><td>dBase III</td><td>\$ 695 \$ 389</td></tr> <tr><td>dBase II, (req. PC-DOS & 128K)</td><td>\$ 495 \$ 289</td></tr> <tr><td>ATI, PC DOS 2.1 Training</td><td>\$ 40 \$ 26</td></tr> <tr><td>BPI, General Acctg. AR, AP, or PR, ea.</td><td>\$ 595 \$ 365</td></tr> <tr><td>BRODERBUND, Bank St. Writer (PC or Jr.)</td><td>\$ 80 \$ 51</td></tr> <tr><td>CDX, Advanced Training for Lotus 1-2-3</td><td>\$ 70 \$ 45</td></tr> <tr><td>CONTINENTAL, Ultrafile</td><td>\$ 195 \$ 115</td></tr> <tr><td>Tax Advantage</td><td>\$ 70 \$ 40</td></tr> <tr><td>Property Management</td><td>\$ 495 \$ 295</td></tr> <tr><td>DATA TRANS., Fontrix</td><td>\$ 155 \$ 99</td></tr> <tr><td>Font Packs, each</td><td>\$ 20 \$ 12</td></tr> <tr><td>DOW JONES, Market Manager Plus</td><td>\$ 249 \$ 159</td></tr> <tr><td>Market Analyzer</td><td>\$ 349 \$ 229</td></tr> <tr><td>Spread Sheet Link</td><td>\$ 249 \$ 159</td></tr> <tr><td>FOX & GELLER, Quickcode III</td><td>\$ 295 \$ 185</td></tr> <tr><td>HARVARD, Total Project Manager</td><td>\$ 495 \$ 295</td></tr> <tr><td>HOWARDSOFF, Tax Preparer '85</td><td>\$ 295 \$ 195</td></tr> <tr><td>HUMAN EDGE, Mind Prober (PC or Jr.)</td><td>\$ 50 \$ 29</td></tr> <tr><td>Sales Edge or Management Edge, ea.</td><td>\$ 250 \$ 139</td></tr> <tr><td>Negotiation Edge</td><td>\$ 295 \$ 165</td></tr> <tr><td>INFOCOM, Cornerstone</td><td>\$ 495 \$ 309</td></tr> <tr><td>LIFETREE, Volkswriter Deluxe</td><td>\$ 295 \$ 159</td></tr> <tr><td>LIVING VIDEOTEXT, Think Tank</td><td>\$ 185 \$ 109</td></tr> <tr><td>LOTUS, 1-2-3</td><td>\$ 495 \$ 309</td></tr> <tr><td>Symphony</td><td>\$ 695 \$ 449</td></tr> <tr><td>MBDS, Knowledgeman</td><td>\$ 500 \$ 275</td></tr> <tr><td>MECA, Managing Your Money (PC)</td><td>\$ 199 \$ 105</td></tr> <tr><td>MICROPRO, Easy</td><td>\$ 150 \$ 99</td></tr> <tr><td>WordStar (PC)</td><td>\$ 350 \$ 189</td></tr> </tbody> </table>	LIST PRICE	CONROY PRICE	ANALYTICA, Reflex	\$ 495 \$ 335	ASHTON-TATE, Framework	\$ 695 \$ 379	dBase III	\$ 695 \$ 389	dBase II, (req. PC-DOS & 128K)	\$ 495 \$ 289	ATI, PC DOS 2.1 Training	\$ 40 \$ 26	BPI, General Acctg. AR, AP, or PR, ea.	\$ 595 \$ 365	BRODERBUND, Bank St. Writer (PC or Jr.)	\$ 80 \$ 51	CDX, Advanced Training for Lotus 1-2-3	\$ 70 \$ 45	CONTINENTAL, Ultrafile	\$ 195 \$ 115	Tax Advantage	\$ 70 \$ 40	Property Management	\$ 495 \$ 295	DATA TRANS., Fontrix	\$ 155 \$ 99	Font Packs, each	\$ 20 \$ 12	DOW JONES, Market Manager Plus	\$ 249 \$ 159	Market Analyzer	\$ 349 \$ 229	Spread Sheet Link	\$ 249 \$ 159	FOX & GELLER, Quickcode III	\$ 295 \$ 185	HARVARD, Total Project Manager	\$ 495 \$ 295	HOWARDSOFF, Tax Preparer '85	\$ 295 \$ 195	HUMAN EDGE, Mind Prober (PC or Jr.)	\$ 50 \$ 29	Sales Edge or Management Edge, ea.	\$ 250 \$ 139	Negotiation Edge	\$ 295 \$ 165	INFOCOM, Cornerstone	\$ 495 \$ 309	LIFETREE, Volkswriter Deluxe	\$ 295 \$ 159	LIVING VIDEOTEXT, Think Tank	\$ 185 \$ 109	LOTUS, 1-2-3	\$ 495 \$ 309	Symphony	\$ 695 \$ 449	MBDS, Knowledgeman	\$ 500 \$ 275	MECA, Managing Your Money (PC)	\$ 199 \$ 105	MICROPRO, Easy	\$ 150 \$ 99	WordStar (PC)	\$ 350 \$ 189	<table border="1"> <thead> <tr> <th>LIST PRICE</th> <th>CONROY PRICE</th> </tr> </thead> <tbody> <tr><td>MICROPRO, WordStar (Jr)</td><td>\$ 195 \$ 109</td></tr> <tr><td>WordStar 2000 (copiable)</td><td>\$ 495 \$ 265</td></tr> <tr><td>WordStar 2000 Plus (copiable)</td><td>\$ 595 \$ 295</td></tr> <tr><td>WordStar Professional, 4 Pak</td><td>\$ 495 \$ 265</td></tr> <tr><td>MICRORIM, R-Base Series 5000</td><td>\$ 695 \$ 385</td></tr> <tr><td>Upgrade 4000 to 5000</td><td>\$ 245 \$ 135</td></tr> <tr><td>R-Base 4000</td><td>\$ 495 \$ 259</td></tr> <tr><td>R-Base Clout</td><td>\$ 249 \$ 133</td></tr> <tr><td>Extended Report Writer</td><td>\$ 150 \$ 92</td></tr> <tr><td>MICROSOFT, Multiplan (PC or Jr)</td><td>\$ 195 \$ 124</td></tr> <tr><td>Chart or Project, each</td><td>\$ 250 \$ 159</td></tr> <tr><td>Word</td><td>\$ 375 \$ 239</td></tr> <tr><td>MOSAIC, Twin</td><td>\$ 145 \$ 75</td></tr> <tr><td>MULTIMATE, Multimate Ver. 3.3</td><td>\$ 495 \$ 229</td></tr> <tr><td>PALADIN, FlashCalc</td><td>\$ 129 \$ 86</td></tr> <tr><td>PEACHTREE, Back to Basics</td><td>\$ 385 \$ 239</td></tr> <tr><td>Peach Pak (GLARIAP)</td><td>\$ 395 \$ 219</td></tr> <tr><td>PRENTICE HALL, Inside the IBM, by P. Norton</td><td>\$ 25 \$ 17</td></tr> <tr><td>QUE, Using 1-2-3 (book)</td><td>\$ 18 \$ 14</td></tr> <tr><td>1-2-3 for Business (book)</td><td>\$ 17 \$ 13</td></tr> <tr><td>Using Symphony (book)</td><td>\$ 20 \$ 15</td></tr> <tr><td>SAMNA, Word Plus</td><td>\$ 695 \$ 349</td></tr> <tr><td>Word III</td><td>\$ 550 \$ 279</td></tr> <tr><td>SATELLITE, WordPerfect (PC)</td><td>\$ 495 \$ 219</td></tr> <tr><td>WordPerfect (Jr)</td><td>\$ 69 \$ 46</td></tr> <tr><td>SOFTW. ARTS, Spotlight</td><td>\$ 150 \$ 95</td></tr> <tr><td>SOFTWARE GROUP, Enable</td><td>\$ 695 \$ 385</td></tr> <tr><td>SOFTWARE PUBL. PFS:Report</td><td>\$ 125 \$ 75</td></tr> <tr><td>PFS:Write, File or Graph, each</td><td>\$ 140 \$ 84</td></tr> <tr><td>PFS:Plan or Access, each</td><td>\$ 140 \$ 84</td></tr> <tr><td>PFS:Proof</td><td>\$ 95 \$ 57</td></tr> </tbody> </table>	LIST PRICE	CONROY PRICE	MICROPRO, WordStar (Jr)	\$ 195 \$ 109	WordStar 2000 (copiable)	\$ 495 \$ 265	WordStar 2000 Plus (copiable)	\$ 595 \$ 295	WordStar Professional, 4 Pak	\$ 495 \$ 265	MICRORIM, R-Base Series 5000	\$ 695 \$ 385	Upgrade 4000 to 5000	\$ 245 \$ 135	R-Base 4000	\$ 495 \$ 259	R-Base Clout	\$ 249 \$ 133	Extended Report Writer	\$ 150 \$ 92	MICROSOFT, Multiplan (PC or Jr)	\$ 195 \$ 124	Chart or Project, each	\$ 250 \$ 159	Word	\$ 375 \$ 239	MOSAIC, Twin	\$ 145 \$ 75	MULTIMATE, Multimate Ver. 3.3	\$ 495 \$ 229	PALADIN, FlashCalc	\$ 129 \$ 86	PEACHTREE, Back to Basics	\$ 385 \$ 239	Peach Pak (GLARIAP)	\$ 395 \$ 219	PRENTICE HALL, Inside the IBM, by P. Norton	\$ 25 \$ 17	QUE, Using 1-2-3 (book)	\$ 18 \$ 14	1-2-3 for Business (book)	\$ 17 \$ 13	Using Symphony (book)	\$ 20 \$ 15	SAMNA, Word Plus	\$ 695 \$ 349	Word III	\$ 550 \$ 279	SATELLITE, WordPerfect (PC)	\$ 495 \$ 219	WordPerfect (Jr)	\$ 69 \$ 46	SOFTW. ARTS, Spotlight	\$ 150 \$ 95	SOFTWARE GROUP, Enable	\$ 695 \$ 385	SOFTWARE PUBL. PFS:Report	\$ 125 \$ 75	PFS:Write, File or Graph, each	\$ 140 \$ 84	PFS:Plan or Access, each	\$ 140 \$ 84	PFS:Proof	\$ 95 \$ 57	<table border="1"> <thead> <tr> <th>LIST PRICE</th> <th>CONROY PRICE</th> </tr> </thead> <tbody> <tr><td>SORCIM, SuperCalc III</td><td>\$ 395 \$ 229</td></tr> <tr><td>Superwriter</td><td>\$ 295 \$ 195</td></tr> <tr><td>SPRINGBOARD, Newsroom</td><td>\$ 50 \$ 37</td></tr> <tr><td>THORN EM, Perfect Pak (Jr) (WhiteSpell/Thesaurus)</td><td>\$ 139 \$ 89</td></tr> <tr><td>UNISON, Print Master</td><td>\$ 60 \$ 38</td></tr> <tr><td>WARNER, Desk Organizer (PC or Jr)</td><td>\$ 99 \$ 63</td></tr> <tr><td>XANARO, Ability</td><td>\$ 495 \$ 319</td></tr> </tbody> </table>	LIST PRICE	CONROY PRICE	SORCIM, SuperCalc III	\$ 395 \$ 229	Superwriter	\$ 295 \$ 195	SPRINGBOARD, Newsroom	\$ 50 \$ 37	THORN EM, Perfect Pak (Jr) (WhiteSpell/Thesaurus)	\$ 139 \$ 89	UNISON, Print Master	\$ 60 \$ 38	WARNER, Desk Organizer (PC or Jr)	\$ 99 \$ 63	XANARO, Ability	\$ 495 \$ 319	<table border="1"> <thead> <tr> <th>LIST PRICE</th> <th>CONROY PRICE</th> </tr> </thead> <tbody> <tr><td>MICROSOFT, Windows</td><td>\$ 95 \$ 63</td></tr> <tr><td>MICROSTUF, Crosstalk XVI (PC or Jr)</td><td>\$ 195 \$ 110</td></tr> <tr><td>MOUSE SYSTEMS, PC Paint</td><td>\$ 99 \$ 69</td></tr> <tr><td>NORTON, Utilities (14 prgms) v 3.0</td><td>\$ 100 \$ 56</td></tr> <tr><td>POLYTRON, Polywindows (copiable)</td><td>\$ 85 \$ 45</td></tr> <tr><td>ROSEOFF, Prokey (New Version)</td><td>\$ 130 \$ 80</td></tr> <tr><td>WESTERN UNION, Easy Link Mail Mgr</td><td>\$ 95 \$ 59</td></tr> </tbody> </table>	LIST PRICE	CONROY PRICE	MICROSOFT, Windows	\$ 95 \$ 63	MICROSTUF, Crosstalk XVI (PC or Jr)	\$ 195 \$ 110	MOUSE SYSTEMS, PC Paint	\$ 99 \$ 69	NORTON, Utilities (14 prgms) v 3.0	\$ 100 \$ 56	POLYTRON, Polywindows (copiable)	\$ 85 \$ 45	ROSEOFF, Prokey (New Version)	\$ 130 \$ 80	WESTERN UNION, Easy Link Mail Mgr	\$ 95 \$ 59
LIST PRICE	CONROY PRICE																																																																																																																																																																		
ANALYTICA, Reflex	\$ 495 \$ 335																																																																																																																																																																		
ASHTON-TATE, Framework	\$ 695 \$ 379																																																																																																																																																																		
dBase III	\$ 695 \$ 389																																																																																																																																																																		
dBase II, (req. PC-DOS & 128K)	\$ 495 \$ 289																																																																																																																																																																		
ATI, PC DOS 2.1 Training	\$ 40 \$ 26																																																																																																																																																																		
BPI, General Acctg. AR, AP, or PR, ea.	\$ 595 \$ 365																																																																																																																																																																		
BRODERBUND, Bank St. Writer (PC or Jr.)	\$ 80 \$ 51																																																																																																																																																																		
CDX, Advanced Training for Lotus 1-2-3	\$ 70 \$ 45																																																																																																																																																																		
CONTINENTAL, Ultrafile	\$ 195 \$ 115																																																																																																																																																																		
Tax Advantage	\$ 70 \$ 40																																																																																																																																																																		
Property Management	\$ 495 \$ 295																																																																																																																																																																		
DATA TRANS., Fontrix	\$ 155 \$ 99																																																																																																																																																																		
Font Packs, each	\$ 20 \$ 12																																																																																																																																																																		
DOW JONES, Market Manager Plus	\$ 249 \$ 159																																																																																																																																																																		
Market Analyzer	\$ 349 \$ 229																																																																																																																																																																		
Spread Sheet Link	\$ 249 \$ 159																																																																																																																																																																		
FOX & GELLER, Quickcode III	\$ 295 \$ 185																																																																																																																																																																		
HARVARD, Total Project Manager	\$ 495 \$ 295																																																																																																																																																																		
HOWARDSOFF, Tax Preparer '85	\$ 295 \$ 195																																																																																																																																																																		
HUMAN EDGE, Mind Prober (PC or Jr.)	\$ 50 \$ 29																																																																																																																																																																		
Sales Edge or Management Edge, ea.	\$ 250 \$ 139																																																																																																																																																																		
Negotiation Edge	\$ 295 \$ 165																																																																																																																																																																		
INFOCOM, Cornerstone	\$ 495 \$ 309																																																																																																																																																																		
LIFETREE, Volkswriter Deluxe	\$ 295 \$ 159																																																																																																																																																																		
LIVING VIDEOTEXT, Think Tank	\$ 185 \$ 109																																																																																																																																																																		
LOTUS, 1-2-3	\$ 495 \$ 309																																																																																																																																																																		
Symphony	\$ 695 \$ 449																																																																																																																																																																		
MBDS, Knowledgeman	\$ 500 \$ 275																																																																																																																																																																		
MECA, Managing Your Money (PC)	\$ 199 \$ 105																																																																																																																																																																		
MICROPRO, Easy	\$ 150 \$ 99																																																																																																																																																																		
WordStar (PC)	\$ 350 \$ 189																																																																																																																																																																		
LIST PRICE	CONROY PRICE																																																																																																																																																																		
MICROPRO, WordStar (Jr)	\$ 195 \$ 109																																																																																																																																																																		
WordStar 2000 (copiable)	\$ 495 \$ 265																																																																																																																																																																		
WordStar 2000 Plus (copiable)	\$ 595 \$ 295																																																																																																																																																																		
WordStar Professional, 4 Pak	\$ 495 \$ 265																																																																																																																																																																		
MICRORIM, R-Base Series 5000	\$ 695 \$ 385																																																																																																																																																																		
Upgrade 4000 to 5000	\$ 245 \$ 135																																																																																																																																																																		
R-Base 4000	\$ 495 \$ 259																																																																																																																																																																		
R-Base Clout	\$ 249 \$ 133																																																																																																																																																																		
Extended Report Writer	\$ 150 \$ 92																																																																																																																																																																		
MICROSOFT, Multiplan (PC or Jr)	\$ 195 \$ 124																																																																																																																																																																		
Chart or Project, each	\$ 250 \$ 159																																																																																																																																																																		
Word	\$ 375 \$ 239																																																																																																																																																																		
MOSAIC, Twin	\$ 145 \$ 75																																																																																																																																																																		
MULTIMATE, Multimate Ver. 3.3	\$ 495 \$ 229																																																																																																																																																																		
PALADIN, FlashCalc	\$ 129 \$ 86																																																																																																																																																																		
PEACHTREE, Back to Basics	\$ 385 \$ 239																																																																																																																																																																		
Peach Pak (GLARIAP)	\$ 395 \$ 219																																																																																																																																																																		
PRENTICE HALL, Inside the IBM, by P. Norton	\$ 25 \$ 17																																																																																																																																																																		
QUE, Using 1-2-3 (book)	\$ 18 \$ 14																																																																																																																																																																		
1-2-3 for Business (book)	\$ 17 \$ 13																																																																																																																																																																		
Using Symphony (book)	\$ 20 \$ 15																																																																																																																																																																		
SAMNA, Word Plus	\$ 695 \$ 349																																																																																																																																																																		
Word III	\$ 550 \$ 279																																																																																																																																																																		
SATELLITE, WordPerfect (PC)	\$ 495 \$ 219																																																																																																																																																																		
WordPerfect (Jr)	\$ 69 \$ 46																																																																																																																																																																		
SOFTW. ARTS, Spotlight	\$ 150 \$ 95																																																																																																																																																																		
SOFTWARE GROUP, Enable	\$ 695 \$ 385																																																																																																																																																																		
SOFTWARE PUBL. PFS:Report	\$ 125 \$ 75																																																																																																																																																																		
PFS:Write, File or Graph, each	\$ 140 \$ 84																																																																																																																																																																		
PFS:Plan or Access, each	\$ 140 \$ 84																																																																																																																																																																		
PFS:Proof	\$ 95 \$ 57																																																																																																																																																																		
LIST PRICE	CONROY PRICE																																																																																																																																																																		
SORCIM, SuperCalc III	\$ 395 \$ 229																																																																																																																																																																		
Superwriter	\$ 295 \$ 195																																																																																																																																																																		
SPRINGBOARD, Newsroom	\$ 50 \$ 37																																																																																																																																																																		
THORN EM, Perfect Pak (Jr) (WhiteSpell/Thesaurus)	\$ 139 \$ 89																																																																																																																																																																		
UNISON, Print Master	\$ 60 \$ 38																																																																																																																																																																		
WARNER, Desk Organizer (PC or Jr)	\$ 99 \$ 63																																																																																																																																																																		
XANARO, Ability	\$ 495 \$ 319																																																																																																																																																																		
LIST PRICE	CONROY PRICE																																																																																																																																																																		
MICROSOFT, Windows	\$ 95 \$ 63																																																																																																																																																																		
MICROSTUF, Crosstalk XVI (PC or Jr)	\$ 195 \$ 110																																																																																																																																																																		
MOUSE SYSTEMS, PC Paint	\$ 99 \$ 69																																																																																																																																																																		
NORTON, Utilities (14 prgms) v 3.0	\$ 100 \$ 56																																																																																																																																																																		
POLYTRON, Polywindows (copiable)	\$ 85 \$ 45																																																																																																																																																																		
ROSEOFF, Prokey (New Version)	\$ 130 \$ 80																																																																																																																																																																		
WESTERN UNION, Easy Link Mail Mgr	\$ 95 \$ 59																																																																																																																																																																		
<p>UTILITIES</p> <table border="1"> <thead> <tr> <th>LIST PRICE</th> <th>CONROY PRICE</th> </tr> </thead> <tbody> <tr><td>BORLAND, Sidekick (copiable)</td><td>\$ 85 \$ 45</td></tr> <tr><td>Turbo Pascal or Super Keys, ea.</td><td>\$ 70 \$ 36</td></tr> <tr><td>Turbo Pascal w/8087 or BCD, ea.</td><td>\$ 110 \$ 66</td></tr> <tr><td>Turbo Pascal w/8087 & BCD</td><td>\$ 125 \$ 69</td></tr> <tr><td>Toolbox or Turbo Graphics, ea.</td><td>\$ 55 \$ 29</td></tr> <tr><td>Turbo Tutor</td><td>\$ 35 \$ 19</td></tr> <tr><td>CENTRAL POINT, Copy II PC</td><td>\$ 40 \$ 22</td></tr> <tr><td>PC Tools</td><td>\$ 40 \$ 22</td></tr> <tr><td>DIGITAL RES., Gem Draw</td><td>\$ 150 \$ 95</td></tr> <tr><td>Gem Collection</td><td>\$ 199 \$ 125</td></tr> <tr><td>PRENTICE HALL, Inside the IBM, by P. Norton</td><td>\$ 25 \$ 17</td></tr> <tr><td>CP/M-86 (PC/XT)</td><td>\$ 100 \$ 64</td></tr> <tr><td>CP/LOGO-86 (CP/M-86)</td><td>\$ 150 \$ 99</td></tr> <tr><td>FLINK SOFTWARE, Sideways</td><td>\$ 60 \$ 37</td></tr> <tr><td>IMSI, PC Paintbrush</td><td>\$ 139 \$ 85</td></tr> <tr><td>LIFEBEAT, Lattice C</td><td>\$ 495 \$ 279</td></tr> <tr><td>Dr. Halo</td><td>\$ 100 \$ 59</td></tr> <tr><td>MAGNUM, Fastrak™, RAM/Disk & spooler</td><td>\$ 50 \$ 39</td></tr> <tr><td>MicroBASIC, Macro Assembler</td><td>\$ 150 \$ 99</td></tr> <tr><td>QuickBASIC</td><td>\$ 99 \$ 65</td></tr> <tr><td>BASIC Compiler or C Compiler, ea</td><td>\$ 385 \$ 269</td></tr> <tr><td>Business BASIC Compiler</td><td>\$ 495 \$ 295</td></tr> <tr><td>COBOL Compiler</td><td>\$ 700 \$ 459</td></tr> <tr><td>FORTRAN Compiler</td><td>\$ 350 \$ 229</td></tr> <tr><td>PASCAL Compiler</td><td>\$ 300 \$ 199</td></tr> </tbody> </table>				LIST PRICE	CONROY PRICE	BORLAND, Sidekick (copiable)	\$ 85 \$ 45	Turbo Pascal or Super Keys, ea.	\$ 70 \$ 36	Turbo Pascal w/8087 or BCD, ea.	\$ 110 \$ 66	Turbo Pascal w/8087 & BCD	\$ 125 \$ 69	Toolbox or Turbo Graphics, ea.	\$ 55 \$ 29	Turbo Tutor	\$ 35 \$ 19	CENTRAL POINT, Copy II PC	\$ 40 \$ 22	PC Tools	\$ 40 \$ 22	DIGITAL RES., Gem Draw	\$ 150 \$ 95	Gem Collection	\$ 199 \$ 125	PRENTICE HALL, Inside the IBM, by P. Norton	\$ 25 \$ 17	CP/M-86 (PC/XT)	\$ 100 \$ 64	CP/LOGO-86 (CP/M-86)	\$ 150 \$ 99	FLINK SOFTWARE, Sideways	\$ 60 \$ 37	IMSI, PC Paintbrush	\$ 139 \$ 85	LIFEBEAT, Lattice C	\$ 495 \$ 279	Dr. Halo	\$ 100 \$ 59	MAGNUM, Fastrak™, RAM/Disk & spooler	\$ 50 \$ 39	MicroBASIC, Macro Assembler	\$ 150 \$ 99	QuickBASIC	\$ 99 \$ 65	BASIC Compiler or C Compiler, ea	\$ 385 \$ 269	Business BASIC Compiler	\$ 495 \$ 295	COBOL Compiler	\$ 700 \$ 459	FORTRAN Compiler	\$ 350 \$ 229	PASCAL Compiler	\$ 300 \$ 199																																																																																																												
LIST PRICE	CONROY PRICE																																																																																																																																																																		
BORLAND, Sidekick (copiable)	\$ 85 \$ 45																																																																																																																																																																		
Turbo Pascal or Super Keys, ea.	\$ 70 \$ 36																																																																																																																																																																		
Turbo Pascal w/8087 or BCD, ea.	\$ 110 \$ 66																																																																																																																																																																		
Turbo Pascal w/8087 & BCD	\$ 125 \$ 69																																																																																																																																																																		
Toolbox or Turbo Graphics, ea.	\$ 55 \$ 29																																																																																																																																																																		
Turbo Tutor	\$ 35 \$ 19																																																																																																																																																																		
CENTRAL POINT, Copy II PC	\$ 40 \$ 22																																																																																																																																																																		
PC Tools	\$ 40 \$ 22																																																																																																																																																																		
DIGITAL RES., Gem Draw	\$ 150 \$ 95																																																																																																																																																																		
Gem Collection	\$ 199 \$ 125																																																																																																																																																																		
PRENTICE HALL, Inside the IBM, by P. Norton	\$ 25 \$ 17																																																																																																																																																																		
CP/M-86 (PC/XT)	\$ 100 \$ 64																																																																																																																																																																		
CP/LOGO-86 (CP/M-86)	\$ 150 \$ 99																																																																																																																																																																		
FLINK SOFTWARE, Sideways	\$ 60 \$ 37																																																																																																																																																																		
IMSI, PC Paintbrush	\$ 139 \$ 85																																																																																																																																																																		
LIFEBEAT, Lattice C	\$ 495 \$ 279																																																																																																																																																																		
Dr. Halo	\$ 100 \$ 59																																																																																																																																																																		
MAGNUM, Fastrak™, RAM/Disk & spooler	\$ 50 \$ 39																																																																																																																																																																		
MicroBASIC, Macro Assembler	\$ 150 \$ 99																																																																																																																																																																		
QuickBASIC	\$ 99 \$ 65																																																																																																																																																																		
BASIC Compiler or C Compiler, ea	\$ 385 \$ 269																																																																																																																																																																		
Business BASIC Compiler	\$ 495 \$ 295																																																																																																																																																																		
COBOL Compiler	\$ 700 \$ 459																																																																																																																																																																		
FORTRAN Compiler	\$ 350 \$ 229																																																																																																																																																																		
PASCAL Compiler	\$ 300 \$ 199																																																																																																																																																																		
<p>HOME & EDUCATIONAL</p> <table border="1"> <tbody> <tr><td>BPI, Personal Accounting</td><td>\$ 99 \$ 63</td></tr> <tr><td>BRODERBUND, Print Shop</td><td>\$ 60 \$ 36</td></tr> <tr><td>CONTINENTAL, Home Accountant (Jr)</td><td>\$ 75 \$ 45</td></tr> <tr><td>Home Accountant Plus (PC)</td><td>\$ 150 \$ 90</td></tr> <tr><td>DAVIDSON, Spell It</td><td>\$ 50 \$ 30</td></tr> <tr><td>ELECTRONIC ARTS, Get Organized</td><td>\$ 95 \$ 75</td></tr> <tr><td>MONOGRAM, Dollars & Sense wirecast</td><td>\$ 180 \$ 100</td></tr> <tr><td>SCARBOROUGH, MasterType (PC or Jr)</td><td>\$ 40 \$ 25</td></tr> <tr><td>Your Personal Net Worth</td><td>\$ 100 \$ 63</td></tr> <tr><td>SIMON & SCHUSTER, Typing Tutor III</td><td>\$ 50 \$ 33</td></tr> </tbody> </table>				BPI, Personal Accounting	\$ 99 \$ 63	BRODERBUND, Print Shop	\$ 60 \$ 36	CONTINENTAL, Home Accountant (Jr)	\$ 75 \$ 45	Home Accountant Plus (PC)	\$ 150 \$ 90	DAVIDSON, Spell It	\$ 50 \$ 30	ELECTRONIC ARTS, Get Organized	\$ 95 \$ 75	MONOGRAM, Dollars & Sense wirecast	\$ 180 \$ 100	SCARBOROUGH, MasterType (PC or Jr)	\$ 40 \$ 25	Your Personal Net Worth	\$ 100 \$ 63	SIMON & SCHUSTER, Typing Tutor III	\$ 50 \$ 33																																																																																																																																												
BPI, Personal Accounting	\$ 99 \$ 63																																																																																																																																																																		
BRODERBUND, Print Shop	\$ 60 \$ 36																																																																																																																																																																		
CONTINENTAL, Home Accountant (Jr)	\$ 75 \$ 45																																																																																																																																																																		
Home Accountant Plus (PC)	\$ 150 \$ 90																																																																																																																																																																		
DAVIDSON, Spell It	\$ 50 \$ 30																																																																																																																																																																		
ELECTRONIC ARTS, Get Organized	\$ 95 \$ 75																																																																																																																																																																		
MONOGRAM, Dollars & Sense wirecast	\$ 180 \$ 100																																																																																																																																																																		
SCARBOROUGH, MasterType (PC or Jr)	\$ 40 \$ 25																																																																																																																																																																		
Your Personal Net Worth	\$ 100 \$ 63																																																																																																																																																																		
SIMON & SCHUSTER, Typing Tutor III	\$ 50 \$ 33																																																																																																																																																																		
<p>RECREATIONAL</p> <table border="1"> <tbody> <tr><td>BLUECHIP, Millionaire, Barron, Tycoon, ea</td><td>\$ 60 \$ 35</td></tr> <tr><td>BRODERBUND, Large Inventory In Stock</td><td>CALL</td></tr> <tr><td>ELECTRONIC ARTS, Large Inventory In Stock</td><td>CALL</td></tr> <tr><td>HAYDEN, Sargon III (Chess)</td><td>\$ 50 \$ 34</td></tr> <tr><td>INFOCOM, Hitchhiker's Guide or Zork I, ea.</td><td>\$ 40 \$ 25</td></tr> <tr><td>Zork II or III, each</td><td>\$ 45 \$ 25</td></tr> <tr><td>MICROPROSE, Strike Eagle</td><td>\$ 35 \$ 23</td></tr> <tr><td>MICROSOFT, Flight Simulator (PC or Jr)</td><td>\$ 50 \$ 33</td></tr> <tr><td>ORIGIN, Ultima III (PC or Jr)</td><td>\$ 80 \$ 39</td></tr> <tr><td>SIERRA/ON-LINE, Ultima II (PC or Jr.)</td><td>\$ 80 \$ 43</td></tr> <tr><td>SPECTRUM HOLOBYTE, Gato</td><td>\$ 40 \$ 25</td></tr> <tr><td>SPIRITMAKER, Amazon, Dragon, each</td><td>\$ 40 \$ 25</td></tr> <tr><td>SUBLOGIC, Jet</td><td>\$ 50 \$ 32</td></tr> </tbody> </table>				BLUECHIP, Millionaire, Barron, Tycoon, ea	\$ 60 \$ 35	BRODERBUND, Large Inventory In Stock	CALL	ELECTRONIC ARTS, Large Inventory In Stock	CALL	HAYDEN, Sargon III (Chess)	\$ 50 \$ 34	INFOCOM, Hitchhiker's Guide or Zork I, ea.	\$ 40 \$ 25	Zork II or III, each	\$ 45 \$ 25	MICROPROSE, Strike Eagle	\$ 35 \$ 23	MICROSOFT, Flight Simulator (PC or Jr)	\$ 50 \$ 33	ORIGIN, Ultima III (PC or Jr)	\$ 80 \$ 39	SIERRA/ON-LINE, Ultima II (PC or Jr.)	\$ 80 \$ 43	SPECTRUM HOLOBYTE, Gato	\$ 40 \$ 25	SPIRITMAKER, Amazon, Dragon, each	\$ 40 \$ 25	SUBLOGIC, Jet	\$ 50 \$ 32																																																																																																																																						
BLUECHIP, Millionaire, Barron, Tycoon, ea	\$ 60 \$ 35																																																																																																																																																																		
BRODERBUND, Large Inventory In Stock	CALL																																																																																																																																																																		
ELECTRONIC ARTS, Large Inventory In Stock	CALL																																																																																																																																																																		
HAYDEN, Sargon III (Chess)	\$ 50 \$ 34																																																																																																																																																																		
INFOCOM, Hitchhiker's Guide or Zork I, ea.	\$ 40 \$ 25																																																																																																																																																																		
Zork II or III, each	\$ 45 \$ 25																																																																																																																																																																		
MICROPROSE, Strike Eagle	\$ 35 \$ 23																																																																																																																																																																		
MICROSOFT, Flight Simulator (PC or Jr)	\$ 50 \$ 33																																																																																																																																																																		
ORIGIN, Ultima III (PC or Jr)	\$ 80 \$ 39																																																																																																																																																																		
SIERRA/ON-LINE, Ultima II (PC or Jr.)	\$ 80 \$ 43																																																																																																																																																																		
SPECTRUM HOLOBYTE, Gato	\$ 40 \$ 25																																																																																																																																																																		
SPIRITMAKER, Amazon, Dragon, each	\$ 40 \$ 25																																																																																																																																																																		
SUBLOGIC, Jet	\$ 50 \$ 32																																																																																																																																																																		

CASH-n-CARRY COMPUTER STORES, INC.
Retail Sales only. Store prices may vary.

SAN FRANCISCO — 550 Washington Street (at Montgomery, opposite the Pyramid). Interstate 80 to Highway 480; take Washington Street Exit. CALL (415) 982-6212.

PORTLAND, OREGON — At Park 217, Tigar at intersection of Highways 217 and 99W. CALL (503) 620-5595.

SEATTLE, WASH. — NEW LOCATION! 1105 Bellevue Way N.E. in Belgate Plaza, 2 blocks north of Bellevue Square. CALL (206) 641-4736.



OUR REFERENCES:
We have been in computers and electronics since 1956, a computer dealer since 1978 and in computer mail order since 1980. Banks: 1st Interstate Bank, (503) 643-4678. We belong to the Chamber of Commerce (503) 228-9411, and Direct Marketing Association; call Dun and Bradstreet if you are a subscriber. Recipient of OREGON BUSINESS MAGAZINE's 1984 Enterprise Award.

NO SALES TAX

CALL (800) 547-1289
In Oregon: (800) 451-5151 (503) 620-9877

QUESTIONS (503) 620-9878
8:00 AM - 5:00 PM (PDT)
Weekdays Only

ORDER DESK HOURS Mon-Fri 8am to 8pm (PDT)
Saturday 8am to 4pm (PDT)
(6 am here is 9 am in New York)

Foreign & Portland Residents Call

E·V·E·N·T Q·U·E·U·E

November 1985

SYMPHONY SEMINARS, various sites throughout the U.S. Automated Digital Offices, 4555 MacArthur Blvd., Washington, DC 20007, (202) 337-1393. *November-January*

ADA COURSES, Rockville, MD. EVB Software Engineering Inc., Suite 100, 451 Hungerford Dr., Rockville, MD 20850, (301) 251-1626. *November-December*

MICRO-TO-MAINFRAME SEMINARS, Atlanta, GA. The MOM Corp., Two Northside 75, Atlanta, GA 30318, (800) 241-1170; in Georgia, (404) 351-2902. *November*

EIGHTH TAMPA COMPUTER SHOWCASE EXPO, Curtis Hixon Hall, Tampa, FL. The Interface Group Inc., 300 First Ave., Needham, MA 02194, (617) 449-6600. *November 1-3*

FIFTH ANNUAL EDUCATIONAL COMPUTING CONFERENCE, Plymouth, NH. Dr. Stephen Weissmann, Educational Computing Conference, Plymouth State College, Plymouth, NH 03264, (603) 536-1550 ext. 460. *November 2*

CONFERENCE ON TESTING COMPUTER SOFTWARE, Washington, DC. Sponsored by the Education Foundation of the Data Processing Management Association. Conference Manager, U.S. Professional Development Institute, 1620 Elton Rd., Silver Spring, MD 20903, (301) 445-4400. *November 4-6*

SOUTHWEST SEMICONDUCTOR & ELECTRONICS EXPOSITION

AND CONFERENCE, Phoenix Civic Plaza Convention Center, Phoenix, AZ. Cartledge & Associates Inc., Suite M259, 1101 South Winchester Blvd., San Jose, CA 95128, (408) 554-6644. *November 5-7*

FIFTH LOS ANGELES COMPUTER SHOWCASE EXPO, Los Angeles Convention Center, Los Angeles, CA. The Interface Group Inc., 300 First Ave., Needham, MA 02194, (617) 449-6600. *November 7-10*

SECOND MARYLAND/VIRGINIA/DC MICRO SHOW AND FLEAMARKET, Sheraton Hotel, New Carrollton, MD. Ken Gordon Productions Inc., POB 13, Franklin Park, NJ 08823, (201) 297-2526. *November 9*

NINTH ANNUAL SYMPOSIUM ON COMPUTER APPLICATIONS IN MEDICAL CARE, Baltimore Convention Center, Baltimore, MD. Office of Continuing Medical Education, George Washington University Medical Center, 2300 K St. NW, Washington, DC 20037, (202) 676-8928. *November 10-13*

TROUBLESHOOTING MICRO-PROCESSOR-BASED EQUIPMENT AND DIGITAL DEVICES, Rodeway Inn East, Indianapolis, IN. Micro Systems Institute, Garnett, KS 66032, (913) 898-4695. *November 12-15*

THIRD INTERNATIONAL TECHNOLOGY OPPORTUNITY

IF YOU WANT your organization's public activities listed in BYTE's Event Queue, we need to know about them at least four months in advance. Send information about computer conferences, seminars, workshops, and courses to BYTE, Event Queue, POB 372, Hancock, NH 03449.

CONFERENCE: THE FUTURE OF OPTICAL MEMORIES, COMPACT DISCS, AND VIDEO-DISKS TO THE YEAR 2000, Union Square Holiday Inn, San Francisco, CA. Technology Opportunity Conference, POB 14817, San Francisco, CA 94114-0817. *November 13-15*

VIDEOTEX ENGINEERING AND TECHNOLOGY, Meridian Hotel, San Francisco, CA. Online International Inc., 989 Avenue of the Americas, New York, NY 10018, (212) 279-8890. *November 13-15*

SIXTH ANNUAL COMPUTER LAW INSTITUTE, McCormick Center Hotel, Chicago, IL. Law & Business Inc., Harcourt Brace Jovanovich, Publishers, 855 Valley Rd., Clifton, NJ 07013, (800) 223-0231; in New Jersey, (201) 472-7400. *November 14-15*

BAY AREA COMPUTER SWAP, Santa Clara County Fairgrounds, San Jose, CA. Microshows, Suite 203, 1209 Donnelly Ave., Burlingame, CA 94010, (415) 340-0104. *November 16*

SOFTWARE TOOLS FOR ARTIFICIAL INTELLIGENCE/EXPERT SYSTEMS, Westin Hotel, Boston, MA. Software Tools Conference, Suffolk University, Boston, MA 02108, (617) 723-2349. *November 18-19*

SOFTWARE-ORIENTED COMPUTER ARCHITECTURE, Hyatt

Rickeys, Palo Alto, CA. Continuing Education Institute, 10889 Wilshire Blvd., Los Angeles, CA 90024. *November 18-22*

WRITING BETTER COMPUTER SOFTWARE DOCUMENTATION FOR USERS, Tempe, AZ. Center for Professional Development, College of Engineering and Applied Sciences, Arizona State University, Tempe, AZ 85287, (602) 965-1740. *November 19-21*

WESCON/85 AND IECON '85, San Francisco, CA. Electronic Conventions Management, 8110 Airport Blvd., Los Angeles, CA 90045, (213) 772-2965. *November 19-22*

IDATE: SEVENTH INTERNATIONAL CONFERENCE, Montpellier, France. IDATE, Bureaux du Polygone, Rue des Etats du Languedoc, 34000 Montpellier, France, tel: 67.65.48.48; Telex: IDATE 490 290 F. *November 20-22*

COMDEX/FALL '85, Las Vegas, NV. The Interface Group Inc., 300 First Ave., Needham, MA 02194, (617) 449-6600. *November 20-24*

THIRD SOUTH JERSEY MICRO SHOW AND FLEAMARKET, Halloran Plaza Hotel, Pennsauken, NJ. Ken Gordon Productions Inc., POB 13, Franklin Park, NJ 08823, (201) 297-2526. *November 23*

FORTH MODIFICATION LABORATORY (FORML), Pacific Grove, CA. FORTH Interest Group, POB 8231, San Jose, CA 95155, (408) 277-0668. *November 29-December 1* ■



LONG DISTANCE OPERATOR

Another day, another country.

You're going to see the director of a large international pension fund, and you need a little insight. Good thing you've got your Epson® Geneva™ portable computer. At your hotel in Stockholm, you use the Geneva to call up the Wharton Econometric World Service Historical Data Base. The optional Geneva modem and software do all the talking. If they don't have what you need, one of 2,000 other public data bases will. With new information and Geneva's word

processing software, you fine-tune your presentation.

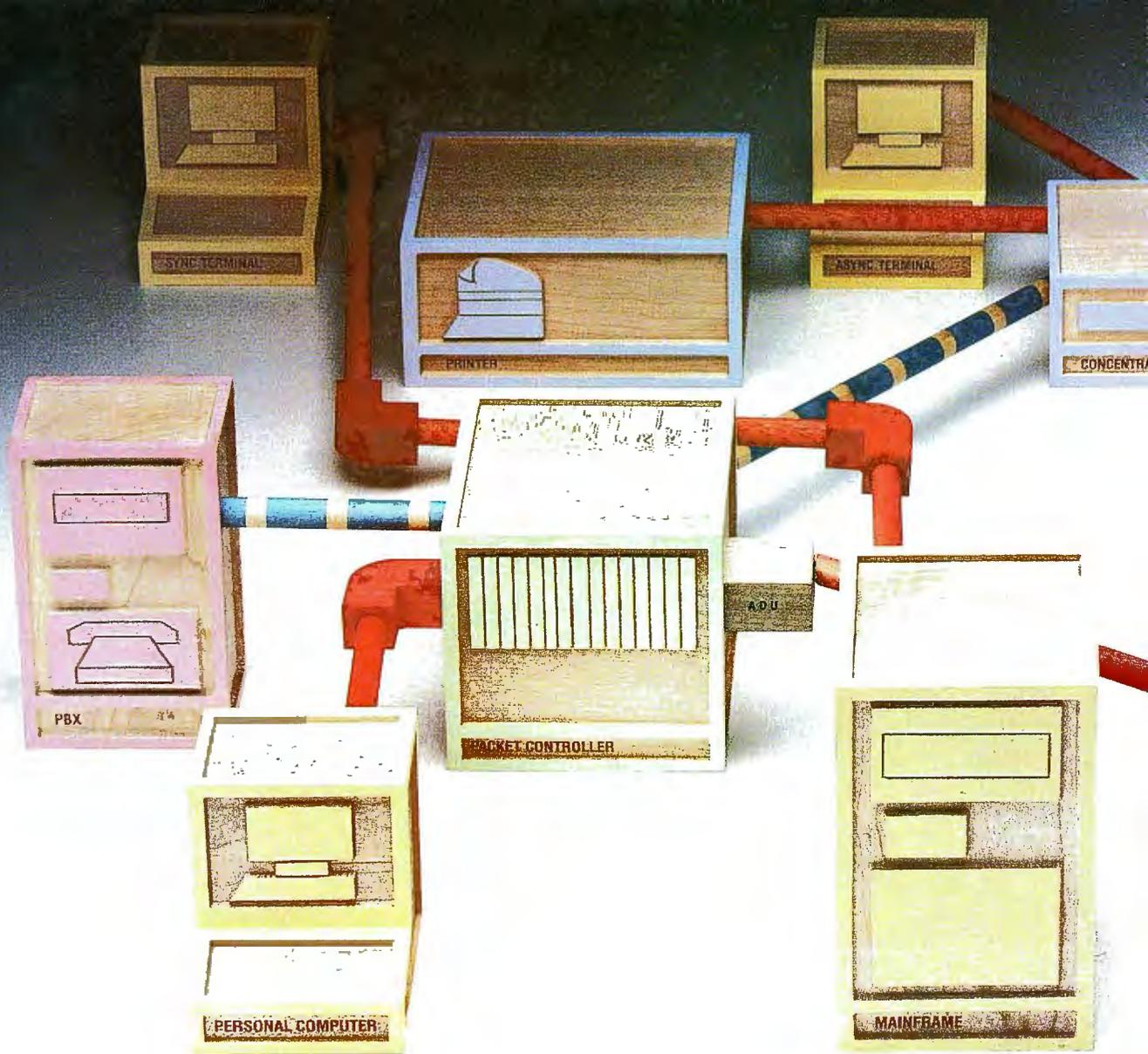
The director wants predicted rates of return for his investments. You model the rates with Geneva's spreadsheet software, and get hard copy from its optional battery powered printer. Because the Geneva is an international machine, you run it out in the Swedish character set, complete with punctuation. The director is delighted. You make the deal, sending a copy to your IBM® PC back in New York.

At the airport, you use the Geneva

to check the currency exchange rates. Next stop, Rome, where your money may not be worth as much, but your expertise is.

With a massive software library and a complete line of system peripherals, the Epson Geneva PX-8™ portable computer can handle any job, anywhere. And for less than \$1000. For more information, call 800-421-5426 or 213-539-9140 in California.

EPSON Geneva



ONLY A NETWORK THIS MANAGEABLE

Are you in control of your data network? Or a slave to it? Locked into hardware that limits your options? Overburdened by maintenance? And trapped by multiple systems you can't manage?

The Information Systems Network from AT&T lets you take command. It's the only data network that allows you to integrate and manage your terminals, workstations, PCs, minis and mainframes as a single corporate-wide data network. It's the only network you can completely control.

You've got the whole network in your hands. ISN's hierarchical star topology centralizes system administration and maintenance. The hub of the system is a fast-switching Packet Controller. It's linked to all data devices and manages all network functions. So, if one device goes down, the Packet Controller keeps your network running.

A System Control Console taps right into the Packet Controller. From this terminal, you can manage the network using simple English commands. You can add or move equipment, monitor network performance, track down faults and take corrective action—without disrupting network operations.

With a special password, you can perform maintenance

functions from any asynchronous terminal in the system. And you have the option of remote maintenance from one of our service centers. ISN gives you multiple points of control.

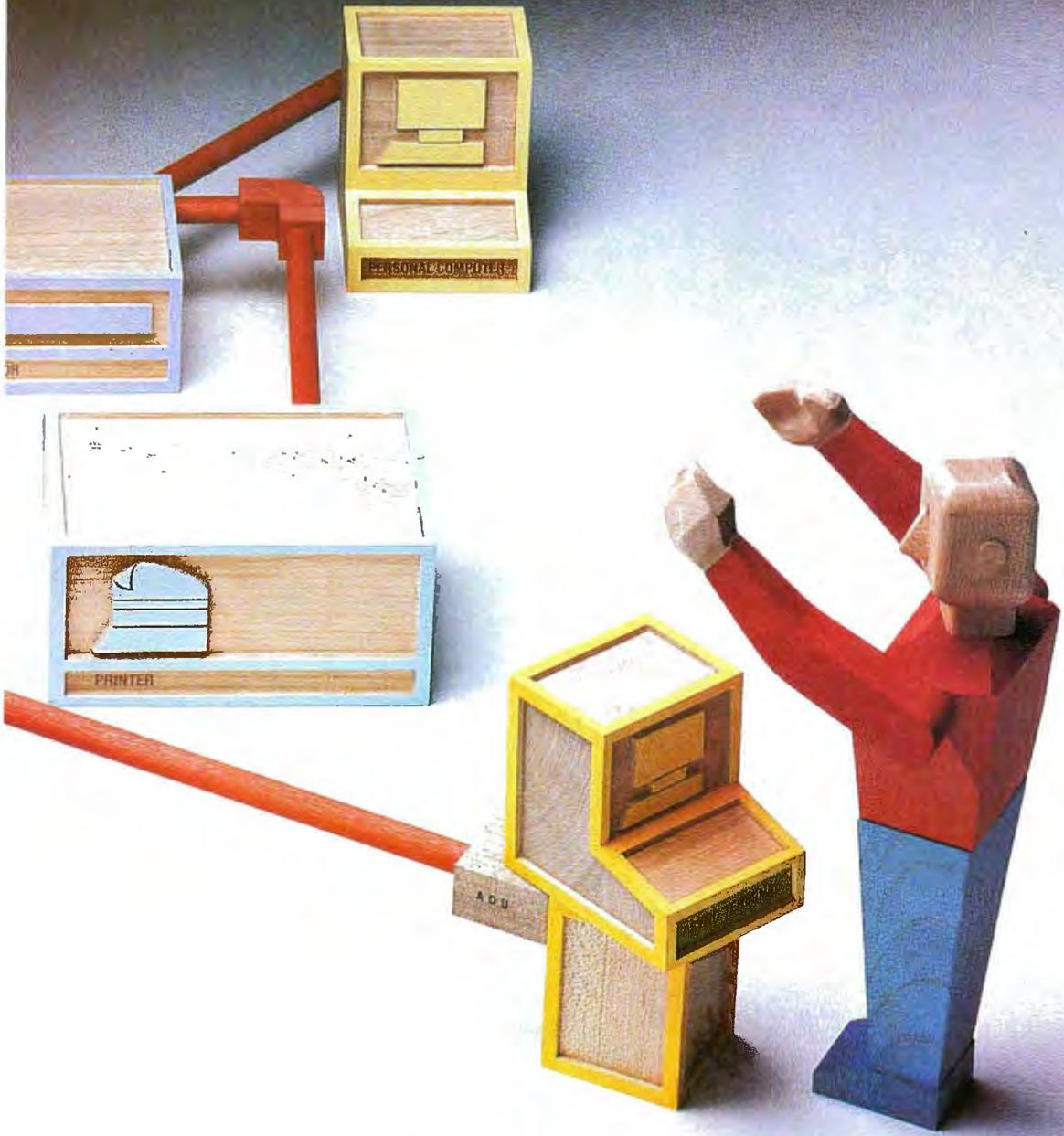
You've got plenty of flexibility. ISN links the devices in your network with twisted copper wire and fiber optics. It uses our Premises Distribution System wiring scheme which allows easy modular growth.

ISN is flexible and open to change. Start with as few as 50 devices and let it grow. ISN's open architecture allows you to easily add on new devices and new technologies as they emerge. ISN can take things as they come.

Linking multiple Packet Controllers lets you expand ISN to any size network. You can grow across one premise or across the country. And no matter how large your network gets, you choose the means of control—centralized or distributed. With ISN you're the boss.

You can bridge the communications gap. What happens to your PBX? PC networks? Data processing systems? And all that hardware from Big Blue? ISN gets them all on speaking terms.

You can link ISN with the AT&T System 85 or AT&T System 75 PBXs. Whatever you have—data processing



LET'S YOU BE MASTER OF YOUR UNIVERSE.

equipment and office automation equipment; isolated Ethernets;™ AT&T's STARLAN PC Network and 3B Net; smart and dumb—ISN gets it all working together. All sharing the same resources. With you in total control.

And what about those IBM 3270s? ISN makes them work even harder. Now your 3270 terminals can access multiple IBM hosts. And low-cost dumb terminals can do the same. Asynchronous and synchronous traffic can travel through your network with the same speed and efficiency.

You can handle heavy traffic. ISN maintains a high end-to-end transmission speed of 8.64 mbps, and a high throughput rate even when traffic is at its peak.

Long messages or bursty transmissions—ISN's been engineered to handle it all. A unique centralized short bus and perfect scheduling access method permit messages to travel through the network almost instantaneously. And arrive with their integrity intact. So there's no waiting. No bottlenecks. No retransmitting data.

You've made the right connection. AT&T has a history of solving complicated networking problems with intelligent solutions. We know how to tie it all together.

And we know how to work with you. Our professional

sales and service people are with you every step of the way—planning, designing and maintaining a network that will meet your business needs today and tomorrow.

ISN reflects AT&T's better approach to office automation. To learn why it's the right choice for your business, call your AT&T Information Systems Account Executive, or 1 800 247-1212.

© 1985 AT&T Information Systems
Ethernet is a registered trademark of Xerox Corp.
IBM is a registered trademark of International Business Machines Corp.





Features

CIARCIA'S CIRCUIT CELLAR: THE WORLD'S SMALLEST 1200-BPS MODEM <i>by Steve Ciarcia</i>	89
PROGRAMMING PROJECT: AN ASSEMBLER FOR VM2 <i>by Jonathan Amsterdam</i>	112
PROGRAMMING PROJECT: EXTENDING TURBO PASCAL <i>by Bruce Webster</i>	123
CD-ROMS AND THEIR KIN <i>by Richard S. Shuford</i>	137
HIGHS AND LOWS OF PARAMETER PASSING <i>by Michael Kilian</i>	151
PROGRAMMING INSIGHT: GAME-PADDLE CONTROL LINEARITY TEST <i>by Marvin L. De Jong</i>	161

THIS MONTH'S CIRCUIT CELLAR is slightly different. Steve does not show how to build the world's smallest 1200-bps modem. This powerful one-chip device, the MOSART, is already available from Xecom. Instead, Steve uses the MOSART in three applications he has developed—as a dumb terminal, an answering machine, and an input system with voice response.

In the first of November's two Programming Projects, Jonathan Amsterdam describes the assembler he wrote for his VM2 virtual machine (see "Building a Computer in Software," October BYTE, page 112). This assembler will let you write programs using instruction mnemonics as well as symbolic names for data. It will also automatically translate these programs into a sequence of numbers that can then be loaded into VM2's memory and run. This project will provide a stepping-stone to Jonathan's ultimate project—the construction of a high-level-language compiler—which he will present in a three-part series beginning next month.

In the second Programming Project, Bruce Webster examines five small libraries he designed to customize Turbo Pascal. These libraries extend predefined procedures and functions of the language.

As users have demanded more speed and capacity in data storage, storage media have gone from paper tape to cassette tape to floppy disk to hard disk. Now optical storage devices can be added to the list. In "CD-ROMs and Their Kin," Richard Shuford explores the basics of various optical storage devices, the advantages of their great storage capacity, and how they might be used in the future.

Michael Kilian's "Highs and Lows of Parameter Passing" deals with techniques that interface assembly language with higher-level languages, such as Pascal and FORTRAN. With these techniques, you can control devices, such as the horizontal timing of a screen; you can use the speed of assembly language for certain calculations, such as pseudorandom-number generation; and you can perform other tasks that expand the use of high-level languages beyond their original design.

In the Programming Insight, Marvin De Jong shows you how to use the game-paddle inputs on an Apple II to measure physical properties like resistance, capacitance, temperature, and light intensity.

Now there's a Mouse that flies.



Introducing the View Control System.™ Ultrasonic technology that moves your cursor at the speed of sight.

Your relationship with your Mac is about to change. Dramatically. Because now the View Control System™ (or VCS) from Personics gives you a powerful new way to control the cursor. Fast. Direct. Intuitive. It's the best thing since the Mouse. In fact, it's better.

Move the Cursor Where You Look On the Screen

A lightweight headset translates natural head movement into cursor movement. Look to the right and the cursor moves right. Look down and left and the cursor moves accordingly. No exaggerated head motion is required, just subtle, natural rotation.



Look Ma, Both Hands!

Now you don't have to take your hand off the keyboard to reach for the Mouse. A unique button pad clips on your keyboard just below the space bar. One button activates the headset. Use the second button for clicking and dragging. No more reach, grab, roll, click, return.

Faster than a Speeding Mouse

Since you can look much faster than you can reach and roll, the VCS is faster than a mouse. And because your hands stay on the keyboard you maintain continuity and concentration. Expect a real boost in productivity.

Reclaim Your Desktop

The VCS flies above the ordinary mouse, leaving more space on your desktop. Now you have room for books, papers and your favorite coffee cup. If you want, connect both your mouse and your VCS to the Mac and use them interchangeably.

State-of-the-art Technology

The VCS uses a proprietary ultrasonic technology to measure subtle changes in the rotation and angle of your head.* These changes are then translated into electrical signals just like those produced by the Mouse. The amount of cursor motion produced by a given amount of head motion depends on the rate your head moves. By monitoring this rate, the VCS can tell whether you are scanning across the screen or zeroing in on a small target. Then, it automatically adjusts to give you the right amount of head-to-cursor translation. Zip from corner to corner, or point to a tiny target with ease, even an individual pixel!

*Patent Pending.
IBM PC and Apple II versions available soon.

Get Acquainted in 15 Minutes

A few minutes of experience will put you in command of the VCS. Before long, moving the cursor will feel like a natural extension



of vision. You'll simply look and click. The VCS headset accommodates eyeglasses and won't muss up your hair. And since it doesn't rest on your ears, you're free to use the phone. The VCS works with any 128K or 512K Mac. No hardware or software modifications are required.

Just \$199.00
and Easy to Order

The VCS is available right now, directly from Personics. Call us toll free. A member of our sales staff will be happy to answer your questions. If you're ready to order, please have your major credit card at hand when you call. When your VCS arrives, try it for 30 days. If you're not completely satisfied, return it and we will swiftly refund your money. And we back the VCS with a full one year warranty. Satisfaction guaranteed.

CALL TOLL FREE800-445-3311
In Massachusetts800-447-1196

The VCS. A simple and direct link between man and computer. Try it, and watch your ideas take off.



VCS™

Personics Corporation
2352 Main Street, Building 2, Concord, MA 01742

THE WORLD'S SMALLEST 1200-BPS MODEM

BY STEVE CIARCIA

*The essential ingredient
in the turnkey bulletin board*



Before you get too excited about building the world's smallest modem, I must state in advance that there is nothing to build per se. Such a device already exists, and I intend to use it as the basis for my project.

Generally speaking, Circuit Cellar projects involve taking some hot new chip and pasting it together with some other components to satisfy a novel application. When that chip becomes the only component in the design, however, it can't exactly be called a construction project. In those cases, I have to demonstrate real purpose for the pages I take up rather than simply waft solder flux fumes in the general direction of my usually adamant supporters.

For a long time I have been receiving letters asking when I was going to design and present a 1200-bps (bits per second) modem (Bell-212A). Readers also ask whether I have ever thought of building a complete interactive computer-messaging system beyond the presentation alluded to in my March project, "Build the Touch-Tone Interactive Message System," which also incorporated a 1200-bps modem.

In truth, such a project has always been in the works. On two separate occasions I sketched out schematics for a 1200-bps modem using the (then) latest available chip

set or single-chip modem. In both cases, these "single chips" required piles of extra ICs (integrated circuits) and interfacing components that would have resulted in relatively large and expensive printed-circuit boards. When you can buy a stand-alone Hayes-compatible smart modem for \$249, it hardly makes sense to spend three times as much merely to say you built it yourself.

This continuously negative build-versus-buy price comparison seemed to be an insurmountable obstacle. Fortunately, on my last trip to California I met a couple of people from Xecom who had just what I needed to break the logjam.

I WANT MORE THAN A MODEM

Getting personal computers to communicate with each other over the telephone network has become a relatively ordinary task for computer users. Many hardware and software products let your machine exchange information with other machines. However, selectively communicating with both people and other machines is not so simple.

(continued)

Steve Ciarcia (pronounced "see-ARE-see-ah") is an electronics engineer and computer consultant with experience in process control, digital design, nuclear instrumentation, and product development. He is the author of several books about electronics. You can write to him at POB 582, Glastonbury, CT 06033.

- Modem Interface**
 - Support for standard 300- and 1200-bps modems
 - External audio interfaces for acoustic coupling where direct connection is not feasible
- Telephone Interface**
 - DTMF generator and pulse dialer
 - Call-progress monitoring
 - Externally accessed audio inputs and outputs to items like support speakers, headphones, and microphones
 - Multiple line control
- Voice Interface**
 - Some form of voice synthesis
 - Ability to store incoming voice on tape or as digitized speech
- Computer Interface**
 - Simple physical interface
 - USART built in for serialization, data framing, parity checking, flag insertion and deletion, and speed selection
 - Smart command set with character-coded error and status codes
- Miscellaneous**
 - On-board control of all device functions as well as the implementation of the smart command language
 - Built-in diagnostics for the board as well as the telephone line
 - FCC-registered direct-connection capability with the appropriate protective circuits
 - Simple power requirements

Figure 1: A wish list for the ultimate computerized interactive communication system.

- Fully Bell-212A- and Bell-103-compatible
- DTMF or pulse dialing
- Call-progress monitoring
- DTMF reception and decoding
- 8251A software compatibility
- Parity generation/checking
- Sync-byte detection/insertion
- Synchronous: 1200 bps; asynchronous: 1200, 300, 110 bps
- Software-controlled audio input and output interface for voice communication or acoustic coupling
- Voice synthesis, LPC-coded
- Extensive built-in diagnostics
- Phone-line diagnostics
- FCC-registered direct connection; Tip and Ring input
- Operates on +/- 5-volt power supply
- ASCII command and error/status codes

Figure 2: Features of the XE1203.

Sure, you can dial numbers with your modem. You can even answer the phone with it. But that's about as far as the low-cost units go. Performance beyond simple auto-dial answer/originate functions is reserved for expensive, commercially available phone-handler systems with single and multiple line-control boards.

The equivalent functions can be emulated with multiple expansion peripheral boards, but such configurations tend to be used in areas like maintaining address books, flash dialing, automatic redialing, or emergency notification calls. Few configurations combine modem functions, phone-handling flexibility, and human caller interaction at a cost that any of us could afford.

This seemingly unattainable system configuration leads us to speculate what the ultimate computerized interactive communication system would include. The feature list might look something like figure 1. Using off-the-shelf peripheral devices and doing the hardware and software yourself, you can satisfy most of these requirements. You will also end up using three or four slots in your computer and could possibly spend more than \$1000 (see table 1).

Keep in mind that most commercial modems like the Hayes Smartmodem don't allow audio inputs and that any voice or DTMF (dual-tone, multiple-frequency) I/O (input/output) must be performed through a separate DAA (data-access arrangement). This configuration doesn't provide phone-line diagnostics, single (nonhost) point of control for all devices, or any way to route the audio signals around. Still, it might be worth trying if you have a few months of free evenings.

WHAT IS A MOSART?

Of course, I wouldn't be running you around this much if I hadn't found a simpler and cheaper method. It turns out that all the functions shown in figure 1 (except the tape recorder) are available on one chip. No, not a board, just one chip! This marvel is the XE1203 hybrid IC from Xecom (374 Turquoise St., Milpitas, CA

95035, (408) 943-0313).

The chip is called a MOSART (modem synchronous/asynchronous receiver/transmitter) and is shown in photo 1. It comes with voice synthesis as the XE1203 or without voice synthesis as the XE1201. I'll be describing the XE1203, which has the features shown in figure 2.

All of this power is packed into a 2¼-by 1-by ½-inch hybrid circuit that plugs into a standard 40-pin DIP (dual in-line pin) socket. (The pin-out diagram of the XE1203 is shown in figure 3.)

Functionally, the MOSART can be divided into six sections: host interface, modem, analog circuits, DAA, speech synthesizer, and microprocessor (see figure 4). Basically, the MOSART can be viewed as a separate communication interface that looks to the host computer like an 8251A USART (universal synchronous/asynchronous receiver/transmitter) chip, including the appearance of registers and interrupt lines (shown in figure 5, it functions as an 8251A but is not pin-compatible with an 8251A). It is not a "dumb" device, like the other single-chip components I've mentioned. Instead, it is a board-level communication system that has been reduced to the size of a hybrid IC. As a Z8-based system, it is intelligent and uses a high-level command protocol between it and the host in much the same way the Hayes Smartmodem does (it is not Hayes-compatible).

The modem is capable of providing both Bell-103 and Bell-212A mode synchronous or asynchronous operation. The analog section consists of switching circuits for routing data among the speech synthesizer, modem, audio inputs and outputs, phone line, and both modulator and demodulator.

What's really impressive, though, is that the XE1203 includes an FCC-registered DAA on chip that provides 1500 volts (V) of isolation from the phone line, protection for the phone company's line, on/off hook control, and ring indication. To use the MOSART, you simply connect it to Tip and Ring on the phone line.

Table 1: A possible bill of materials if you do it yourself.

Hayes Smartmodem	\$349
Speech-synthesis board	\$349
DTMF receiver board	\$60
Tape recorder	\$59
DAA	\$95
Relay-control board	\$150
Total	\$1062

Finally, the speech synthesizer, which is only on the XE1203, is an LPC (linear predictive coding) natural voice synthesizer. Data, in the form of ASCII (American Standard Code for Information Interchange) and binary strings from a word table, is fed to it (as if it were an 8251A) by the host computer. Custom vocabularies can be designed and implemented for special applications, but the package

from Xecom presently includes a vocabulary of 145 words, letters, numbers, and phrases.

WHAT WE'RE NOT BUILDING

For the first time, a single-chip modem actually can be built with only a single 40-pin DIP hybrid chip. (It would have been smaller, but they had to leave some room to fit the DAA transformer.) The only additional circuitry necessary is for the address decoding typically required of any 8251A interface.

Since I have only one hot new chip and can't justify lots of interface glue, it hardly makes sense for me to reinvent the wheel. Instead of a purely hardware Circuit Cellar project, this month will be spent discussing how to use the XE1203 MOSART and how to design the interactive communication system suggested earlier.

Xecom manufactures an XE12XX evaluation board that plugs into the IBM PC, and I have chosen to use that board as a simple vehicle for demon-

(continued)



Photo 1: A close-up of the MOSART module as a 1200-bps modem (and more) on a chip.

Plugging the MOSART into an IBM PC requires only the inclusion of address-decoding logic.

stration rather than hand-wire a prototype of the same thing (after all, how many ways are there to hook up one chip?). The MOSART evaluation board is IBM PC-compatible simply for convenience (see photos 2 and 3).

In addition to Xecom's evaluation software, I have included programs that accomplish the major elements of human/computer interaction. The

software provided in this article is written primarily in BASIC, so it is transportable to virtually any system. If you want to use the MOSART on an Apple or CP/M system, little would have to be changed.

Some of the applications that might be possible with the MOSART board are found in figure 6.

A NOTE OF CAUTION

I must caution you about one significant point regarding this article. This demonstration board and the XE1203 are not Hayes-software-compatible. While the MOSART has an intelligent command structure, the codes themselves are different. This article is intended to present and make available what I consider to be the world's smallest modem. It is not a cheaper alternative to a Hayes-compatible modem but a design alternative for

OEMs and industrious experimenters. For it to be used instead of a Hayes-compatible modem, the communication driver routines must be modified.

Also, since the evaluation board was designed primarily as an engineering evaluation tool and not specifically as a Circuit Cellar project, its documentation is aimed at the experienced programmer or engineer and does not contain the usual broad spectrum of supporting materials that aid beginners.

With that out of the way, I'll introduce you to the XE1203 MOSART and hope it will solve some of your communication problems. I'll demonstrate in software how to program it as a simple dumb terminal, a smart answering machine, and as a DTMF/voice interactive communication device.

PUTTING THE MOSART INTO AN IBM PC

Interfacing to the MOSART is simple since it looks like an 8251A to the host computer and the phone lines merely connect to the Tip and Ring inputs on the chip. Plugging the MOSART into an IBM PC requires only the inclusion of address-decoding logic (see figure 7). The simplest circuit requires only a 74LS02 and a 74LS30. Use of the interrupt lines is optional since the same signals are available from the MOSART's control register.

You simply wire the phone line to the Tip and Ring pins of the MOSART. Connecting a headset and microphone to let you hear or talk directly to the connected party involves the use of three resistors and one capacitor.

Exchanging data and command/status information with the MOSART is straightforward. You initialize the device via a hardware reset line on power-up or by writing the initialization bit of the control register. The MOSART initializes similarly to the 8251A device it emulates (see figure 8). After writing several bytes of hexadecimal 0s to ensure the MOSART is not stuck between initialization states, the initialization bit is written to the control register. The mode byte is

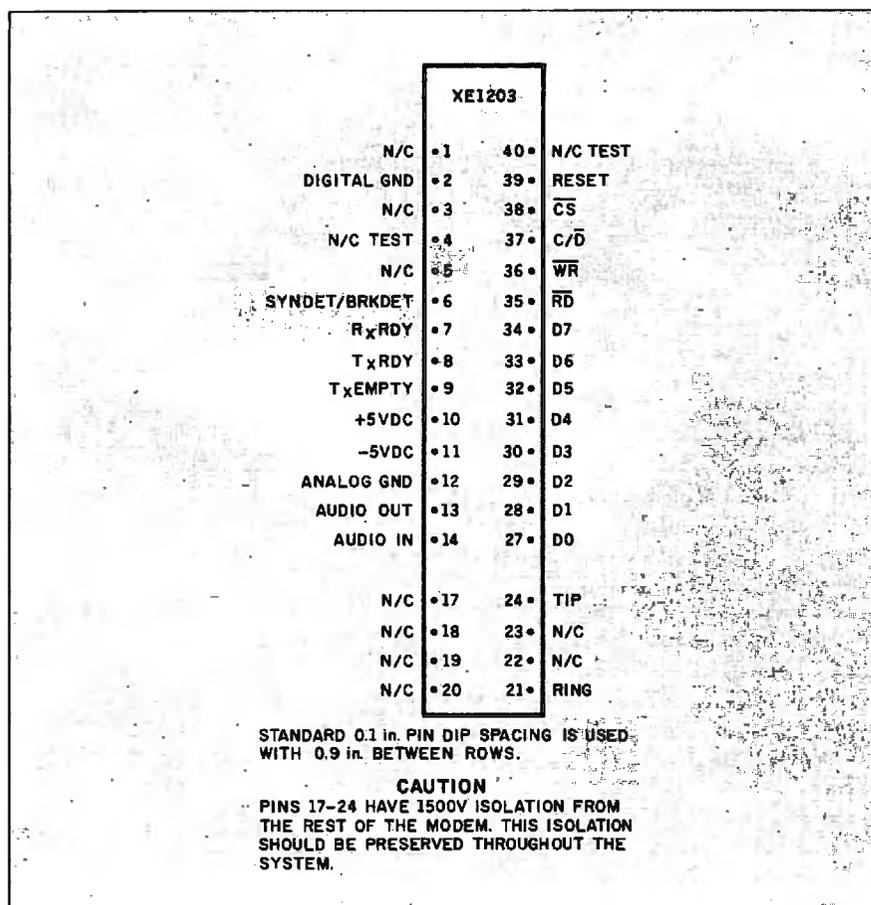


Figure 3: The pin-out diagram of the XE1203 MOSART.

The MOSART outputs both data and status codes to the host computer over the same port.

written next, followed by 1 or 2 sync bytes if you are using synchronous transmission. Lastly, the control byte is written. Once the MOSART is initialized, a new control byte can be set at any time by simply writing to the control register.

All communication takes place through the MOSART's data port. An RTS bit in the control byte allows the MOSART to differentiate between command function codes and data. Setting RTS to a logic 1 indicates that the information is to be accepted as data and sent either to the modem or the speech synthesizer. An RTS bit of logic 0 indicates that the information written to the data port is to be interpreted as a MOSART command function code.

The MOSART outputs both data and status codes to the host computer over the same port. The host

computer interrogates a DSR bit in the control register to determine if the received information is data or a status code.

The command function codes the MOSART recognizes are divided into four categories: modem connection, configuration, telephone control, and tests.

Modem-connection functions include answering and originating modem connections and monitoring for modem carrier or voice. The configuration functions allow speed, framing, and parity selection; rotary or DTMF dialing; and switching control over the synthesizer, external audio, and phone lines.

Telephone-control functions handle dialing and DTMF. The commands consist of line hold, DTMF receive, dial digits, and the */# keys. In addition, the letters a through f can be used to

send the DTMF codes for the normally unimplemented last row of the key-set. (Tone dialing must have been selected previously with the configuration command.) In addition, a detailed monitor function is included that will watch the phone line and every half second give out a code that indicates the frequency heard on the

(continued)

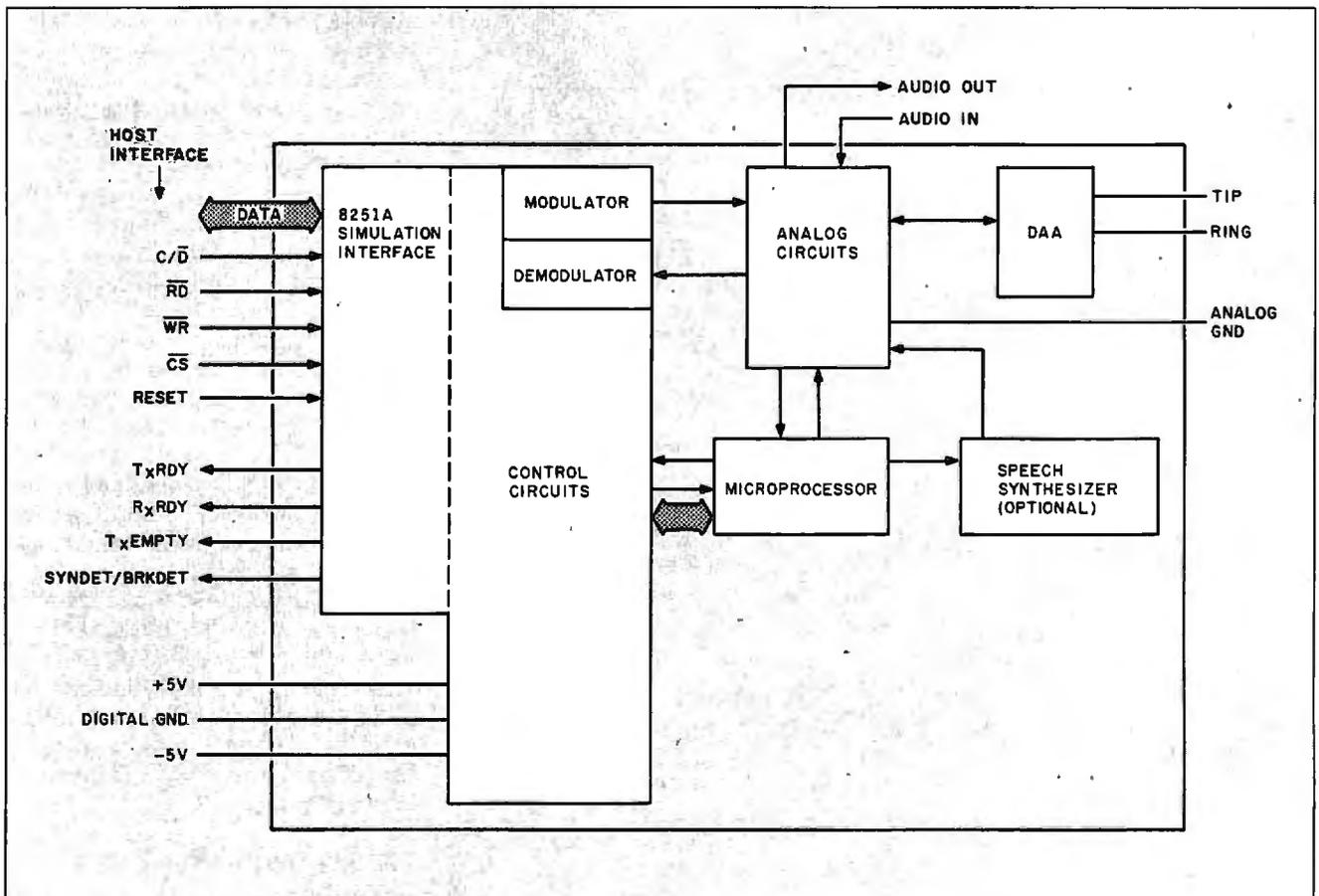


Figure 4: The MOSART's functional block diagram.

line (in tens of hertz). Other standard control functions like pausing and waiting for dial tone are also included in the telephone-control function set.

The test functions are perhaps the most unique to the MOSART. These functions include allowing answer-or originate-mode loopbacks; a line-analysis feature that includes signal/noise, received-carrier level, and carrier-frequency error statistics; and a special analysis of 1200-bps mode

phase-error information.

A detailed description of many of the important command functions is given in table 2.

APPLICATIONS

I'm sure you can think of many uses for such a flexible device. I have already developed three applications for it using the IBM PC: dumb terminal with auto-dial answer/originate capabilities, simple announce or an-

nounce-and-record answering machine, and DTMF input system with voice response.

With the exception of the speech synthesizer, which needs more speed than the usual interpreter can provide, all the applications are written in BASIC to allow you to see what is going on. In a further attempt to keep it simple, no interrupts were used. This does limit the speed of the dumb terminal to only 300 bps, however, unless you switch to a compiled BASIC. [Editor's note: The source codes for the programs mentioned in this article are available for downloading from BYTenet Listings. Call (617) 861-9774 before November 1. Thereafter, call (617) 861-9764.]

MOSTERM: DUMB TERMINAL

Listing 1 (MOSTERM) illustrates the use of the MOSART as the modem and phone handler in a dumb-terminal application. Through the use of configuration files, various modem and phone-number parameters can be stored. The program allows the computer to either originate the connection or wait for a call to be received. When either of these events is complete, the program enters the terminal emulator. The terminal emulator can be stopped at any time by entering Control-A from the keyboard.

In this program, the configuration values for speed, number of data bits, number of stop bits, and parity are used to create a mask for the MOSART-mode byte, as would be done in an 8251A-based device. The values for answer or originate mode, the type of dialing to be used (pulse or DTMF), and the digits to be dialed are saved as MOSART function codes. Lastly, the values for the support of half- or full-duplex mode (really character echo to the screen) and linefeed suppression are stored as flags for the emulator to test as it's running. A simplified flowchart of the program appears in figure 9.

MOSANSWR: ANSWERING MACHINE

The MOSANSWR program (see listing 2) shows how the MOSART can be

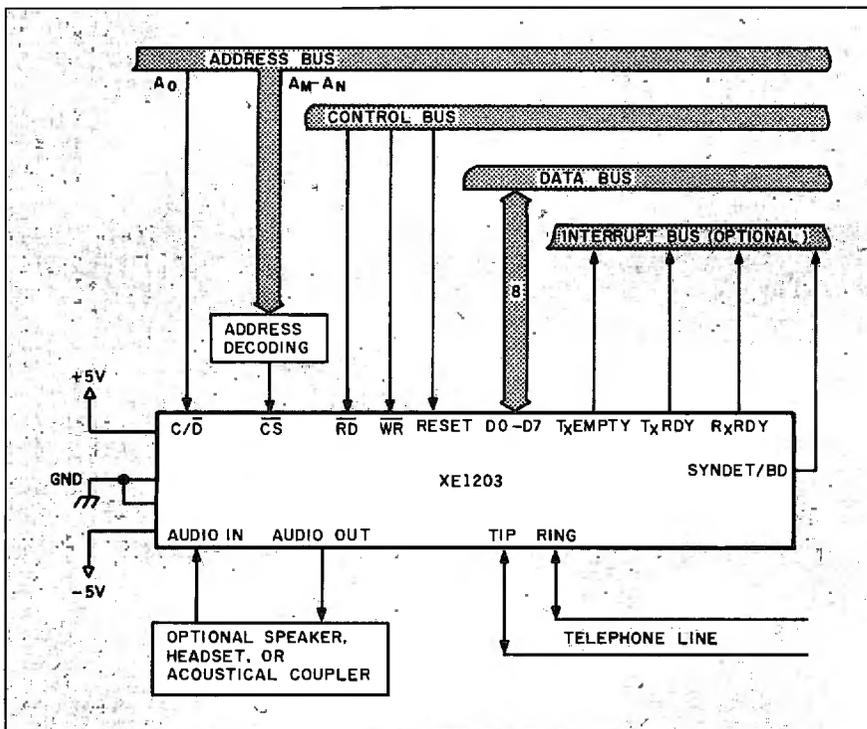


Figure 5: Interfacing details for the MOSART. Notice that it provides the same signals as an 8251A USART.

- Smart auto-dial/auto-answer modem
- Telephone dialer/directory machine
- Answering machine (simple or smart)
- Call-forwarding system
- Security modem
- Wake-up caller
- Emergency dialer
- DTMF input system with voice response
- DTMF home-control system with voice response

Figure 6: Some possible applications for the MOSART.

used to implement a simple answering machine. The system can be configured to announce only or to act as an announce-and-record device. For recording, you need to add only a cassette cable and a cassette tape recorder. The IBM PC's cassette motor-control output is used to turn the cassette recorder on and off, and the audio output of the MOSART is routed to the auxiliary or line input jack of the recorder.

This application is relatively simple, but it does have some neat features. The software has the ability to give out date and time information or a call-forwarding number to the caller. These options, as well as control of the operating mode of the device (announce or announce/record), are all under user control via a setup menu when the program is started.

In addition to the initial setup, you have the ability to create, save, and load a 30-element table that can change the way the machine works based on the date and time. The system will automatically synchronize to the loaded table by executing all changes earlier than the current date and time in chronological order. This lets you program call-forwarding numbers in advance, announce or record mode, and whether or not date and time information is given out. Multiple tables can be created, each containing several "standard" operations as well as custom information for different days or situations.

The entire speech vocabulary is loaded for this program, even though only a few words and phrases were needed. This is to let you customize the messages for your own applications. Canned phrases are voiced using data statements, where the first data item is the count of words or phrases to be spoken concurrently. The rest of the numbers are pointers to the phrase table, (TB(X,Y)), which contains the offsets of the LPC codes and the lengths of the phrases.

All speech is output via a machine-language subroutine call. The starting address of the LPC codes for the phrase and the number of bytes to

(continued)

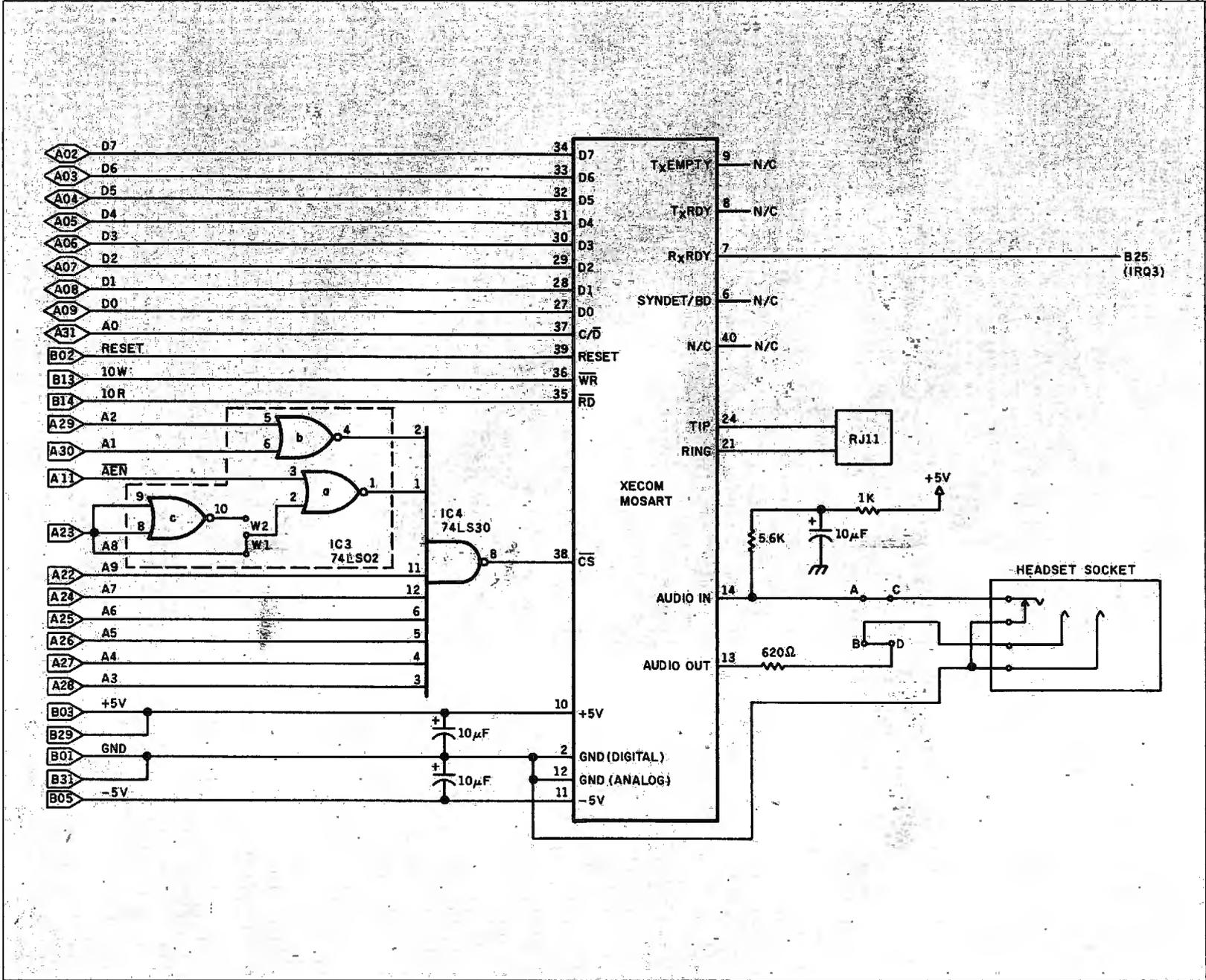


Photo 2: The Xecom IBM PC MOSART evaluation board.



Photo 3: The MOSART evaluation board installed in an IBM PC. Directly behind the MOSART board is a Hayes 1200-bps Smartmodem. Note the difference in complexity between the boards, with the MOSART also having DTMF encoding/decoding and a speech synthesizer.

Figure 7: Schematic diagram of the MOSART interface to an IBM PC.



A LITTLE INCENTIVE

In the spirit of supporting hobbyists, I have often offered free listings or disks of software to those who built my projects from scratch. With this month's project there is nothing to build, and the software is either published here or available through BYTEnet Listings. I mentioned in the article that any commercial modem software would have to be modified to use the MOSART since it is not directly Hayes-compatible. Its use would be beneficial since it actually offers many more features.

There is no sense in trying to convert hardware folk, like me, so I'd like to of-

fer some incentive to any software gurus in the audience. I will offer a \$200 prize to the person who sends in the whizbang best, most complete bells-and-whistles modification file for PC-Talk III, enabling PC-Talk III to really make full use of the MOSART board's capabilities.

PC-Talk III, a shareware communications program for the PC, while not in the public domain itself, has a fair number of customization files floating around in the public domain. These are usually supplied as BASIC ASCII files that can be merged with the source

code to PC-Talk III to add enhancements or changes. A panel selected from the Connecticut Computer Club will review all software submitted by January 31, 1986, and determine the winner by March 15, 1986. I will pay the winner \$200. To be eligible, all submissions may have a copyright but must carry the statement that the author is placing the software in the public domain for noncommercial use only. I will then make the winning software and any other significant entries available to users through BYTEnet or the Circuit Cellar Bulletin Board.

output are passed to the routine as parameters on the stack, as outlined in the IBM BASIC manual. The routine jams the data out to the MOSART to create the synthesized voice. (Xecom provides the LPC codes for 145 words and phrases on a disk with the evaluation package, but all the speech evaluation and demonstration code is written in FORTH. In the process of producing this article, several additional programs were written that translate these files into ASCII text. These have been added to the demonstration routines. Unfortunately, this accumulation of programs is too much to publish here. If you wish to examine the code in the unpublished portions of this software, you are welcome to download the appropriate files through BYTEnet Listings.)

It is possible to do more things with the answering-machine program. "Hooks" were left in the software for DTMF remote-control functions. After any beep during announce or announce-and-record modes, the system briefly checks to see if a DTMF "*" or "#" has been received. These would be used to tell the system to go into special mode for privileged callers or supervisory mode for the owner of the system. Currently, trying this will result in a message stating that the function is unavailable. The hooks are

left there for your use in custom applications.

MOSDTMF: INPUT SYSTEM WITH VOICE RESPONSE

This final program (see listing 3) shows how you might use the MOSART's DTMF recognition function to develop an interactive data inquiry function.

Since I had the native vocabulary of the MOSART to work with, I decided to code a sample routine that would let a remote user hear all the 145 words and phrases.

After receiving a call, the program checks for a correct identification code. In this case, I used the numbers

(continued)

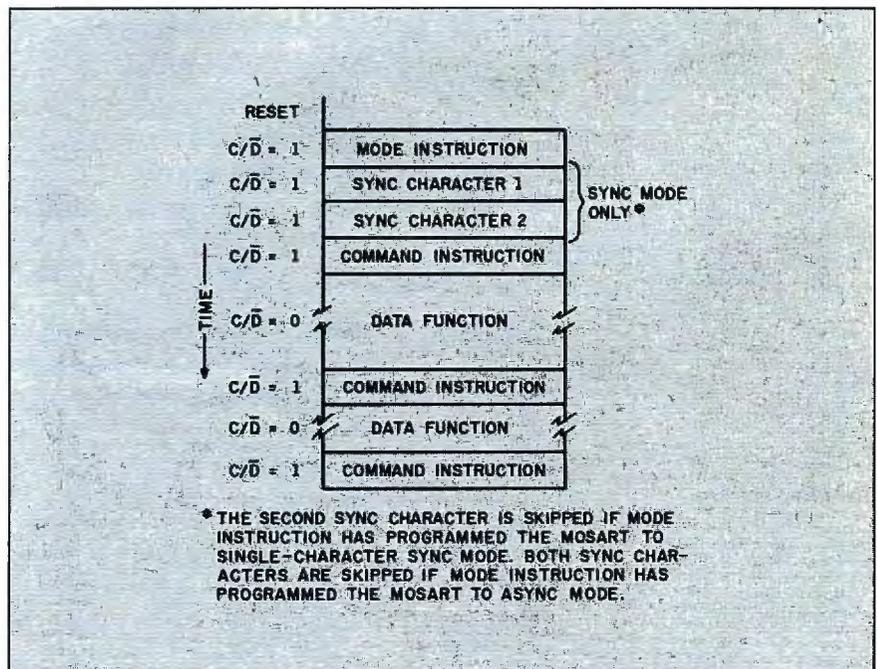


Figure 8: The MOSART's initialization sequence.

CIRCUIT CELLAR

Table 2: Most of the important command functions available on the MOSART.

ASCII Code (hexadecimal)	Character	Function
41	A	Answer incoming call.
01	Control-A	Controlled answer. This function can be aborted by the caller by pressing "1" on a Touch-Tone dial or speaking. The MOSART will return a 1 or a v, respectively.
4D	M	Monitor the line and return status. MOSART returns R (ring back), D (dial tone), B (busy), V (voice), and others as appropriate.
4F	O	MOSART modem enters the originate mode.
52	R	Rotary dial.
54	T	Touch-Tone dial.
0F	Control-O	Set data-transmission rate to 110 bps.
14	Control-T	Set data-transmission rate to 300 bps.
08	Control-H	Set data-transmission rate to 1200 bps.
16	Control-V	Enable voice to phone-line connection. Returns an I (inappropriate) if a modem connection exists.
56	V	Enable voice locally. The synthesizer and audio input are connected to the audio output.
76	v	Disable voice.
58	X	Enable audio-output connection to the phone line (enables you to listen to the phone line).
78	x	Disable audio-output connection to the phone line.
5A	Z	Coupler on. The modulator is connected to audio-out, and the demodulator listens to audio-in.
7A	z	Coupler off.
3D	=	Parity checking/generation off.
3E	>	Even parity checking/generation.
3C	<	Odd parity checking/generation.
13	Control-S	Seven-bit character length.
05	Control-E	Eight-bit character length.
44	D	DTMF receive mode. The MOSART recognizes keys entered from a Touch-Tone phone and returns their associated ASCII codes.
48	H	Performs a logical disconnect of the modem but leaves the line in hold status.
49	I	Identify. Returns a letter corresponding to the version of the MOSART.
0D	Control-M	Detailed monitor. Every 0.05 second the MOSART returns a data byte indicating the line frequency in tens of hertz.
6D	m	Same as M.
70	p	Pause for 2 seconds.
50	P	Pause for 5 seconds.
57	W	Wait for dial tone.

CIRCUIT CELLAR

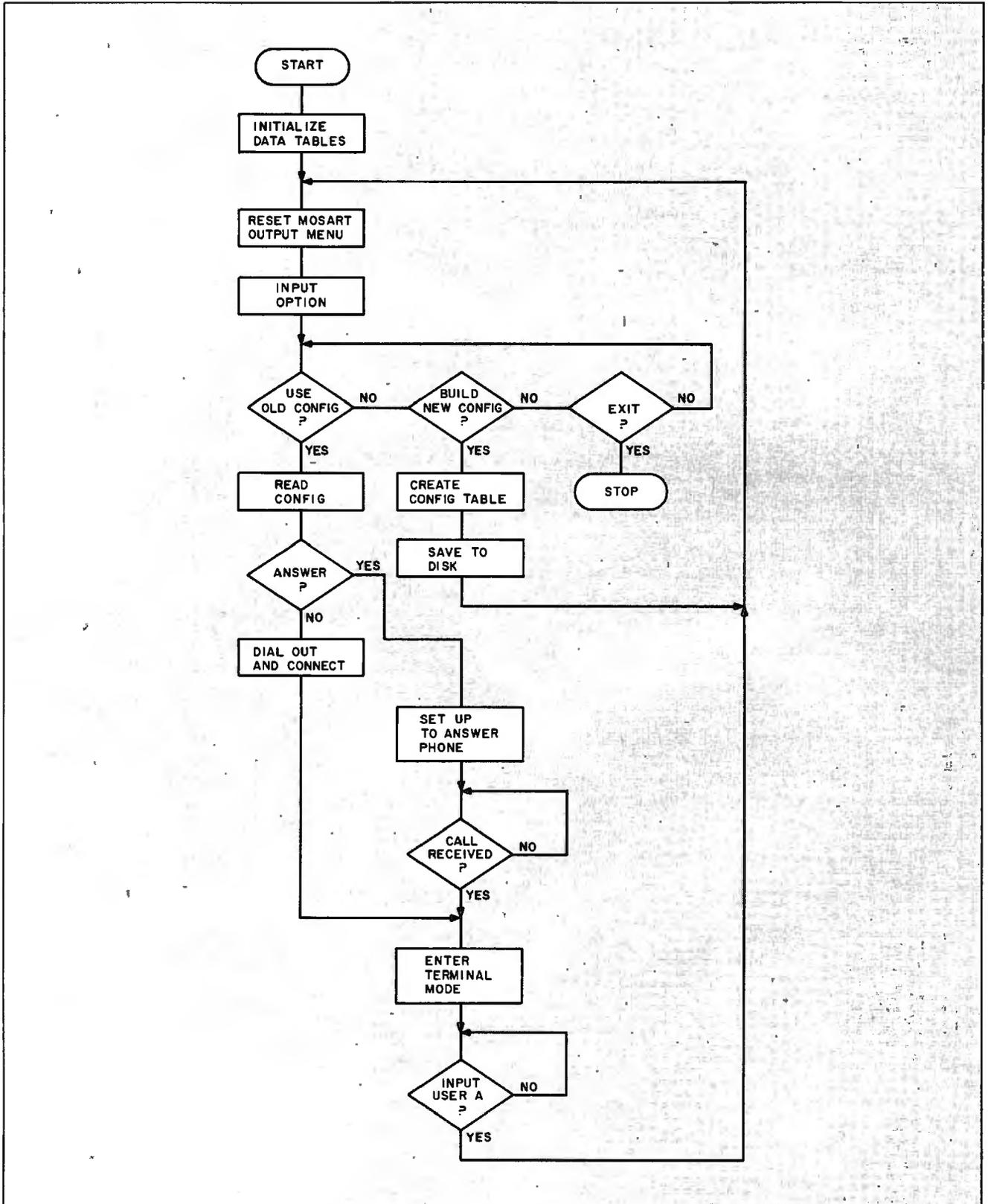


Figure 9: Flowchart for the MOSTERM program (see listing 1).

Listing 1: Source code for the MOSTERM program.

```

10 KEY OFF
20 DIM TB(4,3),P(6)
30 GOSUB 1450
40 CLS
50 PRINT "MOSTERM"
60 PRINT "MOSART routine #1, Auto-dial/Auto-answer
  Modem,"
70 PRINT "with built-in dumb-terminal driver."
80 PRINT:PRINT
90 REM reset MOSART
100 OUT &H2F9,0
110 OUT &H2F9,0
120 OUT &H2F9,0
130 OUT &H2F9,&H40
140 PRINT:PRINT
150 PRINT " Please Select an Option "
160 PRINT
170 PRINT " 1 — Use a predefined Configuration File"
180 PRINT " 2 — Create a Configuration File"
190 PRINT " 3 — Exit to BASICA"
200 PRINT
210 INPUT "please enter 1-3 ";C
220 IF C=3 THEN CLS:KEY ON:END
230 IF C<1 OR C>2 OR C<>INT(C) THEN 210
240 ON C GOSUB 260,740
250 GOTO 40
260 REM bring in a config file and start terminal emulation
270 CLS
280 INPUT "Please Enter Filename : ";F$
290 F$=F$+"*.cfg"
300 OPEN F$ FOR INPUT AS #1
310 M=0
320 REM get speed, # data bits, # stop bits
330 REM mask values for MOSART-mode byte
340 FOR X=1 TO 4
350 INPUT #1,Y
360 M=M+Y
370 NEXT X
380 REM get duplex and linefeed-suppression codes
390 INPUT #1,D
400 INPUT #1,L
410 REM get orig/answer mode and optional phone
  number
420 A$=""
430 INPUT #1,A$
440 IF A$<>"O" THEN 480
450 INPUT #1,A1$
460 INPUT #1,A2$
470 A$=A2$+A1$+A$
480 CLOSE #1
490 OUT &H2F9,M
500 OUT &H2F9,&H7
510 GOSUB 1280
520 PRINT "CONNECTION ESTABLISHED"
530 PRINT:PRINT "press enter key to start terminal mode"
540 PRINT "press ctrl-a to end emulation and hang up
  phone"
550 INPUT A$
560 REM quick terminal-emulation stuff
570 CLS
580 LOCATE ,,1

```

```

590 OUT &H2F9,&H27
600 IF (INP(&H2F9) AND 2) THEN GOSUB 670
610 IF (INP(&H2F9) AND &H40) THEN CLS : PRINT "line
  drop..press return" : INPUT A$ : RETURN
620 A$=INKEY$
630 IF LEN(A$)=0 THEN 600
640 IF ASC(A$)=1 THEN RETURN
650 OUT &H2F8,ASC(A$):IF D<>1 THEN PRINT A$;
660 GOTO 600
670 REM check for cr/lf and output character
680 A$=CHR$(INP(&H2F8))
690 IF L=0 THEN PRINT A$;:GOTO 730
700 IF (ASC(A$)=&HA) AND CR=1
  THEN CR=0:GOTO 730
710 IF ASC(A$)=&HD THEN CR=1
720 PRINT A$;
730 RETURN
740 REM create a config file
750 CLS
760 PRINT "Build a Configuration File "
770 PRINT:PRINT
780 INPUT "enter speed (1=110, 2=300, 3=1200) ";P
790 IF P<1 OR P>3 OR P<>INT(P) THEN 780
800 P(1)=TB(1,P)
810 INPUT "enter # of data bits (1=7, 2=8) ";P
820 IF P<1 OR P>2 OR P<>INT(P) THEN 810
830 P(2)=TB(2,P)
840 INPUT "enter # of stop bits (1=1, 2=1.5, 3=2) ";P
850 IF P<1 OR P>3 OR P<>INT(P) THEN 840
860 P(3)=TB(3,P)
870 INPUT "enter parity (1=even, 2=odd, 3=none) ";P
880 IF P<1 OR P>3 OR P<>INT(P) THEN 870
890 P(4)=TB(4,P)
900 INPUT "enter duplex mode (0=half, 1=full) ";P
910 IF P<0 OR P>1 OR P<>INT(P) THEN 900
920 P(5)=P
930 INPUT "suppress LF after CR ? (0=no, 1=yes) ";P
940 IF P<0 OR P>1 OR P<>INT(P) THEN 930
950 P(6)=P
960 INPUT "type of connection (0=originate,
  1=answer) ";P
970 IF P=0 THEN T$="O":GOTO 1000
980 IF P=1 THEN T$="A":GOTO 1000
990 GOTO 960
1000 IF P<>0 THEN GOTO 1100
1010 INPUT "type of dialing (0=rotary, 1=DTMF) ";P
1020 IF P=0 THEN T2$="R":GOTO 1050
1030 IF P=1 THEN T2$="T":GOTO 1050
1040 GOTO 1010
1050 INPUT "enter phone #, use 'p' for pauses ";T1$
1060 PRINT "you entered ";T1$;" - "
1070 INPUT "enter 0 to redo, 1 to accept ";P
1080 IF P=1 THEN 1100
1090 GOTO 1050
1100 PRINT:PRINT
1110 PRINT "enter filename for config file (drive spec
  and 8 digits max.)"
1120 INPUT F$
1130 PRINT "you entered ";F$;" - "
1140 INPUT "enter 0 to redo, 1 to accept ";P
1150 IF P=1 THEN 1170

```

```

1160 GOTO 1110
1170 F$=F$+" .cfg"
1180 OPEN F$ FOR OUTPUT AS #1
1190 FOR X=1 TO 6
1200 PRINT #1,P(X)
1210 NEXT X
1220 PRINT #1,T$
1230 IF T$ <> "O" THEN 1260
1240 PRINT #1,T1$
1250 PRINT #1,T2$
1260 CLOSE #1
1270 RETURN
1280 REM command process routine
1290 IF A$ <> "A" THEN 1330
1300 A$="pA"
1310 PRINT :PRINT "Answer mode selected...Awaiting call"
1320 IF (INP(&H2F9) AND &H40) <> &H40 THEN 1320
1330 FOR X=1 TO LEN(A$)
1340 Y=0
1350 Y=Y+1:IF Y>2000 THEN PRINT "MOSART device
      busy error":STOP
1360 IF (INP(&H2F9) = 5) OR (INP(&H2F9) = &H85)
      THEN 1370 ELSE 1350
1370 T$=MID$(A$,X,1)
1380 OUT &H2F8,ASC(T$):PRINT T$;
1390 IF (INP(&H2F9) AND 2) THEN 1410
1400 IF ((INP(&H2F9) AND 5) = 5) THEN 1420 ELSE 1390
1410 PRINT:PRINT "information byte from command : ";T$;
      " was ";CHR$(INP(&H2F8))
1420 NEXT X
1430 PRINT
1440 RETURN
1450 REM initialize data tables
1460 FOR X=1 TO 4
1470 FOR Y=1 TO 3
1480 READ TB(X,Y)
1490 NEXT Y
1500 NEXT X
1510 DATA 3,2,1
1520 DATA 8,12,0
1530 DATA 64,128,192
1540 DATA 48,16,0
1550 RETURN

```

Listing 2: Source code for the MOSANSWR program.

```

10 KEY OFF
15 PRINT "MOSANSWR"
20 PRINT "MOSART ROUTINE-#2, MOSART-BASED
  PHONE-ANSWERING SYSTEM"
30 REM INITIALIZE THE SYSTEM
40 GOSUB 1000
50 REM RUN THE SYSTEM
60 GOSUB 2000
70 REM STOP SYSTEM
80 STOP

```

```

1000 REM INITIALIZE
1010 PRINT "STARTING INITIALIZATION"
1020 REM SYSTEM INIT
1030 GOSUB 3000
1040 REM DO EVENTS SETUP
1050 GOSUB 4000
1060 REM LOAD SPEECH TABLES AND DRIVER
      PROGRAM
1070 GOSUB 5000
1080 PRINT "INITIALIZATION COMPLETE"
1090 RETURN
2000 REM RUN THE SYSTEM
2010 REM RESET THE MOSART
2020 GOSUB 6000
2030 PRINT "WAITING FOR CALL OR EVENT, PRESS
      ANY KEY TO END PROGRAM"
2040 REM TEST KEYBOARD
2050 REM TEST KEYBOARD
2060 IF INKEY$ <> "" THEN GOTO 2160
2070 REM TEST EVENT
2080 GOSUB 9000
2090 REM CHECK FOR RING
2100 IF (INP(&H2F9) AND &H40) <> &H40 THEN GOTO
      2050
2110 IF (INP(&H2F9) AND &H40) <> 0 THEN 2110
2120 REM CHECK MODE AND DO IT
2125 PRINT "RING DETECTED"
2127 PRINT "ANSWERING PHONE"
2129 C$="HxDV"
2130 GOSUB 29000
2135 SP=0
2140 ON MO GOSUB 7000,8000
2150 GOTO 2000
2160 RETURN
3000 REM SYSTEM INITIALIZATION
3010 PRINT "SYSTEM INITIALIZATION STARTING"
3020 REM CHECK DATE AND TIME
3030 GOSUB 10000
3040 REM INITIALIZE THE MOSART
3050 GOSUB 6000
3060 REM GET SYSTEM MODE, DATE/TIME, AND CALL-
      FORWARD FLAGS
3070 GOSUB 11000
3080 PRINT "SYSTEM INITIALIZATION COMPLETE"
3090 RETURN
4000 REM EVENTS SETUP
4005 DIM E$(30,3)
4010 PRINT:PRINT "TIME-BASED SYSTEM MODE
      CHANGES"
4020 PRINT
4030 PRINT "1 — BUILD NEW TABLE"
4040 PRINT "2 — MODIFY TABLE IN MEMORY "
4050 PRINT "3 — LOAD TABLE FROM DISK"
4060 PRINT "4 — SAVE TABLE TO DISK"
4070 PRINT "5 — CLEAR TABLE IN MEMORY"
4080 PRINT "6 — EXIT THIS ROUTINE"
4090 PRINT
4100 PRINT "ENTER YOUR CHOICE (1-6) "
4110 INPUT C
4120 IF C=6 THEN GOTO 4160

```

(continued)

CIRCUIT CELLAR

```

4130 IF C<1 OR C>5 OR C<>INT(C) THEN GOTO 4090
4140 ON C GOSUB 12000,13000,14000,15000,31000
4150 GOTO 4010
4160 RETURN
5000 REM LOAD SPEECH TABLES AND DRIVER
PROGRAM
5005 DIM TB%(146,2)
5010 DEF SEG = 0
5020 X = PEEK(&H510) + (256 * PEEK(&H511))
5030 X = X + &H1000
5040 DEF SEG = X
5050 PRINT "STORING SPEECH ROUTINE"
5060 BLOAD "SPEECH.BIN",0
5160 PRINT "LOAD OF SPEECH TABLES"
5170 OPEN "SPEECH.TBL" FOR INPUT AS #1
5180 FOR X = 1 TO 145
5190 INPUT #1,W$,TB%(X,1),TB%(X,2)
5260 NEXT X
5290 PRINT "SPEECH AND DRIVER LOAD COMPLETE"
5295 CLOSE #1
5297 CLOSE #2
5300 RETURN
6000 REM MOSART INITIALIZATION
6010 PRINT "RESETTING MOSART"
6020 OUT &H2F9,0
6030 OUT &H2F9,0
6040 OUT &H2F9,0
6050 OUT &H2F9,&H40
6053 FOR X = 1 TO 100: NEXT X
6055 OUT &H2F9,&HFA
6057 OUT &H2F9,&H7
6060 X = 0
6070 X = X + 1:IF X>3000 THEN PRINT "MOSART HUNG
UP":STOP
6080 IF (INP(&H2F9) AND 5) <>5 THEN GOTO 6070
6100 C$ = "xv"
6110 GOSUB 29000
6120 PRINT "MOSART RESET COMPLETE"
6123 PRINT "BRIEF PAUSE TO ALLOW LINE TO QUIET"
6125 FOR X = 1 TO 3500:NEXT X
6130 RETURN
7000 REM ANNOUNCE-ONLY MODE
7010 PRINT "ANNOUNCE MODE ENTERED"
7020 REM MAKE CANNED ANNOUNCEMENTS"
7030 GOSUB 33000
7040 IF SP<>1 THEN GOTO 7070
7050 GOSUB 34000
7060 GOTO 7090
7070 IF SP<>2 THEN GOTO 7090
7080 GOSUB 16000
7090 PRINT "EXITING ANNOUNCE MODE"
7100 RETURN
8000 REM RECORD A CALL
8010 PRINT "RECORD MODE ENTERED"
8020 REM ANNOUNCE FIRST AND CHECK
SPECIAL/SUPER
8030 GOSUB 17000
8040 IF SP<>1 THEN GOTO 8070
8050 GOSUB 34000
8060 GOTO 8090
8070 IF SP<>2 THEN GOTO 8090

```

```

8080 GOSUB 16000
8090 PRINT "EXITING RECORD MODE"
8100 RETURN
9000 REM CHECK EVENTS
9010 IF EI=0 THEN GOTO 9270
9020 REM BUILD CURRENT TIME VARIABLES
9030 D1$ = DATE$
9040 T1 = TIMER
9050 REM BUILD DATE NUMERIC CODE FOR COMPARE
9060 D1 = VAL(MID$(D1$,4,2))
9070 D1 = D1 + (VAL(MID$(D1$,1,2))*100)
9080 D1 = D1 + (VAL(MID$(D1$,9,2))*1000)
9090 REM T1 = SECS AFTER MIDNIGHT, D1 = DATE
NUMERIC CODE
9100 REM CHECK OUT EVENTS TABLE FOR EVENT
TO DO
9110 REM EI POINTS TO NEXT CHRONOLOGICAL
EVENT
9130 REM BUILD COMPARISON NUMBERS
9140 D2$ = MID$(E$(EI,2),1,10)
9150 T2$ = MID$(E$(EI,2),11,8)
9160 D2 = VAL(MID$(D2$,4,2))
9170 D2 = D2 + (VAL(MID$(D2$,1,2))*100)
9180 D2 = D2 + (VAL(MID$(D2$,9,2))*10000)
9190 T2 = VAL(MID$(T2$,7,2))
9200 T2 = T2 + (VAL(MID$(T2$,4,2))*60)
9210 T2 = T2 + (VAL(MID$(T2$,1,2))*3600)
9220 IF D2<D1 THEN GOTO 9270
9230 IF D2>D1 THEN GOTO 9250
9240 IF T2>T1 THEN GOTO 9270
9250 REM DO EVENT
9260 GOSUB 30000
9270 RETURN
10000 REM CHECK DATE/TIME
10010 PRINT:PRINT "CURRENT DATE IS : ";DATE$
10020 INPUT "ENTER NEW DATE OR PRESS ENTER TO
USE THIS DATE : ";D1$
10030 IF D1$ = "" THEN GOTO 10060
10040 DATE$ = D1$
10050 GOTO 10010
10060 PRINT:PRINT "CURRENT TIME IS : ";TIME$
10070 INPUT "ENTER NEW TIME OR PRESS ENTER TO
USE THIS TIME : ";T1$
10080 IF T1$ = "" THEN GOTO 10110
10090 TIME$ = T1$
10100 GOTO 10060
10110 RETURN
11000 REM SET MODES
11005 MO = 1:DT = 0:CF = 0:CN$ = ""
11010 PRINT:PRINT "SET OPERATING MODE"
11020 PRINT:PRINT "1 — ANNOUNCE ONLY"
11030 PRINT "2 — ANNOUNCE AND RECORD"
11040 PRINT "3 — GIVE DATE AND TIME TO CALLER"
11050 PRINT "4 — DON'T SAY DATE AND TIME"
11060 PRINT "5 — GIVE OUT A FORWARDING
NUMBER"
11070 PRINT "6 — DON'T SAY A FORWARDING
NUMBER"
11080 PRINT "7 — SET FORWARDING NUMBER"
11090 PRINT "8 — EXIT THIS ROUTINE"
11100 PRINT:PRINT "CURRENT SETTINGS ARE : "

```

CIRCUIT CELLAR

```

11110 PRINT "ANNOUNCE ";
11120 IF MO=2 THEN PRINT "AND RECORD MESSAGE"
      ELSE PRINT
11130 IF DT=1 THEN PRINT "GIVE OUT DATE AND
      TIME" ELSE PRINT "NO DATE/TIME"
11140 IF CF=1 THEN PRINT "GIVE FORWARDING
      NUMBER TO CALLERS" ELSE PRINT "NO
      FORWARDING NUMBER GIVEN OUT"
11150 IF CNS="" THEN PRINT "NO FORWARDING
      NUMBER SET" ELSE PRINT "FORWARDING
      NUMBER IS : ";CNS$
11160 PRINT
11170 INPUT "PLEASE ENTER CHOICE (1-8) : ";C
11180 IF C=8 THEN RETURN
11190 IF C<1 OR C>7 OR C<>INT(C) THEN
      GOTO 11160
11200 ON C GOSUB 11210,11220,11230,11240,11260,
      11250,11270
11205 GOTO 11010
11210 MO=1:RETURN
11220 MO=2:RETURN
11230 DT=1:RETURN
11240 DT=0:RETURN
11250 CF=0:RETURN
11260 CF=1
11270 PRINT "ENTER CALL-FORWARDING NUMBER "
11280 PRINT "NO SPECIAL PUNCTUATION EXCEPT FOR
      - () / OR SPACES "
11290 INPUT CNS$
11300 RETURN
12000 REM BUILD EVENTS TABLE
12010 GOSUB 31000
12020 FOR X=1 TO 30
12025 PRINT "THERE IS ROOM FOR ";31-X;
      " MORE EVENTS"
12030 PRINT:PRINT "ENTER EVENT DATE, OR PRESS
      ENTER TO STOP INPUT"
12040 INPUT "USE FORMAT MM-DD-YYYY : ";D1$
12050 IF D1$="" THEN X=30:GOTO 12076
12060 IF LEN(D1$)<>>10 THEN GOTO 12040
12065 E$(X,1)="E"
12070 E$(X,2)=D1$
12072 GOSUB 12080
12074 NEXT X
12075 GOSUB 31000
12076 RETURN
12080 PRINT "ENTER EVENT TIME"
12090 INPUT "USE FORMAT HH:MM:SS : ";T1$
12100 IF LEN(T1$)<>>8 THEN GOTO 12090
12105 E$(X,2)=E$(X,2)+T1$
12110 PRINT "ENTER 1 TO ANNOUNCE ONLY, 2 TO
      ANNOUNCE AND RECORD "
12120 INPUT T$:IF T$<>"1" AND T$<>"2" THEN
      GOTO 12110
12130 E$(X,3)=T$
12140 PRINT "ENTER 1 TO GIVE OUT DATE/TIME, 0 NOT
      TO SAY "
12150 INPUT T$:IF T$<>"0" AND T$<>"1" THEN
      GOTO 12140
12160 E$(X,3)=E$(X,3)+T$
12170 PRINT "ENTER 1 TO GIVE OUT FORWARDING

```

```

      NUMBER, 0 NOT TO SAY "
12180 INPUT T$:IF T$<>"0" AND T$<>"1" THEN
      GOTO 12170
12190 E$(X,3)=E$(X,3)+T$
12200 PRINT "ENTER FORWARDING NUMBER "
12210 INPUT T$
12220 PRINT "FORWARDING NUMBER IS NOW : ";T$;"
      PRESS ENTER TO CONFIRM, OR ENTER NEW
      NUMBER"
12230 INPUT T1$
12240 IF T1$<>" " THEN T$=T1$:GOTO 12220
12250 E$(X,3)=E$(X,3)+T$
12260 RETURN
13000 REM MODIFY EVENTS TABLE
13010 PRINT:PRINT "MODIFY EVENTS TABLE"
13020 PRINT:PRINT "1 — ADD AN EVENT"
13030 PRINT "2 — DELETE EVENT"
13040 PRINT "3 — DISPLAY EVENTS TABLE"
13050 PRINT "4 — EXIT THIS ROUTINE"
13060 PRINT:PRINT "PLEASE ENTER CHOICE (1-4)"
13070 INPUT C
13080 IF C=4 THEN GOTO 13530
13090 IF C<1 OR C>3 OR C<>INT(C) THEN 13060
13100 ON C GOSUB 13120,13270,13360
13110 GOTO 13010
13120 REM ADD EVENT
13130 PRINT "SEARCHING FOR OPEN TABLE ENTRY"
13135 Y=0
13140 FOR X=1 TO 30
13150 IF E$(X,1)<>" " THEN 13240
13160 Y=1
13170 PRINT "ENTER EVENT DATE OR PRESS ENTER
      TO STOP"
13180 INPUT "USE FORMAT MM-DD-YYYY : ";D1$
13190 IF D1$="" THEN X=30 : GOTO 13240
13200 IF LEN(D1$)<>>10 THEN GOTO 13180
13210 E$(X,1)="E":E$(X,2)=D1$
13220 GOSUB 12080
13230 X=30
13240 NEXT X
13250 IF Y=0 THEN PRINT "NO OPEN TABLE
      ENTRIES...DELETE SOME FIRST"
13260 RETURN
13270 REM DELETE AN EVENT
13280 PRINT "PLEASE ENTER EVENT NUMBER TO BE
      DELETED"
13290 INPUT "ENTER 0 TO ABORT ";C
13300 IF C=0 THEN 13350
13310 IF C>0 AND C<31 AND C=INT(C) THEN GOTO
      13340
13320 PRINT "EVENT NUMBER MUST BE 1-30"
13330 GOTO 13280
13340 E$(C,1)=" "
13350 RETURN
13360 REM PRINT OUT TABLE
13370 FOR X=1 TO 30
13380 PRINT X;" - ";
13390 IF E$(X,1)<>" " THEN GOTO 13420
13400 PRINT "OPEN"
13410 GOTO 13460

```

(continued)

CIRCUIT CELLAR

```

13420 PRINT MID$(E$(X,2),1,10);" ";MID$(
      E$(X,2),11,8);" "
13430 PRINT MID$(E$(X,3),1,3);" "
13450 IF LEN(E$(X,3))>3 THEN PRINT
      MID$(E$(X,3),4,LEN(E$(X,3))-3)
13460 IF X=15 THEN INPUT "PRESS ENTER TO
      CONTINUE ";T$
13510 NEXT X
13515 INPUT "PRESS ENTER TO CONTINUE";T$
13520 RETURN
13530 REM EXIT ROUTINE
13540 GOSUB 32000
13550 RETURN
14000 REM LOAD EVENTS TABLE
14010 PRINT:PRINT "ENTER NAME OF TABLE TO BE
      LOADED (# CHARS MAX)"
14020 INPUT "OR PRESS ENTER TO ABORT : ";T$
14030 IF T$="" THEN GOTO 14130
14040 IF LEN(T$)>8 AND MID$(T$,2,1)<>"." THEN
      GOTO 14010
14050 T$=T$+"EVT"
14060 OPEN T$ FOR INPUT AS #1
14070 FOR X=1 TO 30
14080 INPUT #1,E$(X,1),E$(X,2),E$(X,3)
14090 NEXT X
14100 PRINT "TABLE LOADED":CLOSE #1
14110 REM BUILD INDEX POINTER
14120 GOSUB 32000
14130 RETURN
15000 REM SAVE EVENTS TABLE
15010 PRINT:PRINT "ENTER NAME OF TABLE TO BE
      SAVED (8 CHARS MAX)"
15020 INPUT "OR PRESS ENTER TO ABORT : ";T$
15030 IF T$="" THEN GOTO 15130
15040 IF LEN(T$)>8 AND MID$(T$,2,1)<>"." THEN
      GOTO 14010
15050 T$=T$+"EVT"
15060 OPEN T$ FOR OUTPUT AS #1
15070 FOR X=1 TO 30
15080 PRINT #1,E$(X,1)
15090 PRINT #1,E$(X,2)
15100 PRINT #1,E$(X,3)
15110 NEXT X
15120 PRINT "TABLE SAVED":CLOSE #1
15130 RETURN
16000 REM SPECIAL ACCESS
16010 GOSUB 40000
16020 RETURN
17000 REM RECORD MODE
17010 REM DO CANNED MESSAGE FOR RECORD
17020 GOSUB 25000
17030 REM DO DATE/TIME IF DESIRED
17040 IF DT=1 THEN GOSUB 19000
17050 REM DO CALL-FORWARD NUMBER IF DESIRED
17060 IF CF=1 THEN GOSUB 20000
17070 REM PUT OUT RECORD MESSAGE AND BEEP
      TONE
17080 GOSUB 38000
17090 REM DO RECORD A MESSAGE (INCLUDES
      SUPER/SPECIAL TEST)
17100 GOSUB 26000

```

```

17110 RETURN
18000 REM CANNED ANNOUNCEMENT
18010 REM DATA FOR CANNED PHRASE BUILD
18020 DATA 4,55,46,57,89
18030 REM SPEAK STUFF
18040 RESTORE 18020
18050 READ P
18060 FOR P1=1 TO P
18070 READ S
18080 GOSUB 36000
18090 NEXT P1
18100 RETURN
19000 REM SPEAK DATE AND TIME
19010 REM DO TIME FIRST
19020 S=79
19030 GOSUB 36000
19035 S=93:GOSUB 36000
19040 T1$=TIME$
19050 T1=VAL(MID$(T1$,1,2))
19060 IF T1>20 THEN GOTO 19090
19070 S=T1:IF S=0 THEN S=91
19080 GOTO 19120
19090 S=20
19100 GOSUB 36000
19110 S=T1-20
19120 GOSUB 36000
19125 S=93:GOSUB 36000
19130 T1=VAL(MID$(T1$,4,2))
19140 IF T1>20 THEN GOTO 19170
19150 S=T1:IF S=0 THEN S=91
19160 GOTO 19220
19170 T1=VAL(MID$(T1$,4,1))
19180 S=18+T1
19190 GOSUB 36000
19200 T1=VAL(MID$(T1$,5,1))
19210 S=T1:IF S=0 THEN 19230
19220 GOSUB 36000
19230 REM DO DATE NOW
19232 S=93
19234 GOSUB 36000
19240 S=64
19244 GOSUB 36000
19246 S=93
19250 GOSUB 36000
19260 D1$=DATE$
19270 D1=VAL(MID$(D1$,1,2))
19280 S=D1
19290 GOSUB 36000
19295 S=93:GOSUB 36000
19300 D1=VAL(MID$(D1$,4,2))
19310 IF D1>20 THEN GOTO 19340
19320 S=D1
19330 GOTO 19390
19340 D1=VAL(MID$(D1$,4,1))
19350 S=18+D1
19360 GOSUB 36000
19370 D1=VAL(MID$(D1$,5,1))
19380 S=D1:IF S=0 THEN GOTO 19400
19390 GOSUB 36000
19395 S=93:GOSUB 36000
19400 D1=VAL(MID$(D1$,7,2))

```

CIRCUIT CELLAR

```

19410 S=D1
19420 GOSUB 36000
19430 D1=VAL(MID$(D1$,9,2))
19440 IF D1>20 THEN GOTO 19470
19450 S=D1:IF S=0 THEN S=28
19460 GOSUB 36000
19470 D1=VAL(MID$(D1$,9,1))
19480 S=18+D1
19490 GOSUB 36000
19500 D1=VAL(MID$(D1$,10,1))
19510 S=D1:IF S=0 THEN 19530
19520 GOSUB 36000
19530 RETURN
20000 REM GIVE CALL-FORWARDING NUMBER
20010 DATA 4,66,90,45,93
20020 RESTORE 20010
20030 READ P
20040 FOR P1=1 TO P
20050 READ S
20060 GOSUB 36000
20070 NEXT P1
20080 FOR Z=1 TO LEN(CN$)
20090 T$=MID$(CN$,Z,1)
20100 IF T$="-" OR T$="/" OR T$=" " OR T$="(" OR T$=")" THEN S=95:GOTO
    20130
20110 T1=VAL(T$)
20120 S=T1:IF S=0 THEN S=91
20130 GOSUB 36000
20140 NEXT Z
20142 S=93
20144 GOSUB 36000
20150 RETURN
25000 REM RECORD ANNOUNCE #1
25010 REM DATA FOR CANNED PHRASE BUILD
25020 DATA 4,55,46,57,89
25030 REM SPEAK STUFF
25040 RESTORE 25020
25050 READ P
25060 FOR P1=1 TO P
25070 READ S
25080 GOSUB 36000
25090 NEXT P1
25100 RETURN
26000 REM RECORD A CALL
26010 REM FIRST SET UP MOSART AND START
    RECORDER
26020 C$="XD"
26030 GOSUB 29000
26040 MOTOR 1
26045 GOSUB 35000
26050 IF SP<>0 THEN 26140
26060 REM RECORD UNTIL TIMER GONE OR HANG-UP
26070 T1=TIMER
26080 T1=T1+90:IF T1>86400! THEN T1=T1-86400!
26090 IF T1>90 THEN 26120
26100 IF TIMER>T1 AND TIMER<100 THEN 26140
26110 GOTO 26135
26120 IF TIMER>T1 THEN 26140
26130 C$="M":GOSUB 29000
26132 IF CHR$(INP(&H2F8))="T" OR

```

```

    CHR$(INP(&H2F8))="D" THEN GOTO 26140
26135 GOTO 26090
26140 MOTOR 0
26150 RETURN
29000 REM PROCESS MOSART COMMANDS
29010 REM C$=COMMAND STRING
29020 FOR X=1 TO LEN(C$)
29025 OUT &H2F9,&H7
29030 Y=0
29040 Y=Y+1:IF Y>5000 THEN PRINT "MOSART
    LOCKED UP":STOP
29050 IF (INP(&H2F9) AND 5) = 5 THEN 29060 ELSE
    29040
29060 T$=MID$(C$,X,1)
29070 OUT &H2F8,ASC(T$)
29080 IF (INP(&H2F9) AND 2) = 2 THEN 29100
29090 IF (INP(&H2F9) AND 7) = 5 THEN 29110 ELSE
    29080
29100 PRINT:PRINT "INFO BYTE FROM COMMAND
    ";T$;" WAS ";CHR$(INP(&H2F8))
29110 NEXT X
29130 RETURN
30000 REM DO EVENT
30005 PRINT "EVENT IN PROGRESS ";DATE$,TIME$
30010 E$(E1,1)=" "
30020 MO=VAL(MID$(E$(E1,3),1,1))
30030 DT=VAL(MID$(E$(E1,3),2,1))
30040 CF=VAL(MID$(E$(E1,3),3,1))
30050 IF LEN(E$(E1,3))=3 THEN CN$="":GOTO 30070
30060 CN$=MID$(E$(E1,3),4,(LEN(E$(E1,3))-3))
30070 GOSUB 32000
30075 PRINT "EVENT COMPLETED"
30080 RETURN
31000 REM CLEAR EVENTS TABLES
31010 E1=0
31020 FOR X=1 TO 30
31030 FOR Y=1 TO 3
31040 E$(X,Y)=" "
31050 NEXT Y
31060 NEXT X
31070 PRINT "EVENTS TABLE CLEAR COMPLETE"
31080 RETURN
32000 REM SET UP EVENT INDEX POINTER
32010 REM SET TEST VALUES TO HIGH VALUES
32020 E1=0:D1=999999!:T1=99999!
32030 REM LOOP THROUGH TABLE AND GET NEXT
    CHRONOLOGICAL EVENT
32040 FOR X=1 TO 30
32050 IF E$(X,1)=" " THEN GOTO 32180
32060 REM BUILD COMPARE NUMBERS
32070 D2$=MID$(E$(X,2),1,10)
32080 T2$=MID$(E$(X,2),11,8)
32090 D2=VAL(MID$(D2$,4,2))
32100 D2=D2+(VAL(MID$(D2$,1,2))*100)
32110 D2=D2+(VAL(MID$(D2$,9,2))*10000)
32120 T2=VAL(MID$(T2$,7,2))
32130 T2=T2+(VAL(MID$(T2$,4,2))*60)
32140 T2=T2+(VAL(MID$(T2$,1,2))*3600)
32150 IF D2>D1 THEN GOTO 32180
32160 IF D2<D1 THEN D1=D2:T1=T2:E1=X:GOTO

```

(continued)

```

32180
32170 IF T2<T1 THEN D1=D2:T1=T2:EI=X
32180 NEXT X
32190 RETURN
33000 REM ANNOUNCEMENT ONLY
33010 REM DO CANNED MESSAGE FOR ANNOUNCE
33020 GOSUB 18000
33030 REM DO DATE/TIME IF DESIRED
33040 IF DT=1 THEN GOSUB 19000
33050 REM DO CALL-FORWARD NUMBER IF DESIRED
33060 IF CF=1 THEN GOSUB 20000
33065 REM SAY GOODBYE LIKE NICE FELLOW
33067 S=93:GOSUB 36000
33068 S=54:GOSUB 36000
33069 S=93:GOSUB 36000
33070 REM TEST TO SEE IF SPECIAL OR SUPER
      REQUESTED
33075 REM OUTPUT TONE
33077 S=96:GOSUB 36000
33080 GOSUB 35000
33090 RETURN
34000 REM SPECIAL ACCESS
34010 GOSUB 40000
34020 RETURN
35000 REM WAIT A BIT AND CHECK SPECIAL/SUPER
35010 SP=0
35015 C$="XD"
35017 GOSUB 29000
35020 FOR X=1 TO 500
35030 IF (INP(&H2F9) AND 2) = 0 THEN 35060
35040 IF INP(&H2F8)=&H2A THEN SP=1:X=300:GOTO
      35060
35050 IF INP(&H2F8)=&H23 THEN SP=2:X=300:GOTO
      35060
35060 NEXT X
35065 IF SP<>0 THEN PRINT "SPECIAL ACCESS
      REQUESTED"
35070 RETURN
36000 REM SPEECH OUTPUT
36010 REM S= POINTER TO PHRASE IN TABLE TB(X,Y)
36020 REM ASSUMES CONNECT IS ESTABLISHED
      ALREADY
36030 C$="x"+CHR$(22)
36040 GOSUB 29000
36050 OUT &H2F9,&H27
36060 REM WRITE OUT SPEECH DATA
36070 SYNTH%=0
36080 START%=TB%(S,1):COUNT%=TB%(S,2)
36090 CALL SYNTH%(START%,COUNT%)
36100 OUT &H2F9,&H7
36110 C$="v"
36120 GOSUB 29000
36130 RETURN
38000 REM RECORD ANNOUNCE #2
38010 REM DATA FOR CANNED PHRASE BUILD
38020 DATA 7,39,67,88,93,77,94,96
38030 REM SPEAK STUFF
38040 RESTORE 38020
38050 READ P
38060 FOR P1=1 TO P
38070 READ S

```

```

38080 GOSUB 36000
38090 NEXT P1
38100 RETURN
40000 REM SUPERVISORY AND SPECIAL FUNCTIONS
      ARE NOT YET IMPLEMENTED
40010 DATA 10,57,93,115,52,117,53,58,63,93,93
40020 RESTORE 40010
40030 READ P
40040 FOR P1=1 TO P
40050 READ S
40060 GOSUB 36000
40070 NEXT P1
40080 RETURN

```

Listing 3: Source code for the MOSDTMF program.

```

10 KEY OFF
20 CLS
30 PRINT "MOSDTMF"
40 PRINT "MOSART ROUTINE #3, DTMF INPUT,"
50 PRINT "VOICE RESPONSE DEMO SYSTEM"
60 PRINT:PRINT
70 REM INITIALIZE SPEECH TABLES
80 GOSUB 770
90 REM RESET MOSART
100 PRINT "RESETTING MOSART"
110 OUT &H2F9,0
120 OUT &H2F9,0
130 OUT &H2F9,0
140 OUT &H2F9,&H40
150 OUT &H2F9,&HFA
160 OUT &H2F9,&H7
170 C$="xv"
180 GOSUB 1250
190 BAD=0
200 REM AWAIT INCOMING CALL
210 PRINT "WAITING FOR LINE TO QUIET"
220 FOR X=1 TO 2000:NEXT X
230 PRINT "AWAITING CALL"
240 IF (INP(&H2F9) AND &H40) <> &H40 THEN 240
250 IF (INP(&H2F9) AND &H40) <> 0 THEN 250
260 FOR X=1 TO 500
270 NEXT X
280 PRINT "ANSWERING PHONE "
290 REM ANSWER PHONE
300 C$=CHR$(22)+"D"
310 GOSUB 1250
320 REM ANNOUNCE FIRST MESSAGE
330 PRINT "REQUESTING ID CODE"
340 DATA 8,55,93,67,87,56,61,42,73
350 RESTORE 340
360 GOSUB 1100
370 REM INPUT ID CODE
380 TIME-OUT=0
390 GOSUB 950
400 REM TEST TIME-OUT

```

CIRCUIT CELLAR

```

410 IF TIME-OUT = 0 THEN GOTO 440
420 GOTO 450
430 REM TEST ID CODE
440 IF CODE$ = "78383" THEN GOTO 490
450 REM BAD ROUTINE
460 BAD=BAD+1
470 IF BAD>=3 THEN GOTO 90
480 GOTO 320
490 REM NO TIME-OUT, AND CODE GOOD
500 BAD=0
510 REM OUTPUT MESSAGE
520 PRINT "CONNECTED MESSAGE AND REQUEST FOR
    PHRASE NUMBER"
530 DATA 21,92,49,81,74,93,67,118,61,52,91,81,1,28,22,5,
    42,73,92,83,94,72
540 RESTORE 530
550 GOSUB 1100
560 REM INPUT NUMBER
570 TIME-OUT=0
580 GOSUB 950
590 REM TEST TIME-OUT
600 IF TIME-OUT = 0 THEN GOTO 630
610 GOTO 670
620 REM TEST END CODE AND THEN
630 REM TEST GOOD-NUMBER RANGE
640 S=VAL(CODE$)
650 IF S = -1 THEN GOTO 90
660 IF S>=0 AND S<=145 THEN GOTO 710
670 REM BAD ROUTINE
680 BAD=BAD+1
690 IF BAD>=3 THEN GOTO 90
700 GOTO 510
710 REM SAY SPEECH STUFF
720 PRINT "SAYING PHRASE NUMBER ";S
730 OUT &H2F9,&H27
740 GOSUB 1200
750 OUT &H2F9,&H7
760 GOTO 510
770 REM LOAD SPEECH TABLES AND DRIVER
    PROGRAM
780 DIM TB%(146,2)
790 DEF SEG=0
800 X=PEEK(&H510)+(256*PEEK(&H511))
810 X=X+&H1000
820 DEF SEG=X
830 PRINT "STORING SPEECH ROUTINE"
840 BLOAD "SPEECH.BIN",0
850 PRINT "LOAD OF SPEECH TABLES"
860 OPEN "SPEECH.TBL" FOR INPUT AS #1
870 FOR X=1 TO 145
880 INPUT #1,W$,TB%(X,1),TB%(X,2)
890 NEXT X
900 TB%(0,1)=34:TB%(0,2)=TB%(145,1)+TB%(145,2)-35
910 PRINT "SPEECH AND DRIVER LOAD COMPLETE"
920 CLOSE #1
930 CLOSE #2
940 RETURN
950 REM GET DTMF INPUT
960 PRINT "AWAITING DTMF INPUT"
970 CODE$=""
980 REM INPUT DTMF DIGITS UNTIL #,* OR TIME-OUT

```

```

990 REM (TIME-OUT MEANS LOOP EXHAUSTED)
1000 TIME-OUT=1
1010 FOR X=1 TO 1750
1020 IF (INP(&H2F9) AND &H2) <> 2 THEN 1040
1030 X=1750:TIME-OUT=0
1040 NEXT X
1050 IF TIME-OUT=1 THEN RETURN
1060 IF INP(&H2F8)=&H2A THEN PRINT "DTMF DATA
    INPUT WAS : ";CODE$:RETURN
1070 CODE$=CODE$+CHR$(INP(&H2F8))
1080 IF INP(&H2F8)=&H23 THEN CODE$=" - 1":PRINT "#
    KEY PRESSED":RETURN
1090 GOTO 980
1100 REM CANNED ANNOUNCEMENT
1110 OUT &H2F9,&H27
1120 REM SPEAK STUFF
1130 READ P
1140 FOR P1=1 TO P
1150 READ S
1160 GOSUB 1200
1170 NEXT P1
1180 OUT &H2F9,&H7
1190 RETURN
1200 REM SPEECH OUTPUT
1210 SYNTH%=0
1220 START%=TB%(S,1):COUNT%=TB%(S,2)
1230 CALL SYNTH%(START%,COUNT%)
1240 RETURN
1250 REM PROCESS MOSART COMMANDS
1260 REM C$=COMMAND STRING
1270 FOR X=1 TO LEN(C$)
1280 OUT &H2F9,&H7
1290 Y=0
1300 Y=Y+1:IF Y>5000 THEN PRINT "MOSART LOCKED
    UP":STOP
1310 IF (INP(&H2F9) AND 5) = 5 THEN 1320 ELSE 1300
1320 T$=MID$(C$,X,1)
1330 OUT &H2F8,ASC(T$)
1340 IF (INP(&H2F9) AND 2) = 2 THEN 1360
1350 IF (INP(&H2F9) AND 7) = 5 THEN 1370 ELSE 1340
1360 PRINT:PRINT "INFO BYTE FROM COMMAND ";T$;
    " WAS ";CHR$(INP(&H2F8))
1370 NEXT X
1380 RETURN
1390 REM SPEECH OUTPUT
1400 REM S= POINTER TO PHRASE IN TABLE TB(X,Y)
1410 REM ASSUMES CONNECT IS ESTABLISHED ALREADY
1420 C$="x"+CHR$(22)
1430 GOSUB 1250
1440 OUT &H2F9,&H27
1450 REM WRITE OUT SPEECH DATA
1460 SYNTH%=0
1470 START%=TB%(S,1):COUNT%=TB%(S,2)
1480 CALL SYNTH%(START%,COUNT%)
1490 OUT &H2F9,&H7
1500 C$="v"
1510 GOSUB 1250
1520 RETURN

```

1st PLACE

COMPUTER SYSTEMS
13422 N. CAVECREEK RD.

PHOENIX, AZ. 85022

OTHER INFORMATION: 602-867-9897



Send cashier's check or money order all other checks will delay shipping two weeks.
Prices & availability subject to change without notice.

CALL FREE
1-800-841-2748



Hi - I'm Joan,
I want to wish you all Happy Holidays and thank you for making my business a success.

All of you who haven't tried us and are afraid of mail order, call us and give us a try. I'm sure you will like our fast and courteous service.

Get your order in soon, as Christmas is not far away. Thanks again and God bless.

Joan

P.S. Hearing handicap, call us on your TTY.

COMPUTERS

ALTOS 186-10	\$4415
ALTOS 486-20	\$4195
ALTOS 580-20	\$3310
ALTOS 586-20	\$5300
ALTOS 986T-40	9355
ALTOS 2086-2MB	\$14,930
IBM PC	\$CALL
ITT PC	\$CALL
LEADING EDGE	\$CALL
ZENITH	\$CALL
SOFTWARE	\$CALL

PRINTERS

CITIZEN. MSP-10	\$255
C. ITOH	\$CALL
EPSON	\$CALL
JUKI 6100	\$359
OKIDATA	\$CALL
STAR MICRONICS. SG10	\$207
NEC 3550	\$1029
DIABLO D-25	\$530
SILVER REED	\$CALL
TOSHIBA 351P	\$1119

TERMINALS - MONITORS

WYSE. 50	\$419
WYSE 85	\$579
QUME 101G	\$299
QUME 202G	\$599
TELEVIDEO	\$CALL
AMDEK	\$CALL
TAXAN GREEN	\$115
TAXAN 420	\$399
PRINCETON MAX 12E	\$169
PRINCETON HX 12	\$445
PRINCETON SR 12	\$615

DISK DRIVES & BOARDS

AST 6 PK	\$225
PARADISE MLT	\$198
HERCULES CL. GR.	\$145
EVEREX EDGE	\$315
TANDON	\$CALL
TEAC	\$CALL
BERNOULLI BOX	\$CALL
TALLGRASS	\$CALL

MODEMS

PROMETHEUS 1200 EXT	\$305
PROMETHEUS 1200B	\$259
PROMETHEUS 1200A	\$299
HAYES SMARTMODEM 1200	\$379
HAYES SMARTMODEM 1200B	\$319
HAYES SMARTMODEM 2400	\$609

CIRCUIT CELLAR

The MOSART makes it much easier for system designers to incorporate sophisticated features at low cost.

that correspond to Steve (7-8-3-8-3). After entering the numbers, followed by an asterisk, the program moves to the output section. Entering any number from 1 to 145 will cause the corresponding phrase to be spoken. Entering 146 will dump the whole vocabulary, and entering an asterisk will cause the program to hang up the phone line. Time-out, hang-up, and error detection are all included to allow the system to handle the phone line without attendance by an operator. Using customized vocabularies would allow the use of MOSART in both inquiry and data-collection applications.

IN CONCLUSION

If you are dead set against writing your own software, Xecom has an application package called Xenial, which includes Dialing Directories, Auto Answer, File Transfer (using the XMODEM protocol), and Access to DOS files by drive ID and Path. It is written to run on the evaluation board, but it is intended more as support for OEMs than as a competitive communications software package.

Compatibility is a moot point when the implemented functions don't exist in the devices that you might strive to be compatible with. The MOSART sets a new standard for computer communications and makes it much easier for system designers to incorporate sophisticated features at low cost. Perhaps it will be the new pace-setter and all others will strive to be compatible with it.

CIRCUIT CELLAR FEEDBACK

This month's feedback is on page 450.

NEXT MONTH

I'll become one of the OEMs I often refer to as I design a modem-communications expansion board for the SB180 single-board computer using the MOSART. This communications board combined with some fancy software will turn the SB180 into a turnkey bulletin-board system. ■

Special thanks to Bill Curlew for his software expertise.

Drawings and specifications of the XE12XX MOSARTs are reprinted by permission of Xecom Inc.

The following items are available from

The Micromint Inc.
25 Terrace Dr.
Vernon, CT 06066
(800) 635-3355 for orders
(203) 871-6170 for information

1. XE1203 MOSART demonstration board for the IBM PC. Complete with data sheets and programs on DOS 2.0 disk.

assembled and tested . . . X1253, \$299

2. COMM180 combination MOSART-based modem and SCSI hard-disk-interface expansion board for the SB180 computer. Modem section comes with Term III communication software. Either version can be upgraded to include both functions. Software supplied on 5¼-inch double-sided double-density SB180 format disks. Assembled and tested, with manual included.

COMM180 MOSART modem and Term III COMM180-M, \$350

COMM180 SCSI interface

. COMM180-S, \$150

COMM180 MOSART modem and SCSI interface COMM180-M-S, \$500

Please include \$5 for shipping and handling in the continental United States, \$10 elsewhere. Connecticut residents please include 7.5 percent sales tax.

Editor's Note: Steve often refers to previous Circuit Cellar articles. Most of these past articles are available in book form from BYTE Books, McGraw-Hill Book Company, POB 400, Hightstown, NJ 08250.

Ciarci's Circuit Cellar, Volume I covers articles in BYTE from September 1977 through November 1978. *Volume II* covers December 1978 through June 1980. *Volume III* covers July 1980 through December 1981. *Volume IV* covers January 1982 through June 1983.

To receive a complete list of Ciarci's Circuit Cellar project kits, circle 100 on the reader-service inquiry card at the back of the magazine.

GoldStar



Another Futuristic Leap From Goldstar's Long Line of Electronics—5 1/4" & 3 1/2" Floppy Disks

Goldstar is determined to keep pace with the new frontiers in this electronic age. So, we now market both 5 1/4" Floppy Disks and 3 1/2" Micro Floppy Disks for all of your computer consumers.

All of Goldstar's pioneering experience, research, and demand for excellence has been channelled into this surge for technology. Therefore, you can be sure of our reliability, as Korea's electronic history-maker.

Our self-imposed demands match yours exactly—nothing less than perfection; and we're even trying to improve that, as we keep on top of the latest developments in computers and peripherals. Both lines of disks, the 5 1/4" and 3 1/2", are manufactured with the most advanced technology.

All Goldstar disks are individually certified 100% error-free at all levels, equal to or above ANSI, DIN, ECMA, ISO and JIS standards.

Goldstar Floppy Disks are engineered to the highest possible quality precision for the maximum in long archival life, accuracy, data integrity, and reliability.

So, for superiority and reliability—
CHOOSE GOLDSTAR FLOPPY DISKS, either 5 1/4" or 3 1/2".

LINE-UP

Item	Type	Tracks/Inch	Bits/Inch	Capacity
5 1/4"	M-1S	48	2768	125 KB
	M-1D	48	5536	250 KB
	M-2D	48	5876	500 KB
	M-2DD	96	5922	1 MB
3 1/2"	MF-1D	67.5	8128	250 KB
	MF-2D	67.5	8650	500 KB
	MF-1DD	135	8190	500 KB
	MF-2DD	135	8720	1 MB

(Unformatted)



LUCKY-GOLDSTAR INTERNATIONAL CORP.

Magnetech Group: C.P.O. Box 1899, Seoul, Korea; Tel. (02)756-9090; Tlx. LGINTL K29579.

 LUCKY-GOLDSTAR

•New York Office: 2nd Floor 1050, Wall Street West, Lyndhurst, New Jersey 07071, U.S.A.; Tel. (201) 460-8010; Tlx. LGI UR 219108; Fax. (201) 935-5686 •Los Angeles Office: 13013 East 166th Street, Cerritos, Calif. 90701, U.S.A.; Tel. (213) 404-2626/9; Tlx. LGI LA (910) 583-5719; Fax. (213) 926-0849 •London Office: Tel. (01) 840-7111; Tlx. 21765 LGI UK •Frankfurt Office: Tel. 069-6664083/5; Tlx. 4185337 LGIF •Paris Office: Tel. 734-52-06; Tlx. LGIPAR 201877.

COMPAQ could have stopped here



...but we didn't.

Presenting the COMPAQ PORTABLE 286™ More features, more speed...more useful.

Most people think the IBM® Personal Computer-AT™ can do more than any other personal computer. But COMPAQ® offers a personal computer that does more in a package *half* the size, complete with a handle.

Incredibly fast

Most computer companies would consider it a breakthrough to make a computer with the power and speed of the IBM PC-AT. But not COMPAQ. The COMPAQ PORTABLE 286 runs all the popular programs 30% *faster*.

And no doubt most would have been elated to put 20 Megabytes of fixed disk storage in a portable computer. But we didn't stop there. We designed the COMPAQ PORTABLE 286 to accept an internal fixed disk drive back-up system as well. It protects your data on pocket-sized tape cartridges, something not even the IBM PC-AT can do.

Room to grow

Once we got started, it was hard to stop. There's room for up to three internal storage devices. Choose from 1.2-Megabyte or 360-K byte diskette

drives, the fixed disk drive and fixed disk drive back-up.

Add up to 640-K bytes of memory on the main board. Then add up to 2 more Megabytes using an expansion board. That gives you more memory than most desktop computers.

For displaying your work, a built-in monitor shows high-resolution text *and* graphics. A second monitor isn't necessary.

Does more—anywhere

Together, all these features add up to our fastest, most powerful portable computer. It helps you do more, in more places.

Of course, if you need a computer with even more power, we designed a model that stays in one place.

The COMPAQ DESKPRO 286™. With up to 8.2 Megabytes of memory and 70 Megabytes of storage, it can take you beyond today's limits of desktop personal computing.

COMPAQ offers personal computers beyond compare. Because we make them without compromise.

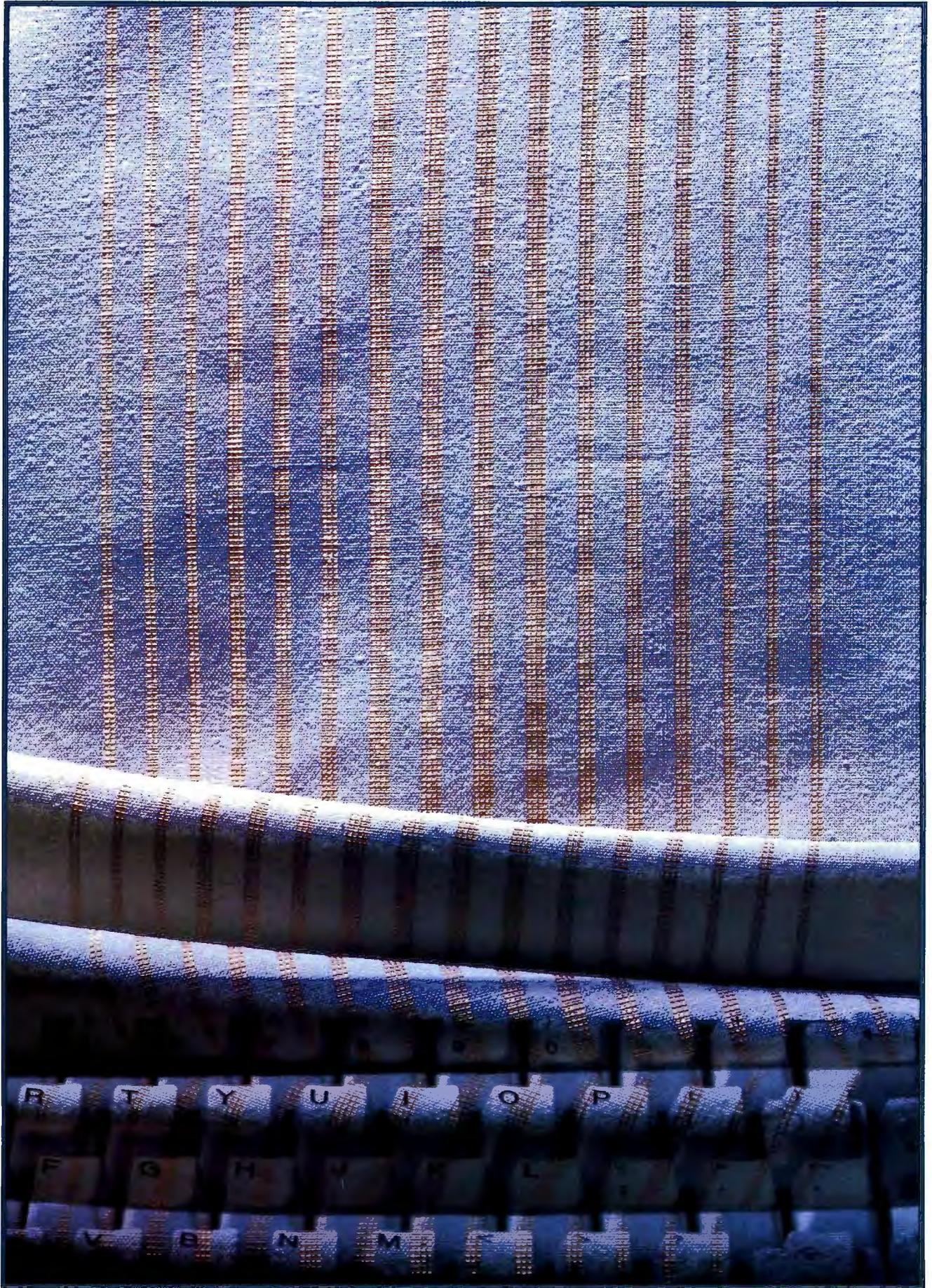
For a free brochure or the location of your nearest Authorized COMPAQ Computer Dealer, call toll-free 1-800-231-0900 and ask for operator 6.



It simply works better.

COMPAQ
PORTABLE 286™





AN ASSEMBLER FOR VM2

BY JONATHAN AMSTERDAM

*This assembler can ease the pain
of machine-language programming*



Last month I discussed my design for the VM2 virtual machine. The VM2 interpreter and a simple monitor program are available on BYTEnet Listings. (Call (617) 861-9774 before November 1; thereafter, call (617) 861-9764.)

This month I will present an assembler that will make VM2 easier to use and will provide a stepping-stone to my ultimate project—the construction of a high-level-language compiler. The assembler is written in Modula-2 and can also be downloaded from BYTEnet Listings.

You may recall that VM2 is a stack machine, which means that most of its instructions expect their arguments or place their results on the computer's stack. ADD, for example, takes the top two values off the stack, adds them, and pushes the result back on the stack. Some instructions expect their arguments to follow them directly in memory; an example is PUSHC, which pushes a constant on the stack.

As it stands now, the only way to get VM2 to do anything is to use the monitor program I described last month, which allows you to poke instructions and data one word at a time into memory. The assembler I am presenting this month will let you write programs using instruction mnemonics as well

as symbolic names for data. This tool will also automatically translate these programs into a sequence of numbers that can then be loaded into VM2's memory and run.

WHAT IS AN ASSEMBLER?

An assembler is a computer program that translates other programs from one form to another. The input to the assembler is source code—human-readable text that uses symbolic names for instructions and data. The output is object code—a sequence of bit patterns (or numbers) that can be loaded directly into the machine's memory and executed. Figure 1 is a graphic description of the assembler's function.

The assembler's job is fairly easy because the level of the source code is close to the computer's actual instruction set. Consider the following VM2 program listing that adds 5 and 6, leaves the result on the top of the stack, and then stops.

```
PUSHC 5  
PUSHC 6  
ADD  
HALT
```

Each of the assembler's instructions—

(continued)

Jonathan Amsterdam is a graduate student at the Massachusetts Institute of Technology Artificial Intelligence Laboratory. He can be reached at 1643 Cambridge St. #34, Cambridge, MA 02138.

PUSHC, ADD, and HALT—is an actual VM2 instruction, represented in the computer as some word-long pattern of bits called an op code. Say, for example, that the op code for PUSHC is the number 1, for ADD is 2, and for HALT is 3. The object code for the short program listing just shown would then be the following:

1 5 1 6 2 3

Based on this example, you might think that something like the algorithm shown in figure 2 would serve for the assembler. It just keeps reading items from the input and translating them.

Such a program would certainly be useful, but you can improve it in two ways. First, you might want to provide some error checking. In its present form, this program will cheerfully assemble the sequence PUSHC HALT, even though PUSHC is supposed to

be followed by an argument.

Second, you might want to be able to supply your own symbolic names for memory locations. This means you can name locations in which you want to store data, and it allows you to label points in your program to which you might want to branch. Listing 1 shows both of these uses of symbolic names, or labels, as they are usually called. This program counts down from 10 to 0. First the variable COUNT—that is, the contents of the memory location to which the label COUNT refers—is pushed on the stack. The BREQL instruction pops this value off the stack and, if it's 0, branches to DONE—that is, to the memory location to which the label DONE refers. If COUNT isn't 0, it is decremented and you go around the loop again.

Listing 1 also illustrates the syntax I used in my assembler. Assembly-lan-

guage programmers will find it familiar; certain of its aspects are universal. The syntax can be described as follows:

- Labels appear at the beginning of the line and are followed by a colon.
- An instruction mnemonic may appear next. If the instruction takes an argument, the argument immediately follows the mnemonic.
- An argument may be a number or a label name.
- A mnemonic need not follow a label. Instead, an argument—that is, a number or label name—may follow a label (as with COUNT, above).
- Anything between a semicolon and the end of a line is a comment and is ignored by the assembler.

How are labels assembled? Well, whenever a label is defined (that is, whenever it appears at the beginning of a line and is followed by a colon), you need to associate the label name with the current memory location in some table. When the label is used (as an argument, for example), you retrieve the value from the table and output it. You can keep track of the current memory location by setting a counter to 0 before you start assembling and by incrementing it every time you assemble an item.

A revised version of my original algorithm is shown in figure 3. It keeps track of the current memory location and records labels and their values in a data structure called the label table. It also checks to see if arguments are provided for the instructions that require them.

This algorithm is closer to what I want, but it's not exactly right; it actually fails to work in some cases. In fact, it won't work in listing 1. I'll explain why in the next section.

BACKPATCHING FORWARD REFERENCES

The second algorithm (figure 3) can't handle a situation where a label is used before it is defined. These so-called forward references are quite common. They occur twice in listing

(continued)

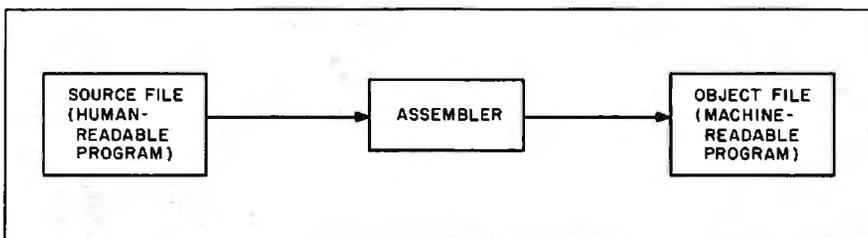


Figure 1: *The function of an assembler.*

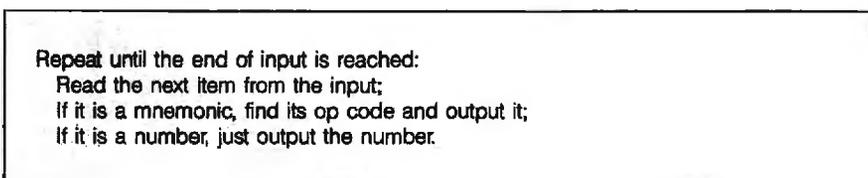


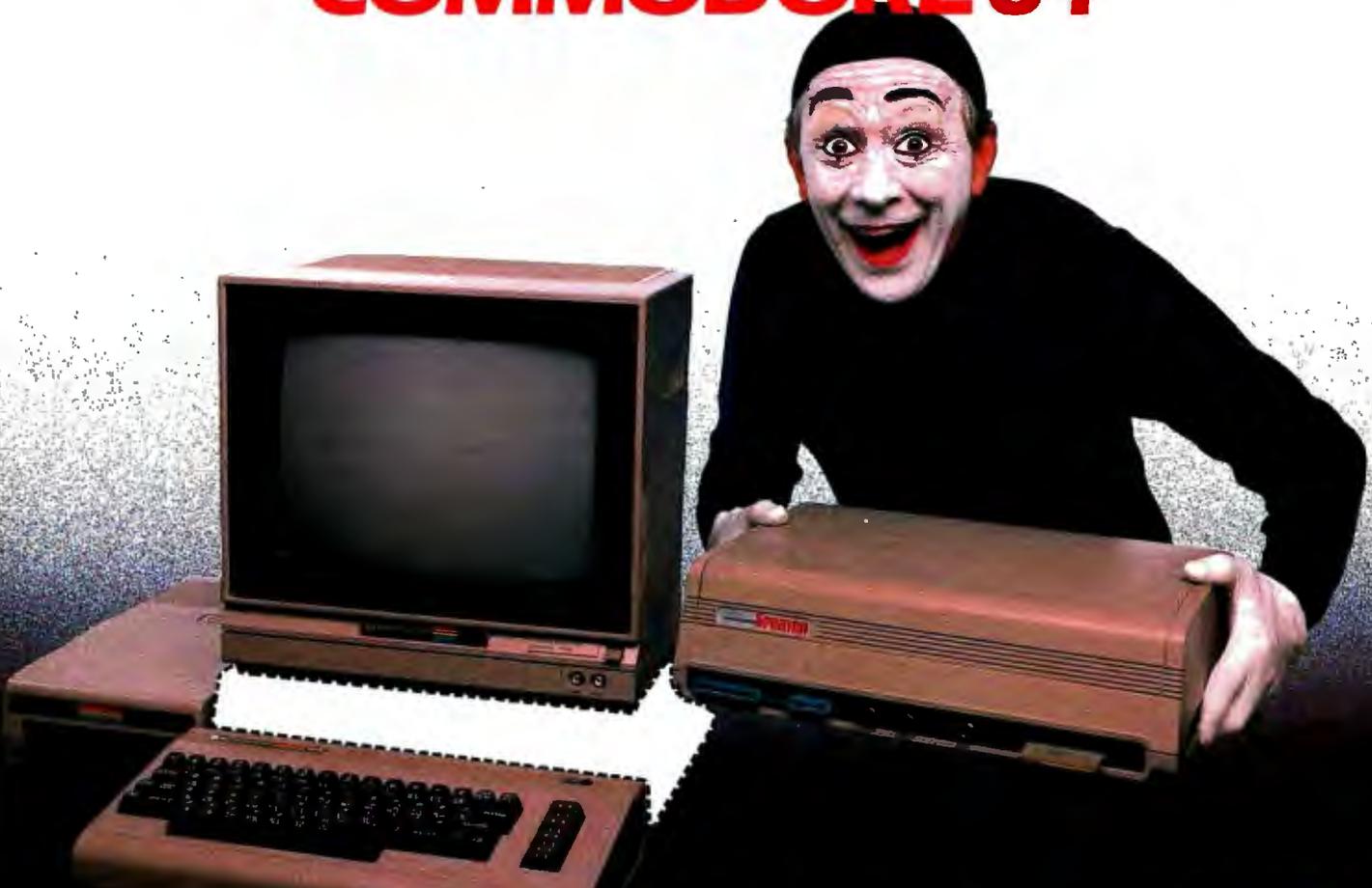
Figure 2: *A first try at an assembler.*

```

Listing 1: A VM2 program with labels.

LOOP:  PUSH    COUNT
        BREQL  DONE    ; stop when COUNT = 0
        PUSH   COUNT
        PUSHC  1
        SUB
        POPC   COUNT  ; COUNT := COUNT - 1
        BRANCH LOOP
DONE:  HALT
COUNT: 10
  
```

HOW TO GET OVER \$2000 WORTH OF NEW CAPABILITIES FOR YOUR COMMODORE 64™



FOR \$599*

The Spartan™ is the Apple™ II+ emulator for your Commodore 64™ that will open up a whole new world of hardware and software for you! Imagine adding these features to your Commodore 64™ for the Spartan™ price of \$599: Apple™ II+ hardware and software capabilities 64K RAM expansion four software selectable Commodore 64™ cartridge slots non-dedicated 8-bit parallel port standard audio cassette deck capabilities for your C-64™.

The suggested retail value of comparable products offering only these capabilities is over \$2200.00* — but the Spartan™ gives you much, much more! By building on your investment in your Commodore 64™ — an excellent introductory computer — you create a whole new system with both C-64™ and Apple™ II+ capabilities. There is a whole other world out there! The huge selection of Apple™ II+ hardware and software is now yours to explore! Call toll free for the Spartan™ dealer nearest you.



MIMIC

FOR INFORMATION WRITE:
MIMIC SYSTEMS INC.
1112 FORT ST., FL. 6H
VICTORIA, B.C.
CANADA V8V 4V2

TO ORDER CALL:
1-800-MODULAR
(663-8527)

*All prices quoted are in U.S. funds. Freight and taxes not included. Value of components equivalent to the Spartan™ system are quoted from Apple™ II+ CPU and Apple™ II+ single disk drive 1983 list prices, and from current suggested list prices and component specifications of other peripheral manufacturers. Commodore 64™ and Commodore logo are trademarks of Commodore Electronics Ltd. and/or Commodore Business Machines, Inc. Apple™ II+ is a trademark of Apple Computer Inc. Spartan™ is a trademark of Mimic Systems Inc. and has no association with Commodore Electronics or Apple Computer Inc. The Spartan™ is manufactured by Mimic Systems Inc. under license granted by ATG Electronics Inc. of Victoria, B.C. Canada

Lexical analysis is the process of organizing a sequence of characters into meaningful chunks.

1: Both COUNT and DONE are used as arguments before they are defined. In listing 1 you could avoid the problem by moving the label definition to the beginning, but sometimes it's impossible.

This is a serious problem in the second algorithm. When the assembler reaches the item COUNT in the first line of listing 1, it doesn't know what the label's value is. Yet it has to output the correct value if it is to produce a proper translation of the program.

One possible solution is to read the input file twice. The first time through you just gather label definitions. The next time around you do the actual assembling. This method is reasonable, but it's time-consuming.

Instead, you could choose to reread the output file. You assemble as

before, except that when you find an undefined label you output a special marker. When the input is finished, go back and read the output file, substituting the label definitions for the markers. You could read the output file faster than you could read the input file, because it has a simpler structure, but this method is still slow.

I used a third algorithm, shown in figure 4, that trades time for space. With this algorithm you don't need to reread any files, but you do need to keep the assembled program in memory. Instead of outputting an assembled value, you save it in a table I'll call the program array, which is indexed by VM2 memory address. Not until you have read the whole input file do you output the program array. When you first see an undefined label, you insert it in the label table with an indication that it is undefined. Each time you encounter the label, you add the current location to a forward reference list. When you finally find the label's definition, you go back through the program array, patching each location in the forward-reference list with the correct value. This technique is called backpatching.

The algorithm shown in figure 4 is the same as the second one but it is augmented with backpatching. There

are a few slight additions I want to make to this algorithm. It would be nice to be able to specify characters as well as integers so that a single quote followed by a character denotes the ASCII value of that character. For example, the instruction PUSHC '?' would result in the ASCII value for a question mark being pushed on the stack. I also want to let a sequence of characters enclosed in double quotes indicate a string, so I could write "BYTE" instead of 'B' 'Y' 'T' 'E'. I also want to add a facility for assembler directives, that is, commands to the assembler that can be embedded in the source code. I'll say that a dot followed by a symbol indicates a directive. The only directive I'm going to include is .BLOCK, which reserves a chunk of memory. It's useful for specifying buffers, arrays, and tables. For example, I could write NED: .BLOCK 30 to reserve 30 words of memory and label the first word NED.

THE DETAILS

Three key sections of my assembler program need to be explained more fully: scanning the input, the organization of the label table, and backpatching.

LEXICAL ANALYSIS

The three algorithms I've presented ask us to read the next item from the input. But what constitutes an item? Obviously, the items should be chunks of input that are meaningful to the program. For the assembler, a label would be an item, as would an integer. Unfortunately, most programming languages can't help much with this job: Usually, they allow you to read the input only a character at a time. The process of organizing the sequence of characters into meaningful chunks is called lexical analysis, and usually the chunks are called tokens, not items. Successive calls on a lexical analyzer's getToken routine return successive tokens in the input stream.

If you pick up any textbook on compilers, you can find out more about lexical analysis than you probably want to know. For my purposes, a

```

Main program:
  Set the current location to zero.
  Repeat until the end of input is reached:
    Read the next item from the input;
    If it is a comment, ignore it;
    If it is a label definition, record it along with the current location
      in the label table;
    If it is a mnemonic, find and output its op code, and increment
      the current location;
    If the instruction takes an argument,
      Read the next item from the input and treat it as an argument;
    If it is not a mnemonic, treat it like an argument.

Handling arguments:
  If the item is a number, output it and increment the current location;
  If it is a label name, then
    If the label is defined, then get its value from the label table,
      output the value, and increment the current location;
    If the label is not defined, signal an error;
  If it is anything else (e.g., a mnemonic), signal an error.

```

Figure 3: The revised assembler algorithm.

rather simple scheme will suffice. This scheme requires that you back up over the input occasionally (which is something the fancy lexical analyzers never have to do—that's why they're faster). The first task is to provide low-level routines that allow you to read characters from the input and put them back onto the input when you need to. Since you'll never have to put back more than one character at a time, this is not difficult to implement. These two procedures, which I call `getChar` and `ungetChar`, are used by the rest of the lexical analyzer in building up tokens. The lexical analyzer consists of several different procedures, each designed to read a different kind of token. Typically, a procedure keeps getting characters until it finds one that does not belong in the token it is constructing; it then "ungets" that character and returns the token. For example, the procedure for reading an integer reads characters from the input until a nondigit is encountered, "ungets" the nondigit, and returns the integer represented by the string of digits it has read.

When called on to get a token, the lexical analyzer uses the next character of the input to decide which of these token-building procedures to call. If, for example, the next character is a digit, the number routine is called. This decision is most elegantly implemented by a dispatch table, which is an array of procedures indexed by character. The dispatch routine needs merely to get the next character, use it to index into the table and call the associated procedure. You can use this technique only if your programming language has procedure variables, as do C and Modula-2. If not, you will have to resort to a case statement.

Although the procedures using `getChar` are under the impression that only one character at a time is being read from the input, `getChar` itself doesn't have to work that way. In particular, the input can be read a line at a time, with `getChar` doling out characters in the line one by one. The advantage of this scheme is that the whole line is available for printing out

when an error is detected, to give you some idea of where in the program the error occurred.

A lexical analyzer is a handy tool to have on your software workbench. Unfortunately, every program has its own way of carving up the input. Still, much of the guts of the lexical analyzer can be separated from the program-specific details, providing a general-purpose toolkit for building lexical analyzers. One of the modules for this project, `LexAnStuff`, is just

such a toolkit. It provides `getChar` and `ungetChar`, a dispatch mechanism, an error-display procedure, and some useful reading routines that construct strings and integers. To build a lexical analyzer with `LexAnStuff`, you write your program-specific reading routines and install them in the character table. The dispatch routine does the rest.

My assembler's lexical analyzer recognizes eight different kinds of

(continued)

Main program:

```

Set the current location to zero.
Repeat until the end of the input is reached:
  Read the next item from the input;
  If it is a comment, ignore it.
  If it is a label definition, then
    Look it up in the label table;
    If it is not present, enter it along with the current location;
    If it is present but undefined, backpatch using the forward-
      reference list for the label;
    If it is present and defined, signal an error.
  If the item is a mnemonic, find its op code, place the op code
    in the program array at the current location, and
    increment the current location;
  If the instruction takes an argument, then
    Read the next item from the input and treat it as an argument.
  If the item is a directive, then
    If the directive is BLOCK, then
      Read its argument, which should be an integer;
      Increment the current location by the argument;
    If the directive is not BLOCK, signal an error.
  If the item is none of the above, treat it like an argument.
When the end of the input is reached,
  Check for labels that were used but not defined;
  Output the program array.

```

Handling arguments:

```

If the item is a number, place it in the program array and increment the
  current location.
If it is a character, place it in the program array and increment
  the current location.
If it is a string, treat it as if it were a list of characters.
If it is a label name, then
  If the label is defined, then
    Get its value from the label table;
    Place the value in the program array and increment the
      current location;
  If the label is not present in the label table,
    Enter it into the table;
    Start the forward-reference list by making the label-table
      entry point to the current location and placing a
      NIL in the program array at the current location.
  If the label is present in the label table but is undefined,
    Add the current location to the forward-reference list.
If the item is anything else (e.g. a mnemonic), signal an error.

```

Figure 4: The final assembler algorithm.

The label table provides some sort of mapping between label names and values.

tokens: identifiers (strings of alphanumeric characters), label definitions (identifiers followed by a colon), directives (identifiers preceded by a dot), integers; character constants (a single quote followed by a character), string constants (a list of characters enclosed by double quotes), and end-of-line and end-of-file indicators. As all good lexical analyzers should do, it skips over comments, never mentioning their presence. So the callers of the lexical analyzer need not even consider comments—they can treat the program as comment-free. However, it does not distinguish mnemonics from uses of a label, although it easily could. Instead, it considers both to be identifiers, leaving the job of separating the two to higher-level functions. This was an arbitrary decision; you could do it either way.

THE LABEL TABLE

The label table provides some sort of mapping between label names and their values (the addresses at which they were defined). The simplest way to implement this mapping scheme would be to create a list of <label, value> pairs—used, perhaps, as an array or linked list of records. Searching this list for a label could take a long time, because there would be as many comparisons as there are labels. And since redefining labels is not allowed, you would need to search the whole list every time you want to insert a label to make sure it hasn't already been defined. Other schemes involving sorted lists or trees are also possible, but it is probably best in this case to use some form of hashing.

Hashing is based on the observation that, ideally, you'd like to be able to get the value of a label by just indexing into an array, using the label

itself as an index. That would be extremely fast—and more importantly, the time it would take would be independent of the number of labels in the table. But such an array would have to be absurdly large, requiring one entry for every possible label; and even if you just consider, for example, seven-letter labels, there are over 8 billion possibilities.

But of course, no program has anywhere near this number of labels. Could you get by with a much smaller array by somehow compressing the labels into a smaller range of indexes? Perhaps you can take a label—indeed, any string of characters—and hash it up, turning it into a number small enough to index into your array. That's exactly the purpose of a hash function—given a string as input, it produces a number as output. The number serves as an index into an array called, appropriately enough, a hash table. There are several good choices for a hash function; one of the simplest and most effective is to add up the ASCII values of the characters in the string, divide the sum by the size of the hash table and output the remainder.

It is possible that two different strings will hash to the same spot in the table. My implementation handles these collisions by linear probing: If a label hashes to location n in the hash table and n is occupied, then locations $n+1$, $n+2$, . . . are examined until an empty one is found and the string is placed there. If I run off the bottom of the hash table, I continue searching from the top. When looking for a label in the table, I use the same technique, only now when I reach an empty hash-table entry (or when I have searched the entire table) I know that the label is not present.

THE ADVANTAGE OF BACKPATCHING

It may seem that backpatching requires space not only for the assembled program but also for the forward-reference list. But what endears backpatching to me is the fact that you need no additional storage for forward-reference lists. The forward

references for a label form a linked list that is kept in the program array itself, in the very locations that would have been used to store the label values had the label been defined.

When the assembler encounters for the first time a label that hasn't been defined, it inserts that label into the label table with the current location as its value and puts a special value NIL in the program array at the current location. The value cell of the label-table record acts as a pointer into the program array, indicating the beginning of a linked list of forward references. A NIL terminates the linked list. Figure 5a illustrates this situation.

When a second occurrence of an undefined label is encountered, you link the current location onto the front of the forward-reference list. It is easy to do this: You put the contents of the label's value cell in the program array at the current location and replace the contents of the value cell with the current location. This situation is illustrated in figure 5b.

When you finally find the definition for the label, you update the label-table record to reflect this and step through the forward-reference list putting the correct value of the label into the indicated locations in the program array. You destroy the forward-reference list in the process, but so what? Its purpose has been served. Figure 5c shows what memory looks like after you have finished backpatching.

What value should NIL be? Anything that's not a valid VM2 address will do. But what, if any, word-length bit pattern can be a valid address? There's one value that can't be confused with the address of a forward reference; I leave its discovery to you.

INTERFACE TO VM2

My assembler reads in a VM2 assembly-language program and outputs a file that can be loaded by the VM2 monitor, a program I supplied with the VM2 machine simulator. The output file is actually a text file containing integers instead of some specially formatted file; this means you can read it with your friendly text editor.

Not that you'd want to do that too often—it's a little like reading punched paper tape—but I found it useful for debugging.

The loader always starts loading at location 0 and always loads consecutive memory locations. This affects the implementation of the .BLOCK directive. Basically, if a program says .BLOCK 100, you've got to output 100 zeroes (or some other value). This can make for large output files. It would be reasonable to extend the loader so that a special character in the file followed by a number *n* would result in the rest of the file being loaded from location *n*. This would

solve the .BLOCK problem and also make it possible to start loading programs from a location other than 0. But be careful: The assembler assumes that the program will be loaded at a particular memory location—whatever the initial value of the current location variable is—and loading it into any other place will screw up all the program's references to memory.

EXTENSIONS

You can spiff up your assembler in a number of ways. Good assemblers allow the programmer to define symbolic constants with numeric values.

So, for example, you could write

`BUFSIZE = 30`

at the beginning of your program and from then on use the more readable BUFSIZE instead of 30. Often you write arithmetic expressions that the assembler will evaluate for you. So if an array consists of 20 elements of two words apiece, you could write

```
NELEMENTS = 20
ELSIZE     = 2
ARRAYSIZE  = NELEMENTS
            * ELSIZE
```

Another common addition is a macro facility. A macro instruction is a mnemonic that stands for several actual assembly-language instructions. You define the macro in your program by means of an assembler directive, and when you use it, the macro is replaced by the instructions that constitute it. Macro assemblers often have powerful features, but even a simple one will let you write macros with arguments. For example, say you are sick of writing

```
PUSH  A
PUSHC 1
ADD
POPC  A
```

every time you want to increment a variable. You'd like to just write INC A. Of course, you don't want to make the macro specific to A; any other label name should work in its place. The following macro will do the trick:

```
.MACRO INC %1
; the % indicates an argument
PUSH  %1
; argument is substituted here...
PUSHC 1
ADD
POPC  %1 ; ...and here
.ENDM
; the "end macro" directive
```

All these extensions make it easier to write assembly-language code. But, except for a few test programs I wrote, I don't plan to do assembly coding. Instead, next month I'm going to tell you how to program in a high-level language and compile it into VM2 assembly language. ■

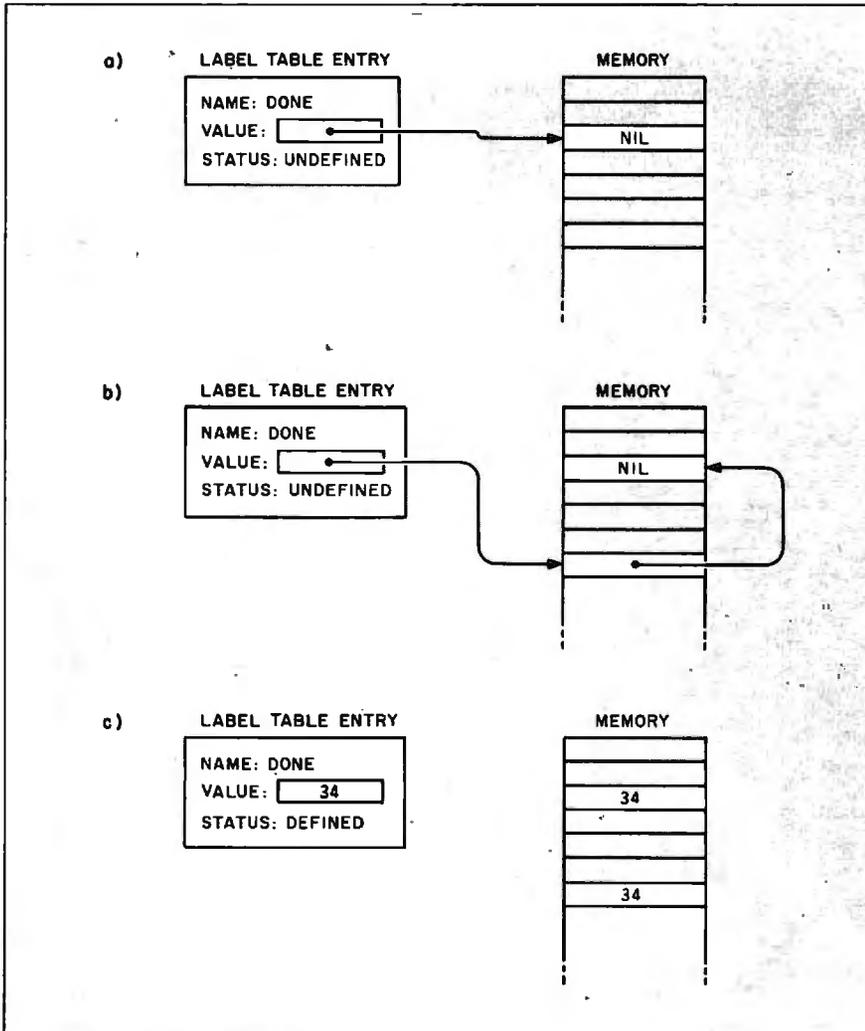


Figure 5: The backpatching algorithm. (a) An undefined label is first encountered. (b) A second occurrence of the label is seen. (c) The label is defined at location 34.

Microsoft Excel. For those who

You may speak more softly now.

For we are delivering into the hands of business, a very big stick.

Microsoft® Excel for the Macintosh™. A financial analysis tool of unprecedented power.

First and foremost, Microsoft Excel is the most

formidable spreadsheet ever to run on a personal computer.

A spreadsheet which is in turn linked with an extraordinary graphics program and a highly capable data filing application.

These already considerable powers are magnified geometrically by Macros.

Which give Microsoft Excel



Enchantment Lakes Corporation
For the fiscal years ended June 30, 1985, and

(Dollars and shares in thousands, except per share amounts)

Net sales	\$2,190,344	1985
Net income	\$114,712	\$1,675,000
Earnings per share	\$1.72	\$65,328
Pretax profit margin	9.1%	\$1.02
Income tax rate	43.1%	7.2%
Return on net sales	5.2%	45.7%
Working capital		
Total assets		
Shareholders' equity		
Return on equity		
Return on assets		
Research and development	\$813	
Marketing and advertising	\$101,500	
Number of shares outstanding		

appreciate the uses of power.

the capacity to learn your most complex routines. And activate them with a single keystroke.

Yet for all its ability, Microsoft Excel (Excel for short) is simple to learn, simple to use. No complex commands to memorize. No classes to take. The only thing complicated about Excel is the problems it can solve.

See your Microsoft dealer for a demonstration of the powers of Excel.

In the right hands, a potent weapon, indeed, in the cause of commerce.

We trust you will use it responsibly.

Microsoft Excel

The rest are history.

For the name of your nearest Microsoft dealer, call (800) 426-9400. In Washington State and Alaska, call (206) 828-8088. In Canada, (416) 673-7638.

Microsoft is a registered trademark of Microsoft Corporation.
Macintosh is a trademark licensed to Apple Computer, Inc.



PC Paintbrush™

Because life is too short for monochrome pie charts.

Fun is the best thing to have.

With PC Paintbrush, you can add color, flair, dimension and creativity to a chart, a presentation, or an otherwise dull day. From charts and graphs to serious computer art, our newest generation 3.0 PC Paintbrush will cheer you on with features no other graphics package can match.

Best of all, it's easy to use. You don't have to learn up to sixty commands, like you do with some products. If you can understand icons as simple as scissors, paintbrush, spray can and paint roller, you're ready to start using PC Paintbrush.

The pen is mightier than the keyboard.

None of history's great artists drew with a keyboard, and you shouldn't have to either. So PC Paintbrush is now available with a cordless PenMouse, to give you complete freedom of expression. Of course, it also supports regular mice, joysticks, graphics tablets, and is compatible with most graphics cards.

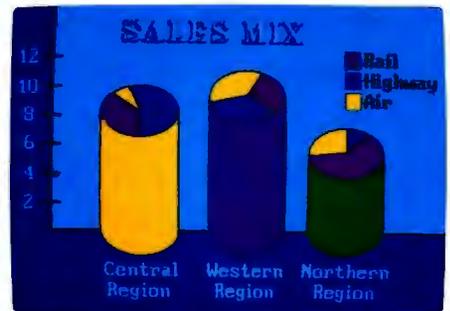
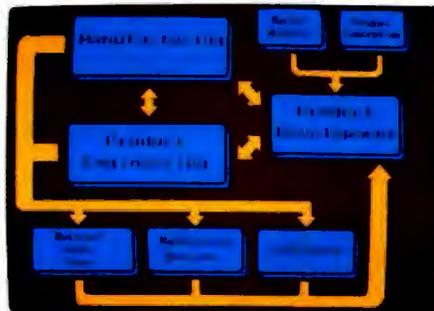
PC Paintbrush also has a beautiful way with words. The text icon lets you write in any of eleven fonts, in nine sizes, with italics, outline, shadow and boldface variations.

What's more, with the new 3.0 PC Paintbrush, you can draw rounded boxes, rubber band curves and circles, and edit pictures many times larger than the screen.

Are we making fun of 1-2-3®? Why not?

For Lotus™ users, PC Paintbrush's new PIC

Go on, live a little.



interpreter loads 1-2-3™ and Symphony™ charts and graphs at your equipment's best resolution, from an IBM EGA™ (640 X 350 X 16 colors) to a Number Nine Revolution™ (512 X 512 X 256 colors).

With our FRIEZE™ frame grabber you can pull graphics created by any program right off the screen into PC Paintbrush. So you can take your Paintbrush and palette anywhere, improving the looks of things as you go. And having a lot of fun on the way. In addition, our optional presentation package, SLIDESHOW, allows you to program your graphics into a first class presentation with fades, zooms, quick cuts and animation.

PC Paintbrush supports 19 video graphics cards and 30 printers and plotters.

For more information on PC Paintbrush, call or write us at the address below, or ask your computer dealer for a demonstration.



Z·SOFT
PC Paintbrush

Corporate Headquarters:

ZSoft Corporation, 1950 Spectrum Circle, Suite A 495, Marietta, GA 30067, 404/980-1950

West Coast Sales Office:

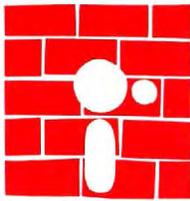
160 Sir Francis Drake Blvd., San Anselmo, CA 94960, 415/456-0955

PC Paintbrush is a trademark of ZSoft Corporation. Lotus, 1-2-3, and Symphony are registered trademarks of Lotus Development Corporation. IBM and Enhance Graphics Adapter are registered trademarks of International Business Machines, Corp. Number Nine Revolution is a trademark of Number Nine Computer Corp.

EXTENDING TURBO PASCAL

BY BRUCE WEBSTER

*Five subroutine libraries can enhance
your Turbo Pascal working environment*



No computer language is complete, although a few attempts have been made at creating a complete language (such as PL/I and Ada) with less-than-spectacular results.

The reasons for such results are obvious. First, an attempt to include every conceivable feature in a language would result in an oversize, bloated compiler (or interpreter). Second, no matter what the language included, there would be users who would want something more or different or who would want certain features removed.

It appears that Niklaus Wirth realized these pitfalls when he designed Pascal some fifteen years ago. The language definition itself is fairly compact. Apple Computer Inc. once put out a remarkably uncrowded poster with the entire language definition on it. Wirth added a small selection of predefined procedures and functions to that definition. His latest effort, Modula-2, goes even further in that minimalist direction.

Unfortunately, Pascal (as Wirth defined it) has some annoying, if not serious, limitations. Most Pascal implementations have sought to overcome those limits by adding language features and predefined procedures and functions. Unfortunately, not all of them add the same things, and many

of them drop features found in Wirth's definition or the later ISO (International Standards Organization) standard. Incompatible compilers and uncertainty about what you can or can't do are the results.

There isn't a whole lot you can do about features of the language itself, but you can add to the predefined procedures and functions by creating subroutine libraries (see my article "Subroutine Libraries in Pascal," June *BYTE*, page 253). Such libraries serve three purposes. First, if you're using two or more Pascal compilers, libraries can help to "standardize" them a little more by providing the same functions in each one. Next, they can help overcome deficiencies in a given implementation. And finally, they let you extend the language to suit your particular needs and help you avoid reinventing the wheel each time you program.

This article looks at five small libraries I developed specifically for Turbo Pascal (version 3.0). These libraries were developed keeping the ideas noted previously in mind. All were written on a Compaq under MS-DOS, but all should work equally well under CP/M and CP/M-86. Most of the routines could also be implemented for other Pascal compilers, such as MS-Pascal, Pascal/MT+, and Apple Pascal.

(continued)

Bruce Webster (846 East 840 N, Orem, UT 84057) is a contributing editor for *BYTE*.

*It helps to have a set
of bulletproof routines for
user input/output. Having
a library also gives your
programs a consistent,
predictable look.*

Due to space limitations, complete listings aren't given here. Instead, the libraries (USERIO.LIB, INTEGERS.LIB, STRINGS.LIB, STRUCT.LIB, and LINKED.LIB) can be downloaded from BYTEnet Listings. Call (617) 861-9774 before November 1; thereafter, call (617) 861-9764.

USER INPUT/OUTPUT

Most programs you write will have a certain amount of user interaction. In particular, you'll prompt the user for commands and values. It helps to have a set of "bulletproof" routines that you can call to take care of the user I/O (input/output). Having a library also gives your programs a consistent, predictable look.

Figure 1 shows the data types and routines defined in USERIO.LIB. The two data types, MsgStr and CharSet, are needed for parameter passing because Turbo Pascal doesn't allow a string or set specification within a parameter list. Also, you might want to use the {\$V-} compiler directive if you're going to be passing strings with differently defined lengths (i.e., string[30], string[255], etc.). The variables IOErr and IOCode are used by the routine IOCheck, which I will describe later.

The routine WriteStr is the basis for the rest of the library. All that WriteStr does is move to the indicated location on the screen, clear the rest of that line, write out the string passed to it, and leave the cursor sitting at the end of that string. The rest of the routines use the top line of the screen (Column=1, Line=1) when calling WriteStr; you, of course, are free to change that as you wish.

The routine Error writes its message on the top line, along with a beep (Control-G) and the added note (hit any key). It then waits for the user to hit any key.

GetChar puts a command prompt across the top of the screen, much like the UCSD p-System. It then waits for the user to enter a single character. That character is converted to uppercase (where appropriate) and then compared against the set OKSet. If the character is in OKSet, then GetChar returns it in Ch; otherwise, it just prompts for another character. A sample call to the function GetChar might look like this:

```
GetChar(Ch,'U)p D)own L)eft R)ight',['U','D','L','R'])
```

The Boolean function Yes makes a special call to GetChar. It appends the string (Y/N) onto the string Question and prompts for a Y or an N. Yes then returns True if Y has been entered, False otherwise. This is handy for loops and conditional statements like this:

```
repeat
    . . .
until Yes('Are you finished yet?');
```

GrabInt and GetInteger both serve the same purpose. They prompt the user for an integer in the range Min..Max. Both append a string to Prompt showing Min and Max so the user can see what the limits are. The only difference between the two is that GrabInt returns the value as a function, while GetInteger passes the value back through the parameter Val. Why the difference? Well, if you've got integer subranges that are only 1 byte in size, you can't pass them as var integer parameters, but you can assign them integer values, hence the function. The procedure GetInteger isn't necessary—you could do everything with GrabInt—but it's included for those who want it. Assuming that TVal is of type Integer, the following calls have identical results:

```
TVal := GrabInt('Enter your age' ,0,150);
GetInteger(TVal,'Enter your age' ,0,150);
```

Both would write the string Enter your age [0..150]: to the top line of the screen and would continue to prompt until you entered an integer value from 0 to 150.

WriteReal writes out the real number RVal in one of two formats, fixed point (352.5) or floating point (3.525E+02). It uses fixed point if the number can fit within the fixed-point format, that is, if it has sufficient space before or after the decimal point; otherwise, it uses floating point. The parameter Width lets you specify the total field width; the parameter Digits, the number of digits after the decimal point if fixed-point format is used.

GetReal performs the same function as GetInteger, but (of course) for real variables. It calls WriteReal to print out the Min and Max values.

GetString is like the other Get routines; it writes the prompt on the top line of the screen and waits for the user to enter something acceptable. In this case, that something is a string not longer than the specified length (MaxLen) and containing only the characters specified in OKSet. GetString bypasses Turbo Pascal's string input routine and uses low-level character input to build the string itself. The only characters that GetString accepts are backspace (BS), carriage return (CR or Enter), and those in OKSet. BS deletes one character from the string and backs the cursor up a space, erasing the previous character. CR accepts the string you've entered so far. One special feature of GetString: If you hit CR without entering anything, the parameter TSr is left unchanged and is written out on the line after the prompt.

The last routine, IOCheck, is handy if you're doing any
(continued)

Tools That Make Your Job Easier

For PC DOS/MSDOS (2.0 and above/128K) • IBM PC/Compatibles, PC Jr., Tandy 1000/1200/2000, & others
For CPM80 2.2/3.0 (Z80 required/64K) • 8" SSSD, Kaypro 2/4, Osborne I SD/DD, Apple II, & others

MIX EDITOR

Programmable, Full/Split
Screen Text Processor

Introductory
Offer

29⁹⁵

Great For All Languages

A general purpose text processor, the MIX Editor is packed with features that make it useful with any language. It has auto indent for structured languages like Pascal or C. It has automatic line numbering for BASIC (255 character lines). It even has fill and justify for English.

Split Screen

You can split the screen horizontally or vertically and edit two files simultaneously.

Custom Key Layouts

Commands are mapped to keys just like WordStar. If you don't like the WordStar layout, it's easy to change it. Any key can be mapped to any command. You can also define a key to generate a string of characters, great for entering keywords.

Macro Commands

The MIX Editor allows a sequence of commands to be executed with a single keystroke. You can define a complete editing operation and perform it at the touch of a key.

Custom Setup Files

Custom keyboard layouts and macro commands can be saved in setup files. You can create a different setup file for each language you use.

MSDOS Features

Execute any DOS command or run another program from inside the editor. You can even enter DOS and then return to the editor by typing exit.

MIX C COMPILER

Full K&R Standard C Language
Unix Compatible Function Library

Introductory
Offer

39⁹⁵

Complete & Standard

MIX C is a complete and standard implementation of C as defined by Kernighan and Ritchie. Coupled with a Unix compatible function library, it greatly enhances your ability to write portable programs.

The Best C Manual

MIX C is complemented by a 400 page manual that includes a tutorial. It explains all the various features of the C language. You may find it more helpful than many of the books written about C.

Fast Development

MIX C includes a fast single pass compiler and an equally fast linker. Both are executed with a simple one line command. Together they make program development a quick and easy process.

Fast Execution

The programs developed with MIX C are fast. For example, the often quoted prime number benchmark executes in a very respectable 17 seconds on a standard IBM PC.

Standard Functions

In addition to the functions described by K&R, MIX C includes the more exotic functions like *setjmp* and *longjmp*. Source code is also included.

Special Functions

MIX C provides access to your machine's specific features through BDOS and BIOS functions. The CHAIN function lets you chain from one program to another. The MSDOS version even has one function that executes any DOS command string while another executes programs and returns.

Language Features

- Data Types: char, short, int, unsigned, long, float, double (MSDOS version performs BCD arithmetic on float and double-no roundoff errors)
- Data Classes: auto, static, extern, register
- Struct, Union, Bit Fields (struct assignment supported)
- Typedef, Initialization
- All operators and macro commands are supported

30 DAY MONEY BACK GUARANTEE

Orders Only: Call Toll Free 1-800-523-9520, (Texas only 1-800-622-4070)

MIX Editor ____ \$29.95 + shipping (\$5 USA/\$10 Foreign) Texas residents add 6% sales tax

MIX C ____ \$39.95 + shipping (\$5 USA/\$25 Foreign) Texas residents add 6% sales tax

Visa ____ MasterCard ____ Card # _____ Exp. Date _____

COD ____ Check ____ Money Order _____, Disk Format _____

Computer _____ Operating System: MSDOS ____ PCDOS ____ CPM80 ____

Name _____

Street _____

City/State/Zip _____

Country _____

Phone _____

MIX 2116 E. Arapaho
Suite 363
Richardson, Tx 75081
software
Dealer Inquiries Welcome
Call (214) 783-6001

MSDOS is a trademark of Microsoft PCDOS is a trademark of IBM CPM80 is a trademark of Digital Research WordStar is a trademark of MicroPro

B

file I/O. To use it, you should turn off I/O error checking for your program with the compiler directive `{$I-}`. After each file I/O call, call `IOCheck`. If there's an I/O error, you'll get an error message at the top of the screen (via the routine `Error`), and `IOErr` will be set to `True`; otherwise, nothing happens, and `IOErr` is set to `False`. In either case, `IOCode` is assigned the error number so that you can take appropriate action. The following piece of code (using Turbo Pascal's structured-constant feature) shows one way of opening a file for input:

```
const
  FileSet : CharSet = [' ','0'..'9','A'..'Z','a'..'z'];
var
  FileName : string[12];
  InFile : Text;
begin
  repeat
```

```
    GetString(FileName, 'Enter input file: ',12,FileSet);
    Assign(InFile,FileName);
    Reset(InFile); IOCheck
  until not IOErr;
```

You could make several changes to this library. You could pass line and column values to most or all of the routines, allowing input (and output) anyplace on the screen. That would make it easy to set up a formatted screen with data fields. You could drop the prompts from most of the `Get` routines and specify a field width for all input values. The important thing is to decide what you like best and implement it. Once you've done that, you don't have to worry about it each time you start to write a new program.

INTEGERS

Turbo Pascal lets you do more with integers than most Pascal implementations. In addition to the standard operations, you can use the operators `and`, `or`, `xor`, `shl`, and `shr` with integers. Additional procedures and functions, such as `Hi` and `Low`, are also provided. But there are, of course, those little things that you always want to do: minimum and maximum values, swapping two integers, and so on. The library `INTEGERS.LIB` provides some of those functions for you. The declarations for `INTEGERS.LIB` are shown in figure 2.

The first function, `Sign`, simply returns the sign (-1, 0, or +1) of the integer `Val`. It makes a good companion to the function `Abs`, which is already defined in Turbo Pascal. The next two, `Min` and `Max`, also do what you would think: return the minimum (or maximum) of the two values passed. And the routine `ISwap` swaps the values of `Val1` and `Val2`.

The function `ISqrt` lets you find square roots without resorting to real arithmetic. It returns the integer square root of `Val`, that is, the real square root of `Val` rounded to the nearest integer. For example, this code fragment:

```
for Indx := 0 to 9 do
  WriteLn('ISqrt(',Indx,') = ',ISqrt(Indx));
```

would produce this output:

```
ISqrt(0) = 0
ISqrt(1) = 1
ISqrt(2) = 1
ISqrt(3) = 2
ISqrt(4) = 2
ISqrt(5) = 2
ISqrt(6) = 2
ISqrt(7) = 3
ISqrt(8) = 3
ISqrt(9) = 3
```

The procedure `Condition` lets you force an integer (`Val`) to be in the range `Min..Max`. You can use this to make other routines more bulletproof; for example, a graphics routine might call `Condition` to force coordinates passed

(continued)

```
type
  MsgStr      = string[80];
  CharSet    = set of Char;
var
  IOErr      : Boolean;
  IOCode     : Integer;
procedure WriteStr(Col,Line : Integer; TStr : MsgStr);
procedure Error(Msg : MsgStr);
procedure GetChar(var Ch : Char;
  Prompt : MsgStr; OKSet : CharSet);
function Yes(Question : MsgStr) : Boolean;
function GetInt(Prompt : MsgStr;
  Min,Max : Integer) : Integer;
procedure GetInteger(var Val : Integer; Prompt : MsgStr;
  Min,Max : Integer);
procedure WriteReal(RVal : Real; Width,Digits : Byte);
procedure GetReal(var Val : Real; Prompt : MsgStr;
  Min,Max : Real);
procedure GetString(var TStr : MsgStr; Prompt : MsgStr;
  MaxLen : Integer; OKSet : CharSet);
procedure IOCheck;
```

Figure 1: Data types and routines from the library `USERIO.LIB`. Due to space limitations, just the procedure statement for each routine is shown.

```
function Sign(Val : Integer) : Integer;
function Min(Val1,Val2 : Integer) : Integer;
function Max(Val1,Val2 : Integer) : Integer;
procedure ISwap(var Val1,Val2 : Integer);
function ISqrt(Val : Integer) : Integer;
procedure Condition(Min : Integer; var Val : Integer;
  Max : Integer);
function AMin(var IAddr, Size : Integer;
  var Mndx : Integer) : Integer;
function AMax(var IAddr, Size : Integer;
  var Mndx : Integer) : Integer;
```

Figure 2: Routines from the library `INTEGERS.LIB`.

What Would You Say To 20,000,000 Pixels?

Good-bye Redraw!

**Now Supports AutoCAD
See Us At COMDEX**



So, your CAD/CAM software is hot stuff, eh? Well think how hot it might be if you had 20,000,000 pixels of video memory to work with in your IBM PC, XT or AT.

The GraphAx 20/20 color graphics card from ACS offers you just that, and it's sensibly and flexibly organized.

ONE BOARD — ONE SLOT

Notice that we said "color/graphics card" as in singular. The 20/20 utilizes 256K memory chips in a unique physical array that requires only one of your precious expansion slots.

YOUR WINDOW ON A BIGGER WORLD

The GraphAx 20/20 utilizes a huge 2K x 2K drawing area. At .01" resolution that's big enough for a drawing 20" x 20"! You view this drawing area through a 1K x 1K viewing window* that pans and scans smoothly over the entire area . . . without redrawing!

32 COLORS OR . . .

The 20/20 is organized in five planes to give you a choice of 32 brilliant colors or . . .

You can utilize four planes (16 colors) and reserve the fifth plane for a 1/4 resolution display of the entire 2K x 2K drawing, or . . .

You might want to use the fifth plane as a "Phantom Drawing Area" where changes can be previewed before being transferred to another plane. Dynamically "drag" a drawing into position, reduce it or enlarge it, even stretch it one dimension at a time, the 20/20 lets you have it your way.

You can even use the five planes as five separate pages for fast high resolution animation.

FAST DRAW

Sooner or later even with 20,000,000 pixels in memory, you're going to have to redraw, and you don't want to have to wait all day. That's why the 20/20 is turbocharged with high speed hardware.

Let your software crank out the numbers and the NEC 7220 specialized graphics processor will crank out the graphics. Your software can elect to draw only during retrace, or ignore sync for high speed execution. How does 1.2 million pixels per second sound . . . with a burst rate of 10 million?

NOT FOR EVERYONE

The GraphAx 20/20 ultra-res graphics card is a professional tool for demanding applications in the world of CAD/CAM. Uses include engineering drawings, PC layout, architectural graphics, and a host of metering and monitoring applications. Drivers are currently being written for many of the more popular CAD/CAM programs. To find out more, call or write:

ACS International, Inc.

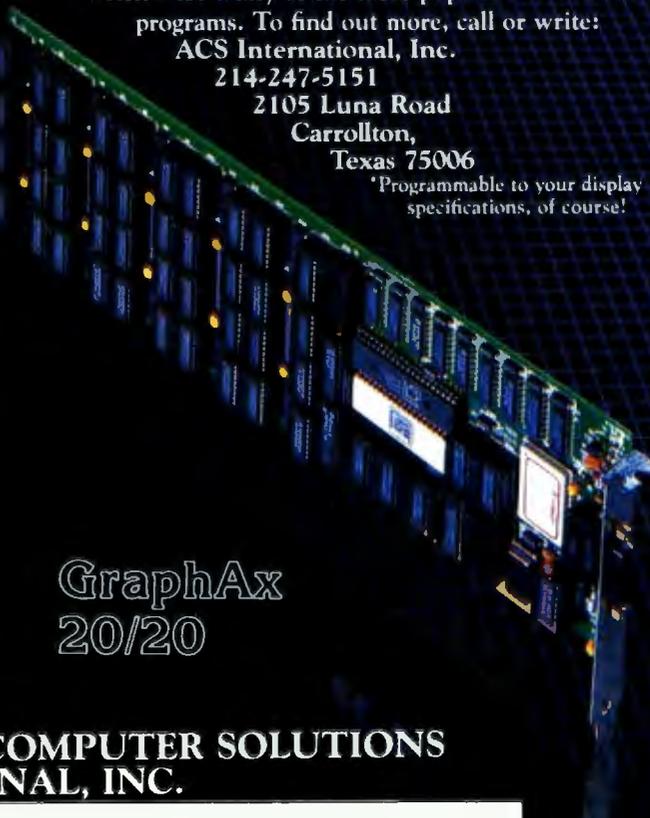
214-247-5151

2105 Luna Road

Carrollton,

Texas 75006

*Programmable to your display specifications, of course!



GraphAx
20/20



**ADVANCED COMPUTER SOLUTIONS
INTERNATIONAL, INC.**

Inquiry 401

Replace can be thought of as the "junk mail" procedure, substituting each instance of OldStr with NewStr.

to it to be within screen limits. By the way, Condition will call ISwap(Min,Max) if Min is greater than Max.

AMin and AMax provide the same functions as Min and Max, but for arrays of integers. The array can be of any length, and you can start at any point in the array. You also tell the routine how many integers to look at. You pass the array and the length (in integers), and the routine returns the minimum (or maximum) value as well as the index of that value, relative to the starting point. Given the following code:

```
const
  NumList : array[1..10] of Integer =
    (-20, 3, 523, -1, 72, 44, -10, 7, -1000, 25);
var
  Val,Indx : Integer;
begin
  Val := AMin(NumList,10,Indx);
  Write('Min: NumList[',Indx,'] = ',Val);
  Val := AMax(NumList,10,Indx);
  Write('Max: NumList[',Indx,'] = ',Val);
  Val := AMin(NumList[3],5,Indx);
  Write('Local min = NumList[',Indx,'] = ',Val)
end.
```

you'll get the following output:

```
Min: NumList[9] = -1000
Max: NumList[3] = 523
Local min = NumList[7] = -10
```

Similar routines for arrays of bytes could be written.

STRINGS

One of Pascal's greatest flaws is the lack of a standard character string type. When working in a punched-card, magnetic-tape mainframe environment, Wirth just used arrays of type Char for any string manipulation. Unfortunately, that makes for clumsy string handling.

The closest thing to a standard for Pascal strings is that found in UCSD Pascal. A string of length N (defined as string[N]) is implemented (invisible to the user) as an array[0..N] of Char, with the current length of the string stored in location 0. Several procedures and functions are provided for string manipulation. Turbo Pascal uses that standard and adds a few routines to it. The library STRINGS.LIB adds a few more.

Figure 3 shows the declarations in STRINGS.LIB. Note that the compiler directives {\$R-} and {\$V-} are used

to turn off range checking and length checking of string parameters. The data type BigStr (which has the maximum allowable size of a string) is used for all parameters. Note that there is another definition, SetOfChar, for character sets. This is needed for parameter passing, just like the type CharSet in USERIO.LIB, but a different name has been chosen to avoid definition conflicts should you use both libraries in the same program. The two data types are equivalent so that variables of one type can be passed as parameters to routines using the other.

LowToUp is a simple routine that converts all lowercase alphabetic characters (a through z) in TStr to uppercase letters. This procedure is useful when you want to compare two strings that might have the same text but different capitalization: Just convert both to all uppercase and then compare.

The procedure Strip removes any characters from the start of Line that are found in the character set Break. This lets you remove leading blanks, punctuation, and so on. The new length of Line is returned in the variable Len.

The next routine, Parse, uses Strip to help pull off the next "word" in Line. A word is defined as a substring that doesn't contain any of the characters found in Break. Parse calls Strip to remove any leading unwanted characters, then copies the following word into Word. It then calls Strip again to clean up any trailing characters. The following code:

```
Line = 'Come here, Watson, I need you!';
BreakSet := [' ',';','!'];
while Line <> '' do begin
  Parse(Line,Word,BreakSet);
  WriteLn(' Word = ',Word)
end;
```

produces the output:

```
Word = Come
Word = here
Word = Watson
Word = I
Word = need
Word = you
```

The last routine, Replace, can be thought of as the "junk mail" procedure. It goes through Target and replaces each instance of OldStr with NewStr. MaxLen specifies the maximum size of Target; once that is reached, no more substitutions take place (to avoid overflowing the string boundaries). The following code:

```
Line := 'And so, Mr. <name>, the whole <name>
  family';
Token := '< name >';
Name := 'Lemming';
Replace(Line,Token,Name,80);
WriteLn(Line);
```

results in the output:

(continued)

EXECUTIVE PRIVILEGE.

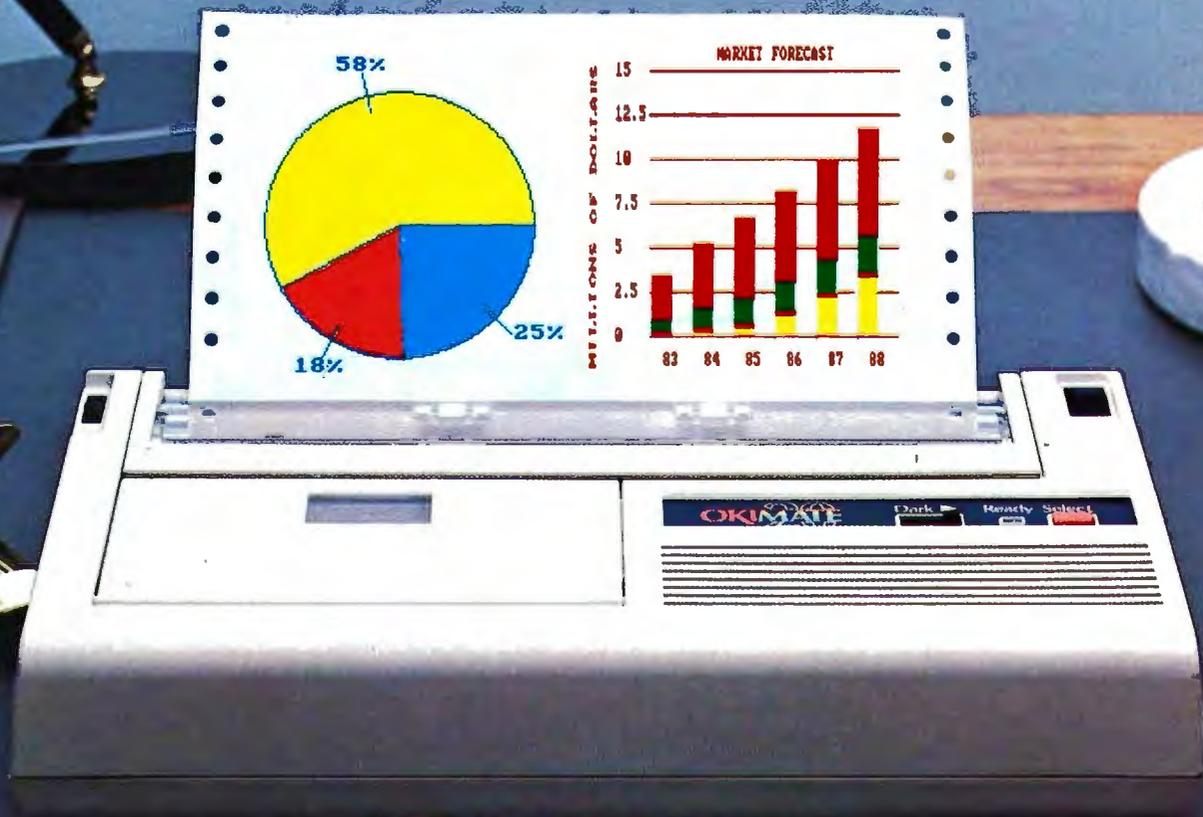
Introducing the \$268 OKIMATE 20 color printer for IBM® and Apple® users.

We admit it—the OKIMATE 20 isn't for everyone. Just IBM and Apple users who like to execute their big ideas with style.

The OKIMATE 20 is a powerful business tool, capable of printing ruthlessly accurate performance charts in over 100 vivid colors. It can paint sales records and forecasts with the same dynamic intensity. Or process your conclusions with crisp, near-letter quality

text. It can even make overhead transparencies to show your recommendations to the entire company. And it's easy enough for a busy executive to operate—everything is included.*

Rank sure has its privileges. And the new OKIMATE 20 certainly is one. For your nearest Okidata dealer, call 1-800-OKIDATA (in New Jersey 609-235-2600). Mt. Laurel, NJ 08054.



OKIDATA

an OKI AMERICA company

We put business on paper.

Inquiry 283

*\$268 is manufacturers suggested retail price.
OKIMATE 20 "Blue II Print" package includes black and color ribbon cartridges, paper and two software programs: "Color Screen Print" and "Learn to Print".
The above charts were created with Fast Graphs® and printed using OKIMATE 20's Color Screen Print program through multiple passes.
Apple is a registered trademark of Apple Computer, Inc.
IBM is a registered trademark of International Business Machines, Inc.

```
{ $R - } { turn off range checking (if on) }
{ $V - } { turn off string parameter length checking }

type
  BigStr          = string[255];
  SetOfChar       = set of Char;

procedure LowToUp(var TStr : BigStr);
procedure Strip(var Line : BigStr;
  var Len : Integer; Break : SetOfChar);
procedure Parse(var Line,Word : BigStr; Break :
  SetOfChar);
procedure Replace(var Target : BigStr;
  OldStr,NewStr : BigStr; MaxLen : Byte);
```

Figure 3: Compiler directives, data types, and procedures from the library STRINGS.LIB.

```
procedure ASwap(var A1Addr,A2Addr; Size : Integer);
function Identical(var A1Addr,A2Addr;
  Size : Integer) : Boolean;
function Any(var SetAddr,VAddr; Size : Integer) : Boolean;
```

Figure 4: Routines from the library STRUCT.LIB.

Listing 1: This procedure from STRUCT.LIB shows how to use the untyped parameter and absolute address definitions to write general-purpose routines.

```
procedure ASwap(var A1Addr,A2Addr; Size : Integer);
{
  purpose           swaps A1 <- -> A2
  last update      23 Jun 85
}
type
  DummyArray       = array[1..MaxInt] of Byte;
var
  A1                : DummyArray absolute A1Addr;
  A2                : DummyArray absolute A2Addr;
  Temp              : Byte;
  Indx              : Integer;
begin
  for Indx := 1 to Size do begin
    Temp := A1[Indx];
    A1[Indx] := A2[Indx];
    A2[Indx] := Temp;
  end;
end; { of proc ASwap }
```

And so, Mr. Lemming, the whole Lemming family
Now you know why it's the "junk mail" procedure.

DATA STRUCTURES

Figure 4 shows the definitions in the library STRUCT.LIB. With these routines you can do certain manipulations of data structures. All are based on a feature in Turbo Pascal that lets you pass the address of a variable without passing any data-type information. Since Turbo Pascal also lets you declare a variable at a given address, you can (within your procedure) declare a data structure at that parameter's address and then manipulate it to your heart's content. (The routines AMin and AMax in INTEGERS.LIB used this technique.) Let's look at an example.

You saw the routine ISwap (in INTEGERS.LIB) that let you swap two integers. Now you can do the same with any two data structures: strings, arrays, records, sets, and so on. The procedure ASwap, shown in listing 1, remaps both of the structures passed into arrays of type Byte, then swaps them on a byte-by-byte basis. Since no data-type information is passed, you have to explicitly pass the size, like this:

```
var
  Str1,Str2 : string[255];
begin
  Str1 := 'Hello, world.';
  Str2 := 'This is a test.';
  ASwap(Str1,Str2,256);
  ...
```

This would do a complete swap of Str1 and Str2, including the length byte (Str1[0] and Str2[0]) and all the currently unused bytes in both strings.

The Boolean function Identical overcomes a serious deficiency in Turbo Pascal. Turbo Pascal does not let you compare two records for equality; given the definitions:

```
type
  QuickRec =
    record
      F1,F2 : Integer;
      Whatever : Real;
      Name : string[10]
    end;
```

```
var
  Rec1,Rec2 : QuickRec;
```

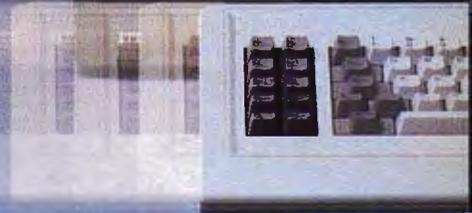
the expression "Rec1 = Rec2" is illegal. The function Identical, though, does a byte-by-byte comparison between the two records, so that you could write

```
if Identical(Rec1,Rec2,SizeOf(QuickRec))
  then WriteLn('records are identical')
  else WriteLn('records are different');
```

The same limitation (and solution) applies to arrays: You cannot do a direct comparison between two arrays, but

(continued)

ITT INTRODUCES THE FASTEST PC IN THE WORLD. BECAUSE TIME IS MONEY.



The new ITT XTRA™ XP is definitely out to break some speed limits and sound barriers.

Thanks, in part, to the added muscle of an Intel 80286 chip buried deep inside, the ITT XTRA XP runs circles around the competition.

It is, in fact, over three and a half times faster than the IBM XT.

And twenty-five percent faster than the AT on a Lotus recomputation.

And as if speed alone weren't enough, the new

XP actually speaks. And listens.

Using our optional Voice Communications Module, you can duplicate key-strokes with just your voice.

Leaving your hands free to go about their business.

You'll also find an extremely economical 3270 emulation option.

And our optional Integrated Graphics Adapter that displays virtually any program on the market — color or monochrome — on one monitor.

All backed by a world-

wide communications company dedicated to total office communication. **ITT listens, too.**

Call us at (800) 321-7661; or in California, (800) 368-7300.

Call today. Time is definitely money.

And time is something the XP can save you a lot of.

ITT

PERSONAL COMPUTERS

© 1985, ITT Systems, Inc.
IBM XT and AT are registered trademarks of International Business Machines; Intel 80286 is a registered trademark of Intel Corporation.

Inquiry 200 for End-Users. Inquiry 201 for DEALERS ONLY.

*Each library is independent
of the others, and there are
no identifier conflicts.*

you can use `Identical` to check them.

A certain danger exists in comparing records, especially if one record has not been directly assigned to the other. Certain fields, such as strings, may have unused portions that currently hold "garbage" values. If you're going to use `Identical`, then you should always fill a record with some value (preferably 0) before initializing its fields. Likewise, if you're changing string fields, then you might want

```

const
  Front      = True; { for use with Add and Take}
  Rear      = False; { ditto }

procedure InsertNode(var NPtr,TPtr : NodePtr);
procedure RemoveNode(var NPtr,TPtr : NodePtr);
function  GetNode(var NPtr : NodePtr) : Boolean;
procedure CreateList(var Header : NodePtr);
procedure RemoveList(var Header : NodePtr);
procedure Push(var NPtr,Header : NodePtr);
procedure Pop(var NPtr,Header : NodePtr);
procedure Add(var NPtr,Header : NodePtr;
             onFront : Boolean);
procedure Take(var NPtr,Header : NodePtr;
             offFront : Boolean);
    
```

Figure 5: Constants and routines in LINKED.LIB.

to zero out the entire string before setting it to its new value.

The last function, `Any`, is specific to sets. You pass it a set and a scalar variable (note that these do not have to be of the same data type, though you'll generally want it that way), as well as the size of the set. (Note: Since sets of the same type can be of different sizes, you should always take the size of the specific set you're passing.) If the set is currently empty, then `Any` returns `False`; otherwise, it returns `True`, assigns the lowest element of the set to the scalar variable, and removes that element from the set. In effect, this lets you set up a `For` loop with the following set of values:

```

var
  LoopSet : set of Byte;
  Indx: Byte;
begin
  LoopSet := [1,4,9,16,25,36,49,64,81,100];
  while Any(LoopSet,Indx,SizeOf(LoopSet)) do begin
    ...
  end
end.
    
```

The code within the `while..do` loop executes once for each value in `LoopSet`, with `Indx` set to each of those values, from the lowest to the highest.

LINKED LISTS

Pascal provides pointer and dynamic storage allocation, so you can create linked lists. The library `LINKED.LIB` is designed to make that as simple and painless as possible. Figure 5 shows the definitions for `LINKED.LIB`. It assumes that you have already defined two data types, `Node` and `NodePtr`:



GRAPHICS FOR WYSE

- ▶ I-300 Graphics field upgrade for Wyse Technology's WY-50, WY-75 terminals
- ▶ True Tektronix 4010/4014 graphics emulation
- ▶ 1024 by 800 pixel display, 1,000,000 pixels per second vector drawing rate
- ▶ Zoom, pan, rich native command set, hardcopy capability



CLEVELAND CODONICS, INC.
18001 Englewood Dr. • Cleveland, Ohio 44130
(216) 243-1198

Tektronix, Wyse Technology, Codonics are registered trademarks

```

type
  NodePtr = ^Node;
  Node =
    record
      Next, Last : NodePtr;
      {other data fields}
    end;

```

These must be defined before the {\$I LINKED.LIB} statement, since the library routines make reference to Node and NodePtr variables.

The routines in LINKED.LIB work on a circular, doubly linked list that uses a header node. "Circular" means that if you go through the list, you'll end up back where you began. "Doubly linked" means that each node points to both the previous and following nodes. A "header node" (usually) contains no information but just points to the start and the end of the linked list; if the list is empty, then it just points to itself.

InsertNode makes the node pointed to by NPtr follow the node pointed to by TPtr. In other words, after calling InsertNode(NPtr,TPtr), then TPtr^.Next = NPtr and NPtr^.Last = TPtr. By contrast, RemoveNode assigns TPtr to NPtr, then removes the node it's pointing to from the linked list. These are the two basic linked-list functions; all the other routines call one or the other of these.

GetNode is a bulletproof Boolean function for creating a new node (which you must do before you can insert it into the linked list). It makes sure that there is enough memory before creating the new node. If there isn't, it returns a value of False and sets NPtr equal to nil; otherwise, it creates a node, points NPtr at it, fills the data fields with all zeros, sets Next and Last to nil, and returns a True value.

CreateList sets up the header for you. If there isn't enough space, Header is returned with a value of nil. Otherwise, Header gets created, and its Next and Last nodes point to itself. This is the first routine you should call when using a linked list. By contrast, RemoveList is the last routine you should call. It removes all the nodes from the linked list, disposes of each of them (thus reclaiming the memory), and then disposes of Header.

The routines Pop and Push let you set up a stack or stacks. Since you pass the header node along with the node being pushed or popped, you can maintain several stacks simultaneously. Pop and Push make the appropriate calls to InsertNode and RemoveNode; if the stack is empty, then Pop sets NPtr to nil.

Likewise, with the routines Add and Take you can implement a queue or a deque (double-ended queue). Besides the node and header pointers, both routines expect a flag indicating whether to use the front (Header^.Next) or rear (Header^.Last) ends of the list. The constant values Front and Rear are defined for your use as that flag.

CONCLUSION

The idea of small, self-contained libraries as language extensions is a powerful one. It lets you expand the language as you need to. Indeed, Modula-2 can be thought of as a "bare bones" Pascal that is customized via libraries. Each of the libraries examined here is independent of the others, and there are no identifier conflicts between them (i.e., no data types, variables, or routines with the same names). Carefully crafted, well-thought-out libraries can greatly increase your effectiveness and productivity and can help you to customize Pascal to suit your own needs and tastes. ■



GRAPHICS FOR ZENITH

- ▶ I-200 Graphics field upgrade for Zenith Data Systems' Z-29, Z-29A terminals
- ▶ True Tektronix 4010/4014 graphics emulation
- ▶ 672 by 500 pixel display, 500,000 pixels per second vector drawing rate
- ▶ Zoom, pan, rich native command set, hardcopy capability

NEW! VT-102 compatible printer port accessory for Zenith Data Systems' Z-29/A terminals. Ask for our model 2910.

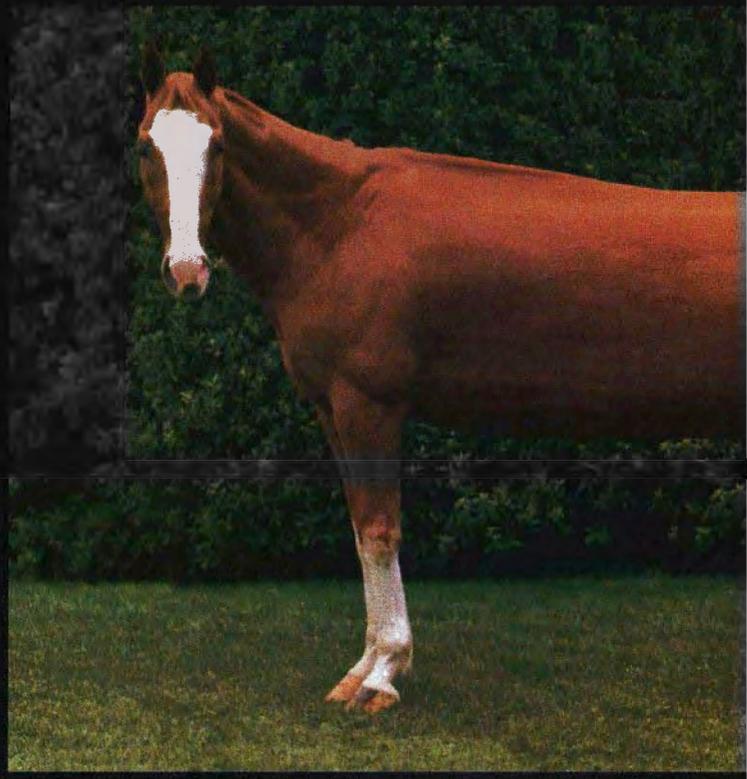


CODONICS
We Bring the Future into Focus

CLEVELAND CODONICS, INC.
18001 Englewood Dr. • Cleveland, Ohio 44130
(216) 243-1188

Tektronix, Zenith Data Systems, Codonics are registered trademarks

HENRY FORD TO CREATE A FOUR-



Although we're told that saddlemakers were all for the idea, and submitted some rather startlingly innovative ideas, breeding the perfect family horse just didn't seem right to Mr. Ford. His mind took a different tack, a new line of thought. A line of assembly. A whole new approach to providing people with a way to get from where they were... to where they wanted to go.

A whole new approach. That seemed like an excellent starting point for a relational database. We did not want to simply rewrite an arcane programming language or rework an old mainframe database.

Our goal was to create a relational database that would, for the first time, really combine power and ease-of-use. And we wanted to bring you that combination no matter what your application requirements or computer sophistication.

The goal has been achieved. If power and ease-

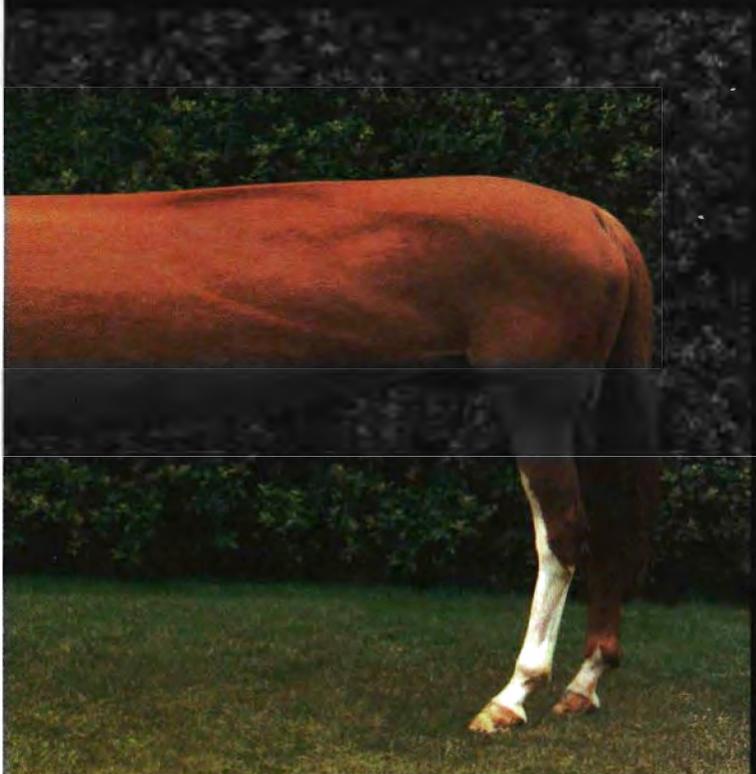
of-use seem to be a paradox you've heard before but never seen, you should know our name is Paradox."

Paradox brings what used to be the contradiction of power and ease-of-use together in several concepts.

First, Paradox brings an easy-to-use Lotus-like standard menu together with a powerful way to interact with the information in your database. With Paradox you simply type in an example of the information you seek, rather than having to write a line-by-line program to do things like join different tables or do calculations.

Second, Paradox brings a rather revolutionary new concept to personal computer technology. Known in artificial intelligence circles as "machine reasoning," Paradox uses this feature to evaluate your request and, *on its own*, writes a program for you that seeks the answer in the fastest possible way. Paradox then exe-

DIDN'T SET OUT -PASSENGER HORSE.



cutes this program and produces the answer. You don't need to know how the information is organized, how to best approach the problem or how to write a program.

The advantages of these features, aside from being rather fascinating we think, are incredible speed, an easy-going experience and a real opportunity to do more with a database than ever before.

If all of that sounds terrific but you're concerned about "driver's education," don't worry. The familiar Lotus-like menu is only one of many ways we've made Paradox easy to use. You'll hum right along.

There's a lot more we'd like to tell you about Paradox (which explains the very last paragraph), but you've really got to see it. All of this may give you that "easier said than done" feeling, when in

truth, it's now "easier done... than said!" We hope you'll visit your computer retailer and see it all for yourself.

You'll see a lot more than just an improved breed. You'll see a whole new way to handle data on the IBM® PC line, the Compaq® line and other 100% compatibles. A new way to get where you want to go with power and ease. We started from a clean base and now, it seems, we've left the others in the proverbial dust. Paradox. The Base of Departure."

*Part of the "lot-more" we'd like to tell you:
Easy importing and exporting of data from Lotus 1-2-3™, Symphony™, dBASE II®, dBASE III™, PFS:FILE®, VisiCalc® and ASCII / Complete report generator / Scripting (macros) with Paradox memorizing key strokes and commands as you go / Our own full-featured application programming language / Forms that you can design / Unlimited number of tables, each up to 260 million characters.*

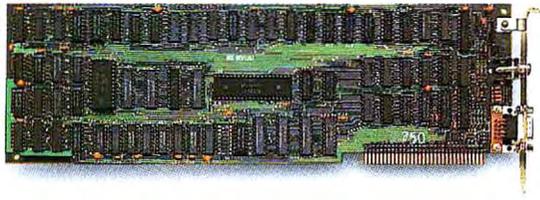
PARADOX™
Relational Database



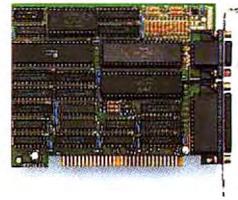
THE BASE OF DEPARTURE.

Compare the Hercules™ Color Card to IBM's.

Five reasons why the Hercules Color Card is better.



IBM Color Adapter \$244



Hercules Color Card \$245

- | | | |
|------------------|--|---|
| 1. Compatibility | Runs hundreds of graphics programs. | Runs the same hundreds of graphics programs. "The Hercules Color Card is so nearly identical to the IBM Color/ Graphics Card that it's almost uncanny." PC Mag. |
| 2. Printer port. | None. | Standard. Our parallel port allows you to hook up to any IBM compatible printer. |
| 3. Size. | 13.25 inches. Limited to long slots. | 5.25 inches. Fits in a long or short slot in a PC, XT, AT or <i>Portable</i> . |
| 4. Flexibility. | Can't always work with a Hercules Graphics Card. | Always works with a Hercules Graphics Card by means of a software switch. |
| 5. Warranty. | 90 days. | Two years. |

Any one of these five features is enough reason to buy a Hercules Color Card. But perhaps the most convincing reason of all is just how easy the Hercules Color Card is to use: "Right out of the box, the Hercules Color Card goes into an empty expansion slot, ready for you to plug in. . . and go to work—no jumpers, no software. For most applications, it's just that easy." PC Magazine.

Call 1-800-532-0600 Ext. 432 for the name of the Hercules dealer nearest you and we'll rush you our free info kit.

Hercules.

We're strong on graphics.

Inquiry 180

CD-ROMS AND THEIR KIN



Developments in optical data storage

The first users of personal computers preserved their data between work sessions (or system crashes) by punching holes in paper tape. It wasn't long before someone discovered how to harness an audio-

cassette recorder for that same task. Since that time, users have demanded ever-increasing speed and capacity in microcomputer data storage and the simple tape gave way to the floppy disk and then to the hard disk. However, the device remained the same: A magnetic field was used to read and write the bits of data.

But traditional magnetic disks now have competition; optical data storage has emerged from the laboratory.

Such optical storage devices, featuring data capacities in the hundreds of megabytes, claim several other advantages over traditional storage: freedom from danger of head crashes, possibility of interchange of disks between drives, and good data permanence.

TYPES OF OPTICAL STORAGE

Just as there are different kinds of magnetic storage devices, there are a variety of optical disks and drives: drives that can only read prewritten data; drives that can be used to imprint data permanently (that is, non-erasably); and drives that can read, write, and erase data on disks.

The simplest optical storage peripherals are the read-only devices. These are used in much the same way as a phonograph record: You buy a program or a database on an optical disk that has been recorded by a professional vendor and "play it back" on the read-only drive. Read-only optical disks promise easier distribution of large software products than has been

(continued)

Richard S. Shuford, formerly a BYTE special-projects editor, is currently a scientific programmer for Siecor Corporation (489 Siecor Park, Hickory, NC 28603).

possible with floppy disks.

If you need to record your own data, the only products currently available off the shelf are optical drives that use a nonreversible process to write data onto their media. Once written, the data can be read back as many times as needed, so that these peripherals are sometimes known as write-once, read-mostly (or WORM) drives. Write-once devices are being used for archival service and for on-line storage in applications where large sets of data are kept that never, or rarely, change.

Data can be recorded on an optical disk by exploiting a wide variety of physical or chemical effects that change either the reflectivity or transmissivity of the media. In a read-only disk, bumps or holes representing bits are formed when the disk is manufactured. In a writable system, any of several phenomena may be exploited to modify a disk from its unwritten condition.

It's not too great a trick to make an optical disk on which you can write data once, indelibly. Several manufacturers, including Alcatel Thomson Gigadisc (ATG), Optimem, Information Storage Inc. (ISI), and Optotech, are beginning to deliver computer peripherals with this capability.

Write-once recording uses the concentrated energy of a strong laser beam to modify a tiny region in a thin sensitive layer in the disk to represent a 1 bit (an unmodified area represents a 0 bit). This modification varies from system to system, but the common effects are ablation, deformation, bubbling, and melting. Later, when a lower-power laser beam is passed over the disk, the written area reflects the beam in a manner different from its surroundings, or not at all. A photodetector can sense the change in reflectivity and generate an electrical signal corresponding to a 1 bit.

Figure 1 shows the structure of a write-once optical disk; in this case, it is that used by Optimem and ATG. The sensitive layer is a thin film of precious-metal alloy sitting on top of a polymer cushioning layer, all of

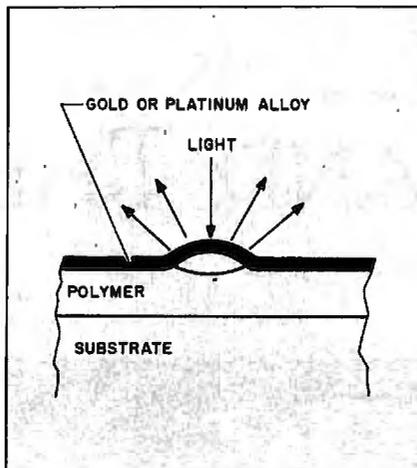


Figure 1: In a write-once optical disk, the readable 1 bit is made by a strong laser beam melting, bubbling, or otherwise deforming the sensitive layer of the media.

which resides on top of a stiff glass substrate. Two layers of this structure can be placed face to face (with separators) for two-sided recording. In practice, the disk has concentric tracking grooves, not shown here, embossed into it during manufacture; the data bits are actually written into the grooves.

The permanence of the melted holes or deformed bubbles is desirable in archival applications, but devices incorporating them are inherently limited to write-once operation. While write-once technology has many potential uses, an optical storage system that can also be erased and rewritten is so obviously desirable that dozens of research teams around the world are feverishly working to develop a practical read/write system. Research is proceeding along two paths: one purely optical and the other a hybrid that borrows a few points from magnetic storage.

CHANGING PHASES

The pure-optical technique of reading and writing (and rewriting) involves changing the physical phase of a thin metal-alloy film.

In the *phase-change* process, the disk contains a thin film of metal alloy (based on tellurium or selenium) that is initially in a polycrystalline state. To

record a bit representing a binary 1, a relatively high-power beam of laser light is concentrated on a small area, inducing heat and causing the film at that spot to melt (changing its phase from a crystalline to an amorphous state). During read-out, when a low-power laser beam is shone on the spot, the amount of light reflected from the amorphous area is less than that reflected from its crystalline surroundings, and the spot appears dark. The data can be erased by applying laser energy and generating enough heat in the film to anneal the material back into the crystalline phase.

One reason phase-change data storage is taking so long to develop is the difficulty of choosing the materials for the disk's sensitive layer. The medium must be sensitive enough that the laser beam's heat can deform it in a few tens of nanoseconds, and it must have enough affinity for crystallization that it can be annealed under slightly less heat in microseconds; yet it must be stable enough in the amorphous condition to stay that way at room temperature for years (see figure 2).

OF LASERS AND MAGNETS

The hybrid *magneto-optic* system for reading and writing (and rewriting) borrows much from conventional magnetic technology and is sometimes referred to as *thermomagnetic* or *optically assisted magnetic storage*. The first commercially distributed medium for magneto-optic data storage was announced by the 3M company. Various companies have demonstrated prototypes of the medium.

A magneto-optic disk drive uses both a laser apparatus and a magnetic read/write head. The sensitive layer of the disk is composed of an alloy film of rare-earth and transition metals, such as TbFeCo (terbium, iron, and cobalt) or GdTbFe (gadolinium, terbium, and iron). In the unwritten state, the magnetic domains in these materials are unaffected by the field of the read/write head. However, when intense light from the laser is focused on a point within the head's

(continued)

Pascal Unlimited.

Once you've gotten some experience under your belt, you'll find that even with a very decent program like Turbo Pascal®, you start scraping the ceiling of its abilities. You need a Pascal that's conditioned for the serious developer.

New Microsoft® Pascal.

A totally comprehensive and complete package, it lets you tackle large projects by giving you the utilities, features, and support libraries that professionals expect.

Unlike Turbo, Microsoft Pascal offers separate compilation. So you can create your own module to use and re-use in your Microsoft language programs.

In addition to full XENIX® compatibility, our compiler also supports the new Microsoft and IBM® Networks.

If you've already invested in Turbo Pascal, we'll make it worth your while to move up. We're offering a rebate of \$40 when you upgrade to Microsoft Pascal.

For the name of your nearest Microsoft dealer, call (800) 426-9400. In Washington State, Alaska, Hawaii and Canada, call (206) 828-8088.

Microsoft Pascal Compiler Version 3.3 for MS-DOS

	Microsoft Pascal v 3.3	Borland Int'l Turbo Pascal v 3.0
Separate module compilation	Yes	No
Conditional compilation	Yes	No
Full memory usage (to 1 megabyte)		
program code	Yes	No
data	Yes	Yes
Overlay support	Yes	Yes
Math library support		
8087/80287 emulation	Yes	No
8087/80287 coprocessor support	Yes	No*
Floating-point	Fast IEEE	non IEEE
BCD floating-point	Yes	No*
MS-DOS® 3.1 network support (incl. IBM LAN)	Yes	No
Link multiple routines	Yes	No
Link existing third-party libraries	Yes	No
Link with Microsoft FORTRAN, C and Macro Assembler	Yes	No
Relocatable object format	Yes	No
Transport source between MS-DOS and XENIX	Yes	No
Do source level debugging	Yes	No
LINKER included	Yes	No
Library Manager included	Yes	No
Utility to modify and examine header	Yes	No
Compress utility	Yes	No
Pascal Benchmarks—done on a COMPAQ Plus™ with 512K memory with no 8087		
	—Execution Time—	
Gauss-Seidel	:05.15	:07.60
Sieve of eratosthenes	:13.15	:15.88
Trig	:13.11	:34.97

*Option available separately



Microsoft, XENIX and MS-DOS are registered trademarks and The High Performance Software is a trademark of Microsoft Corporation. IBM is a registered trademark of International Business Machines Corporation. Turbo Pascal is a registered trademark of Borland International, Inc. COMPAQ Plus is a trademark of COMPAQ Computer Corporation.

field, the laser heats the alloy to a temperature above its Curie point, where it is easily magnetized by even a small field. As the laser beam passes and the spot cools, the medium retains the magnetization of the field and forms a tiny magnetic do-

main. Such magnetized regions may be much smaller than the gap spacing of any ordinary magnetic head.

The real cleverness comes in reading the data back. Certain alloys of rare-earth and transition metals have a peculiar effect on polarized beams

of light, rotating the angle of polarization slightly in a direction that depends upon the direction of magnetization of the domains in the alloy. When this effect occurs through reflection, it is called the Kerr Rotation; if the light is transmitted through the layer, the effect is termed the Faraday Rotation. By aiming the laser back at the recorded bit area (at low power), magneto-optic systems can detect the different polarity angles that represent 1s or 0s of data.

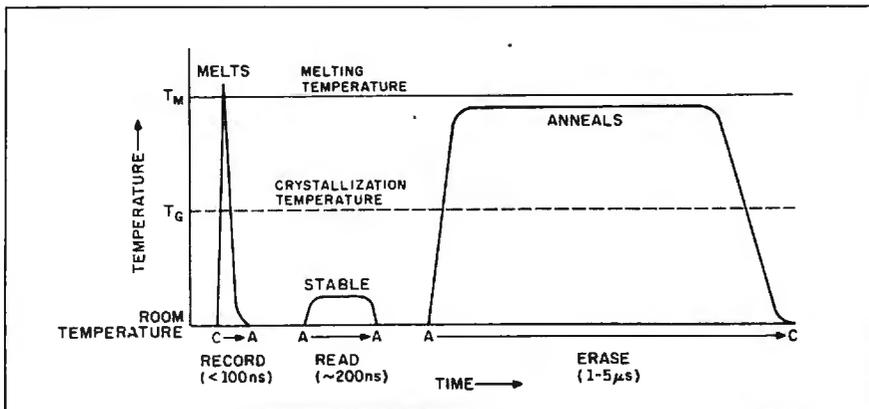


Figure 2: Media for phase-change optical disks can be changed from crystalline to amorphous state by nanoseconds of high heat, and changed back by microseconds of slightly less heat, but they must be stable at room temperature.

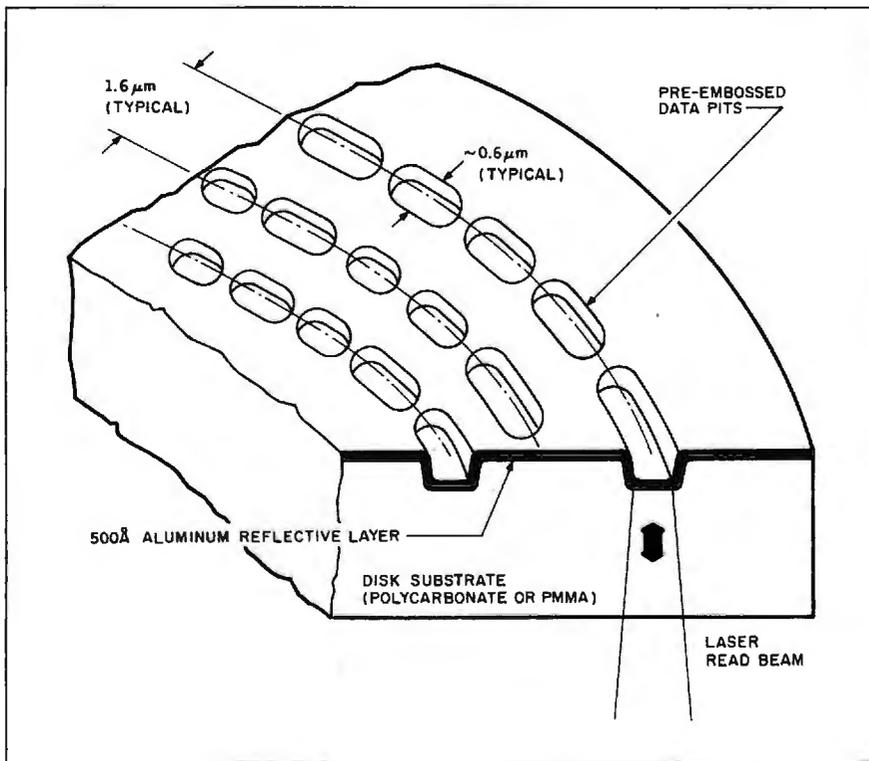


Figure 3: The composition of a typical CD-ROM. The plastic substrate supports an aluminum reflective layer. The data-bearing pits are embossed during the disk's molding; aluminum is then sputtered onto the substrate.

READ-ONLY TECHNOLOGY

Before magneto-optic or even write-once technology becomes widespread, you're likely to hear a lot about another type of data storage—a type that has its roots in a heretofore unrelated realm of electronic endeavor, high-fidelity audio. The same technology used in Compact Discs (CDs) can be easily and inexpensively adapted for use in personal computer systems.

Within the past year Sony, North American Philips, Hitachi, Denon America, and others have announced the development of computer peripherals that incorporate the basic mechanism used in audio CDs. These devices can read data that has been encoded onto a commercially prepared disk, and thus are called CD-ROMs, or compact-disk read-only memories.

The composition of a CD-ROM disk is shown in figure 3. A substrate of plastic (usually polycarbonate, although polymethyl methacrylate [PMMA] has been proposed) supports an aluminum reflective layer, over which another plastic layer has been laid for protection. The interface between the layers is characterized by pits spaced at more or less regular intervals in circular patterns—actually part of one long spiral. The 780-nanometer laser beam is focused on the aluminum layer, so it sees right through the protective layer and even through small amounts of debris on the outside of the disk (see figure 4).

Each CD-ROM disk is recorded in constant-linear-velocity mode. The

(continued)

New Version

Sizzling C.

The fastest C. The C that Microsoft developed to write its own software programs. Hot.

So hot that we can make this claim: Virtually every program runs faster with Microsoft® C Compiler than with any other MS-DOS® C compiler.

Efficient C.

We give you everything you need to write code so tight your computer will scream.

"Preliminary testing on the Microsoft C Compiler produced code that was significantly smaller than that produced by other C compilers."

Paul Springer, Ashton-Tate.

"We found the FAR pointer very helpful for situations where a mix of memory models offers the greatest efficiency."

Robert Frankston, Software Arts.

"The portability of the code between MS-DOS and XENIX® is great."

Jim Bean, Peachtree Software.

But it's really no surprise that our C stretches your micro to its limits. We wrote both the MS-DOS and the XENIX operating systems.

For the name of your nearest Microsoft dealer, or to upgrade from Microsoft C Compiler or Lattice C, **MICROSOFT**, call (800) 426-9400. The High Performance Software™

In Washington State, Alaska, Hawaii and Canada, call (206) 828-8088.

And make your programs really cook.

Microsoft C Compiler Version 3.0

Microsoft C Compiler

- Produces compact code and fast executables.
- Implements register variables.
- Small, Medium and Large Memory model Libraries-Mix models with NEAR and FAR pointers.
- Transport source and object code between MS-DOS & XENIX operating systems.
- Library routines implement most of UNIX System V C library.
- Choose from three Math libraries and generate in-line 8087/287 instructions or floating point calls.
 - Floating point emulator (utilizes the 8087/287 if installed).
 - 8087/287 coprocessor support.
 - Alternate math package—extra speed on systems without an 8087/287.
- Link routines written in Microsoft FORTRAN (V 3.3 or higher), Microsoft Pascal (V 3.3 or higher) or Microsoft Macro Assembler.
- Supports MS-DOS pathnames and Input/Output redirection.
- File sharing and record and file locking is supported.
- Do source level debugging, with the Symbolic Debug Utility, available separately with the Microsoft Macro Assembler Package.*

Library Manager

Create, organize and maintain your object module libraries created with Microsoft languages.

Object Code Linker

Simple overlay linker combines relocatable object modules created using Microsoft Languages into a single program.

• Link very large programs (over 1MB, using overlays).

EXEPAK Utility

A new utility to compress sequences of identical characters from an executable file and to optimize the relocation table.

EXEMOD Utility

A new utility used to modify the fields in the header according to the instructions given by the user in the command line.

*C Benchmarks—done on a Compaq Plus with 512k memory with no 8087. Program "SIEVE," with register variables,

	Exec Time	Code Size	EXE Size
Microsoft C	:9.39	141	5,914
Lattice C	:12.24	164	20,072

*Purchase both Microsoft C Compiler and Microsoft Macro Assembler and get a \$25 rebate direct from Microsoft. See package for details.

Microsoft, MS-DOS and XENIX are registered trademarks and The High Performance Software is a trademark of Microsoft Corporation.



MSOFT

claimed capacity of a CD-ROM disk differs between manufacturers but is agreed to be at least 540 megabytes. This generous storage region is divided into blocks; the user-addressable portion of each block is 2048 bytes, and there are around 270,000 blocks on a disk. Software houses are

already studying the potential of this medium for distributing programs and databases too large to fit conveniently on a floppy disk.

DRIVE STRUCTURE

Figure 5 shows the physical structure of the pure optical and magneto-optic

disk drives. In addition to the mechanical parts needed to spin the disk, the key elements are the laser and the data photodetector. A complex secondary optical structure links these together, providing the path through which the light beam travels. These secondary components include various prisms, beam splitters, mirrors, lenses, wavelength filters, and polarizing filters; most designs also have more than one photodetector for ease of tracking. The heavier components of the light path are mounted in a stationary position off to the side, while the remaining components are mounted on a carriage across the radius of the disk; this permits reading and writing any track on the disk.

Three types of movement occur in aiming the laser beam at the disk. A coarse-tracking mechanism moves the entire optical head back and forth along the radius of the disk. Fine adjustment of tracking is performed by the galvo-mirror, which deflects the light beam to modify its angle of incidence to the disk. And a lens mounted on a voice-coil-type actuator moves in and out to maintain focus on the data-bearing layer of the disk.

The disks in many systems contain embossed tracking grooves that absorb or scatter part of the light; the scattering varies according to how much light is falling on the walls and how much on the bottom, resulting in variations in reflected intensity that allow the tracking photodetector to tell whether the laser is aimed in the right place. When the reflected beam is directed onto the data photodetector, the variation in intensity can be measured so that the disk drive can tell if the beam has passed over a recorded area.

The data rate of optical disks varies. The Philips CD-ROMs run at 150,000 bits per second, whereas drives for larger systems often record at 3 megabits per second.

Some drives maintain the synchronous timing of the system through the presence of very shallow depressions, not as deep as a fully written data pit

(continued)

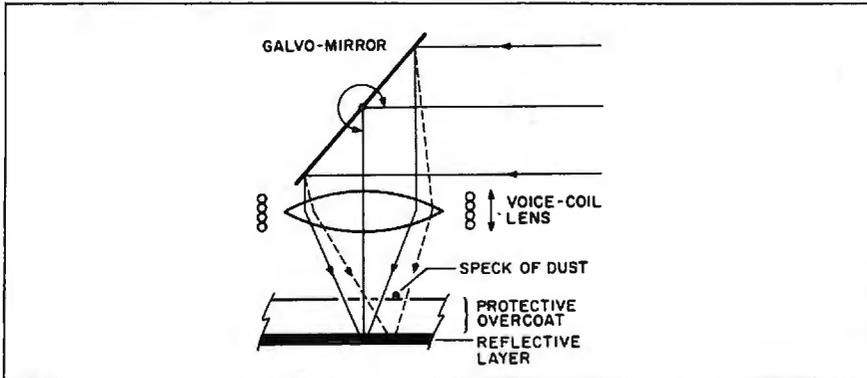


Figure 4: The optical head contains two significant mechanisms. The galvanometer-mounted mirror (galvo-mirror) rotates slightly on an axis parallel to the disk to provide the fine-scale tracking adjustment essential to correct for minor wobble, disk asymmetry, etc., as well as high-speed track-to-track access for up to 25 tracks (spaced at 1.6 microns). The voice-coil-mounted lens keeps the laser beam in focus on the reflective layer. Both these tracking mechanisms are servo-controlled by corrective signals derived from photodiode arrays that sense the intensity of the reflected laser light.

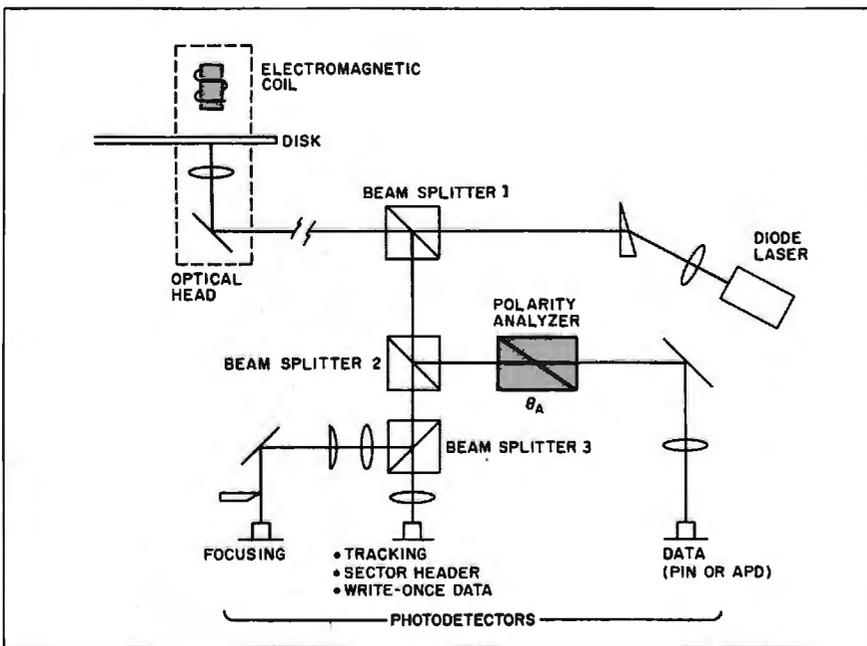


Figure 5: The physical structure of a typical optical-disk drive. Shown here is a magneto-optic drive. Without the electromagnetic coil and the polarity analyzer (shown in red), the figure would represent a purely optical drive.



Westinghouse brought in TI's Personal Consultant™ because these experts don't have time to waste.

Personal Consultant is the expert systems development software that's turning the time they spend answering routine questions into research and development.

Dr. Neil Pessall and Dr. Jan Schreurs, research scientists at the Westinghouse Research and Development Center, had a problem. How could they make hundreds of man-years worth of practical knowledge at the Center readily available to Westinghouse and its customers, without pulling the scientists away from their research to answer routine questions?

Their solution was Personal Consultant, a new expert systems development software tool from Texas Instruments for TI or IBM® personal computers.

Designed to run on 512K-Class Personal Computers, Personal Consultant

provided Westinghouse an eminently affordable new tool for the development of expert systems. Pessall and Schreurs were especially impressed with its ability to aid experts in developing the knowledge bases and prototyping programs which even first-time computer users could consult for expert advice.

"With Personal Consultant software," says Schreurs, "we found it far easier to teach our experts how to develop a system than teach a programmer to be an expert." In fact, the software's rapid expert system prototyping and simple debugging features enabled the two scientists to demonstrate three different expert systems in as many weeks. Schreurs produced one for training new salespeople and a second to guide repairs and maintenance for the Center's X-ray diffractometer.

Pessall's makes material recommendations for tubes and support plates in steam generators.

"Our development of expert systems isn't aimed at replacing experts," says Dr. Pessall. "Its purpose is to give them the time to extend their expertise while the expert systems handle consultations on well-established knowledge and methodology."

To put Personal Consultant from TI to work for your business, call (800) 527-3500, in Canada call (416) 884-9181. Because an expert's time is too valuable to waste.


**TEXAS
INSTRUMENTS**
Creating useful products
and services for you.

28231
© 1985 TI
Personal Consultant is a trademark of Texas Instruments Incorporated.
IBM is a registered trademark of International Business Machines Corporation.

would be. These modulations within the grooves form a "subliminal" clock signal under the main data stream that increases the accuracy of read-out. In addition to user data, encoded block-header and sector-identification data also appear on the disk. Different manufacturers vary in practice on whether the header information is embossed during molding or recorded in the usual way.

PROBLEMS

The most immediate problem with optical storage—faced by those who invest in the new write-once drives—is that very few software packages can work with a storage medium that cannot be erased. Even accounting packages, where permanent audit trails abound, were developed to run under operating systems assuming erasable magnetic media.

The first purchasers of CD-ROM drives will face a problem common to new technologies: There will not be much software available to use with their new machines. To take greatest advantage of the storage format and access characteristics of the CD-ROM, the data stored on the disks will have to be specially prepared before the disks can be pressed. Companies that plan to use CD-ROMs for distribution

of large databases will have to learn how to do it most efficiently.

There is little progress so far toward standardization. For example, even as Atari and Activision were announcing a CD-ROM product at this year's Consumer Electronics Show in Chicago, Sony Corporation disclosed at the annual conference on optical storage for small systems that it was abandoning support of 12-centimeter (4.7-inch) CD-ROMs in favor of new 13-cm (5¼-inch) DataROM disks—an action that sent manufacturers and software vendors scurrying to adjust their plans (see *Microbytes*, August BYTE, page 9). We can't expect much standardization in a field so new and rapidly changing, but many otherwise attractive optical storage devices and media being developed are not compatible with any other equipment.

The thin, sensitive active layers of writable optical media, while encapsulated in protective layers of glass or plastic, are still subject to some aging and corrosion. One reason for the use of polycarbonate in substrates rather than the optically nicer PMMA is that PMMA absorbs more water from the air. Thus, disks made from PMMA may be more prone to microcorrosion of the data-bearing layer.

Although extensive tests have been

run by every company developing this technology, the ultimate longevity of data stored on these new media can be proven only by the test of time. Some drives automatically keep track of the raw error rate for each disk. When the error rate goes over a certain point, the overworked error-correcting circuitry recommends that the disk be retired.

The raw error rate of even a spanking-new optical disk is still much, much higher than that of inductive magnetic media. And the most common means of alleviating this problem, the use of error-correcting Reed-Solomon codes, introduces a couple of its own stumbling blocks: The electronic components that perform the error correction increase the cost and complexity of the devices, and the technique decreases the capacity of the optical disks to contain useful information.

The DRAW (direct read after write) error-correction technique, highly favored just a few years ago, has not been used in recent designs. The extra read operation takes too long to be practical when data is being recorded at high data rates, and it doesn't work at all in cases where errors are introduced during mass

(continued)

LASERS PERMIT HIGH DENSITY

The key component that allows an optical disk to store so much information in so little space is the laser. A beam of light can be focused precisely on an information-bearing medium in an area much smaller than the area covered by the magnetic head of a traditional disk drive.

In general, merely recording data at ever-increasing densities is not as hard as reading it back. Up to some theoretical limit, in both magnetic and optical processes you can cram bits increasingly close together on the recording surface. The problem comes when you have to detect and sort out the bits.

The traditional magnetic data-storage

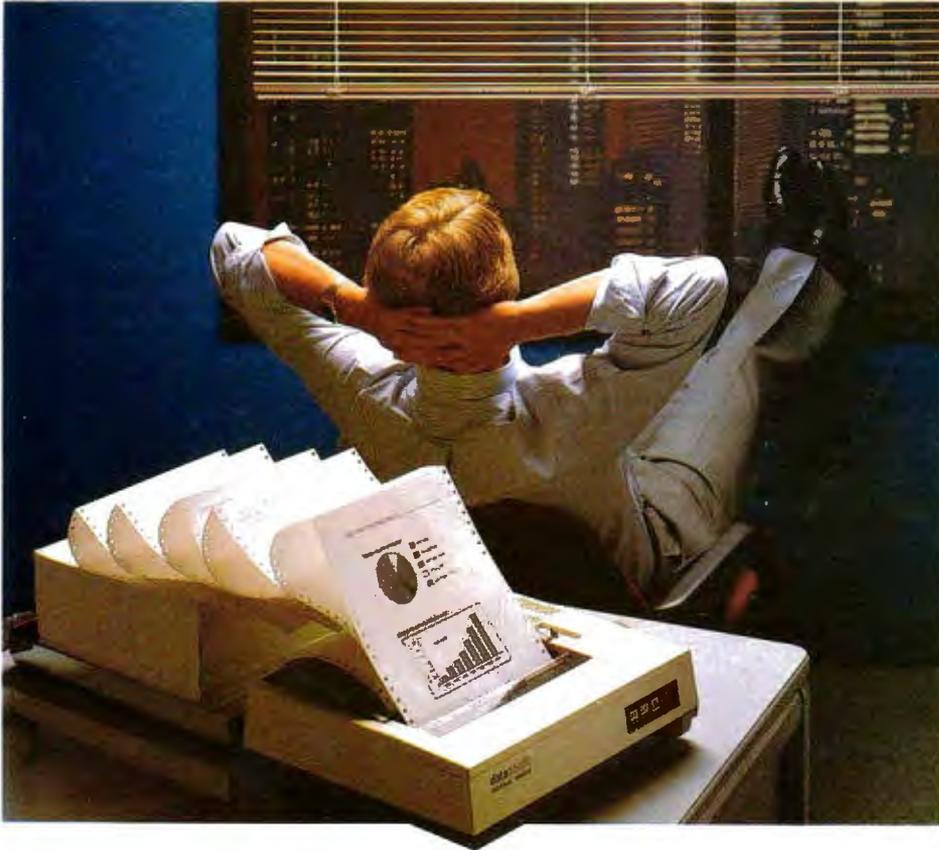
process depends on the inductance of the read head generating a tiny electrical current when the head passes over the magnetic domain that represents a bit. (You can think of the disk platter and head as an extremely inefficient electric generator.) If the domain is below a certain size (which varies between disk designs), its field is too weak, so the head amplifier cannot detect the current and the bit is not read.

The key advantage of optical storage in this regard is that the energy required for detecting the bits is supplied from outside the system. The coherent light beam of the laser is focused onto a tiny spot on a storage

medium, and the effect of the medium on the light is measured.

With the high-precision optical gear available today, the beam can be made to converge on an area as small as 1 micron in diameter—and can read a data bit stored in an area of that scale. The linear density of bits in a track on a typical optical disk runs about 35,000 bits per inch, compared with 15,000 bits per inch in a high-performance traditional magnetic disk drive. With a track-to-track spacing somewhere around 1.6 microns, an optical drive can store around 560 million bits per square inch of surface—more than 20 times that of a very good magnetic disk.

IT'S NICE TO HAVE A WORKAHOLIC PERSONALITY AROUND THE OFFICE.



Relax.

When you need hard copy, leave the hard work to your office workaholic—a Datasouth printer. There's a high performance workaholic Datasouth for every hard copy job around your office.

Move mountains of words and data with a never-say-die DS 180 or a DS 220. Type out correspondence with a speedy DaisyWheel 36. Or get an all-purpose Personal Printer to work overtime next to your desktop PC.

And get personal support direct from Datasouth, toll-free.

Set up an interview with a high performance workaholic today. Call for the name of your nearest Datasouth distributor.



datasouth

H I G H P E R F O R M A N C E

P R I N T E R S

AVAILABLE NATIONWIDE
THROUGH OUR NETWORK OF
SALES AND SERVICE DISTRIBUTORS

Datasouth Computer Corporation
Box 240947 • Charlotte, NC 28224
704/523-8500 • Tlx 6843018 DASOU UW

CALL TOLL FREE:

1-800-222-4528
Ext. 507

WRITE YOUR OWN APPLICATIONS IN LESS THAN 1 HOUR

WITH



Generate entire applications, including reports and menus, from start to finish with amazing speed.

- 300 fields per logical screen, 4 physical screens per logical screen.

- Screens are compiled, not interpreted.

- Predefined I/O types of String, Real, Integer, Phone and Date. User definable types.

- Bullet-proof Data Entry.

- Generates entire Database programs with Add, Change, Inquire, Delete and Backup functions predefined.

- Includes algorithm (and uses) resident Binary Tree Indexing for no wait lookups. Easy to change to other methods.

Visit us at Comdex, Booth #H8142.

- Generates easily modifiable code.

- Completely menu driven.

- Includes Database Generator, Report Generator, Menu Generator, and I/O Function Generator (to define additional I/O types similar to phone and data types, which are predefined).

REQUIRES: Turbo Pascal and PC-DOS 2.0 or higher. Soon available on MS-DOS.

\$59.95 unprotected (includes postage and handling)

CALL TOLL FREE 1-800-JMC-8667

or 1-404-736-8265

JMC Research, Inc.
803 Eisenhower Drive
Augusta, Georgia 30904



CD-ROMS

The attraction of optical data storage is its great capacity.

replication of the disks or by simple aging of the material.

System integrators have a few special problems to look out for. One of them is the variety of methods for interfacing the optical drives to computers. The SCSI (small computer system interface) is often mentioned as a good way to go about it, but the SASI (Shugart Associates Standard Interface) also has proponents. And one maker of CD-ROMs (Philips) uses a high-speed serial interface.

Aside from the intangible value of possessing the most advanced computer add-on available, the attraction of optical data storage is its great capacity. One certainty of computing is that applications always expand to fill available memory. With the main memory of microcomputers currently growing into the 1-megabyte range, the demand for more capacity in secondary storage will make optical storage technology increasingly attractive.

While magnetic storage is also getting better, proponents of optical storage claim that optical will always stay ahead in capacity. When optical disks match their theoretical advantages with practical attractiveness, you'll see a lot more of them. ■

BIBLIOGRAPHY

de Haan, Maarten, Chris Steenbergen, and Di Chen. "Optical Memory Research Pays Off." *Computer Design*, October 1, 1984, page 85.

Miyaoka, Senri. "High-Density Storage Possible with Optical Disk Recording." *Journal of Electronic Engineering*, September 1984, page 94.

"Optical Disk Memory Materials." *Journal of Electronic Engineering*, September 1984, page 138.

Sprague, Robert A., ed. *Third International Conference on Optical Mass Data Storage*. Proceedings of Society of Photo-Optical Instrumentation Engineers, volume 529. Los Angeles, CA: January 22-24, 1985.

TOUGH LOCAL NETWORK PROBLEM:

"How can our department get our six computers and three printers to work together efficiently? We also want to be able to access outside data services and our future company LAN."

SIMPLE \$2995* SOLUTION: NetCommander

NetCommander is a smart, small Local Area Network manager. It lets you link from four to 40 computers and peripherals — in any mix of models and makes. A 50K buffer (expandable to 250K) makes sure that productivity is high — keeping fewer printers humming — while computer and PC users do their thing, without waiting for a printer, modem, or shared disk. Those devices can be specified with names defined by users — and allocated on the basis of availability and capability. And NetCommander handles multiple protocols and different baud rates simultaneously — without modifications to hardware or software. It will also tie into your company's LAN. The latest in a family of products in use since 1979, NetCommander is a smart, small, efficient network manager.

For more information, call or write:

NetCommander

Digital Products Inc. • The Simple Network Solution Company
600 Pleasant Street • Watertown, MA • 02172
(617) 924-1680 • Outside Mass., call 1-800-243-2333
And check out our 30-day trial evaluation.

*For 16 ports



MAKE THE CONNECTION . . .

Our **Connection** systems will solve your problem of trying to read and write diskettes or tapes from almost any computer system using your PC.

The **Diskette Connection** is a hardware system that enables the IBM PC or compatible to read and write most 8 inch, 5¼ inch, or 3½ inch diskettes.

With our **File Connection** software programs you can transfer data files between most computer systems, including CP/M, DEC, Honeywell, Univaq, IBM 3740, S/1, S/3, S/23, S/32, S/34, S/36, and S/38.

Our **Word and Typesetting Connection** programs use IBM standard Document Content Architecture (DCA-RFT) to transfer document files between most word processing and typesetting systems, including Compugraphic MCS, CPT, Displaywriter, OS/6, Multiset, NBI, Quadex, Xerox, and Wang.

Our **Tape Connection** system will read and write IBM or ANSI standard ½ inch 1600 BPI magnetic tape. A full size 2400 foot tape can store a 45 MByte file and be written in 6 minutes.

Since 1982, we have supplied thousands of systems to customers around the world, including IBM, NASA, AT&T, Kodak, and General Motors.

Our specialty is conversion systems and we can provide a solution to your problem. Call us today to discuss your requirements.

This ad is one of a series featuring NASA missions. For a free poster, send us your written request.

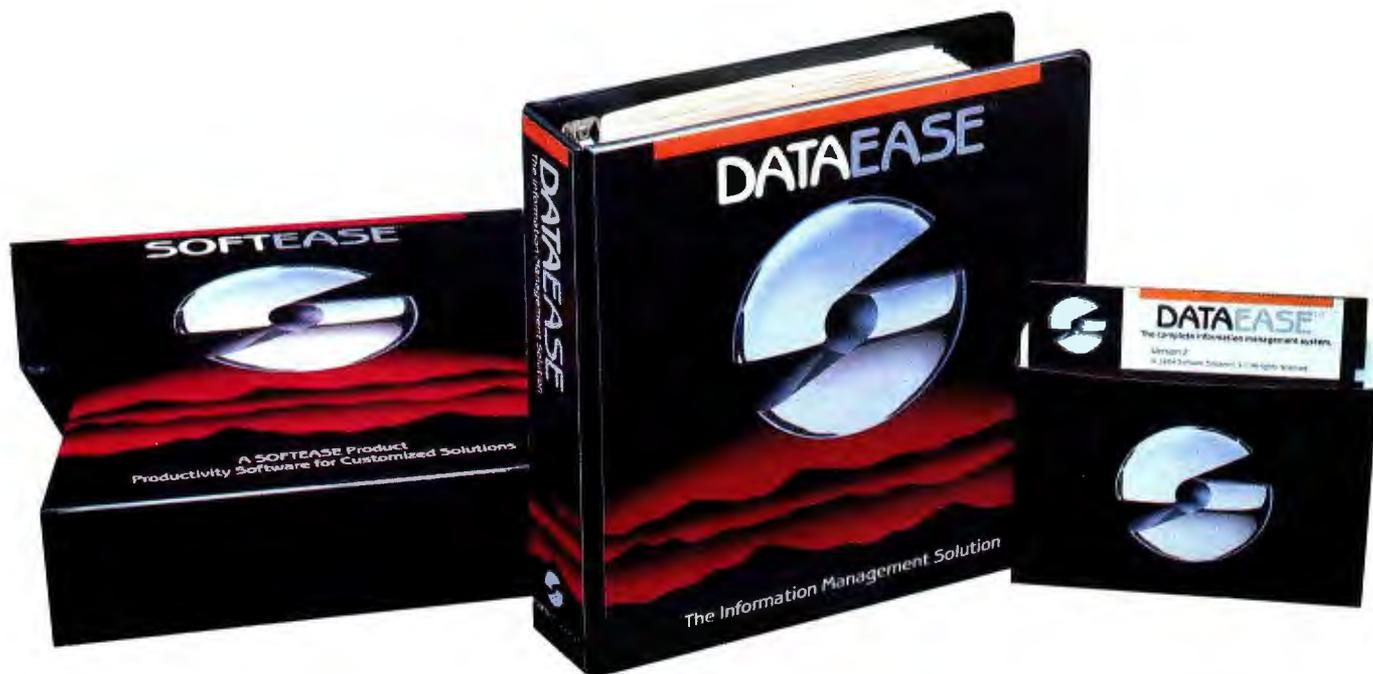
**Box 1970 Flagstaff, AZ 86002
(602) 774-5187 Telex 705609**

Inquiry 156 for End-Users. Inquiry 157 for DEALERS ONLY.

**SEE YOU AT COMDEX
BOOTH R8724**

. . . FLAGSTAFF ENGINEERING

**YOU CAN'T GET
A GOOD FEEL
FOR A
SOFTWARE
PACKAGE
FROM AN AD.**



Come see us at COMDEX

If you're searching through the ads in this magazine for the "right" software package, good luck.

Let's say you're looking for a data base manager. You read a dozen ads. Each one offers its list of features. Each one talks about the ideal combination of power and ease of use. And each one promises to "solve your problems", "answer your needs", or both.

Don't Believe Anybody

We could make the same claims for DATAEASE. Even before Release 2.5, tens of thousands of users made DATAEASE the corporate data base standard. We could tell you that they found DATAEASE to be an invaluable productivity tool because of its fully relational capabilities, full screen editor and unique combination of menus and commands. But don't believe us.

More than 100 reviewers from major publications agree with our productivity claims. Data Decisions called DATAEASE "perhaps the most effective blend of ease-of-use and performance available for PC users to date." But don't believe the reviewers.

Application developers, MIS/DP/IC managers, and all kinds of other users from Fortune 1000 companies throughout the country have reached strikingly similar conclusions. A user at General Instruments reports that "those same factors that

make DATAEASE preferable for non-programmers — ease of use and speed of development — make it the program of choice for many technical types, too." But don't even believe other users.

Nobody knows what you know.

Even if all these people are absolutely right about DATAEASE, does that mean it's the right product for you?

The best way to know if DATAEASE fits your needs is to get your hands on our free sample diskette. Fifteen minutes with the sample will give you a feel for our best DATAEASE yet — Release 2.5. It has features that appeal to all users; from developers to data entry people: A complete procedural language; quick reports at the press of a button; a direct interface to Lotus 1-2-3; the ability to move rapidly from file to file on a common piece of data; and built-in scientific, mathematical, financial, date, time, and string functions.

Productivity takes more than a good product.

It takes a good company, too. Buying a software package is the beginning of a relationship. Technical support, product upgrades, special corporate and dealer programs and informational seminars should all be part of this relationship. If the only thing you get is a product, forget about productivity. At Software Solutions, you find more than a product. You find software solutions.

Find out for yourself.

The advances in DATAEASE's Release 2.5, and the support behind it, offer you practical advantages that leave all the other data base managers far, far behind — including R:Base 5000™ and dBase III™. But don't believe us. Call or write for information and your free sample diskette today.



Software Solutions, Inc.

CALL OR WRITE FOR YOUR FREE SAMPLE DISKETTE.

Send information and a free DATAEASE sample diskette for my PC (check one):

IBM WANG DEC TI

Include materials relating to:

Corporate Client Retailer

MIS/DP/IC Professional VAD

Other _____

Name: _____

Title: _____ Phone: _____

Company: _____

Street: _____

City: _____ State: _____ Zip: _____

Mail to: _____ BYT 11/85

Software Solutions, Inc.,
12 Cambridge Drive,
Trumbull, CT 06611 Telex: 703972

Don't like samples? Then just call us. We'd be happy to talk about your information management needs and advise you.

800-243-5123

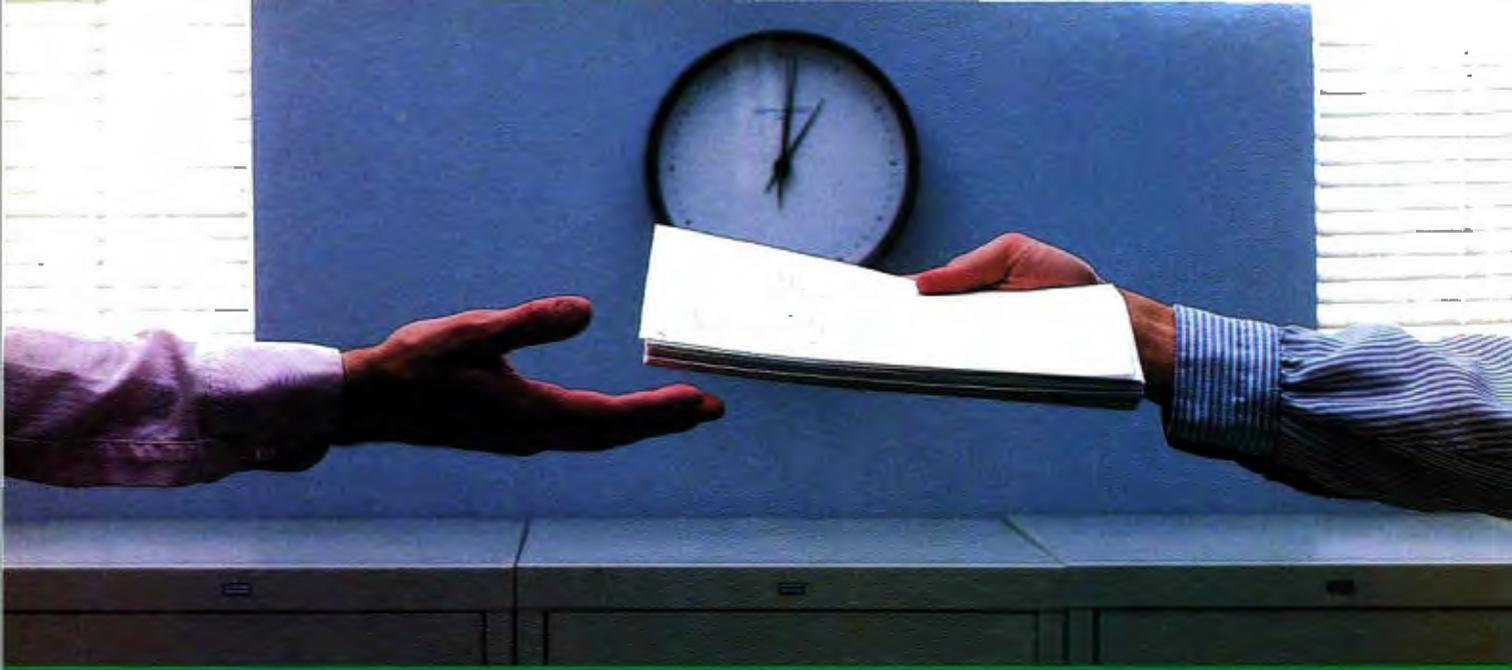
©1985 Software Solutions, Inc.
Trademarks are of their respective companies

Scandinavia
West Soft AS, Alesund, Norway, (47) 71-41141

Switzerland, France
Softsource, S&A 1222 Vesenz, Switzerland; 022-3518-55

United Kingdom
Sapphire Systems, Essex, 01-554-0582

West Germany, Austria
M&T Software Verlag, Munich; 089-4613-0



2400 bps modems: Do you Really need another speed?

- Is the shift from 300 to 1200 bps going to repeat itself at 2400 bps? The answer is both yes and no. There certainly are applications for 2400 bps asynch dial-up modems, but we shouldn't expect 1200 bps to die overnight.
- 2400 bps modems can improve throughput, thereby getting tasks done quicker and more economically. However, 1200 bps has become the virtual standard for professional dial-up communications, and most users are satisfied with it. So why consider a 2400 bps modem at all?
- One reason is flexibility. If the modem you select operates at all three speeds (300, 1200 & 2400) in accordance with accepted industry standards, it will serve virtually all dial-up applications now and in the foreseeable future.
- The modem you select should be the MultiModem224. It is Bell 212A and 103 compatible at 1200 and 300 bps, and CCITT V.22bis compatible at 2400. It is also 100% compatible with the Hayes command set, meaning that it will work with virtually all communications software packages, at all three speeds. Other features include both synchronous and asynchronous operation, full intelligence and a phone number memory.
- The MultiModem224 is available in both desktop and IBM PC™ internal card versions. (There is also a rack-mounted version for central sites.) And as a bonus, we provide free offers from ten of the most popular on-line information services, including CompuServe™, Dow Jones™ and The Source™.
- A 2400/1200/300 bps modem is just a plain good investment. Why not let the MultiModem224 provide your communications for both today and tomorrow?

Inquiry 269 for End-Users. Inquiry 270 for DEALERS ONLY.

For more information, call us toll-free at
1-800-328-9717 (in Minnesota, call **1-612-631-3550**).

MultiTech
Systems 

The right answer every time.

82 Second Ave. S.E., New Brighton, MN 55112 (612) 631-3550, TWX. 910-563-3610

MultiTech
Systems 

MultiModem 224
2400/1200/300 BPS Intelligent Modem



HIGHS AND LOWS OF PARAMETER PASSING

*You can access
assembly-language
routines from your
Pascal or
FORTRAN programs*

There are times when you need to know how to interface assembly-language routines to higher-level-language programs, specifically those using the Microsoft IBM PC Pascal, FORTRAN, and COBOL compilers. By using my techniques, you can control devices, use the speed of assembly language for certain calculations, and perform other tasks requiring low-level support and high-level control.

In this article, I use the Microsoft IBM Pascal Compiler and Assembler for illustrative purposes. However, the techniques apply directly to other Microsoft languages—particularly FORTRAN and COBOL—and to non-Microsoft languages. (I have applied some of these designs to 6809 p-code Pascal with great success.)

REASONING

A great benefit of languages like Pascal and FORTRAN is the simplification of tasks that are complicated on the machine level. You do not want to write the amount of code required to calculate the function $\sin(x)$ in assembly language. A language like Pascal liberates you from these wearisome programming tasks and lets you simply use the result of $\sin(x)$.

However, high-level languages es-

entially allow only one way to do things. FORTRAN has only one function, which is $\sin(x)$. In standard Pascal, the only way to display on the output device is with a write or writeln command. While these are usually sufficient, you occasionally need more. For example, the Microsoft Pascal compiler for the IBM does not provide cursor addressing. The cursor, for all intents and purposes, sits in the lower-left corner of the screen. It would be nice if you could tell the cursor where it should move to and then do the write or writeln. It would be ideal if you could write code like this:

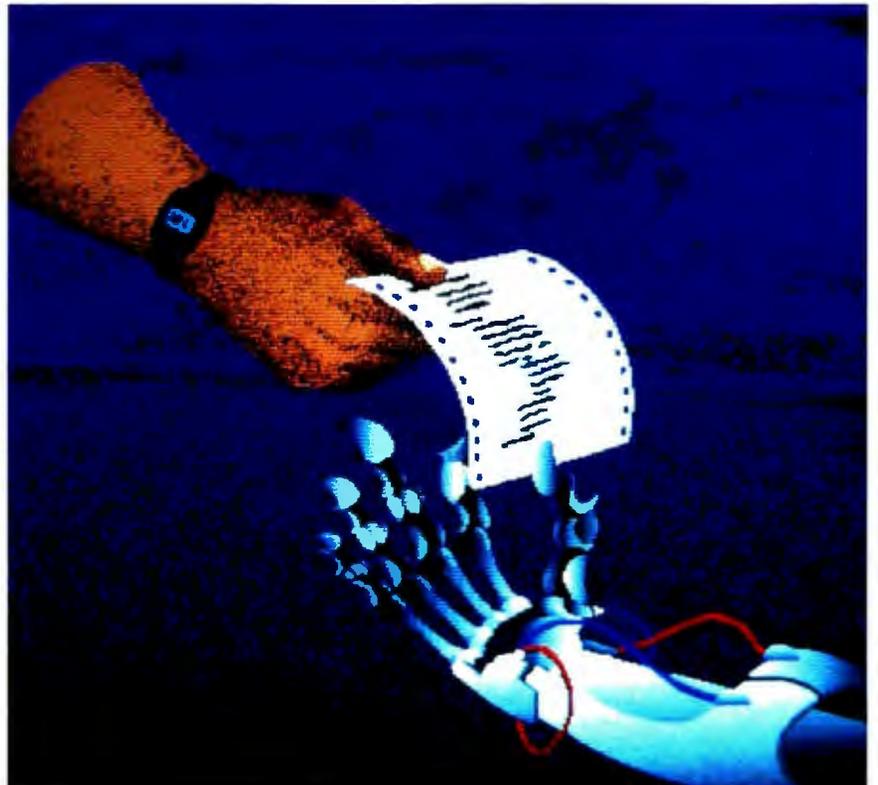
```
set__cursor(row,column);
```

```
writeln('This sentence begins  
at',row,',',column);
```

Writing the function set__cursor in assembly language and accessing it

(continued)

Michael Kilian (River St., Unit 3, Hudson, MA 01749) is currently a senior software engineer working on object-based compilers at Digital Corporation's Eastern Research Labs. He holds a master's degree from Rensselaer Polytechnic Institute and is the author of *Screen Machine*, a set of assembly-language routines that interface with Pascal to provide direct screen access, multiple windows on the screen from within the higher-level language, and the ability to get key input directly from the BIOS.



from Pascal gives you the ability to calculate row and column using easy number crunching in Pascal, FORTRAN, or even COBOL. You can also use Pascal to do the I/O (input/output) that is almost always tedious in assembly language. In short, you can write a program using a low-level function without writing the whole program in the low-level language.

GETTING THERE AND BACK

Pascal calls an assembly-language routine, referred to as an *external* routine, exactly the same as if it were a standard Pascal procedure. This involves an activation record that con-

tains bits of information, including return addresses, various pointers, local variables, and parameters for the procedure. For every procedure call Pascal makes, an activation record is placed on the program stack. For more information on activation records, see references 1 and 2.

Here is a simple example. Suppose you have the following declaration in a Pascal program:

```
procedure set__cursor(row,column:
                    integer); external;
...
set__cursor(5,10);
```

When the set__cursor call is reached,

the following actions occur to build the activation record. First, the integers 5 and 10 are pushed onto the stack. Since the formal parameters *x* and *y* were not declared as type VAR or VARS, the actual values are placed on the stack. This is referred to as *call-by-value* and differs from *call-by-reference*, which occurs with VAR-type parameters.

Next, the return address is pushed onto the stack. This is where the external routine should return. In this example, the return address occupies 4 bytes: 2 for a segment register and 2 for a byte offset into that segment. (In 8088 assembly language, this would be a FAR call.)

Control then transfers to the external routine responsible for maintaining a proper stack frame. See figure 1 for a diagram of the activation record at this time. Note that the stack grows from high memory to low. The base pointer of this stack frame is somewhere above (i.e., at a larger memory address than) the activation record. The stack pointer points to the last byte pushed on the stack. You can consider everything below the stack pointer free space for the external routine, which must now set up its own stack frame. The first step is to save the old frame pointer—the BP register—and set up a new one. You can do this with two instructions:

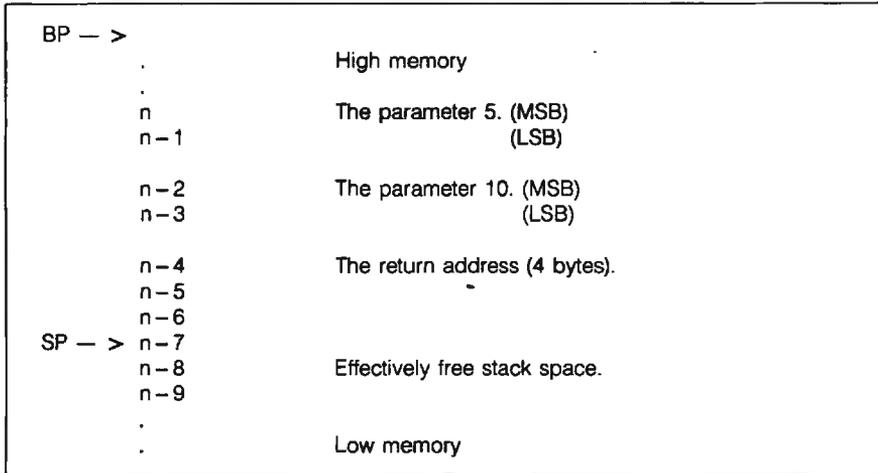


Figure 1: A diagram of the activation record when control is transferred to the external routine. Note that the stack grows from high memory to low.

```
PUSH    BP
; Save old frame pointer.
MOV     BP,SP
; And initialize a new one.
```

The stack now looks like figure 2. The external routine has its own stack frame and can proceed. It is also responsible for cleaning up after itself—removing the saved registers and parameters from the stack. This is as simple as establishing the stack frame and requires only two instructions:

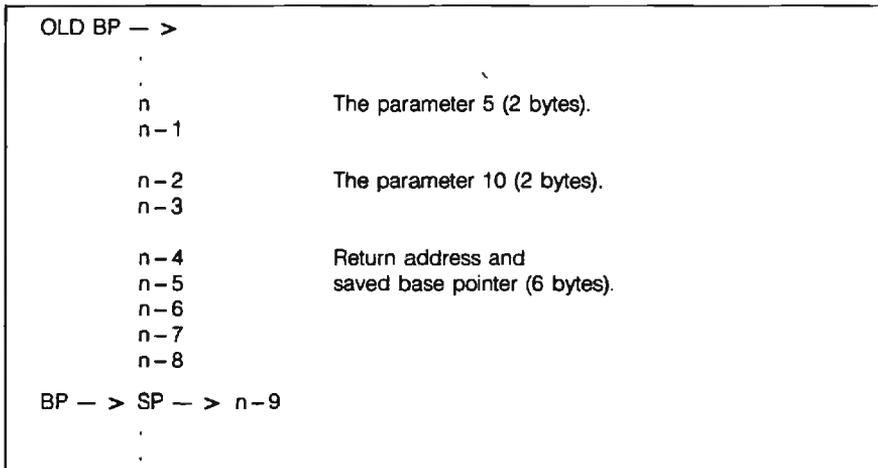


Figure 2: A diagram of the stack after the external routine has been activated. It now has its own stack and can proceed.

```
POP     BP
; Recover old stack frame.
RET     4
; Recover return address
; and remove parameters.
```

(continued)



IF STAYING WELL INFORMED CAN KEEP YOU WELL AHEAD, COMPU SERVE'S GOT BIG NEWS FOR YOU.

Introducing the Executive News Service and state of the art access to all the news you need.

CompuServe's exclusive Executive News Service is an electronic clipping service that puts the power and scope of the entire Associated Press news wire at your fingertips. Simply enter words or phrases that interest you ... from business to politics to hometown news. The Executive News Service then screens all state and national AP wires around the clock and files selected stories for reading at your convenience.

Then there's USA TODAY Update, with late breaking business information available

for quick analysis by busy executives. USA TODAY's editors monitor hundreds of national and international news sources to bring you the latest, most important developments. General news reports are updated hourly. Reports for specific industries are provided daily in a concise, executive summary format.

Or access The Washington Post, with its fingers on the pulse of the national political scene. CompuServe delivers it all, plus a variety of other information, entertainment and communications options.

You can access CompuServe with almost any computer and modem, terminal or communicating word processor. To buy a Subscription Kit, see your nearest computer dealer. To receive our informative brochure, or to order direct, call 800-848-8199

(In Ohio, call 614-457-0802). Or send this coupon today.

YES. Please send me your CompuServe Information Services brochure.

Name _____

Address _____

City _____

State _____ Zip _____

Business Phone _____

CompuServe®

Information Services

P.O. Box 20212, 5000 Arlington Centre Blvd.

Columbus, Ohio 43220

800-848-8199

In Ohio, call 614-457-0802

ENS-411

An H&R Block Company



PROJECTED GROWTH

BASF
TO TAKE THE DOUBLE DENSITY
FLEXYSKIS



FlexyDisk



The data you'll have to
depend on tomorrow
could depend on the
disk you choose today.

BASF

BASF QUALIMETRIC™ 5.25" FLEXYDISKS™. CERTIFIED 100% ERROR-FREE AND WARRANTED...

F O R E V E R



BUT HERE'S SOMETHING THAT WILL— AND IT'S FREE!

Just like our FlexyDisks, BASF Video and Audio Cassettes are warranted for a lifetime.* And when you buy specially-marked boxes of BASF FlexyDisks between now and January 31, 1986, you have your choice of a free BASF High-Grade Chrome Video Cassette (VHS or Beta) or two free top-of-the-line BASF Chrome Maxima II Audio Cassettes. Just mail the coupon below, plus the special labels and the bar codes from the disk packages along with \$1.00 for postage and handling. Visit your nearest BASF dealer (to find out where he is, call toll-free 1-800-343-4600) and take advantage of our free offer and sweepstakes today.



WIN A COMPLETE \$7,500 COMPUTER SYSTEM,

featuring the new COMPAQ DESKPRO 286™ and the Epson® MODEL LQ-1500 letter-quality printer, in our new BASF Computer Sweepstakes! To enter, simply fill out the coupon below and send it to us; or stop by any BASF FlexyDisk® dealer between now and January 31, 1986, and fill out the official entry form; or send a postcard with your name and address to BASF Giveaway, P.O. Box 8920, Westport, CT 06888.



*For a copy of the Lifetime Warranty, write BASF Systems Corporation, 19 Crosby Drive, Bedford, MA 01730.

© 1985, BASF Systems Corporation, Bedford, MA 01730
COMPAQ DESKPRO 286 is a trademark of COMPAQ Computer Corp
Epson is a registered trademark of Epson Corporation.

Inquiry 35

Mail to: BASF Giveaway, P.O. Box 8920, Westport, CT 06888
CHECK YOUR CHOICES (Limited time offer, mail before 1/31/86)

Please send me the free cassette(s) indicated at right, and enter me in the BASF Computer Sweepstakes. My order represents a total of one two three Offer Requests, and I am enclosing for each request the special offer sticker(s) and bar code(s) from the BASF FlexyDisk pack(s) I have purchased, together with \$1.00 postage & handling (2 requests = \$2, 3 requests = \$3).

NO PURCHASE NECESSARY. I am not participating in the BASF Free Mail-In Offer, but enter my name in the Computer Sweepstakes.

Name _____

Address _____

City _____ State _____ Zip _____

Name of Your BASF Dealer _____

Additional Terms: Offer good in U.S.A. Allow 4-6 weeks for cassette(s) delivery. Void wherever prohibited or restricted by law. Limit one mail-in certificate redemption for up to three (3) Free Offer Requests per customer. This certificate may not be mechanically reproduced and must accompany all requests. Offer expires 1/31/86. Computer Sweepstakes winner will be notified before 2/28/86.

FREE CASSETTE REDEMPTION ORDER

Limit of three (3) Offer Requests per customer, each request good for either one (1) BASF Video Cassette or two (2) BASF Audio Cassettes. Fill in the detail for my total order.

	Quantity
• VIDEO CASSETTE _____	_____ VHS _____ Beta
• AUDIO CASSETTES _____	_____

This order represents a total of _____ Offer Request(s)

PARAMETER PASSING

The RET 4 recovers the return address as well as removing the 4 bytes that the parameter values occupied. The following is a rough outline of the external routine:

```
ROUTINE__NAME PROC FAR
    PUSH    BP
    MOV     BP,SP
```

; Routine's actions.

```
    POP     BP
    RET     n
ROUTINE__NAME ENDP
```

In general, other registers should be pushed onto a stack to avoid losing them: this is a good habit to get into when programming in assembly language. To prevent inconsistencies among a set of external routines, you could define a pair of macros as follows:

PASCAL__ENTRY MACRO

```
    PUSH    BP
    MOV     BP,SP
    PUSH    reg1
    PUSH    reg2
```

; etc.

PASCAL__ENTRY ENDM

PASCAL__EXIT MACRO

NUM__OF__BYTES

; NUM__OF__BYTES = the total
; number of bytes of parameters.

```
    POP     regn
```

; etc.

```
    POP     reg2
    POP     reg1
    POP     BP
    RET     NUM__OF__BYTES
```

PASCAL__EXIT ENDM

This is exactly how to begin and end each of the external routines you wish to link with Pascal.

GETTING AT PARAMETERS

Although you can have *parameterless* procedures such as moving the cursor up, down, left, and right, you are more likely to have parameters as in the set_cursor(row,column) example. You need a way to access these parameters so you can use them. This is where the BP pointer that was

(continued)



BASF

IEEE-488



GPIB ↔ PC

Hardware Flexibility

- Low cost for instrument control
 - 300K bytes per second
 - \$395 complete with software
- High performance data links
 - Maximum speed of GPIB
 - On-board buffering

Software

- Over \$1,000,000 in software development
- Easy to use, yet handles any GPIB application
- Works with Lotus 1-2-3
- UNIX, DOS and over 12 languages

Applications Support

- Applications Library with sample programs & TIPS for all major instruments
- Full staff of Applications Engineers dedicated to support your specific needs

Other IEEE-488 Products

- Interfaces & Software for
 - Multibus VMEbus
 - DEC Q-bus & UNIBUS
 - STD & S-100 bus
- General GPIB Products
 - GPIB Bus Testers
 - GPIB Bus Extenders
 - Stand-Alone Controllers



12109 Technology Boulevard
Austin, TX 78727
1 (800) 531-GPIB
In Texas (800) IEEE-488
Telex: 756737 NAT INST AUS

PARAMETER PASSING

saved and repositioned to the bottom of the activation record in figure 2 comes in. By using an indexed + offset addressing mode, you can easily obtain a parameter.

When an external routine is entered and a new stack frame initialized, BP always points to just below the return address at the saved BP value. In the `set_cursor` example, the first parameter (5) is always 8 bytes above the BP register—remember that the stack grows from high memory to low memory. If you use the indexed + offset addressing, retrieving the first parameter requires only a single instruction: `MOV AX,word ptr [BP + 8]`. You can retrieve the second parameter similarly: `MOV BX,word ptr [BP + 6]`. In this example, the row must be between 1 and 25 (one screen length) and the column between 1 and 160 (two screen widths). Due to the reversed-byte storage of words in 8088 architecture and since each of these values can fit into a single byte, a single 16-bit register can hold the coordinates:

```
MOV AH,byte ptr [BP + 8]
MOV AL,byte ptr [BP + 6]
```

This parameter retrieval can be simpler if you use the 8088 assembly-language feature for defining structures. This option lets you define patterns that serve as addressing templates. They are analogous to Pascal's record types. (See reference 3 for details on structure definition.) The pattern you want to describe is one of two parameters plus 6 bytes consisting of the return address and the saved BP register. The structure for this is

```
P_2  STRUC
      DB      6 DUP (?)
P2_2 DW      ?
P1_2 DW      ?
P_2  ENDS
```

This structure is identical to the activation record if you scan it from low memory to high, or backward. The fields are named `P2_2` and `P1_2`, representing parameter 2 of a two-parameter set and parameter 1 of a two-parameter set, respectively. The first parameter of a routine with three parameters is offset differently than the

first parameter of a two-parameter routine. The three-parameter routine STRUC includes `P3_3`, meaning the offset to `P1_3` is 2 bytes greater than the offset to `P1_2`.

You can address the first of two parameters `MOV AX,[BP].P1_2`. The assembler calculates the offset of `P1_2`—in this case it is an 8—and automatically translates this to `MOV AX,[BP + 8]`.

When you use a STRUC routine, the painstaking job of counting bytes and figuring out reversed bytes disappears. Also, each operand is essentially *typed* by the assembler—the parameters in the STRUC example would be typed WORDs. This lets the assembler do more error checking for you and helps you avoid type mismatches.

In most cases the parameters sent to an external routine are integers. Implementing STRUCs as parameter templates is an equally effective method for dealing with other types of parameters. For example, suppose the row and column of `set_cursor` were 6-byte (three-word) real integers. You would only have to change the entries in the STRUC to `DW 3 DUP (?)`, and the addressing offsets in the program would automatically change. Using STRUCs makes your program easier to read, more self-documenting, and easier to maintain.

RETURNING PARAMETERS

You would commonly use the structure and base-pointer-indexed addressing scheme to access the assembly-language parameters. However, at times the external routine must return values to the calling routine, such as the cursor location. You must pass it a pointer telling it where to put the returned values. This is referred to as *call-by-reference* parameter passing, and Pascal implements it with VAR parameters in procedures. Microsoft's version of IBM Pascal has two varieties of VAR: VAR and VARS. For the purposes of this article, I will assume that all call-by-reference parameters are declared as VARS.

An example of a typical heading in a Pascal program follows:

(continued)


```
procedure read__cursor(VARS
    row,column: integer);
    external;
```

```
read__cursor(i,j);
```

The VARS tells the compiler to put pointers to the variables making up the parameters into the activation record, not the values of those parameters. (It is illegal in Microsoft's IBM Pascal to use anything but variables as VARS-type parameters.) In this illustration, a pointer to the variable i and a pointer to the variable j are placed in the activation record. Because of the VARS, the pointers are in segment/offset form so they can reside anywhere in the 8088's 1-megabyte address space. If you used a VAR statement, only the offset into the current data segment would be passed. The STRUC for read__cursor's activation record would be formatted as follows:

```
VP__2  STRUC
        DB      6 DUP (?)
VP2__2  DD      ?
; double word.
VP1__2  DD      ?
VP__2  ENDS
```

The only difference between VP__2 and P__2 is that in VP__2 the parameters are allotted double words, one word for the segment register and one for the offset. Accessing the parameters, however, is very different. It becomes a two-step process to retrieve or store a parameter. One method for transferring AX to parameter I might be:

```
LDS    SI[BP],VP1__2
MOV    word ptr (SI),AX
```

The DS and SI registers have been loaded with the pointer off the stack and the value put in AX where the pointer indicated. When the routine completes, the value of the variable passed as a parameter is changed.

OTHER PARAMETER PASSING

Another area of interest is the use of functions instead of procedures. While parameter passing is the same as call-by-value—the way in which the function returns its value is different: The value is not returned on the activation

In FORTRAN, all parameters are passed as call-by-reference.

stack. Instead, it is placed in a register: AX for 16-bit quantities, AX-DX for 32-bit quantities. While not all compilers return values in this convenient manner, it is fairly common.

In FORTRAN, all parameters, even constants, are passed as call-by-reference. Therefore, every parameter entry in a STRUC should be a double word, DD. You should expect only the addresses of values to be on the stack, not the actual values; therefore, you must be careful in accessing the parameters so you don't inadvertently change a variable that was supposed to remain fixed.

LINKING

Once you have written your high-level-language and external support routines, you must set up communication between them. The IBM PC has a nice mechanism for accomplishing this. The object modules (i.e., the compiled high-level-language code and the assembled support code) are linked together. In Pascal, external routines are given a special header:

```
procedure set__cursor(row,column:
    integer); external;
```

The keyword external notifies the compiler that this routine exists outside the source code and that it will not be available until link time. However, the header is stored so that the type and number of parameters passed to the procedure can be checked by compile time.

FORTRAN does not require such an external declaration; any unresolved subroutine calls are assumed to be external. While this may seem convenient at first, it can lead to disastrous results if the subroutine named is spelled incorrectly or the number or type of parameters does not match what the external routine expects. Pascal has the advantages of detect-

ing these errors at a much earlier stage than FORTRAN and of giving more useful error diagnostics.

That defines the external routine to the high-level-language program, but how about on the level of the external routine? It too has the responsibility of telling the linker—and in effect the higher-level language—what routines it offers. In 8088 assembly language, this is done with the EXTRN directive, which contains a list of symbol names and types, e.g., NEAR and FAR (see reference 3). The symbols referenced then become accessible to the higher-level routine.

The high-level-language routine knows what it wants, and the low-level-language routine knows what it has. All that's left is the linker. The purpose of a link is to put two or more object programs together to make a single one. The linker can move object programs around, but it patches their code so they still function correctly. It resolves external symbols, fills in CALL operands, and makes the appropriate linkages between the high-level and the low-level languages. The resulting object code looks as though the various pieces had never been separate, and they function together as one.

CONCLUSION

The ability to link from high-level to low-level external routines is useful. While activation records and call-by-whatever might seem confusing at first, once you set up the appropriate macros and structures, the whole process becomes almost transparent. Loading parameters requires only a move and you are almost unaware of the activation record. This allows greater flexibility and expands the use of high-level languages beyond their original design. ■

REFERENCES

1. Aho, Alfred, and Jeffrey Ullman. *Principles of Compiler Design*. Reading, MA: Addison-Wesley, 1977.
2. Lewis, Philip, Daniel Rosenkrantz, and Richard Stearns. *Compiler Design Theory*. Reading, MA: Addison-Wesley, 1976.
3. *8088 IBM Assembler Reference Manual*, Microsoft Corporation.

Princeton SR-12 and Sigma Designs Color 400 "The Ultimate in Graphics Resolution and Performance"..

PC Products June 1985

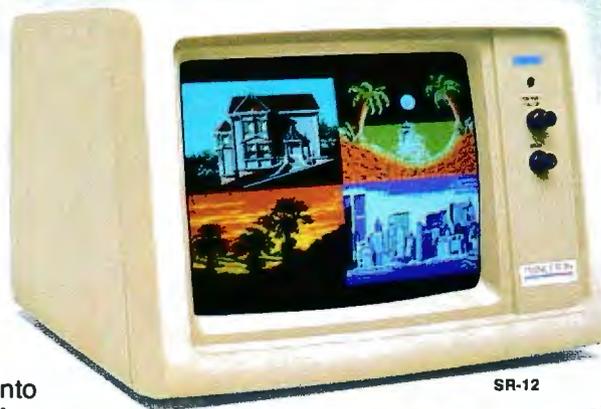
SR-12 and Color 400. A brilliant combination for super-high resolution graphics and a crisp character display.

For a brighter, sharper display with your IBM PC, XT, or AT, here's a team that can't be beat. The SR-12 super-high resolution RGB monitor from Princeton Graphic Systems and Color 400, the advanced color graphics adapter card from Sigma Designs.

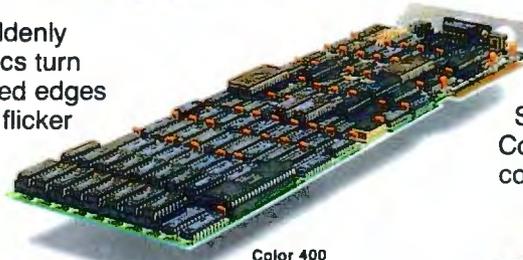
A Revolution in Resolution. Begin by snapping the Color 400 into your PC. Without any software modification, text suddenly becomes readable. Graphics turn sharper and cleaner. Jagged edges smooth out, and annoying flicker fades away. Color 400 automatically *doubles* the number of lines on standard line software. It allows true high

resolution display of

Lotus 1-2-3 and Symphony charts, graphics from Dr. Halo, CadPlan, Lumena 400, and others. Also, create dazzling business charts in 16 vibrant colors with Paintbrush 400, included with the card. Enjoy fully formed, monochrome quality characters in text mode. For word processing, spreadsheet, CAD/CAM, or pro-



SR-12



Color 400

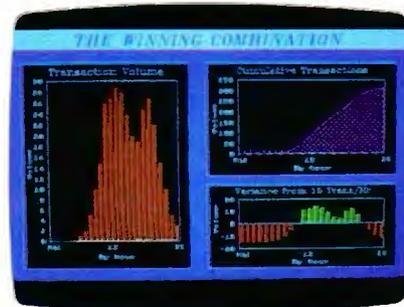
fessional design applications, Color 400 is the answer to your graphic needs.

Turn on SR-12 for the impressive

results. The SR-12 displays your Color 400 image with unmatched clarity and brilliant color. Because the SR-12 combines a .31mm dot pitch tube and a non-glare screen with an incredible 640 x 400 non-interlaced resolution, you get a flickerless image that's as crisp and clean as a personal computer can produce.

See how impressive this state-of-the-art image can be on your own PC system. Visit your local retailer today and ask about this new color graphics team. Princeton Graphic Systems' SR-12 and Sigma Designs' Color 400. An unmatched, brilliant combination.

**color
400**



**SIGMA
DESIGNS**

SIGMA DESIGNS, INC., 2023 O'Toole Avenue, San Jose, CA 95131
(408) 943-9480 Telex: 171240

PRINCETON
GRAPHIC SYSTEMS
AN INTELLIGENT SYSTEMS COMPANY

Princeton Graphic Systems, 601 Ewing Street, Bldg. A, Princeton, N.J. 08540
(609) 683-1660, Telex: 821402 PGS PRIN, (800) 221-1490 Ext. 1204

Graphic Screens courtesy Mouse Systems, Inc. and Forthright Systems, Inc.

IBM PC, PC XT, and PC AT are registered trademarks of International Business Machines, Inc.

Engineering
Excellence

CROSSTALK™
XVI



THE STATE OF THE ART IN
DATA COMMUNICATIONS
SOFTWARE

DESIGNED BY

MICROSTUF®

CROSSTALK IS A TRADEMARK OF
MICROSTUF, INC., ATLANTA, GEORGIA

CROSSTALK IS AVAILABLE FOR
MOST SMALL BUSINESS
COMPUTERS

DATE

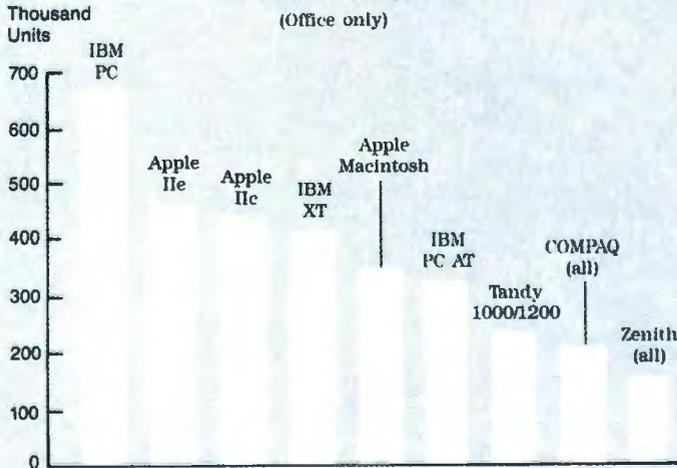
2/16/84

BYTE International Advertising Section



Projected 1985 Unit Sales of Leading Personal Computers

(Office only)



Source: Office 85: The Turning Point; Future Computing Inc. ©

Advertisers in this Section

Inquiry No.	Page No.
500	AMERICAN BUYING & EXPORT SERVICES.....160F
*	BYTE.....160A, 160D
501	CASIO.....160H
502	CITIZEN PRINTERS.....160G
503	DELIN INFORMATICA.....160B
504	FIGURE FLOW LTD.....160B
505	FORTH-SYSTEME.....160B
506	GREY MATTER.....160B
507	ING. C. OLIVETTI.....160C
508	MULTITECH INDUSTRIAL CORP. 160E

For Advertising Information, Call:

England: Arthur Scheffer, 01 493 1451

France: Jean-Christian Acis, 720 33 42

Italy: Savio Pesavento, 02 86 90 656

Japan: Hiro Morita, 02-581-9811

U.S.A.: Dennis Riley, 1-603-924-9281

West Germany: Fritz Krusebecker, 72 01 81

LMI FORTH™ in Europe

European Professionals:

- You can solve your problems much better and quicker than before, if you are using FORTH.
- We supply and support from stock the complete range of FORTH products by LMI and offer also our own products for you. (see also ad of Laboratory Microsystems in the normal section).
- If you are using a VAX for program development, we can give you interactive power under VMS too.

For detailed information call or write to us. Consulting and Educational Services available at special arrangement.

FORTH-SYSTEME Angelika Flesch

P.O.B. 1226, D-7820 Titisee-Neustadt
West Germany · Phone: (49) 7651 - 1665
VAX and VMS are trademarks of Digital Equipment.



Inquiry 505

C COMPILERS

New versions from CI and Microsoft, several new libraries and utilities, and many price reductions this month.

8-bit	Aztec C II v1.06D	£150
	Aztec C65 v1.05C	£150
	BDS C v1.50a	£110
	Toolworks C/80 v3.1	£ 45
	Eco-C v3.1	£140
16-bit	Aztec C86 Personal v3.2	£150
	Aztec C86 Comm. v3.2	£325
	CI Optimizing C86 v2.3	£270
	C-Systems C v2.08	£210
	C-terp v2.07	£250
	De Smet C88 v2.4	£145
	Digital Research C v1.1	£270
	Instant-C v1.27	£375
	Lattice C v2.15	£325
	Mark Williams MWC86 2.0	£360
	Microsoft C v3.0	£325
	RUN/C v1.2	£120
	Toolworks C/86 v3.2	£ 45
	Wizard C v2.1	£350

C LIBRARIES

Data base	C-tree (source)	£295
	Multikey	£170
	db-VISTA (source)	£375
	Btrieve	£245
	C-to-dBase (source)	£120
	Lattice dBC	£175
	SoftFocus Btree(source)	£ 70
	Softfocus ISAM (source)	£ 40
Graphics	Multi-Halo	£195
	GraphiC v2.1	£225
	MetaWINDOWS	£140
Screen	Panel	£245
	Lattice Windows	£195
	Windows for C	£185
	C Power Windows	£ 95
Misc	Greenleaf Functions, sce	£155
	C Food Smorgasbord	£120
	Plink-86	£295
	C Helper, source	£135
	Basic C	£150
	Bastoc	£295

More libraries not listed here.
Prices include delivery in Europe but not VAT or other local taxes.
For information or advice call us.

4 Prigg Meadow, Ashburton, Devon TQ13 7DF
TEL. (0364) 53499

Inquiry 506

development tools

C-DOC: a cross-reference and documentation system, £275.

The Program Tuning Kit: a symbolic execution profiler, £145.

The C Browser: an intelligent code display system, £125.

All three £445.

An invaluable suite of British tools for C software development under MS-DOS/PC-DOS.

Figure Flow Ltd

0473 822917
+44 473 822917

Inquiry 504

AUTOMATIC AND MANUAL DATA SWITCH

THE BEST SOLUTION

FOR COMPUTER/PRINTER COMBINATION

CENTRONICS MODELS

- PRESSURE SENSITIVE CONTROL PANEL
- LINE LIGHTS INDICATOR
- AUTOMATIC/AUTOMATIC AND MANUAL COMMAND AVAILABLE

ONE INPUT TWO OUTPUTS MANUAL VERSION \$ 85
TWO INPUT ONE OUTPUT MANUAL VERSION \$ 75
ONE INPUT TWO OUTPUTS AUT. AND MANUAL VERSION \$ 75

SERIAL RS232 MODELS (ONLY MANUAL VERSION)

ONE INPUT TWO OUTPUTS \$ 59
ONE INPUT THREE OUTPUTS \$ 70
TWO INPUTS ONE OUTPUT \$ 85

delin
INFORMATICA
VIA F. BARACCA 148-U PHONE 055/418767
30127 FLORENCE ITALY

Inquiry 503

PASCAL COMPILERS

Both v3.2 & v3.3 Microsoft are in stock at a good price. New libraries include several for Turbo-Pascal.

8-bit	Turbo Pascal v3.0	£ 55
	DR Pascal/MT+	£ 99
	Pro Pascal	£199
16-bit	Turbo Pascal v3.0	£ 55
	Microsoft Pascal 3.2	£ 95
	Microsoft Pascal 3.3	£195
	SBB Personal	£160
	SBB Professional	£395
	Practical Pascal	£145
	Pro Pascal	£290
	DR Pascal/MT+86	£295

PASCAL LIBRARIES

Turbo Toolbox	Turbo Graphix
Paragon Supertools	Blaise Tools
Turbo Tutor	Asynch Manager
Btrieve	Shark
MetaWINDOWS	Multi-Halo
Prospect	Panel
View Manager	Turbo Screen

The excellent XTC Editor comes with source code in Pascal and costs £95.

MODULA-2 COMPILERS

The Zurich Compiler makes friends and a new low price Interface Compiler.

Modula Corp (MS-DOS)	£120
Zurich Compiler (Z80 CPU)	£140
Volition (various)	from £265
Logitech (MS-DOS, CP/M-86)	£380
Interface SDS-XP (PC-DOS)	£195
Interface SDS (PC-DOS)	£ 99

ADA (subset) COMPILERS

The Janus C pack and Augusta offer a low cost introduction to ADA.

Augusta (CP/M-80)	£ 80
Supersoft (CP/M-80)	£250
Janus D-Pack (CP/M-86, MS-DOS)	£750
Janus C-Pack (CP/M-86, MS-DOS)	£ 99

Prices include delivery in Europe but not VAT or local taxes. For advice or information call us.

4 Prigg Meadow, Ashburton, Devon TQ13 7DF
TEL. (0364) 53499

Inquiry 506

PROGRAMMING TOOLS

Ada Compilers	Algol Compilers
Assemblers	Basic Compilers
Basic Interpreters	Basic Utilities
BCPL Compilers	C Compilers
C Interpreters	C Libraries
C Utilities	Cobol Compilers
Comms. Libraries	Cross Assemblers
Database Libs.	Debuggers
Dis-Assemblers	Editors
Expert Systems	Fortran Compilers
Fortran Libraries	Graphics Libraries
Linkers	Lisp
Modula-2	Nial Interpreters
Pascal Compilers	Pascal Libraries
Prolog	Screen Libraries
Smalltalk	Snobol

We have a wide stock, competitive prices, can supply on over 400 disk formats, and deliver free in Europe.

Call us for more information

4 Prigg Meadow, Ashburton, Devon TQ13 7DF
TEL. (0364) 53499

Inquiry 506

THE END OF DISCORD



Olivetti Pubblicità

The harmonics of present and future dp language and architecture you offer your customers has a bottom line significance that's becoming more and more obvious. Even to non-technical management who have had to deal with the logistics and costs of a conflicting babble of application languages.

UNIX* System V offers the language orchestration and the hardware independence your customers want. With minimum disruption and expense, it lets them take advantage of developing technology while protecting installations from obsolescence.

Now is the time to start writing software for UNIX System V. As more and more companies in Europe and elsewhere turn to UNIX-based machines, the market for applications is exploding. You will be able to market your packages to the widest variety of installations without expensive conversions. And you can create new applications faster, thanks to the powerful software development tools intrinsic to UNIX System V. UNIX Europe Ltd. provides the licences for UNIX source code.

Come to Olivetti for a full range of UNIX System V VAR products: micros, 32-bit Olivetti AT&T superminis, simple or windowed graphic terminals. And come to Olivetti for UNIX software training and technical assistance in developing more marketable programs.

*Trademark of AT&T Bell Laboratories

olivetti

- Please call me for an appointment
 Please send me additional details on the Olivetti VAR programme

NAME _____

ADDRESS _____

CITY _____ STATE _____

TELEPHONE _____

Please mail this coupon to:

Ing. C. OLIVETTI & C., S.p.A. - Dir. OEM/VAR
Via Caldera 21 - 20153 MILANO - ITALY



Fly BYTE International. BYTE Leaves Home So You Don't Have To.

Only BYTE reaches a paid audience outside North America of 50,000 technically-elite businesspeople—readers who make billions of dollars worth of purchasing recommendations and decisions for their companies.

You can reach the audience you want at a substantially lower rate, in BYTE's International Advertising Section (IAS). Target just the BYTE readership outside North America, or reach the entire world with each full issue. Your BYTE representative has details on our exclusive IAS offer.

The international micro market is growing *faster than the market in the U.S.* Now is the time to make your product or service well-known all over the world...with BYTE, the international standard.

For advertising information, call:

Austria, Vienna	Hans Csokor	75 76 84
France, Paris	Jean Christian Acis	720 33 42
Hong Kong	Seavex, Ltd.	260149
Israel, Bat Yam	Gurit Gepner	866 561 321 39
Italy, Milan	Savio Pesavento	86 90 656
Japan, Tokyo	Hiro Morita	581-9811
Singapore	Seavex, Ltd.	734-9790
Spain, Madrid	Maria Sarmiento	45 52 891
Sweden, Nacka	Andrew Karnig	44 0005
U.K., London	Arthur Scheffer	493 1451
W. Germany, Frankfurt	Fritz Krusebecker	72 01 81

**When BYTE Speaks Micro,
 The World Listens.**

BYTE

THE SMALL SYSTEMS JOURNAL

70 Main Street
 Peterborough, NH 03458
 (603) 924-9281



For subscription information in Europe, call
 Jean Tobias in England: 628-23431.

The Epochal Event of the Computer Age!

Introducing the Multitech POPULAR 500

Personal Computing will never be the same again.

For the first time ever, quality IBM compatibility is popularly affordable, thanks to Multitech. The POPULAR can serve as a powerful 16 bit business assistant in both the home and office. When your children let you use the computer, you can simply insert the floppy you bought home from the office, and pick up where you left off. In the office, the attractive POPULAR is expandable and can be networked, or linked up with a modem or serve as an intelligent terminal.

The Multitech POPULAR 500 — 16 Bit Computing without Compromise.



Shift into High Speed 8 MHz Mode for Performance PLUS.

The MPF-PC family set the previous standard for options. Thanks to its new 8088-2 micro-processor, Multitech's PLUS 700 goes one better. In its LED indicated high speed mode, the PLUS can run your favorite programs sixty percent faster, with no loss of compatibility. And with six IBM PC compatible slots for user interface, the PC PLUS can grow as you grow. It is no wonder that this computer is called PLUS.

Multitech — Leading the World into the Computer Age

OEM AND VAR INQUIRIES WELCOME

IBM is a trademark of International Business Machines Corp.



Multitech INDUSTRIAL CORP.

9 Fl., 266 Sung Chiang Road, Taipei 104, Taiwan, R.O.C.
Tel: (02) 551-1101 Tlx: 19162 MULTIIC Fax: (02) 542-2805

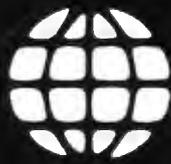
MULTITECH ELECTRONICS INC.

195 W. El Camino Real, Sunnyvale, Ca. 94087 U.S.A.
Tel: 408-7738400 Tlx: 176004 Fax: 002-1-408-7498032

EUROPEAN LIAISON OFFICE

Liesegangstr. 9, 4000 Dusseldorf 1, West Germany
Tel. 0211-353941 Tlx: 8584103 MELO D Fax: 0211-353946

Authorized Distributors: **TAIWAN:** Sertek International Inc., Taipei, Tel: 501-0055; **SINGAPORE & MALAYSIA:** Advanced Computer Pte Ltd., Tel: 2932937, 2967211; **THAILAND:** Sahaviriya Infortech Computer Co., Ltd., Bangkok, Tel: 235-7366; **INDONESIA:** P.T. Bukit Centera Graha Scientific, Jakarta, Tel: 760-733; **PAKISTAN:** East West Systems, Karachi, Tel: 516635, 529827; **BAHRAIN:** Computer World, Manama, Tel: 245566; **SAUDI ARABIA:** Modern Elec. Systems Co., Ltd., Riyadh, Tel: 4650041 **SOUTH AFRICA:** Embel Data Systems (Pty) Ltd., Cape Town, Tel: (021) 236177; **NORWAY:** Universal Computer Systems A/S, Oslo 1, Tel: 47-02-202250 **HOLLAND:** Sciento B.V., Hertogen bosch, Tel: (073) 424055; **SWITZERLAND:** Zentrara Technik AG, Biel, Tel: (032) 233553; **SPAIN:** Comercial Electronica de Computadoras S.A., Madrid, Tel: 34-1-4353701 **W. GERMANY:** Ce-Tec Trading, Hamburg 1, Tel: 040-2801045-49; **FINLAND:** Elektrotel Oy Kielote 47, SF-01350 VANTAA, Tel: 8734700 **AUSTRIA:** ZEMA, Vienna, Tel: (0222) 96-15-19; **ARGENTINA:** Latindata S.A., Buenos Aires, Tel: 33-7993; **CHILE:** Cientec Instrumentos Cientificos Ltda., Santiago, Tel: 2257350-747028 **COSTA RICA:** Compania de Procesos Tecnicos S.A., San Jose, Tel: 24-0651, 24-1293; **MEXICO:** Grupo Printaform, Colima, Tel: 553-99-91; 553-99-98 **CANADA:** Tithes Business Systems (Canada) Inc., Vancouver B.C., Tel: 733-5725



Exporting Services

**We Are Buyer's Agent for
Overseas Dealers and Distributors**

- Lowest prices, immediate quotations,
prompt delivery.**
- Access to all major hardware and
software manufacturers.**
- All professional services provided:
Licensing, Export Documentation, and
Follow-through.**

**24-Hour Response as Close as Your Telex
TELEX 470851**

**American Buying and Export Services
1042 Country Club Drive, Moraga, CA 94556
(415) 376-7600**

Four printers you can forget about two years running.

MSP-10

- 80 columns
- 150 cps draft
- 40 cps correspondence quality
- Fast line feed, high through-put
- Industry standard compatibility
- Full bit image graphics
- Push feed tractor standard (Simple paper loading)
- Exceptional value
- Full two-year warranty.



CITIZEN MSP-10

LINE FEED	ON LINE	LF	FF
LINE FEED			

MSP-15

- 136 columns
- 150 cps draft
- 40 cps correspondence quality
- Fast line feed, high thro
- Industry standard compatibility
- E ceptions
- Full two-e warranty.



CITIZEN MSP-15

MSP-20

- 80 columns
- 200 cps draft
- 50 cps correspondence quality
- Fast line feed, high through-put
- Industry standard compatibility
- Full bit image graphics
- Push feed tractor standard (Simple paper loading)
- Proportional spacing
- BK buffer standard
- Exceptional value
- Full two-year warranty.

LINE FEED	ON LINE	LF	FF
LINE FEED			

CITIZEN MSP-20

LINE FEED	ON LINE	LF	FF
LINE FEED			

MSP-25

- 136 columns
- 200 cps draft
- 50 cps correspondence quality
- Fast line feed, high through-put
- Industry standard compatibility
- Full bit image graphics
- Push feed tractor standard
- Simple paper loading
- Proportional spacing
- BI buffer standard
- E ceptional value
- Full two-year warr



CITIZEN MSP-25

LINE FEED	ON LINE	LF	FF
LINE FEED			



There are some things you can always depend on.

For full details ring Robin Marriott at Citizen Europe in the U.K. on (0895) 72621.

Runs the World's Most Popular Software

Casio introduces a computer that does just what you want it to. The FP-4000 Series lets you run any software that uses the MS-DOS* (compatible with PC-DOS) operating system. No matter how many different business applications you require, you'll appreciate the FP-4000's versatility.

This consummate user-friendliness is enhanced by many other features. A compact design. Communications and printer interfaces plus five expansion slots, allowing you to connect a wide range of peripheral equipment. And easy operability. The Casio FP-4000 Series. It's just what you want.



FP-4000 16-Bit Personal Computer
SERIES

CASIO®

CASIO COMPUTER CO., LTD. Tokyo, Japan

*MS-DOS and MS-PASCAL are registered trademarks of Microsoft Corporation. VisiCalc IV is a registered trademark of VisiCorp, Inc. pfs: graph is a registered trademark of Software Publishing Corporation.

GAME-PADDLE CONTROL LINEARITY TEST

BY MARVIN L. DE JONG

Measuring resistance with the Apple II

IT IS POSSIBLE to use the game-paddle inputs on the Apple II to measure physical properties like resistance, capacitance, temperature, and light intensity. There are two important considerations in such measurements. The first is whether the output of the game-paddle instruction, $y = PDL(x)$, varies linearly with the physical property. Equally important is the scale factor—the ratio of y to the value of the physical property corresponding to y .

The program in listing 1 tests the linearity of the game-paddle input and obtains the scale factor. The program contains two simple loops. The inside loop reads the game-paddle port, prints the output on the screen of the video monitor, and tests the keyboard of the Apple II for a keystroke. When a keystroke occurs, the program requests the input of a physical quantity.

I measured a resistance connected between +5 V (volts) and the GC1 input, pins 1 and 10, respectively, on the Apple II game I/O (input/output) connector. The resistance was a resistance substitution box of the type

found in a high school or college physics laboratory. The box uses resistors with a precision of 0.5 percent. I could also have used a 10-turn potentiometer.

After adjusting the resistance to a desired output, I pressed a key on the Apple keyboard and, following the prompt, entered the value. The program then plotted y and the value of the resistance on the high-resolution screen, and the printer, interfaced through card slot #1, plotted the same two values. For this example, I applied a scale factor of 159/120 in order to use most of the high-resolution screen.

Figure 1 shows r , resistance, as a function of y after plotting approximately 100 points. I used a ruler to draw a straight line through the points. Clearly, the output, y , is a linear function of r , between +5 V and the game-control input.

You can obtain the scale factor from the printed output. For example, with the GC0 input, I got a y of 224 when r was 100K Ω (ohms), resulting in a scale factor of 2.24/K Ω . With GC1, we got a scale of 2.19/K Ω . Fitting a least-

squares line to the points would probably be overkill.

The game-control circuitry in the Apple II consists of a QUAD 558 timer. This integrated circuit holds a 0.022- μ F (microfarad) capacitor in a discharged state until a pulse is applied to a trigger input on the 558. This pulse is produced by referencing location 49264 (C070 hexadecimal). After a pulse is applied, the 558 allows the capacitor to charge until it reaches two-thirds of the supply voltage. At this time, the q output of the 558 switches to logic zero. The time between the trigger pulse and the q output switching to logic zero is approximately

$$t = 1.1 * r * c$$

where r is the resistance of the game-

(continued)

Marvin L. De Jong teaches in the Department of Mathematics-Physics at The School of the Ozarks. He has a Ph.D. in Astronomy from Rensselaer Polytechnic Institute and is the author of several books and articles on microcomputing. He can be reached at the Department of Mathematics-Physics, The School of the Ozarks, Point Lookout, MO 65726.

LINEARITY TEST

paddle potentiometer in ohms and c is $0.022 \mu\text{F}$.

The Apple II uses a simple machine-language timing loop to measure this time interval. Although the Apple II

reference manual indicates that this cycle is 12 clock cycles long, it is actually only 11 clock cycles long. Thus the time, t , is related to the value of y returned by the $y=\text{PDL}(x)$ instruction

by the formula $t=11*y*tc$, where tc is the period of the microcomputer clock. For the Apple II, $tc = 0.9778 \mu\text{s}$ (microseconds). The maximum value of y , 255, produces a t of 2.743 ms (milliseconds), which corresponds to an r of $113.3\text{K} \Omega$. With the GC0 input, I obtained a y of 255 when r was between 113K and $114\text{K} \Omega$. With the GC1 input, I obtained a y of 255 when e was between 116 and $117\text{K} \Omega$. Thus, given the precision of the components, the game paddles behave exactly as expected.

My results show that the game-paddle outputs vary linearly with resistance. They also show that each game-control input must be individually calibrated for best results. This program provides a simple check of the linearity of the game-control inputs.

The fact that the game-control output varies linearly with resistance implies that it varies inversely with current. Devices such as thermistors will show a highly nonlinear behavior if the program in listing 1 is used to find y as a function of temperature. In that case, the program can be used to plot a calibration curve. The game-control outputs will vary linearly with the capacitance placed in parallel with the $0.022\text{-}\mu\text{F}$ capacitance internal to the Apple II.

This information should be helpful for computer users who want to use the game-control inputs to measure physical quantities. These inputs exhibit a high degree of linearity, and sample experiments allow the inputs to be calibrated. Inherent in the timing-loop approach is a timing error. My analysis shows that the largest error is 10 clock cycles, while the smallest error is -1 clock cycle. This error is independent of y ; the most precise measurements are therefore obtained when y is as large as possible.

You also might want to try to expand the range of resistances that can be measured using the game-control inputs, either by placing another capacitor in parallel with the one inside the Apple II or by using a 16-bit timing loop. ■

Listing 1: A program to graph the output of $y=\text{PDL}(x)$ as an input parameter is changed.

```
10 INPUT X
20 KYBD = 49152
30 HGR : HCOLOR = 3
40 HPLOT 0,0 TO 255,0
50 HPLOT 0,0 TO 0,159
60 Y = PDL(X)
70 FOR J = 1 TO 50
80 NEXT J
90 PRINT Y
100 Z = PEEK(KYBD)
110 IF Z < 128 THEN 50
120 INPUT R
130 Z = INT(R*160/120+.5)
140 HPLOT Y,Z
150 PR# 1 : PRINT R,Y
160 PR# 0 : GOTO 50
```

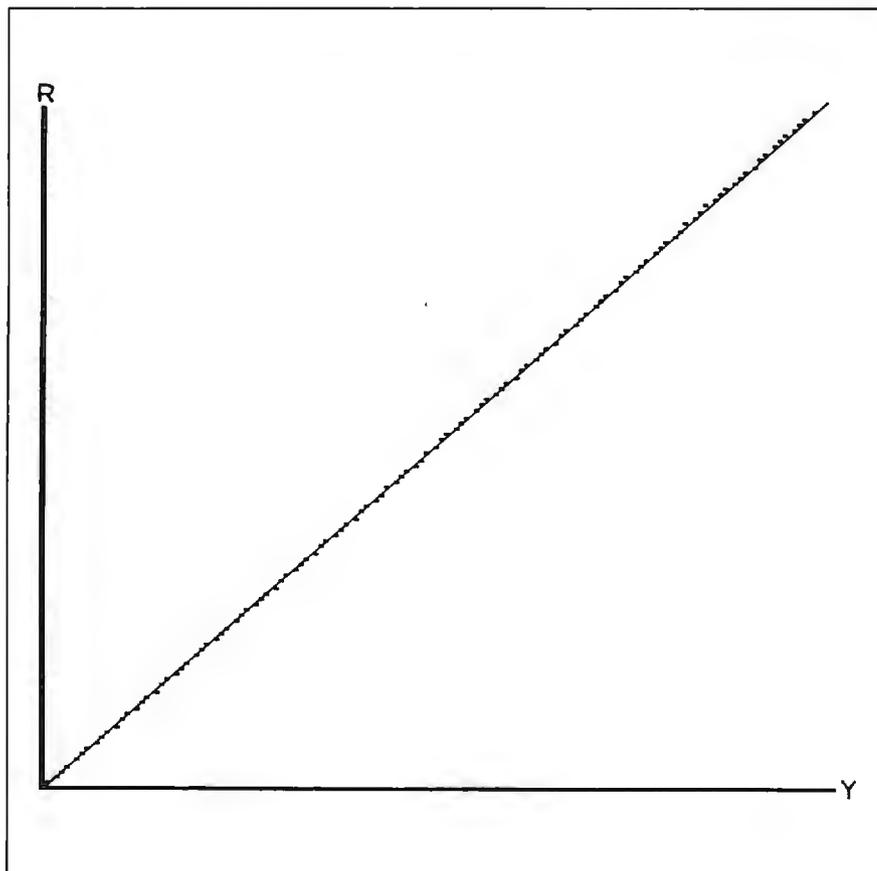


Figure 1: The resistance, r , as a function of the quantity $y=\text{PDL}(x)$ as it is graphed on the high-resolution screen by the program in listing 1. The relationship between y and r is clearly linear.

100 MHz scope, counter, timer, multimeter: All one integrated system.

100 MHz dual time base scope. 3.5 ns risetime; sweeps from 0.5 s to 5 ns/div; alternate sweep; $\pm 2\%$ vertical/horizontal accuracy; vertical sensitivity to 2 mV/div @ 90 MHz.

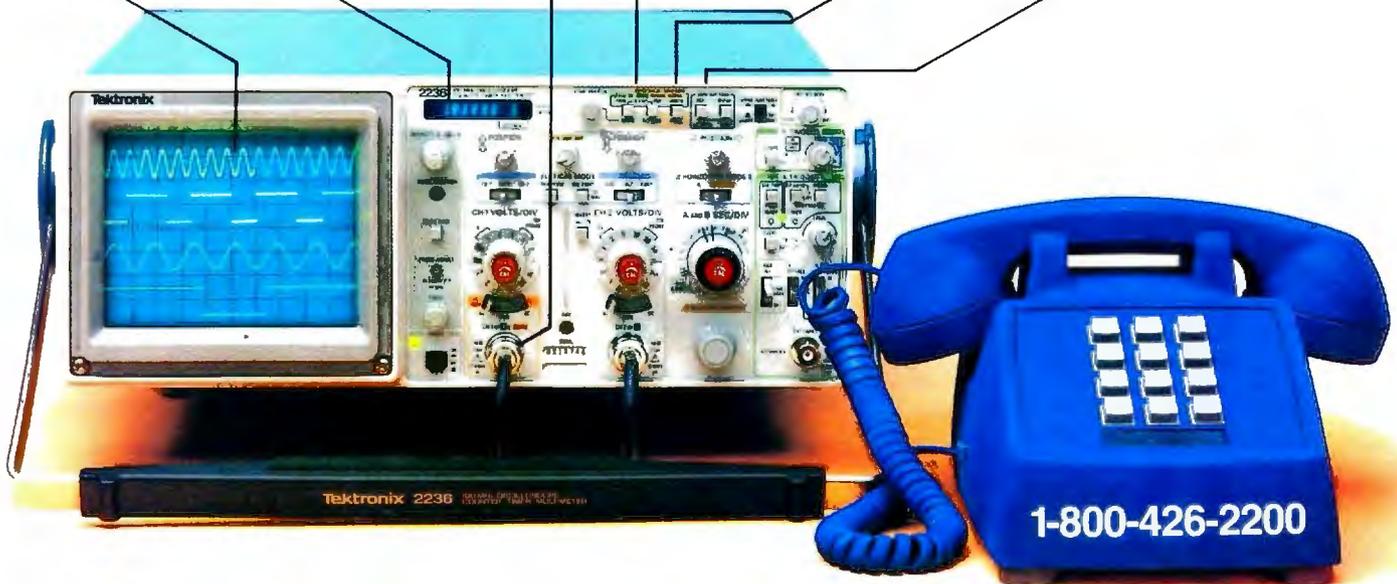
9-digit fluorescent display. Digitally accurate readouts accompany the CRT waveform. Error messages and prompts also appear on the display.

Dc volts and ac coupled true RMS volts. Measured through the Ch 1 scope input.

Gated measurements. Use the scope's intensified marker to measure frequency, period, width and to count events within specified portions of the signal.

Auto-ranged, auto-averaged counter/timer. Frequency, period, width, delay time, Δ -time, plus totalize to more than 8 million events —with 7 digits plus exponent displayed.

Auto-ranged DMM. Use floating DMM side inputs with up to 5000-count resolution. Get precise readouts of average dc and true RMS voltage. Measure resistance from milliohms to gigohms.



Now make measurements faster, easier, with greater accuracy and user confidence. The Tek 2236 makes gated counter measurements, temperature, time, frequency, resistance and voltage measurements push-button easy. You see results concurrently on the 9-digit numeric readout and CRT display.

Its complete trigger system includes pushbutton trigger view, plus peak-to-peak auto, TV line, TV field, single sweep and normal modes.

At just \$2650*, the 2236 includes the industry's first 3-year warranty on all parts and labor, including the CRT.

Integrated measurement system. 3-year warranty. 15-day return policy. And expert advice. One free call gets it all! You can order, or obtain literature, through the Tek National Marketing Center. Technical personnel, expert in scope applications, can answer your questions and expedite delivery. Direct orders include probes, operating

manual, 15-day return policy, full warranty and worldwide service back-up.

**Order toll-free:
1-800-426-2200
Extension 57**

In Oregon call collect:
(503) 627-9000 Ext. 57
Or write Tektronix, Inc.
P.O. Box 1700
Beaverton, OR 97075

Tektronix
COMMITTED TO EXCELLENCE

Guess floppy flopped.

Apart from one small detail, they're exactly alike.

We know. We made both these diskettes ourselves, controlling every aspect of the manufacturing process. From the liquid polyester to the magnetic oxides.

Then we checked them. Inside and out. The two you

see here lived up to 326 of the most demanding standards around. Standards that guarantee our diskettes for life. Which we conservatively estimate to be 200 years at the rate of one read/write pass on every track, every hour of every day. Without losing a scrap of data.

So where's the problem?

The floppy on top flunked standard #327. The label is a teensy bit crooked. A minor detail, sure. But a 3M floppy has to be flawless.

Or it flops.

One less thing to worry about.™

which





CPK

Graphics Hardware

THE AMIGA'S CUSTOM GRAPHICS CHIPS <i>conducted by Phillip Robinson</i>	169
RASTER OPERATIONS <i>by John Bennett</i>	187
MOVING PICTURES <i>by Stefan Demetrescu</i>	207
HIGH-RESOLUTION PRINTER GRAPHICS <i>by Mark Bridger and Mark Goresky</i> . . .	219
THE μPD7281 PROCESSOR <i>by Tom Jeffery</i>	237

ONE CLEAR FACT about microcomputing is this: The field has grown tremendously large and wide. Organizing this Graphics Hardware theme demonstrated that fact immediately and forcibly. Our initial goal was to recruit at least one article from each area of possible interest. But that would have produced a haphazard array of articles that wouldn't slake any particular thirst. So we focused attention on the silicon behind many of these devices.

When memory chip prices took a nosedive in 1984, many companies had to look for other, more profitable ways to turn sand into logic. The popular appeal of interfaces such as the Macintosh's and the unending hunger for more powerful CAD and CAM workstation displays led many designers to graphics. The lack of a clear standard chip, after the first-generation NEC 7220, was also a factor. Many companies hoped to set the next standard and capitalize on it in a big way.

Even after we decided to focus on chips, it was soon obvious that there were far too many developments to cover. Intel, AMD, Texas Instruments, Hitachi, Silicon Compilers, and an avalanche of other firms were announcing new, more powerful graphics controllers. Instead of repeating much of the same coverage available elsewhere, we chose to look at some of the basic design philosophies behind graphics silicon.

Custom graphics chips are at the heart of the new Amiga microcomputer from Commodore that we previewed in the August BYTE. For this issue, we went back for a talk with Jay Miner, the designer of the Amiga's custom chip set.

The new generation of computer displays based on bit maps simplifies the graphics-control scheme and allows multiple fonts, sizes, and modifications of characters. To handle the manipulations of such a screen, a new type of hardware has been developed that performs RasterOp (raster operations) or BitBlt (for bit-mapped block transfer; a name coined at Xerox PARC). John Bennett, the president of Pacific Mountain Research (a Seattle firm that has designed the 96016 Blt chip) describes the theoretical underpinnings and reasons for BitBlt operations.

One surprising facet of graphics silicon is the rush to new memory architectures. Stefan Demetrescu, a vice president of Lasergraphics, describes the bottlenecks in displaying data and then explains the possible silicon solutions, including his own novel RAM architecture.

Nippon Electric created the first graphics-controller standard with its 7220 chip. Now, NEC is trying a new tack with the μ PD7281 processor that is not based on the standard von Neumann computer architecture. Instead it uses pipelining and data-flow architecture to bring parallelism to image processing. Tom Jeffery of NEC describes the inner workings of this new kid on the block.

After summarizing that slew of silicon specialties, we end on relief note: the software that will convince a dot-matrix printer to print up to 240 dots per inch horizontally and 216 dots per inch vertically. Mark Bridger and Mark Goresky give the details.

What conclusion can be tied together from these various strands? The sure answer is that there is room for a lot more coverage of graphics hardware.

—Phillip Robinson, Senior Technical Editor

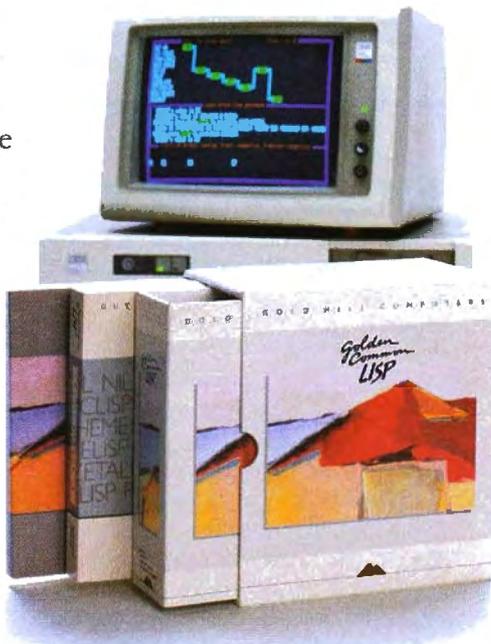
AI: The Future is at Gold Hill Today.

You know artificial intelligence is the wave of the future. Programs based on the ideas of artificial intelligence are being written today in COMMON LISP—the new LISP standard developed by researchers from universities and corporations such as Carnegie Mellon, DEC, MIT, Stanford, Symbolics and TI. LISP allows the development of programs that are intelligent, flexible, and even human-like. The problem has been that hardware needed to run LISP is expensive.

No longer. GOLDEN COMMON LISP (GC LISP) makes it possible for you to learn and use LISP on your *personal computer*. When you use GC LISP in combination with the AI examples provided, you will be able to develop such exciting applications as expert systems, natural language systems, and intelligent interfaces to complex software. The possibilities are endless. With GC LISP you can tackle problems that you could not solve before with ordinary number crunching programs. You will be able to write powerful programs that can accommodate casual computer users who want intelligible answers quickly.

Easy to Learn

GC LISP makes it easy for you to learn the technology of AI at your own pace. Each package includes the *San Marco LISP Explorer*—an interactive software tutorial developed by Patrick H. Winston and his associates. This 800-frame instructional



GOLDEN COMMON LISP is the best selling AI language.

system guides you through the steps of LISP programming and makes the full range of LISP's power accessible to both novice and experienced programmers. The second edition of the classic *LISP* textbook by Winston and Horn is also included.

More Power

GC LISP comes complete with the intelligent GMACS editor (based on EMACS), full on-line documentation of all GC LISP and GMACS functions, the *Common LISP Reference Manual* by Steele, and a comprehensive user manual. In short, GOLDEN COMMON LISP comes with everything you need to program in LISP. GC LISP is the most powerful

LISP available today on PCs; some of its advanced features include lexical and dynamic scoping, defstructs, closures, stream I/O, and multiple-value returning functions.

The Complete Solution

In addition to GC LISP, Gold Hill offers an entire line of development and delivery tools designed to increase your organization's productivity in artificial intelligence. These include the GC LISP Compiler, PC-to-Symbolics™ network, HALO™ Graphics, and training and consulting services. Gold Hill is also proud to introduce GC LISP LM (Large Memory)—the first PC-DOS language to take advantage of the 15-megabyte memory capacity of the latest generation of PCs (such as the IBM PC AT). For multiple-user sites, Gold Hill offers a Corporate License Package which features quantity discounts and service and support.

Order Today

For order information on Gold Hill products please call today.

800-2GC-LISP

GC LISP requires an IBM PC, PC XT, PC AT, or IBM-compatible with a minimum 512K and PC-DOS 2.0.

*Gold Hill Computers
Setting the AI Standard for
Personal Computers.*

G O L D H I L L C O M P U T E R S

163 Harvard Street, Cambridge, Massachusetts 02139

GOLDEN COMMON LISP and GC LISP are trademarks of Gold Hill Computers. The San Marco LISP Explorer is a trademark of San Marco Associates. LISP is copyrighted by Addison-Wesley Publishing Company, Inc. The *COMMON LISP Reference Manual* is copyrighted by Digital Equipment Corporation. IBM PC, PC XT, PC AT, and PC-DOS are trademarks of International Business Machines. Halo Graphics is a trademark of Media Cybernetics. Symbolics is a trademark of Symbolics, Inc.

THE AMIGA'S CUSTOM GRAPHICS CHIPS

CONDUCTED BY PHILLIP ROBINSON

*A conversation with Jay Miner,
the chips' designer*

COMMODORE'S NEW AMIGA micro-computer contains a custom NMOS (negative-channel metal-oxide semiconductor) chip set that provides many powerful graphics functions. The Amiga preview in the August issue of BYTE ("The Amiga Personal Computer" by Gregg Williams, Jon Edwards, and Phillip Robinson, page 83) briefly described those chips. Later, we went back for more details and talked to Bill Kolb, Amiga's director of hardware engineering, and Jay Miner, the vice president of product development and the designer of the chips. Miner also designed the graphics hardware for the Atari VCS (2600), 400, and 800 personal computers.

Although the Amiga team set out to build a general-purpose microcomputer, Kolb states firmly, "We not only wanted graphics, we wanted enough power to do real animated graphics—where you're not just moving one sprite around on the screen. We wanted to take the next major step, and VLSI [very-large-scale integration] was the only way to be that aggressive and keep the cost within reason."

The Amiga was originally Miner's idea for the world's most powerful game machine. But as other people joined the team, that conception changed, and features, capabilities, and more ROM (read-only memory) were added to the system.

Block diagrams of the three chips and of the Amiga's overall architecture accompany this interview (see figures 1, 2, 3, and 4).

ORIGINS

BYTE: What are the names of the three chips?

Kolb: Agnus, Denise, and Paula. All DMA (direct memory access) channels reside in Agnus. Agnus is sort of a shortening of address generator. Denise handles most of the video output. Paula's two main functions are sound and the various I/O [input/output] functions. Logically, it's one big chip. For instance, both Denise and Paula are dependent on Agnus for their addresses, but they just weren't feasible as one chip. So they were split up functionally, but it looks like a giant control block to an assembly-language programmer.

BYTE: When did this design start?

Miner: It really started with the beginning of the company. In the early days there was more emphasis on the video game than there was on the personal computer. The cost targets were for a much lower-priced ma-

chine. We were thinking in terms of \$300 or less at the beginning.

At that time we planned to use the 68000 chip, and we didn't expect to have much memory or a built-in disk. The low-cost game machine might not even have a keyboard, but it would have high resolution, a 68000 chip, and superior graphics. Then as time went on, it grew and grew. The individual chips grew, too. The software people talked us into putting in things like hardware line-draw and hardware area-fill.

BYTE: So even at the beginning you were picturing custom chips for the graphics?

Miner: Oh, yes. I did the chip set that was in the Atari 400 and 800 and in the original Atari VCS machine. I had a good appreciation for the power of custom graphics chips. We didn't have nearly the extent of the circuitry that's on the chips now. We had visions of a fairly crude form of blitter, nothing

(continued)

Phillip Robinson is a senior technical editor for BYTE. He can be contacted at McGraw-Hill, 1000 Elwell Court, Palo Alto, CA 94303.

as sophisticated as the three-input, generalized blitter we have now.

THE BIMMER

BYTE: Tell us about the blitter.

Miner: I like to call it a *bimmer* because that stands for bit-mapped image manipulator. The term *blitter* is left over from literature referring to block transfer. This machine does block transfer, but it does much more because it has three inputs, and those three inputs can be combined in many different ways.

The logic operations that can be performed are complete. If you think of three variables, you can perform 256 logic operations on them. The *bimmer* is intended to be a non-real-time machine that transforms images from one location to another or back. Its main distinguishing features are the logic functions on all four inputs

and the capability of barrel shifting, so you can move an image on any pixel boundaries. Only two of the sources have barrel-shift capability. Also, the *bimmer* can do "modulos," which means that if you're looking at a large image in bit-mapped memory, the *bimmer* can operate on a small portion of that image. When it gets to the end of that small portion, you add a modulo to the address to jump it to the next line. That's true of the entire display circuitry; all of the bit planes have the same feature, so you can display a small image out of a larger image.

BYTE: We're pretty familiar with the Atari 800 and the chips there. To do horizontal and vertical scrolling you had to reset the pointer to a new byte.

Miner: You could only move one byte before you had to reinitialize things

in memory. Here you can do the same thing, but you can also be displaying a portion of an actually larger memory. You've got both ways you can go here. The engine that puts the bit planes up on the screen also has modulo capability, so the address at the end of one line doesn't necessarily have to be one less than the address of the beginning of the next line. It can be many less. Simply by changing the beginning pointer of the entire screen, you can move the image through memory. You give it a starting address, which is the address of the point at the top left of the screen. You give it a length and a modulo value.

BYTE: That would be the whole width?

Miner: Right. Well, it would be the difference between what you're showing

(continued)

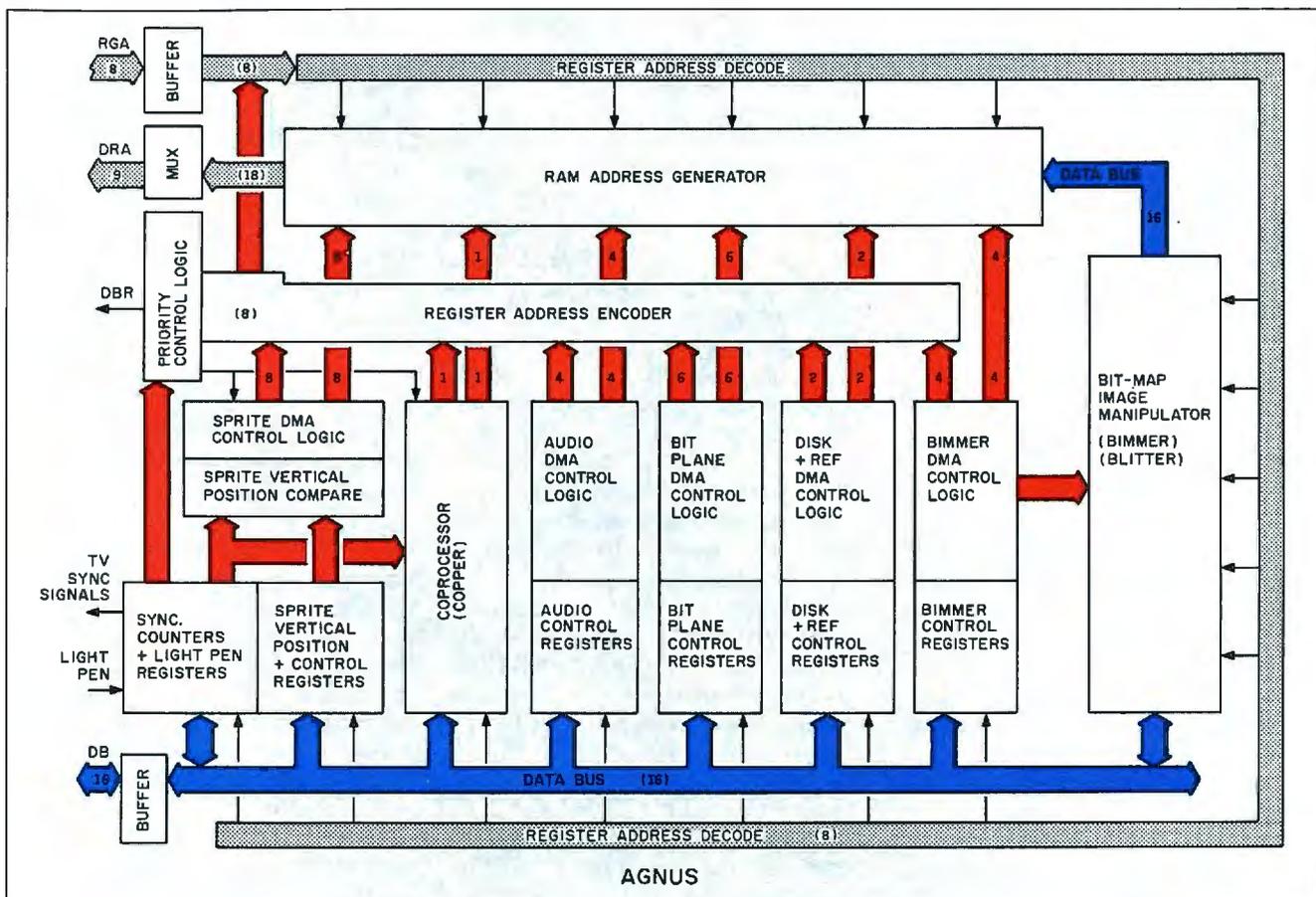


Figure 1: A block diagram of the Agnus chip.

**ORDER
LINE
800-354-7330**

LOWEST PRICES

**NO SURCHARGE
ON BANK CARDS**

SILICON SPECIALTIES

HARDWARE

PRINTERS

Anadex All Models	Save
Brother All Models	Save
C-10h A-10-30	\$439
8510 AP+	\$314
Citizen MSP-10	\$255
MSP-15	\$349
MSP-20	\$319
MSP-25	\$489
Datasouth DS180	\$1079
DS220	\$1299
DS-PP#1	\$419
DS-PP#2	\$615
Diablo D-25	\$549
630API	\$1484
630 ECS/IBM	\$1659
Other Printer Models	Save
Epson All Printer Models	Save
Juki 5500	Save
6000	\$169
6100	\$349
6300	\$679
NEC 2010, 2015, 2050	\$619
3510, 3550	\$969
3515	\$1009
3530	\$935
8810, 8830, 8850	\$1379
P2, P3	Save
EH 360	\$399
EH 370	\$389
Okidata All Printer Models	Save
Panasonic 1090	\$175
1091	\$235
1092	\$349
1093	\$429
KXP3151	\$409
Star Micronics	Save
All Printer Models	Save
Silver Reed	Save
EXP400 Parallel	\$205
EXP500 Parallel or Serial	\$279
EXP550 Parallel or Serial	\$389
EXP770 Parallel or Serial	\$699
Toshiba P1340 Parallel or Serial	\$309
P351 Parallel	\$975

MODEMS

AT&T	
4000 External	\$319
Anchor Automation	
Anchor Express	\$235
Mark XII	\$229
Hayes Smartmodem 300 Baud	\$129
Smartmodem 1200 Baud	\$369
Smartmodem 1200B (IBM)	\$319
Smartmodem 2400 Baud	\$519
Micromodem IIE (Apple)	\$129
Novation Smart Cat Plus	\$279
Prometheus All Models	Save
US Robotics Courier 2400	\$389
Password 1200	\$195

BOARDS

AST Advantage	\$389
Six Pack Plus	\$219
Everax Boards	SAVE
Hercules Color Card	\$145
Graphic Card	\$289
Paradise Modular Graphic 06-1	\$259
Five Pak	\$119
Quadram	
Quadlink	\$325
Tec Mar Graphics Master	\$449
Captain No Memory	\$159

COMPUTERS

Sonya MBC-775 Portable	\$1789
Televideo PM 4T	\$589
PM 16T	Save
Wyse Wyse pc Dual	\$1199
Wyse pc 10 Meg	\$1959
Zenith	
Z-158 All Models	SAVE
Z-160 All Models	Save
Z-138	Save
Z-148	Save
Z-171	Save
Z-200	Save

VIDEO TERMINALS

Altos Smart III	\$599
IBM 3161 & 3163 Series	SAVE
Qume QVT Green 101	\$299
QVT Amber 101	\$314
Televideo 921	\$445
922	\$599
955	\$459
Wyse 30	\$279
50	\$419
75	\$559
Wyse 85	\$579
Wyse 350	\$859
Zenith Z-22	\$489
Z-29	\$609
Z-49	Save

DISK DRIVES

Alpha Omega Turbo 10	\$529
Turbo 20	\$699
Turbo 30	\$949
Everax	
10 Megabyte	\$349
20 Megabyte	\$689
60 Megabyte Tape	\$879
Haba Habadisk for Macintosh	\$279
Iomega Bernoulli Box for IBM	
10 Megabyte	Save
20 Megabyte	Save
20 Megabyte Plus	Save
5 Megabyte for Macintosh	Save

DISKETTES

3M 5 1/4 DS/DD (Qty 100)	\$169
Maxell MD-1 (Qty 100)	\$115
MD-2 Magnetic Box (Qty 100)	\$149
Sony MD/2 (Qty 100)	\$170

PLOTTERS

Enter Sweet-P600	\$759
Epson HI-80	Save

ZENITH COMPUTERS
Always the lowest prices.
Call us for a quote.

SOFTWARE

WORD PROCESSORS

Leading Edge Word Processor	\$50
Leading Edge W/P with Spell & Mail	\$137
Microsoft Word 2.0	\$227
Multimole 3.3	\$206
PFS:Write	\$78
Wordstar w/Tutor	\$169
Wordstar Pro Pack	\$239

Word Perfect (Ver.4.0)	\$199
Wordstar 2000	\$239
Wordstar 2000 Plus	\$285

GRAPHICS

Charmaster	\$215
PC Paintbrush	\$62
Turbo Graphic Tool Box	\$28
Diagram Master	\$190
Dr. Halo	\$53
Energraphics	\$179
Energraphics w/ Plotter Option	\$228
Microsoft Chart	\$149
PC Draw	\$203
PC Draw Light Pen	\$104
PC Paint w/ Mouse	\$123
PC Mouse w/ Paintbrush	\$112
PFS Graph	\$78
Printmaster	\$30
Signmaster	\$135

LANGUAGES

C Compiler (Microsoft)	\$235
Fortran Compiler (Microsoft)	\$209
Macro Assembler	\$89
Pascal Compiler (Microsoft)	\$178
Turbo Pascal 3.0	\$35
Lotus C Compiler	SAVE
Run C Interpreter	\$85
Quick Basic	\$59
Turbo Tool Box	\$28

UTILITIES

1 DIR	\$48
Copy II PC	\$19
Norton Utilities 3.0	\$49
Sidelick	\$28
Sidelick (Unprotected)	\$43
Sideways	\$31
Superkey	\$35
Printworks	\$36
Spotlight	\$43

TRAINING

Flight Simulator	\$30
Typing Instructor	\$29
Typing Tutor III	\$29

MONEY MANAGEMENT

Dollars & Sense w/Forecast	\$95
Tablors Managing Your Money	\$94

Gem Collection	\$115
Gem Desktop	\$29
Gem Draw	\$85

PROJECT MANAGEMENT

Harvard Total Project Manager	\$239
Microsoft Project	\$149
Super Project	\$182
Timeline 2.0	\$253

COMMUNICATIONS

CompuServe Starter Kit	\$17
Crosstalk XVI	\$94
PFS Access	\$76
Remote	\$99

INTEGRATIVE SOFTWARE

Enable 1.1	\$299
Framework	Save
Smart Software System	\$459
Symphony	Save

SPREADSHEETS

Lotus 1-2-3	Save
Multiplan	\$114
Spreadsheet Auditor 2.0	\$83

Supercalc 3 (Ver.2)	SAVE
---------------------	------

DATA BASE MANAGEMENT

Cornerstone	\$255
dBase II	Save
dBase III	Save
Nuthell	Save
PFS:File	\$78
PFS:Report	\$70
Quickcode	\$139
QuickReport	\$139
Extended Report Writer	\$80
Think Tank	\$93
Clipper	\$355
Knowledgegem II	SAVE
Knowledgegem Upgrade Kit	SAVE
Powerbase	
(New Ver. Reg. 320K)	\$205

R:Base 5000 \$335

MONITORS

Amdek All Monitors	Save
NEC All Monitors	Save
Princeton Graphics	SAVE
Samsung	
All Models	Save
Toxcan 121 Green	\$125
122 Amber	\$129
Zenith All Models	SAVE

KEYBOARDS

Keytronics 5151	\$159
5151 Jr.	\$179



Prices reflect 3% to 5% cash discount. Product shipped in factory cartons with manufacturer's warranty. Please add \$10.00 per order for UPS shipping. Prices & availability subject to change without notice. Send cashier's check or money order... all other checks will delay shipping two weeks.

Inquiry 338 for MS-DOS Products. Inquiry 339 for all others.

SILICON SPECIALTIES
2034 WEST SOUTHERN
MESA, ARIZONA 85202
602-969-0909

CS-85

and the whole width. There's the capability of six bit planes in this thing. The bit planes can be grouped into two playfields, and each playfield has its own modulo and its own horizontal-scroll register, the same type of horizontal scrolling as in the Atari 800. We thought several times about giving each bit plane its own modulo, but I couldn't think of any display that would really make good use of that, and the extra hardware didn't seem worth it. All the pointers, modulos, backups, and the 18-bit adder that makes them work—by doing both the incrementing and the modulo jumps—are on Agnus, as is all the control logic that sets the priority for which one of those DMA channels gets on the bus at which time.

AGNUS PRIORITY-CONTROL LOGIC—DMA

Miner: The line coming from Agnus's priority-control-logic block should really be labeled DBR, which stands for data-bus request. But it's really not a request, it's a demand, because Agnus always has control.

BYTE: How do you determine who has priority?

Miner: The whole priority structure is really interesting. There are a lot of things that have individual time slots that occur, for example, during horizontal blanking. All of the sprite data transfer takes place during horizontal blanking, and it's assigned definite time slots. Each sprite has its own time slot, so it can't interfere with the transfer of the other sprites.

BYTE: So after each horizontal sync, there are set chunks of time?

Miner: There are set chunks of time for these data transfers, which include the sprites; the audio, which has some time slots there [four audio channels]; the disk, the refresh—all of these things are assigned. And the display itself, of course, is out here in the display time, so in a sense it also has fixed time slots; it can never compete with these other things. This is all highest, top-level priority. They don't compete with each other because they're always independent. You could have them all at the same priori-

ty level without worrying about it. And the stuff at the top priority is the display stuff and data transfer that goes in fixed time slots during horizontal blanking.

The three other things that we have to worry about are the coprocessor, the bimmer, and the main CPU [central processing unit]. That's the way it goes, in that order. The coprocessor is the next most important. It's a real-time coprocessor that's used frequently as a real-time engine to synchronize with the beam for various things like display and audio. It gets any cycles that are empty that it can use, but in order to not make it a hog, it's an every-other-cycle machine at the most. It's looking for empty cycles. If it finds one, it will use it, but it won't use two in a row.

BYTE: In the top priority, there are no empty spaces?

Miner: Oh, there are some empty spaces, especially in low resolution. At low resolution, the display portion has empty spaces, another key feature

(continued)

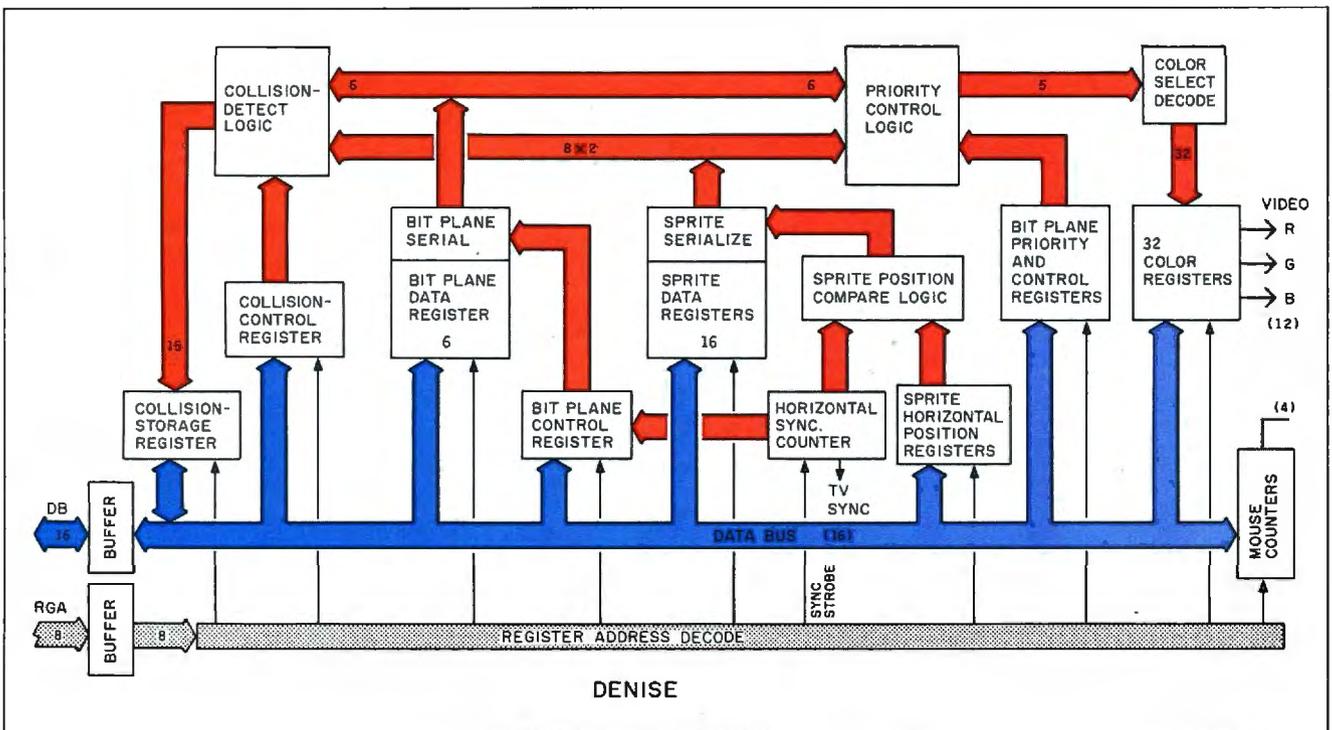


Figure 2: A block diagram of the Denise chip.



Protect your microcomputer system from destructive power loss and surges with clean, uniform standby power.

WHY POWER LOSS PROTECTION?

If your microcomputer system is unprotected against power loss and surges, it's a disaster waiting to happen. And it will happen. A typical commercial power line will experience over 2,000 disturbances a year. Any one of these disturbances could destroy equipment, data, even your ability to conduct daily business.

POWERHOUSE/300—STANDBY POWER AND MORE

Powerhouse/300 will provide clean, uniform and safe power to your microcomputer system in the event of

any power irregularity. In the event of a blackout, Powerhouse/300 will provide up to 20 minutes of 120-volt power, ample time for you to power-down your system. It will also emit a periodic "power-on" signal to tell you Powerhouse/300 has taken over. The Powerhouse/300 will also totally eliminate destructive power fluctuations.

Powerhouse/300 works for you in the standby mode. It provides full-time power line conditioning with its built-in proprietary Surge Sentry® protection. Unlike the competition, Powerhouse/300 automatically regulates power to $\pm 2\%$ of the requirements of the equipment it is protecting.

DYNATECH—THE LEADER IN ELECTRICAL PROTECTION PRODUCTS

Like all Dynatech power products, the Powerhouse/300 has superior engineering and reliability. See our complete line of electrical protection products at your local dealer or call TOLL FREE 1-800-638-9098 for more information.

Powerhouse/300 is UL recognized and CSA approved.

Dynatech
COMPUTER POWER, INC.

4744 Scotts Valley Drive
Scotts Valley, CA 95066
408/438-5760, 800/638-9098

Powerhouse/300 is a trademark of Dynatech Computer Power, Inc. Surge Sentry is a registered trademark of Dynatech Computer Power, Inc.

of the machine. Our normal resolution, what we consider normal low resolution—320 dots across the screen—leaves 50 percent empty slots during the display.

BYTE: It puts out a dot and then it has a little time?

Miner: No, putting out dots is continuous. I'm talking about memory fetches to support those dots, which have every other cycle empty.

BYTE: And there's enough time to switch over and let somebody else use that memory cycle and then switch back?

Miner: Oh, yes. An empty cycle is up for grabs, always. And during horizontal blanking, to maintain that concept, we have every other time slot assigned to a sprite or an audio refresh. That means that during horizontal blanking, 50 percent of the memory cycles are empty. So looking at the whole time, approximately 50 percent of the cycles are empty. The reason we did this is because the 68000 CPU

can use the bus efficiently only 50 percent of the time.

BYTE: Why is that?

Miner: Because of the way it's made internally. It has to fetch an instruction, which is a memory cycle, decode that instruction, and do some operation like storing data. The way it's set up, the length of time—the number of clock ticks it takes to decode the instruction—is almost equal to the length of time it spends on the bus. So at the lowest resolution—320 dots across the screen—we match the processor, and the processor thinks it's got an empty bus because it interleaves right in between those display cycles. This is something that is unique to this machine. And the processor is as happy as a clam; it thinks it's got full bus access.

If we go from 320 dots up to 640 dots, then that fills in the display time. But what I just said is still true during horizontal blanking. The microprocessor has the bus all the time that

Agnus lets it. The coprocessor is an every-other-cycle machine. It goes along using time slots as it can, based on those rules.

The bimmer, however, is a real hog. If a time slot is available, the bimmer will use it, especially when it's in what's called the nasty mode. Now there is a mode where you can tell the bimmer, "Hey, don't be so nasty, don't take so many cycles, leave some for the main microprocessor in case there's an interrupt." Because if the bimmer gets to operating heavily, it's operating on a large area of screen in a non-real-time way; churning memory up, it can hog a lot of bus cycles. Of course, it's the right arm of the main microprocessor, so it's doing things that the main micro would have to do otherwise, in terms of graphics manipulation. Still, if you want to be at all responsive to interrupts—and in a multitasking machine like this, you have to be responsive to interrupts—you've got to have a mode where the

(continued)

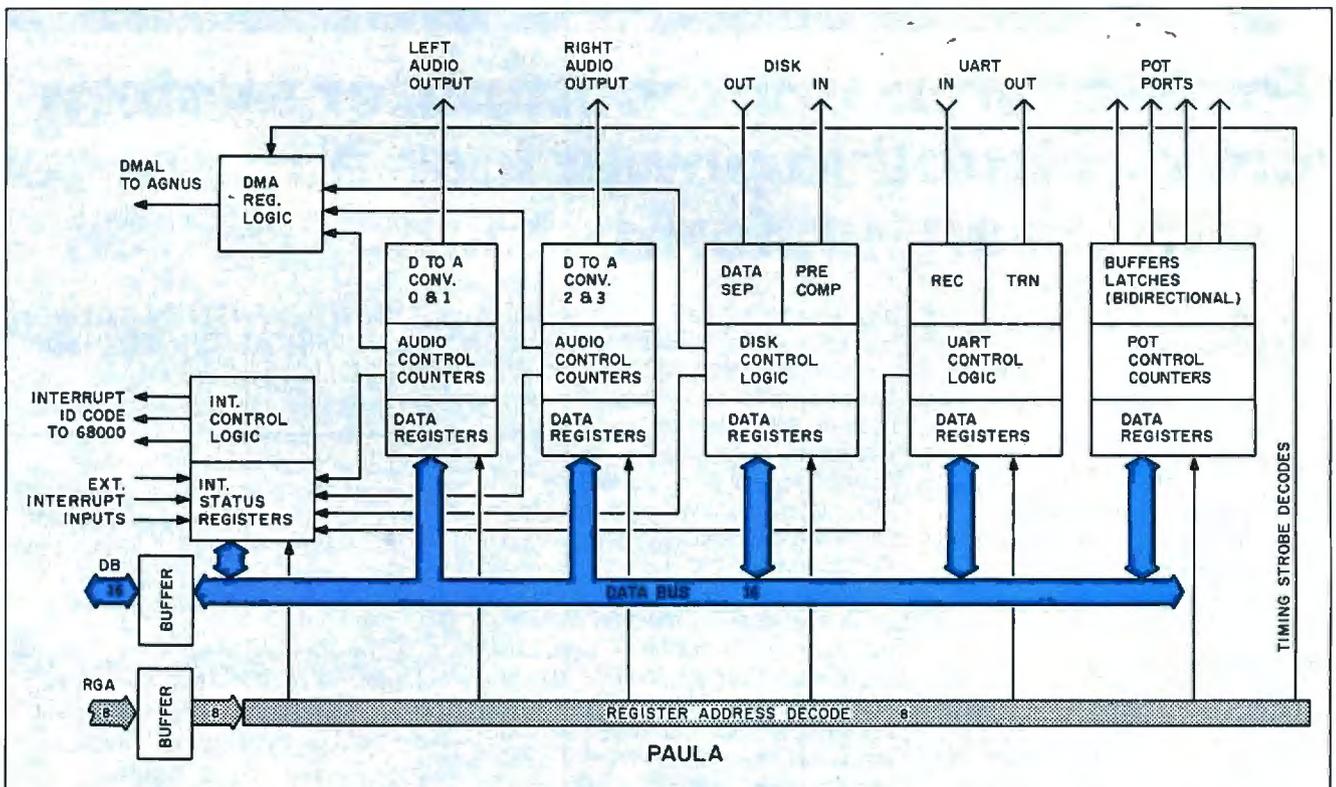


Figure 3: A block diagram of the Paula chip.



Leaders have always recognized good advice...

Bring your company's presentation graphics into the computer age with the best recommendation you can make: Hewlett-Packard.



Hewlett-Packard's Graphics Plotters introduce *professional-quality* graphs and charts to the office... quality that, quite frankly, makes the competition look stone-age by comparison.

Combine our brilliant color capability, precise line quality, and proven reliability—and HP becomes the obvious choice for your presentation graphics needs. When it comes to plotters, it's easy to see why HP has become the world's Number One recommendation.

Compare the quality of an HP Plotter...

Before making *your* graphics plotter recommendation, find out how HP stacks up against the competition. Here's a quick checklist:

Are the lines sharp and bold? Do they meet precisely? Are the diagonal lines smooth? Is the text easy to read?

In a chart, is the area fill uniform? With HP the answer is always yes, yes, and...yes.

Runs with leading PC's and software packages.

HP Graphics Plotters are compatible with most of the personal computers in your office, including IBM, Compaq, and AT&T—as well as a host of HP computers. You even have a choice of many off-the-shelf software packages, such as Lotus 1-2-3™ and Symphony™,* that give you "first-day" productivity.

Send today for your **FREE** sample plots—and see exactly what we mean.

Return the coupon—or call us toll-free at (800) FOR-HPPC. We'll send you a detailed brochure, a list of available software, plus sample plots from both an HP Graphics Plotter and a leading printer. Don't resort to stone-age methods before seeing the difference an HP Graphics Plotter can make. Call Hewlett-Packard *today*.

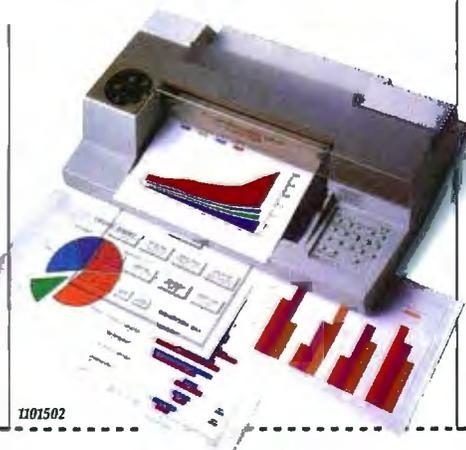
*1-2-3 and Symphony are trademarks of Lotus Development Corporation.

*Leadership in Business Graphics.
For Leaders in Business.*



**HEWLETT
PACKARD**

Inquiry 182



1101502

YES, I'd like to make the most informed business graphics recommendation I can. Please send me your detailed brochure, plus sample plots so I can see exactly what my company's presentations have been missing. I understand I will receive this information without cost or obligation.

Name _____

Title _____

Company _____

Address _____

City _____

State _____

Zip _____

Mail to: Hewlett-Packard, 16399 W. Bernardo Dr.
San Diego, CA 92127-1899.

Attn: Marketing Communications.

11502 BTX

bimmer once in a while takes a pause and says, "Okay, microprocessor, here, I'll give you a couple of time slots."

SPRITES

BYTE: We're curious about the sprite hardware.

Miner: Unlike the Atari 400 and 800, we do not have "players"—sprites with a vertical bit map. The idea was to save vertical registers and vertical comparisons in hardware and put them into the software by requiring the programmer to reposition the image in the vertical bit map.

BYTE: That was a direct outgrowth of the way you did the players in the Atari 2600, where they were only one line long and one bit wide. You had to redefine them on the fly for each video line. A logical extension would be to make that two-dimensional.

Miner: It wasn't that so much. You see, the 2600 had no bit map at all except in ROM, where there were some bit maps of sprite images. All of the stuff was created on the fly. I was really tight on register space—the design rules were *big*—we were trying to save as much hardware as we could

and put functions into software. So we came up with the idea that if we didn't have any vertical comparators at all, and no vertical position registers, then what we would end up with is a sprite that is not a real sprite in both directions, but only in the horizontal direction. In the vertical direction it's a bit map. That was the concept that we patented in the Atari machine. We don't have that here at all. We've got a general-purpose sprite both horizontally and vertically—a classical sprite concept with a vertical start position and a vertical stop position.

BYTE: The sprite is 16 bits wide, but it can have any height?

Miner: It can be any height because it can have any start and stop position, but its height is not related to the bit-map image like it is in the Atari 400 and 800. Its height is related to the line count given by a start-control register and a stop-control register. There are eight sprite engines. Each one is 2 bits deep (which allows for four colors per sprite) and 16 bits wide at low resolution (at the 320-dot horizontal rate).

BYTE: What choices do you have for the four colors? Is there a separate color table for each sprite?

Miner: There's a separate color table, but not for each sprite. There's some sharing that has to go on. We've got only 32 color registers, and those have to be shared between the playfields and the sprites. Sometimes the playfield uses 16 of the colors and the sprites have the other 16. Sometimes some of them are shared, depending on how many colors you're trying to show on the playfield. Those eight sprites can be combined to make four sprites that are 4 bits deep with 16 colors each. The total sprite bit resolution, however, does not go down to as fine as the high-resolution playfield.

BYTE: How do you get more than eight sprites?

Miner: You can reuse the sprite engines any time you want.

BYTE: You mean you just have to reset them between frames?

Miner: You reset them horizontally or vertically. Once you finish using one

(continued)

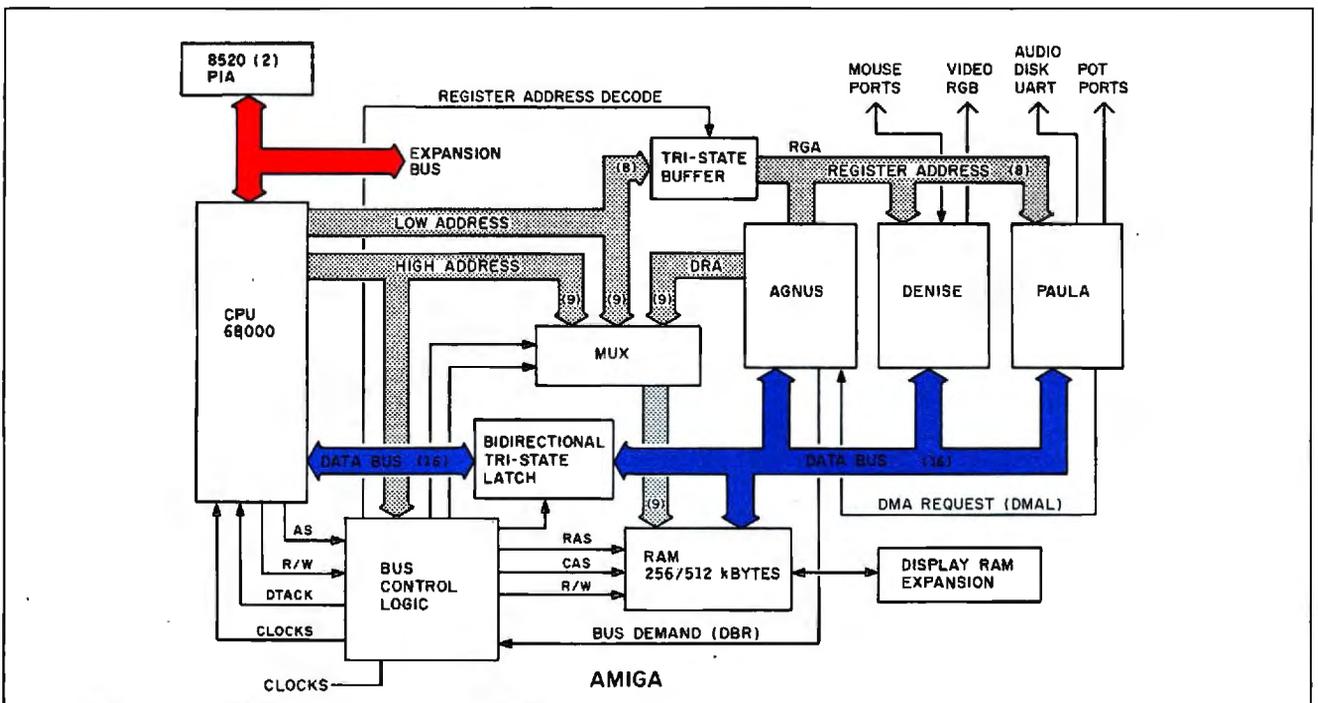
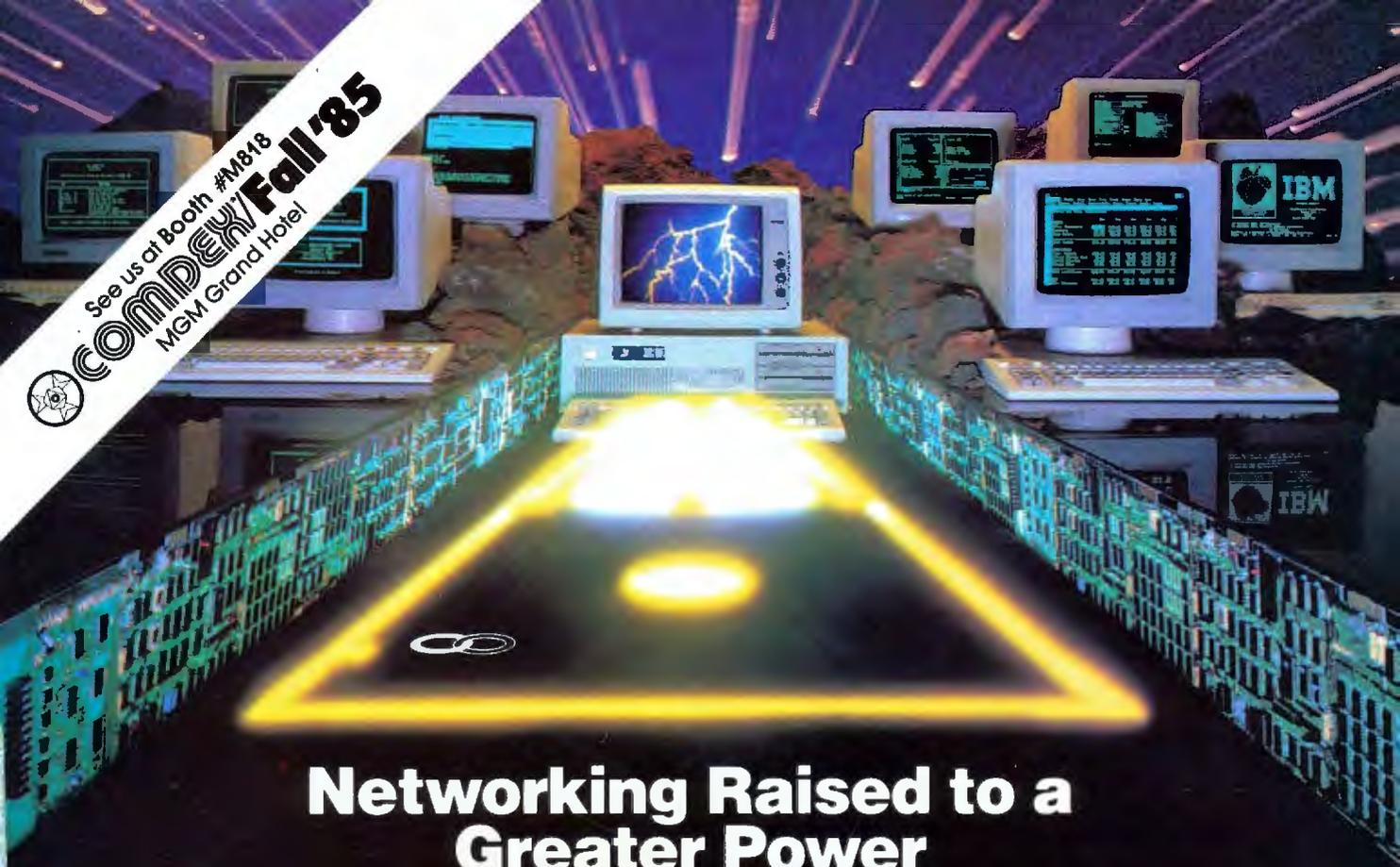


Figure 4: A block diagram of the Amiga's overall architecture.

See us at Booth #M818
COMDEX Fall '85
 MGM Grand Hotel



Networking Raised to a Greater Power

Advanced Technology. With it, IBM tripled the speed of the PC and increased its memory capacity five-fold. Nowhere is this increase in computing power more important than in networking situations. If the AT's technological advances have prompted you to look into a multi-user network, you owe it to yourself to take a closer look at MultiLink Advanced™ . . . a unique multi-tasking, multi-user networking system that runs programs under PC-DOS 3.0.

Eight Workstations for the Price of an AT. MultiLink Advanced™ represents the next generation in networking systems for IBM microcomputers. The system enables terminals, connected to a single AT, to emulate IBM-PC's having up to 448K of RAM (The PC-Shadow™ terminal, shown above, even has a PC look-alike, as well as work-alike keyboard and display).

This means that instead of spending \$3,000 per workstation for a PC with a Kilobuck "Network Interface Board," you can use inexpensive terminals . . . eight of which cost less than an IBM AT. Even if you need only one workstation connected to your AT, you'll realize significant savings.

MultiLink Advanced™ . . . Instant Access to All of Your Resources. Central to most multi-user situations is the need to coordinate a variety of printers. With what's been described by *PC-Tech Journal* as ". . . by far, the best print spooler for the IBM PC," MultiLink Advanced™ gives users the option to print either at their workstations, or at a central location. In addition, programs and files can be shared by multiple users locally or through use of a modem. Just think of it . . . having remote access to an AT with a lightweight terminal/modem.

Although designed to take advantage of the AT, MultiLink Advanced™ runs on all versions of PC-DOS, except 1.0, and certain implementations of MS-DOS. A wide range of leading programs are supported which include WordStar, dBASE III, Multimate, and Lotus 1-2-3.

Get the Advanced Story Today. Call The Software Link Today for complete details and the dealer nearest you. MultiLink Advanced™ is immediately available at the suggested retail price of \$595 (U.S.) and comes with a money-back guarantee. VISA, MC, AMEX accepted.

MultiLink™ ADVANCED

 THE SOFTWARE LINK, INC.

8601 Dunwoody Place, Suite 632, Atlanta, GA 30338 Telex 4996147 SWLINK
 CALL: 404/998-0700

Dealer and Distributor Inquiries Invited:

IBM PC, AT, & PC-DOS are trademarks of IBM Corp. MS-DOS, WordStar, dBase III, Lotus 1-2-3, and Multimate are trademarks of Microsoft Corp. MicroPro, Ashton-Tate, Lotus Development Corp., & Multimate International, respectively.

Distributed in United Kingdom:
Intercompany Communications Technology Ltd.
 Prince Rupert House
 Queen St. London EC4R 1AD
 Tel: (01) 248 8895

Distributed in France, Germany, Benelux:
COMPUCON
 Bredabaan 876, 2060 Merksem, Belgium
 Tel.: + 32/3 647.04.99
 Telex: 32027 COMPCN B

MultiLink Advanced™ & PC-Shadow™ are trademarks of The Software Link, Inc.

vertically, you have to wait one line time before you can use the same engine again vertically. You can use the same engine over and over again on a horizontal line if you can get enough microprocessor or coprocessor time to go in there and rewrite the registers.

DIGITAL RGB, ANALOG RGB, AND NTSC

BYTE: *When you put out RGB [red-green-blue] data, how does it come out?*

Miner: It comes out as 4 bits, 4 bits, and 4 bits.

BYTE: *And that's how RGB monitors normally take their information?*

Miner: Off chip it goes into a ladder. There are three groups of 4 bits coming right out of the 32 color registers, and then there's a four-resistor ladder on each one of those that converts it into three analog values. That's what goes to the monitors.

BYTE: *Then the values of that analog data—which you've changed from the digital data—determine how strong each of the RGB guns is when it's firing at a particular point?*

Miner: Yes, on the so-called analog RGB. There are two kinds of RGB: digital and analog. This is important to stress because IBM talks about 16 colors, but what IBM really means is two shades of eight colors, and those two shades are always the same color. There's no way to change them. That's what's called digital RGB, or RGBi. It's got red on and off, it's got green on and off, it's got blue on and off, and it's got an intensity level that determines brightness or darkness for each one of those. It's a four-wire control, but it's completely digital. We put that out too, in order to be compatible, but we also put out the analog RGB, which has 4 bits, 4 bits, and 4 bits, into ladders, so you get 16 values of red, 16 values of green, and 16 values of blue. It's equivalent to 2^{12} total colors and luminances.

BYTE: *So on the analog output, you could have any number of bits that you wanted? You could put out 10 bits on each line?*

Miner: Yes, if you had big enough registers. In fact, that's probably one of the things we'll be expanding in the future chip set.

BYTE: *Why did you choose 4 bits in the first place?*

Miner: Originally, this wasn't going to be RGB; it was going to follow the NTSC [National Television System Committee] standard. NTSC works on intensity, hue, and saturation. Color and luminance. YIQ is what they call it. The Y is the intensity, and the I and the Q define a vector that determines the saturation. Having 4 bits of each was about the best we could tackle in terms of having on-chip ladders that would take the 4 bits for each one of these and convert them into an actual phase angle.

BYTE: *So that ladder is on Denise?*

Miner: No, it was when we had the YIQ; when we were emphasizing NTSC, we had a ladder on board. Then we deemphasized it. We found a Motorola chip that did a good job of converting RGB into NTSC. We needed the extra room on the Denise chip for extra resolution on the color registers, so we dropped the YIQ NTSC completely. But we've still stuck with the 4, 4, 4 bits. Also, you've got a real pin limitation on a chip like this. We tried to keep the chip simple and low-cost to manufacture, and on-chip ladders take up a lot of area. They're notoriously inaccurate, and you can buy 1 percent resistors external for a penny a piece.

BYTE: *Is there still NTSC output from the Amiga?*

Miner: In the box there is, yes. But not in the chips.

BIT PLANES

BYTE: *Explain the bit planes to me a little better. You've got ones and zeros in memory and you overlay them; you look at a group of them simultaneously to determine what the color is of something that's actually on the screen. Do you have an address for the beginning of each bit-plane area?*

Miner: Yes. The concept of bit planes is very deeply ingrained in this archi-

ture. There are really two conflicting display concepts here. One is pixel addressing; the other is bit-plane addressing. We've chosen bit-plane. One reason for our decision is that we wanted to do a very efficient area-fill.

BYTE: *You mean filling in a particular zone on the screen?*

Miner: Yes, and that's done quite well and efficiently with bit-plane addressing on a single bit-plane basis. We wanted to have a lot of variety in the number of bit planes that you can specify. We wanted to have our two separate playfields—each one with a controllable number of bit planes in it. We didn't want to waste a lot of data transfers if we had fewer bit planes than others did. So we decided not to transfer data on a pixel basis, which wastes a lot of transfer time if you don't use all of your pixels or all the bits within a pixel. Even if you don't use them all, you still have to address them, and it still takes a memory cycle. When you're bit-plane-oriented, if you've got only two bit planes instead of eight, since you're moving data out of a single bit plane only, it doesn't matter because you're using all the bits that come across. That was really why it came about: to increase the efficiency of data transfers and the sprite transfers for different numbers of bit planes and different organizations.

BYTE: *When the bimmer is operating on its three sources and sending to its destination, is it operating on pieces of bit planes?*

Miner: It's always operating on only one bit plane at a time. If you want to do a picture with multiple bit planes, you just do the same routine and point it to where that other bit plane is located.

BYTE: *But it can't take a chunk and move it from bit plane number 1 over to bit plane number 2?*

Miner: It could, sure. But that isn't normally the way it's done. Usually you define the bit planes, and you operate on them as though they were images one behind the other.

(continued)

Living C-Personal™

RELEASE
FULL
TM

GIVES LIFE TO C PROGRAMMING

Living C™ is the fully integrated interactive programming environment for C. By replacing the headaches of programming in C with total control and understanding - whether new to C or an expert - Living C is the exciting solution to maximise your creativity and productivity.

£99

The Living C editor is a true full function commercial editor, fully menu-driven with help facilities on call. The editor is fully integrated and can be used at all times throughout the design, development, maintenance and debugging of your C application.

FULL SCREEN EDITOR

Living C allows you to execute all your C source code on the screen. You control the code you wish to examine and the speed of animation. The cursor demonstrates exactly how your source is executing, enabling you to understand instantly how the application or prototype works - or why it doesn't!

ANIMATING C INTERPRETER™

Living C conforms to the full Kernighan and Ritchie standard. Living C not only highlights all errors discovered, but also offers comprehensive error diagnostics and useful hints to solve the problem. Corrections can be made immediately, using the fully integrated Living C editor.

FULL C SOURCE DEBUG

The Living C windows allow you to constantly monitor the variables and I/O of your applications even when you are "zooming" to your next breakpoint!

WINDOWS

Understand that I can write my applications in Living C, but what if I want to debug or modify an existing application - bearing in mind that 75% of my programming time is taken up with maintenance?

You simply compile in your C source and leave the rest to Living C! Living C not only enables you to understand how your application works but also ensures you can interpret a colleague's application and understand why it works or doesn't!

Once in Living C, the full suite of programming tools are automatically available. Combined with your rapid increase in productivity and understanding, you will now find that maintenance time is dramatically reduced.

So now I have written and tested my application, how can I use it?

You have 2 choices:

(1) Simply switch off the animation and use Living C as an interpreter.
(1) Recompile your application into your favourite C compiler (eg Microsoft, Lattice, Computer Innovations, Aztec)

What machines does Living C - Personal run on?

Living C - Personal is available for the IBM PC and all compatibles. You will need PC-DOS, either twin floppy disk drives or a floppy and a hard disk with 192K RAM.

How do I order Living C - Personal?

Just fill out the coupon and send it to us along with £99 or call us on **0272-217040**

Perception Software Systems Ltd., London House, 243-253 Lower Mortlake Road, Richmond, Surrey TW9 2LL
Telex: 946240 CWEASY ref. 19004106

Living C, Living C - Personal and Animating C Interpreter are trade marks of Living Software

Inquiry 424 for U.S.A. Inquiry 425 for International.

Post to Perception Software Systems Ltd., London House, 243-253 Lower Mortlake Road, Richmond, Surrey TW9 2LL

Please send _____ Quantity
Living C-Personal @ £99 x

Postage & Packing
VAT

TOTAL

£ 5.00
£
£
£

To order your copy of Living C-Personal please complete this form
Name _____
Address _____

Telephone _____

Living C-Personal is available for PC-DOS with min 192KB RAM

Payment Access Cheque

Credit Card expiry date _____

Name on Card _____

Card No. _____

BYTE: This screen that you have that's looking at a section of the large image is actually looking at the bit planes stacked on top of each other?

Miner: No, the bit planes are never really stacked.

BYTE: Well, in memory then, because memory is just stretched out.

Miner: Memory is contiguous, right. So the bit planes are really located separately in memory, but since they're fetched by the bit-plane DMA channel, a word at a time from each bit plane, they're placed into these holding registers in Denise. Then when bit plane number 1 comes along, they know they've all been

filled, so you simultaneously convert them all from parallel to serial and start squirting them out. While they're squirting out, the parallel's being reloaded to get ready for the next squirt-out. As they come out, you're looking at them as though they were a pixel, at a single instant in time.

BYTE: How does barrel shifting fit in?

Miner: The bimmer's barrel-shift capability lets you move images on pixel boundaries. If it weren't for the barrel shifter, the bit-plane concept wouldn't work at all. When you're doing pixel addressing, since each pixel has its own address, to move stuff by one pixel all you have to do is increment the address by 1. There's no problem in moving stuff—using pixel addressing—on arbitrary pixel boundaries. But when you're using bit-plane techniques like we are, where each word represents a whole bunch of pixels from one bit plane, then to move that image within a word, within a single pixel boundary, you've got to shift it by an arbitrary number from 0 to 15.

BYTE: Even across words?

Miner: Yes. The barrel shifter allows you to do that here. As the data is transferred from source to destination, you can move it by an arbitrary number of pixels.

SCROLLING

BYTE: Could you explain the scrolling process?

Miner: The bit planes need the horizontal-sync-counter output bits because they have to fetch over and over again across the line. Also, they need to do scrolling. The bit planes have a delay capability called horizontal scrolling built into them. This hardware scrolling actually delays the fetching of data so that it shows later on the screen. To do that, it's got to have a counter that causes 0 to 15 bits of delay.

What shows on the screen is the size of the screen display. The picture in memory can be quite a bit larger than that, and it can have multiple bit planes. There are two ways to change

(continued)

Faster CAD Input

The GTCO DIGI-PAD is a fast tracing device, a function the mouse can't perform at all. It's an absolute screen pointing device for direct cursor control. It can also provide direct, simple menu selection. The GTCO DIGI-PAD is a digitizer tablet in sizes including 12"x 12", 11"x 17", 20"x 20", 24"x 36", 36"x 48" and 42"x 60".

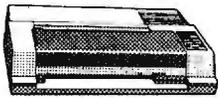
The DIGI-PAD is easily interfaced to PCs and is compatible with most PC/CAD software, such as AutoCAD™ and CADPLAN™.

The digitizer surpasses all other input devices for tracing and pointing and menuing. GTCO digitizers use patented electromagnetic technology for years of silent, maintenance-free operation.

Ask your dealer about the GTCO DIGI-PAD.

® DIGI-PAD and Micro DIGI-PAD are registered trademarks of GTCO Corporation.
™ AutoCAD is a trademark of Autodesk Inc.
™ CADPLAN is a trademark of Personal CAD Systems, Inc.

LycO Computer Marketing & Consultants



SG-10 \$212.00

AXIOM

GP550AT (Atari) 222
 GP550CD (C-64) 222
 GP700AT (Atari) 439
 GP700AP (Apple) 439
 ELITE5CD (C-64) 229

C. ITOH

B510A+ 299
 1550P 437
 1550BP 437
 1550EP 437
 1550BCD 469
 F10-40 859
 F10-55 1039
 7500AP 204
 7500AR 244

TOSHIBA

P1340 557
 P351 1286

SAVE ON THESE IN STOCK PRINTERS

CARDCO
 32K BUFFER. (C-64) 59

CORONA
 LP300 Laser Printer 2686
 200361 Toner Cartridge 89

EPSON

FX85 (New) 333
 LX80 212
 FX185 (New) 464
 LX90 (New) 226
 SQ2000 (New) 1555
 JX80 467
 Homewriter 10 193
 CR-20-Atan 153
 CR-220-C-64 153
 DX-10 (New) 207
 DX-20 (New) 297
 HS-90 (New) 288
 LQ1500P 975
 LQ1500S 1039
 RX-100 356
 FX-100+ CALL

CITIZEN

MSP-10 287
 MSP-15 447
 MSP-20 447
 MSP-25 563
 Sheetldr (10/20) 189
 Sheetldr (15/25) 199

OKIDATA

Okimate 10 CALL
 Okimate 20 CALL
 182 214
 192 348
 193 563
 92P 349
 93P 565
 84P 645
 92 Imagewriter 349
 *IBM versions also

BROTHER

HR-15XL-P 359
 HR-15XL-S 359
 HR-35P 839
 HR-35S 839
 2024L-P 949
 M1009-P 189

JUKI

Juki 6100 347
 RS232 Serial Board 55
 6100 Tractor 119
 6100 Sheet Feeder 209
 Juki 6300 757

LEGEND

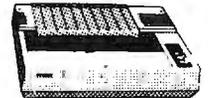
880 196
 1080 222
 1380 262
 1385 296

DIGITAL DEVICES

16K BUFFER 75
 32K BUFFER 89
 64K BUFFER 125

DIABLO

D25 549
 630API 1599
 630ECS 1759
 D801F 2395
 P32CO1 699
 P38 1749
 C150 999



1091 \$233.00

PANASONIC

1091 233
 1090 183
 1092 373
 1093 426
 3151 Letter 426
 4K Buffer 65

SILVER REED

EXP400 249
 EXP500 295
 EXP550 399
 EXP770 749

STAR MICRONICS

SG-10 212
 SG-15 373
 SD-10 336
 SD-15 442
 SR-10 483
 SR-15 583
 Powertype 303
 SB-10 CALL
 SG-10C-64 (NEW) CALL

MONITORS

TAXAN

115 12" Green Composite CALL
 116 12" Amber Composite CALL
 121 12" Green TTL 135
 122 12" Amber TTL 145
 220 14" Color Composite 259
 410 12" RGB Hi Res IBM 329
 420 12" RGB Super Hi IBM 409
 440 12" RGB Ultra Hi Res 555
 Tilt Stand 35

SAKATA

SG1000 12" Green 99
 SA1000 12" Amber 109
 SG1500 12" Green TTL 119
 SA1500 12" Amber TTL 129
 SC100 13" Color Comp 209
 SC200 13" RGB 389
 STSI Tilt Stand 29

PANASONIC

DT 1300 RG1 composite 247

NEC

JB-1260 Green 95
 JB-1201 Green 135
 JC 1215 Color 235
 JC 1216 RGB 375
 JC1460 Color 265
 JB-1205 Amber 139

PRINCETON GRAPHICS

MAX-12 Amber 185
 HX-12 RGB 465
 SR-12 RGB 595

AMDEK

300 Green 118
 300 Amber 128
 310 Amber IBM 155
 Color 300 Audio 234
 Color 500 Composite 369
 Color 600 397
 Color 700 495
 Color 710 569

X-TRON

Comcolor I Composite Green 177

ZENITH

ZVM 122A Amber 75
 ZVM 123G Green 75
 ZVM 124 Amber IBM 129
 ZVM 131 Color 275
 ZVM 133 RGB 389
 ZVM 135 Composite 449
 ZVM 136 Hi Res Color 589

TEKNIKA

MJ-10 Composite 179
 MJ-22 RGB 255

MODEMS

HAYES

SMARTMODEM 300 133
 SMARTMODEM 1200 377
 SMARTMODEM 1200B 347
 SMARTMODEM 2400 598
 MICROMODEM IIE 135

TELE LEARNING

Total Telecommunications
 (C-64) 29.95
 AP-250 (300 Baud Apple) 69.95
 IB-250 (300 Baud IBM) 69.95

ANCHOR

Volkmodem 55
 Volkmodem 12 186
 Mark 12 229

WESTRIDGE MODEM (C-64) 59
 MITEY MO MODEM (C-64) 69
 Compuserve 19.85

NOVATION

IBM-300/1200 MS-DOS ext. 319
 IBM-300/1200 CPM-86 ext. 319
 IBM 300/1200/2400 ext. 529

DISKETTES

SKC (Box 10)

(Qty)	10	100	500
5 1/4 SSDD	13.75	12.99	11.99
5 1/4 DSDD	15.75	14.99	14.25

ELEPHANT (Box 10)

5 1/4 SSDD	13.50	12.99	11.99
5 1/4 DSDD	14.99	13.99	12.99
5 1/4 DSDD	16.99	15.99	14.99
Premium SSDD	15.95	14.95	13.95
Premium DSDD	17.95	16.95	15.95

MAXELL (Box 10)

5 MO 1	16.75	15.75	14.75
5 MO 2	22.99	21.99	20.99

VERBATIM (DataLife) (Box 10)

5 1/4 SSDD	19.99	18.99	17.99
5 1/4 DSDD	24.99	23.99	22.99

DRIVES

INDUS

GT ATARI 199
 GT COMMODORE 199

MSD

SD1 Drive (C-64) 229
 SD2 Drive (C-64) 468

IBM-PC COMPATIBLE

*LEADING EDGE

Nutshell 69.95
 LEWP Basic 65.00
 LEWP Merge Print 99.00
 LE Spell Correction 169.00

*ASHTON-TATE

Framework 385.00
 d Base II 289.00
 d Base III 385.00
 d Base II upgrade 135.00

LEADING EDGE

PC Compatible Call

ZENITH

Z-150 Call

AST

Six Pack Plus 64K CALL
 Mega Plus II 64K 269
 Memory 128K (mega) 199
 Memory 256K (Mega) 335
 Mono-Graph Plus 339
 Advantage-AT-128K 389

TOLL FREE 1-800-233-8760

Inquiry 228



TO ORDER



CALL TOLL FREE

800-233-8760

or send order to

LycO Computer
 P O Box 5088

Customer Service 1-717-327-1825 Jersey Shore PA 17740

RISK FREE POLICY

In stock items shipped within 24 hours of order. No deposit on C.O.D. orders. Free shipping on prepaid cash orders within the continental U.S. Volume discounts available. PA residents add sales tax. APO FPO and international orders add \$5.00 plus 3% for priority mail service. Advertised prices show 4% discount for cash, add 4% for MasterCard or Visa. Personal checks require 4 weeks' clearance before shipping. Ask about UPS Blue and Red label shipping. All merchandise carried under manufacturer's warranty. Free catalog with order. All items subject to change without notice.

what shows on the screen. One is to horizontally scroll smoothly 0 to 15 bits within a word. The other is to change the pointer a whole word value. So you can relocate the thing just by changing the pointer. If you come to the edge of the big picture, then you've got to do something in the software—block moves and so on.

COLLISION DETECTION

BYTE: *What about the information feeding over to the bit-plane controls and the whole interaction of bit planes and sprites? Collision detection has nothing to do with what shows; it just tells you when something has happened, right?*

Miner: Exactly. Collision detection is looking in real time at the simulta-

neous occurrence of objects. Sprites are on the 16 lines out of the sprite-serialize block, and bit planes are on the six lines out of the bit-plane-serialize block. Any simultaneous, real-time occurrence of more than one object at the collision-detection logic will be detected and stored in a latch in the collision-storage register. The program or the programmer can read this back out any time.

BYTE: *How do you know when there's an object here if there's always some sort of data on the line? If this line is low, then do you assume that it's not data?*

Miner: Right. Zero is always nothing. Zero is transparency.

BYTE: *But collision is more complicated than just "There are two things here."*

Miner: Collision control is quite complex. We've got an ability in this machine that I've never seen in any other machine before. Take a four-bit-plane playfield. Here's a sprite coming along. It can collide with that playfield by virtue of hitting any of those planes. This whole architecture is bit-plane-oriented rather than pixel-oriented. I can collide with any bit plane or mask any bit plane from the collision. Or I can actually invert the polarity of the bit plane with which I'll collide. The collision-control register decides which bit planes get looked at by the collision monitor and with what polarity. You can be very picky about what kinds of playfield the sprites collide with. By using all bit planes and getting the right polarity, you could have a collision with any individual color.

BYTE: *With 128 virtual sprites as a possibility and the various bit planes, it seems like you'd have an enormous number of things for the collision-control register to keep track of.*

Miner: Well, the collision-control register doesn't keep track of those virtual sprites. It only keeps track of real sprite-engine collisions. For real sprites, you use the collision-control register every vertical-blank time, and if a sprite collided during the previous frame, then you know that a collision occurred. ■

**USE US...
TO SAVE A BUNDLE!!**

We save educational, business and institutional buyers hundreds or even thousands of dollars on their computer supply needs. **HOW ABOUT YOU?**

We deal only in first quality, guaranteed products — all in stock for immediate shipment!!



BULK DISKETTES

JANUS
FROM .. SS/DD **69¢** EACH 100 LOT DS/DD .. **79¢** EACH 100 LOT

VERBATIM
FROM .. SS/DD **85¢** EACH 100 LOT DS/DD .. **\$1.05** EACH 100 LOT

SENTINEL
FROM .. SS/DD **75¢** EACH 100 LOT DS/DD .. **85¢** EACH 100 LOT

OTHER MAJOR MANUFACTURERS AVAILABLE, CALL...

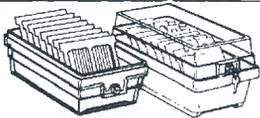
SENTINEL COLOR DISK
SS/DD ... **89¢** EACH 100 LOT
DS/DD ... **99¢** EACH 100 LOT



3-1/2" DISKS
for Macintosh & HP. **\$1.89** EACH 100 LOT

Verbatim DATA CASSETTES T300 **\$4.99** EA A300 **\$4.49** EA

DISK STORAGE BOXES
(many to choose from) including our DX85A — Holds 100 disks
AT JUST \$12.95 EA



PRINT WHEELS

Diablo low as \$5.45
Qume low as 5.45
Wang low as 6.45
Royal low as 14.50
Nakajima low as 13.95
IBM Displaywriter low as 15.95
Ricoh low as 24.95
Silver Reed low as 12.95

ALL TYPES & STYLES IN STOCK.

PRINT RIBBONS
PRICES PER DOZEN RIBBONS
Epson MX 80 low as \$3.49
Epson MX 100 low as 4.99
Diablo low as 3.49
Imagewriter low as 3.99

ALL ABOVE AVAILABLE IN COLOR AS WELL! WE STOCK RIBBONS FOR ALL MAJOR BRAND PRINTERS!!! CALL TODAY!!

CALL FOR VOLUME DISCOUNTS!!!

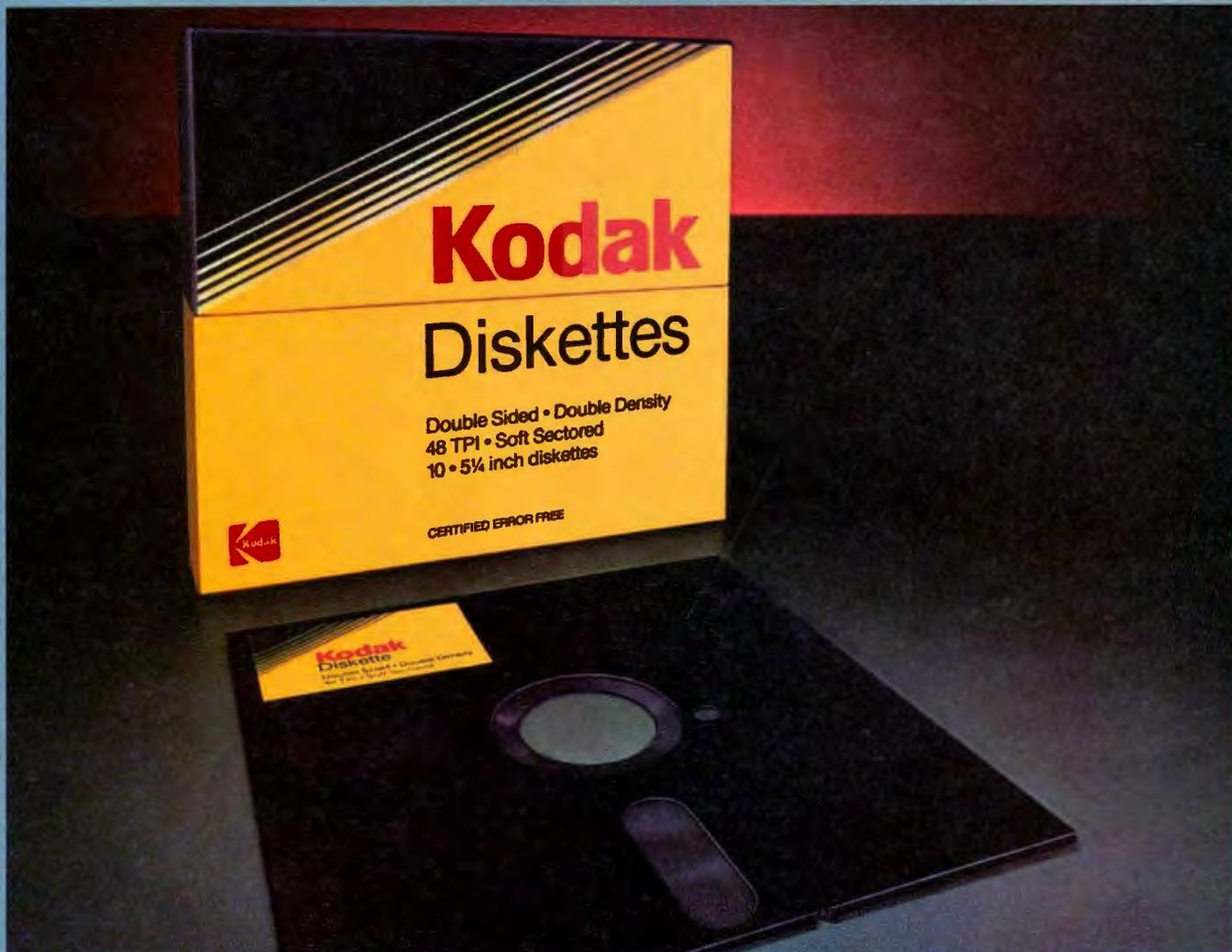


780 Trimble Road, Suite 608, San Jose, California 95131
800/437-0900 • 800/435-9700 in CA
P.O.'s accepted from Institutional, Educational & Government Accounts.
Dealer and Distributor Calls are Welcome.



C.O.D. ADD \$2.00
SUPPLY ORDERS \$25.00 MIN.

THERE IS NO FINE PRINT.



IT PERFORMS, OR WE REPLACE IT.

With all the care and precision that goes into every Kodak diskette, it's only natural that you'd expect extraordinary performance.

And that's exactly what you'll get.

You see, Kodak diskettes are made for any application where trouble-free performance is essential and data protection is critical.

For openers, every Kodak diskette has the stamina to sustain signal strength far above industry performance standards, even after millions of read-write passes.

Every Kodak diskette is individually tested for read-write performance over every sector, every track.

And it's not until those tests and many others are completed that

Kodak diskettes are certified error-free.

Naturally, every Kodak diskette is backed by our Performance Guarantee, which promises a free replacement in the unlikely event that a Kodak diskette is defective. No other warranties are expressed or implied.

You'll find Kodak diskettes at computer stores, office supply dealers, and other retail outlets. In standard-

density 8- and 5 1/4-inch formats, plus high-density 5 1/4-inch diskettes, and 3 1/2-inch micro diskettes.

The Kodak diskettes. Performance without the fine print.



KODAK.
The name says it all.



THE AMERICAN BUS NEVER LOOK

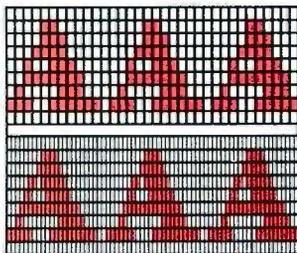
SONY BRINGS THE BRILLIANCE OF TRINITRON™ TO COMPUTER MONITORS.

From now on, business people all across America can enjoy all their favorite programs on a Sony Trinitron.

Because Sony proudly unveils the first computer monitors in the world endowed with Trinitron technology. RGB monitors which, in the laudatory words of Computer Buyer's Guide and Handbook, give you "crisp, brilliant, utterly flicker-free images that take the eyestrain and headaches out of both color graphics and text or data processing."

We've achieved this through technological breakthroughs that literally divide the computer-monitor world in half: Sony's, and all the others'.

First, the patented one-gun, one-lens Trinitron system itself, with a picture so vivid, so critically lifelike, it's become a legend.



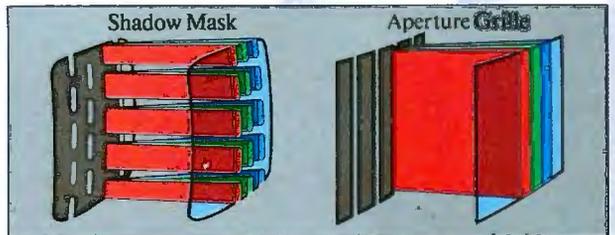
Typical coarse dot pitch vs. Sony Trinitron super-fine dot pitch.

Second, Sony Trinitron's exclusive Super Fine Pitch™ Aperture Grille. It dramatically increases the number of red, green and blue electrons reaching your screen.

Which dramatically increases the vibrance and brightness of the colors reaching your eyes.

And third, a dot pitch so fine, the horizontal resolution of a Sony is not only the highest in its class, but "close to that of models costing twice as much" (Computer Buyer's Guide and Handbook).

You can enjoy this extraordinary picture quality on screens ranging from 9"—the first ultracompact monitor in the business capable of displaying 2,000 characters of text—to 13"—a model that lets you switch from software to



With a Fine Pitch Aperture Grille, Trinitron monitors give you dramatically brighter colors than the conventional shadow mask.

soaps at will by merging a computer monitor and full-feature TV into a single unit.

They're all compatible with the IBM® PC, Portable PC, PC/XT and PC/AT through built-in RGB circuitry. And compatible with most Apple® and other personal computers through optional accessories.

So call Sony for further information at 1-800-222-0878 (In New Jersey, 1-800-222-0879).

Because there's no longer any reason to view your technologically-advanced computer through a technologically-deprived monitor.

SONY
Information Products

registered trademarks, and Super Fine Pitch a compatibility: The microcomputer industry lacks its monitors will be compatible with any combination's compatibility in any particular instance.

Inquiry 348



©1985 Sony Corporation of America. Sony Information Products Division, Sony Drive, Park Ridge, NJ 07656. Sony and Trinitron are trademarks of Sony Corp. IBM PC is a registered trademark of IBM Corp. Apple is a registered trademark of Apple Computer. *Computer standards. Software packages and add-on hardware options vary tremendously. For these reasons, Sony cannot and does not represent that nation of non-Sony products you choose to connect to it. While your Sony dealer may be able to help, you must determine for yourself the

INCESS PICTURE HAS ED BRIGHTER.



Look at what we're plugging now.

Plug-in Teacs.

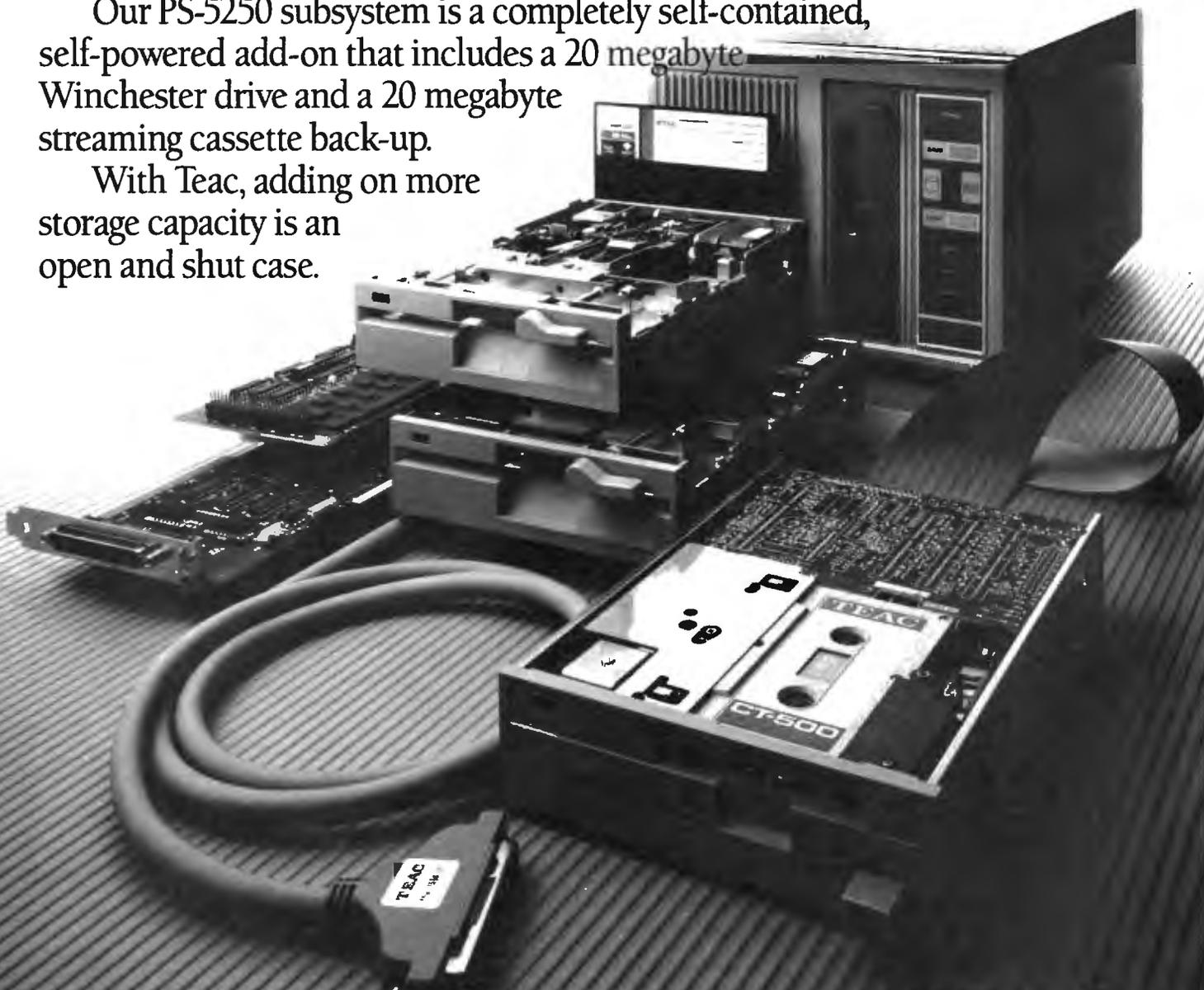
We offer a full line of PC compatible components to increase your floppy storage, to add Winchester drives, or to include a streaming cassette back-up.

Our FD-55 Series, half-height, low power, 5¼-inch floppy disk drives are the world-wide standard of excellence with over 3 million in service to date. A quick and easy way to double your capacity.

Our MT-2st Kit is all you need to plug-in a streaming cassette back-up system. With 90 ips performance, you can store up to 20 megabytes of back-up incredibly quick.

Our PS-5250 subsystem is a completely self-contained, self-powered add-on that includes a 20 megabyte Winchester drive and a 20 megabyte streaming cassette back-up.

With Teac, adding on more storage capacity is an open and shut case.



Built To Fanatical Standards. **TEAC**

INSTRUMENTATION AND COMPUTER PRODUCTS DIVISION, 7733 TELEGRAPH ROAD, MONTEBELLO, CA 90640

East (617) 475-7311 South/Midwest (312) 351-9124 Rocky Mountain (602) 242-4025 (303) 333-1111 (801) 532-2111

Northwest (408) 727-1427 Southern California (213) 726-0303

SEE US AT COMDEX BOOTH 0464

Inquiry 361

©1985

RASTER OPERATIONS

BY JOHN BENNETT

Integrating text and graphics in high-performance systems

IN RECENT YEARS memory prices have fallen to the point that it is economical to represent text and graphics using a bit map. A bit map represents a two-dimensional image by dividing it into a rectangular matrix of pixels, each represented by a fixed number of bits. The pixels are normally displayed by a raster technique; information is fed to the screen as a series of horizontal lines (as in television images).

All bit maps must have at least one bit per pixel assigned to convey color information. Additional bits may be used for more color information or to convey intensity, depth, priority, and a broad range of other application-dependent information.

Because of their flexibility and decreasing cost, raster displays have gained broad popularity. Systems that use more than one bit per pixel are somewhat more complex but are not substantially different in principle than those that use a single bit.

Decreasing memory prices and increasing user demand for display quality have also caused an increase in the resolution of raster displays. This increased resolution has placed significant demands on display hard-

ware. We will examine the origin of these demands and a few cost-effective techniques for meeting them.

RASTER DISPLAY HARDWARE

A basic raster display system is shown in figure 1. The heart of this system is the *frame buffer*, a block of memory with storage assigned to each pixel of the displayed image. This memory is accessed by the *sweeper* and the *graphics processor*. The sweeper accesses the frame buffer periodically to obtain the data necessary to update the display device. The most common raster display device is the cathode-ray tube (CRT). Other examples include bit-mapped impact printers and laser printers.

Since the horizontal and vertical timing of a raster display system is usually fixed, the sweeper must provide new data at precise intervals. For this reason, the sweeper is given priority access to the frame buffer. On a high-resolution system, this decision can have a significant impact on performance. Consider a 1024-pixel by 1024-pixel display that is refreshed by the sweeper at 60 frames per second. The sweeper must obtain 62.9 million

pixels per second from the frame buffer!

The graphics processor also accesses the frame buffer, either to read its current contents or to write new information. The graphics processor must synchronize its requests for access to the frame buffer with the sweeper's requests so that it does not interfere with sweeper access.

Failure to perform this synchronization results in corruption of the displayed image during graphics-processor access to the frame buffer. Since the sweeper must always access the frame buffer, that portion of the frame buffer's bandwidth not used by the sweeper is the time allotted to the graphics processor to manipulate graphic data to be displayed. With conventional memory components, this percentage approaches zero as display resolution increases much beyond 1024 by 1024 pixels. Later we will look at a new memory compo-

(continued)

John Bennett, a computer systems architect, is president of Pacific Mountain Research Inc. He is a Ph.D. candidate in computer science at the University of Washington. He can be contacted at Pacific Mountain Research Inc., 8026 35th Ave. NE, Seattle, WA 98115.

nent called a video RAM (random-access read/write memory) that allows the practical construction of much higher-resolution displays without severely affecting the percentage of time available for graphics-processor update of the frame buffer.

Raster displays are not a panacea for all graphics applications. Line-drawing and point-plotting display systems also serve in several application areas. What is perhaps unique about raster display systems is their ability to effectively emulate other technologies. This ability, coupled with the relative simplicity of raster-based systems, makes them an attractive choice for many graphics applications.

USING RASTER DISPLAYS

Raster displays are used to display and manipulate graphic images and text. Although text is conceptually just another form of graphic data, in practice it is often convenient (and more efficient) to treat text as a distinct entity.

Nontext graphic images are composed of one or more primitive elements. The most common primitive element is the point. A point is a pixel that is displayed with some color and/or intensity. Points are used to compose lines and curves. Lines are used to compose polylines and polygons (open or closed sequences of lines). Curves may be simple (e.g., a circle) or complex (e.g., a parametric cubic surface).

Lines and curves need not be only

a single pixel in width; they may be of arbitrary width. Lines and curves may also be textured. A textured line or curve is created by replacing each pixel with a bit map. Bit maps are themselves primitive graphic elements. Figure 2 shows textured lines created using a bit map composed of a circle.

Bit maps may be much more complex—for example, a LANDSAT (earth reconnaissance satellite) image. Closed regions created with other primitive elements may be filled with a solid color or with a pattern. The pattern is simply another bit map. By combining these primitive elements, virtually any image can be created.

Because text occurs so frequently, it is usually treated as a special graphic element. A character of text may in reality be just a rectangular bit map of some size. Characters may also be created from lines (called *stroke characters*). Examples of stroke characters are character strings displayed on pen plotters or vector displays.

Raster displays customarily use bit-mapped character strings. Characters are stored in a *font*. A font is a set of bit maps of the letters of the alphabet and any other special characters that may be displayed. These bit maps are usually densely packed in a safe area of the address space, such as in ROM (read-only memory).

The characters that make up a font are generated within a rectangular bit map sometimes called a cell. Within a particular font, cell sizes may be fixed or variable. If all cells have the

same width, the font is said to be *monospace*. If cell widths vary according to the character being displayed, the font is said to be *proportionally spaced*. Strings built from proportionally spaced fonts have characters starting at "arbitrary" pixel boundaries along a line of text.

Monospace fonts usually have characters aligned at "specific" pixel intervals along the line. If the character cells are word-aligned within the raster (for example, they might correspond to byte boundaries within the frame buffer), we have the simplest (and least flexible) mechanism for text display.

INTEGRATING TEXT AND GRAPHICS

Many applications require text and graphics to be displayed simultaneously. Bit maps are a natural choice for this environment. Even the lowest-priced personal computers now provide bit-mapped displays and some level of support for interactive graphic editing. High-quality document-preparation systems often have high-resolution displays emulating phototypesetters and laser printers for "what you see is what you get" document preparation.

With the exception of single-pixel-width lines, nearly all graphics primitives involve the display, manipulation, and combination of bit maps. One of the most popular and complete tools for manipulating bit maps is the BitBlt operation (pronounced

(continued)

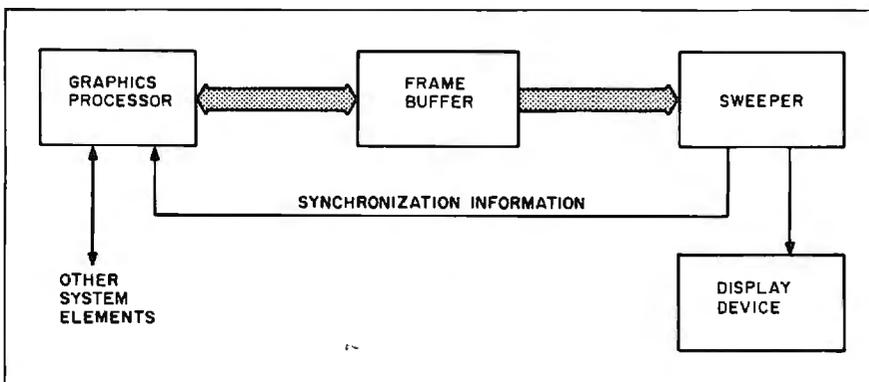


Figure 1: Basic raster display system.

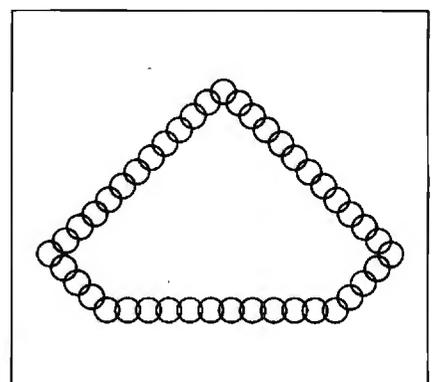


Figure 2: Some textured lines.

CITIBANK DIRECT ACCESS: A PERSONAL COMPUTER BANKING SERVICE SO GOOD IT'LL REPLACE BANKING THE WAY YOU KNOW IT.



And we're so convinced you'll love it we'll give you two months to try it. Free.

Direct AccessSM—the fastest, most convenient way to manage your money, and eliminate the drudgery of bill paying.

Now, eliminating the tedious, time consuming ways of traditional banking is as easy as the touch of a button. With Citibank Direct Access you can pay bills to anyone for any amount on your personal computer. And put the drudgery of check writing, envelope addressing and postage behind you.

Direct Access—up-to-the-minute control over your finances.

Direct Access gives you an on-line relationship with Citibank. So you have up-to-the-minute information on all your accounts. Direct Access also lets you transfer funds between accounts, open new accounts, open CD's, and even access the full resources of Dow Jones News/Retrieval.[®]

The Citibank Citicard and Direct Access—perfect partners for 24-hour banking.



Not even Citibank can accept deposits or send you cash through your computer. That's what the Citicard is for. You can use it to get cash or make deposits at any of hundreds of conveniently located 24-hour Citicard Banking Centers.

Direct Access—your key to great service.

With Direct Access electronic "messaging," just tell us what you need and we'll take care of it. From sending you a mortgage application to stopping payment on a check.

Direct Access—compatible with the most popular personal computers and financial software.

Direct Access works with more than forty personal computers, including IBM, Apple, Macintosh, KayPro, Commodore and Atari. Now you can even download your banking transactions into programs like Lotus and Dollars and Sense, so you can manage your finances without hours of manual input.

Get Direct Access free for two months—no risk, no obligation.

The best place to see a demonstration is on your own personal computer. If you decide after two months that Direct Access isn't for you, we won't charge you a cent. And if you don't have a Citibank checking account, we'll make opening one a snap. So call 1-800-248-4472, ext. 700 today for more information. And start banking a whole new way.



Direct Access is a Service mark of Citicorp. Dow Jones/News Retrieval is a registered Service mark of Dow Jones & Co., Inc.

RASTER OPERATIONS

bit-bit), also known as RasterOp. BitBlit is a general-purpose abstract procedure for copying, moving, and combining portions of bit maps. BitBlit got its name from an instruction called Bit-Boundary Block Transfer on the Alto personal computer developed by the Xerox Palo Alto Research Center in the early 1970s. William Newman

and Robert F. Sproull first coined the term "Raster-OP" in *Principles of Interactive Computer Graphics* (McGraw-Hill, 1979). BitBlit is an integral part of the user interface of the Smalltalk-80 system, also developed at Xerox PARC. BitBlit is general enough to perform a wide variety of graphics operations, including text display using arbitrary

fonts, scrolling, window management, and highlighting. Successive applications of BitBlit can perform operations such as scaling, area fill, rotation by multiples of 90 degrees, and textured line drawing.

Bit maps are usually stored in physical memory in what is called *raster order*. Assuming that the unit of storage is a 16-bit word and that there is one bit of information per pixel, the leftmost 16 bits of the top row of the bit map would be stored in the first word, followed by zero or more words containing the remainder of that row, followed by zero or more additional words containing subsequent rows from top to bottom. The order of pixels within words is dependent on the systems' particular hardware and software implementation.

The left and right edges of bit maps may fall on arbitrary pixel boundaries. Arbitrary pixel boundaries imply arbitrary bit positions within the underlying physical memory. One of the most useful properties of BitBlit is its ability to mask the details of source-to-destination bit-map alignment from the user. All direct handling of bit maps and the word boundaries inherent in them is encapsulated by the BitBlit operation. The user specifies desired operations with dimensions given in pixels.

BITBLIT FUNCTIONS

BitBlit performs the following operation: An arbitrarily aligned rectangular region of a destination bit map is replaced on a pixel-by-pixel basis with one of the 256 Boolean functions of three variables—the previous contents of the destination bit map, the corresponding pixel from an arbitrarily aligned rectangular region of a source bit map, and the corresponding bit from a halftone bit map. The halftone bit map is typically a 16- by 16-pixel array interpreted as one tile of a pattern covering the entire destination bit map. Examples of typical functions are shown below.

- Clear all pixels to 0
- Set all pixels to 1

(continued)

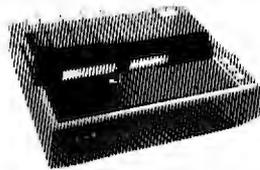
Here are 87 reasons to buy at Elek-Tek, not to mention the fastest delivery anywhere.

MEGA BERNOULLI BOX

- 10 meg 1/2 height Drive for IBM-PC/XT/AT & compatibles \$ 1675
- 20 meg 1/2 height Drive for IBM-PC/XT/AT & compatibles 2335
- Non-Bootable Interface Card 104
- Bootable Interface Card . 234
- 10 meg cartridges for above (3 pak special) 125

Save 30% to 43% off Manufacturer Suggested Ret. prices on
EPSON • Okidata • Star • DIABLO
• TOSHIBA • COMFEX •

- EPSON®**
- LX 80 \$ 215
 - RX 100+ 350
 - FX 85 340
 - FX 185 475
 - LQ 1500 parallel CALL
 - DX10 Daisy Wheel 10CPS . . . 230
 - DX20 Daisy Wheel 20CPS . . . CALL
 - Comrex II Comriter 289
- STAR**
- SG 10 235
 - SD 10/15 CALL
 - SR 10/15 CALL
- OKI**
- Ok 182 CALL
 - Ok 192/193 CALL
 - Ok 84 CALL



EPSON FX 85

TOSHIBA

- Toshiba P341 CALL
- Toshiba P351 CALL
- Toshiba P1340 CALL

PRODUCTS FOR IBM-PC

- | | | |
|--|---|---|
| 23. Amdek 310A Amber Monitor \$ 150 | 31. Orchid Tech. PC Turbo 186 570 | 37. Novation 490603-1 As above inc. MS-DOS Software . . 490 |
| 24. Generic Multi Multifunction Board, 64K . . . 129 | 32. Paradise Modular Graphics Card . . 290 | 38. Hayes 1200B Internal modem w/software . 359 |
| 25. Generic Multi 384K Multifunction Board, 384K . . 169 | 33. Hercules Monochrome Card 329 | 39. AT&T 4000 300/1200 Ext. Modem 335 |
| 26. AST Six Pak + Multifunction Board, 64K . . 225 | 34. Hercules Color Color Graphic Card 170 | 40. Hayes 1200 External modem 399 |
| 27. AST Six Pak + (loaded) Multifunction Board, 384K . . 279 | 35. Novation 490605-1 2400BPS inc. Mite Software . 520 | 41. Hayes 2400 External modem 599 |
| 28. AST Megaplex II Multifunction Board, 64K . . . 270 | 36. Novation 490603 1/2 Card Modem 2400 BPS No software 425 | 42. US Robotics Courier 2400 Ext. 2400B Smart Modem . . . 460 |
| 29. Quadram Quadboard Multifunction Board, 0K . . . 195 | | 43. US Robotics Teipac Telecomm. Software 75 |
| 30. Quadram Quadboard Multi. Board, 64K/384K . . 210/267 | | 44. TEAC FD55B 1/2 ht. D5DD Disk Drive 90 |

DISKETTES

	Dysan	maxell.	3M	SONY	wasbath	MEMOREX
3 1/2" SSDD	25.00	25.00	25.00	25.00	20.00	—
DSDD	30.00	37.00	37.00	37.00	24.00	—
5 1/4" SSDD	16.00	14.00	14.50	13.00	11.50	11.50
DSDD	20.00	18.00	18.00	16.00	12.50	14.00
SSDD96TP1	24.00	24.00	24.00	—	—	—
DSDD96TP1	29.00	29.00	29.00	—	—	—
5 1/4" DSDDHD (for IBM AT)	36.00	39.00	40.00	—	24.00	—
8" SSDD**	22.00	29.00	25.00	—	19.00	—
8" DSDD**	26.00	32.00	29.00	—	20.00	—

Call for Quantity pricing for 10 boxes or more.

3M DATA CARTRIDGES

- | | | |
|-------------------------------|--------------------------------|-------------------------------|
| 85. DC100A \$ 14.00 | 87. DC300XL \$ 21.00 | 89. DC800A \$ 23.50 |
| 88. DC300A 18.00 | 88. DC300XL/P 22.00 | 90. DC1000 15.00 |

Call for Quantity pricing for 10 cartridges or more.

CALL TOLL FREE 800-621-1269 EXCEPT Illinois, Alaska

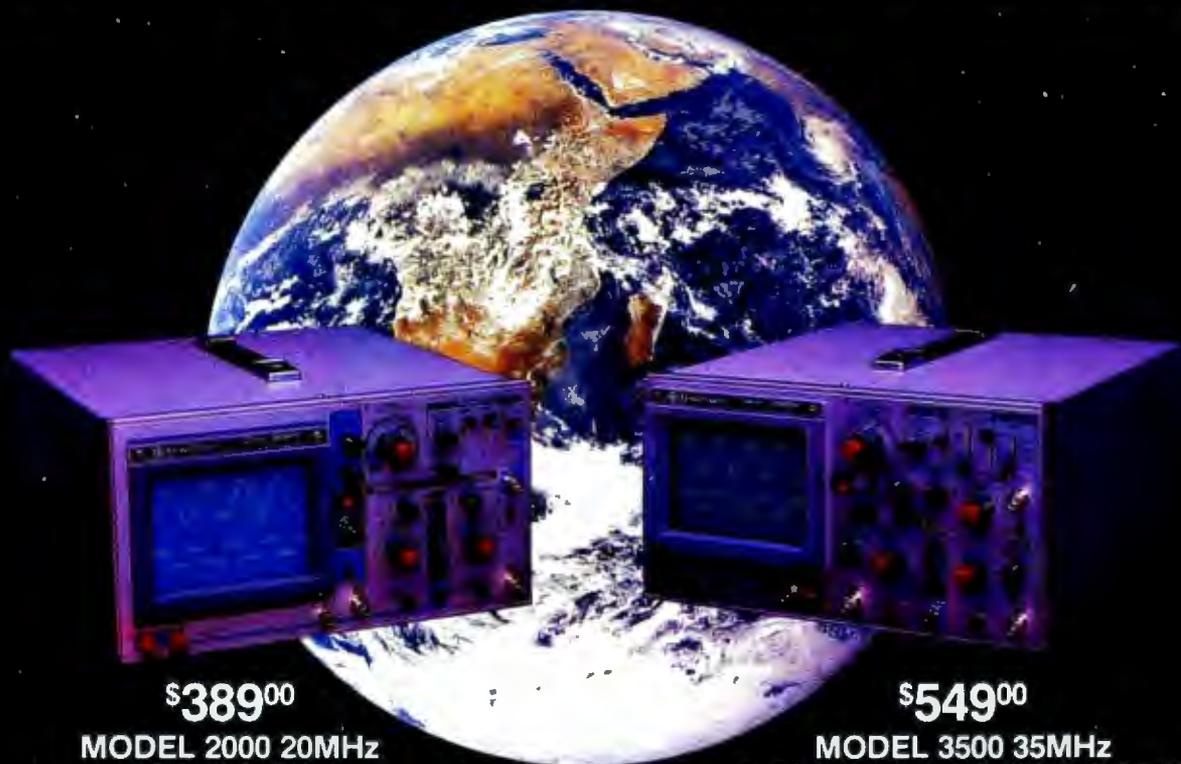
Corp. Accts. Invited. Min. Ord. \$16.00. Visa or MasterCard by Mail or Phone. Mail Cashier's Check, Mon. Ord., Personal Check (2 wks. to clear) Add \$4.00 1st Item. (AK, HI, P.R., Canada add \$10.00 first item) \$1.00 ea. add 1 shipg. & handl. Shipments to IL address add 7% tax. Prices subject to change. WRITE for free catalog. RETURN POLICY: Defective Driv: Most products replaced within 30 days of purchase with identical merchandise only. Computer and large peripherals replaced only when defective on arrival (within 3 work days of delivery). Other problems covered by mfr. warranty. ALL ELEK-TEK MERCHANDISE IS BRAND NEW, FIRST QUALITY AND COMPLETE. Delivery subject to availability. BURS 906-718-0617

ELEK-TEK, inc.

6557 N. Lincoln Ave., Chicago, IL 60645
(312) 631 7900 (312) 677 7660

PERFORMANCE

THAT IS OUT OF THIS WORLD...



\$389⁰⁰

**MODEL 2000 20MHz
DUAL TRACE**

\$549⁰⁰

**MODEL 3500 35MHz
DUAL TRACE DELAYED SWEEP**

...AT A DOWN TO EARTH PRICE

At last! Truly affordable test equipment with no compromise in design, and features you would expect to find only on oscilloscopes costing hundreds of dollars more! JDR Instruments presents two, new, high-performance models backed by a two year warranty and technical support which is only a phone call away. Perfect for the technician or advanced hobbyist, both models feature Dual Trace capability and a variety of operating and triggering modes, including CH-B Subtract and X-Y operation.

MODEL 2000 has a 20 MHz bandwidth and 20 calibrated sweeps ranging from .2s to .2 μ s. A convenient built-in component tester provides additional diagnostic power.



INCLUDES TWO HIGH QUALITY
1x, 10x TEST PROBES

MODEL 3500 features a 35 MHz bandwidth and exceptional 1mV/DIV sensitivity. Delayed sweep and variable holdoff allow stable viewing of complex waveforms.

Inquiry 204

ORDER TOLL FREE
800-538-5000
800-662-6279 (CA)



JDR INSTRUMENTS

1224 South Bascom Avenue
San Jose, California 95128 (408) 995-5430

NEW!! The NEW!! Express Pass

Don't Order Software
Without It!

Express Business Software is proud to announce the introduction of its new service, **The Express Pass**.

Your **Express Pass** is absolutely Free. Just call one of our 800 numbers. You will receive:

- **Express Pass**- for instant credit to qualified customers
- **Discount Coupon**...worth \$\$ off your first order!
- **Express Software Catalog**
- **Express Monthly Newsletter**, reviews...specials
- **Exclusive industry announcements**
- **Guaranteed lowest software prices** anywhere. No hidden charges!

The Express Pass Benefits You!

CORPORATIONS:

Quick and efficient responses to each of your US or International location divisions.

PURCHASING AGENTS:

Your customer code does it all. Easy ordering and a guarantee that you're receiving the lowest available prices anywhere. Quantity Discount Prices, of course!

INDIVIDUALS:

Personalized service with a sales staff eager to answer your questions. Assistance in making the right software decisions.

TO ORDER CALL TOLL-FREE:

(800) 235-3020 (USA)

(800) 235-3021 (CA)

(415) 382-9085

CALL TODAY

448 IGNACIO BLVD., STE. 332
NOVATO, CA 94947

EXPRESS
BUSINESS SOFTWARE

Many Years of Experience
Specializing in Corporate and
Educational Accounts

RASTER OPERATIONS

- Invert destination
- Erase (clear where source = 1)
- Copy inverse of source
- XOR (invert destination where source = 1)
- Copy source
- Copy halftone
- Paint halftone (source = "brush," halftone = "paint")
- Paint (source OR destination)

With the exception of single-pixel-width vectors and arcs, BitBlt provides a natural and powerful tool for manipulating text and graphics. Although BitBlt can be performed one pixel at a time, such an implementation would be quite slow. It is therefore highly desirable to devise a means of performing the BitBlt operation on multiple pixels simultaneously. We will examine this and other techniques for improving the performance of BitBlt in the next section.

IMPROVING PERFORMANCE

Increases in resolution and capability in a raster display system place the sweeper and graphics processor in conflict for frame-buffer access. Since sweeper bandwidth requirements are usually inflexible, two alternatives exist for reducing this conflict: Allow the sweeper to obtain more pixels per frame-buffer cycle, or provide a means to dual-port the frame buffer, enabling concurrent sweeper and graphics-processor access.

The first alternative requires increasing the width of the data path between the frame buffer and the sweeper. This approach is usually practical only for widths up to 64 bits, where component cost and layout considerations tend to make further increases infeasible. Because of this limitation, increasing data-path width can provide only a four- to eightfold improvement in bandwidth.

Further improvements require dual-porting the frame buffer. Since standard memory devices are single-ported, special hardware is required.

VIDEO RAMS

Recently, Texas Instruments, NEC, and AMD have announced products that

can dual-port the frame buffer. These so-called video RAMs consist of a conventional memory element and a large shift register. The shift register is loaded with a number of bits (on the order of 256) with a single memory cycle. These bits can then be shifted out independently of other access to the memory element. Video RAMs have other capabilities that may also be useful in graphics applications—for example, shifting in data to the shift register and copying the register to the memory element with one memory cycle.

In a frame buffer constructed from video RAMs, the graphics processor accesses the frame buffer in the usual manner. The sweeper, however, needs to access the memory only from time to time when the shift register requires new data. When video RAMs are employed in a system with a wide data path to the sweeper, extremely high data rates are possible.

Put in simple terms, a 2K by 2K 60-Hz noninterlaced display is nearly impossible to attain with conventional memory devices. With the use of video RAMs, it is a comparatively easy task.

A VLSI SOLUTION

When we reduce sweeper demand on frame-buffer bandwidth, the graphics processor is potentially able to access the frame buffer at a higher rate. This will not be the case, however, if the graphics processor is compute-bound, which is to say it is overwhelmed attempting to perform the computation necessary to generate the graphic elements of interest. In this case the raw performance of the graphics processor must be improved before the benefits of higher bandwidth can be exploited.

As an example, consider BitBlt. Because BitBlt is a powerful abstraction, it is difficult to implement efficiently. Microcoded implementations have proved successful. Other combinations of hardware and software have met with varying success.

Since BitBlt is a repetitive process, an obvious mechanism for improving

(continued)



AT™ Pfantasies for your PC or XT.™

Want better speed and memory on your PC or XT without buying an AT?

You've got it!

Phoenix's new Pfaster™286 co-processor board turns your PC or XT into a high-speed engine 60 percent faster than an AT. Three times faster than an XT. It even supports PCs with third-party hard disks. But that's only the beginning.

You can handle spreadsheets and programs you never thought possible. Set up RAM disks in both 8088 and 80286 memory for linkage editor overlays or super-high-speed disk caching. All with Pfaster286's 1mb of standard RAM, expandable to 2mb, and dual-mode design.

You can develop 8086/186/286 software on your XT faster. Execute 95 percent of the application packages that run on the AT, excluding those that require fancy I/O capabilities your PC or XT hardware just isn't designed to handle. Queue multi-copy, multi-format print jobs for spooling. Or, switch to native 8088 mode to handle



hardware-dependent programs and back again without rebooting. All with Pfaster286's compatible ROM software. And, Pfaster286 does the job unintrusively! No motherboard to exchange. No wires to solder. No chips to pull. Just plug it into a standard card slot, and type the magic word, "PFAST!"

If you really didn't want an AT in the first place, just what it could do for you, call or write: Phoenix Computer Products Corp., 320 Norwood Park South, Norwood, MA 02062; (800) 344-7200. In Massachusetts, 617-762-5030.

Programmers' Pfantasies™
by

Phoenix

XT and AT are trademarks of International Business Machines Corporation. Pfaster286 and Programmers' Pfantasies are trademarks of Phoenix Computer Products Corporation.
For the Ferrari aficionado: yes, we know this is a rear engine car. We are showing the addition of a second engine to symbolize how Pfaster can be added to your PC or XT to increase performance.

SEE US AT FALL COMDEX

Inquiry 301

RASTER OPERATIONS

the performance of BitBlt is to optimize the inner loop. Within the inner loop, the following actions occur:

1. Data from a region in the source bit map is shifted and aligned to produce words of source pixels aligned with destination words. This is necessary since, in general, word boundaries of the source bit map will not line up with word boundaries in the destination bit map. Two words of the source bit map may be required.
2. Source, destination, and halftone values are combined according to the specified function. Recall that the function can be any of the 256 possible functions of three Boolean variables.
3. Destination modifications are clipped so that only pixels within the designated destination region are affected. The left and right boundaries of this region will not usually fall on word boundaries.

After studying several techniques

for improving performance of BitBlt, we decided that a hardware accelerator for the inner loop was the most cost-effective solution. We first built an MSI (medium-scale integration) TTL (transistor-transistor logic) version of the accelerator to demonstrate the validity of our ideas. Encouraged by excellent results, we developed a full custom CMOS (complementary metal-oxide semiconductor) VLSI (very-large-scale integration) device that embodied what we learned from the TTL version. Some key design criteria of the device were:

- The device should function as a general-purpose data path so as not to constrain the user to a particular microprocessor family or memory technology. Control should be kept external to ensure this flexibility.
- The device should support all of the 256 possible Boolean functions of source, destination, and halftone.
- The performance of the device

should not place limits on system-design criteria. The device should support current and projected memory speeds.

- The device should have a low-power-consumption design to allow its inclusion in battery-operated equipment.
- The device should have TTL inputs and outputs and require only a single 5-volt power supply.
- The device should be as small as possible to facilitate multiple device configurations.

The result of these design decisions was the PMR 96016 (called the "Blt chip"). A block diagram of the 96016 is shown in figure 3.

PMR 96016 CIRCUIT DESCRIPTION

The PMR 96016 contains a data path and a number of configuration registers. The data path performs (in *continued*)

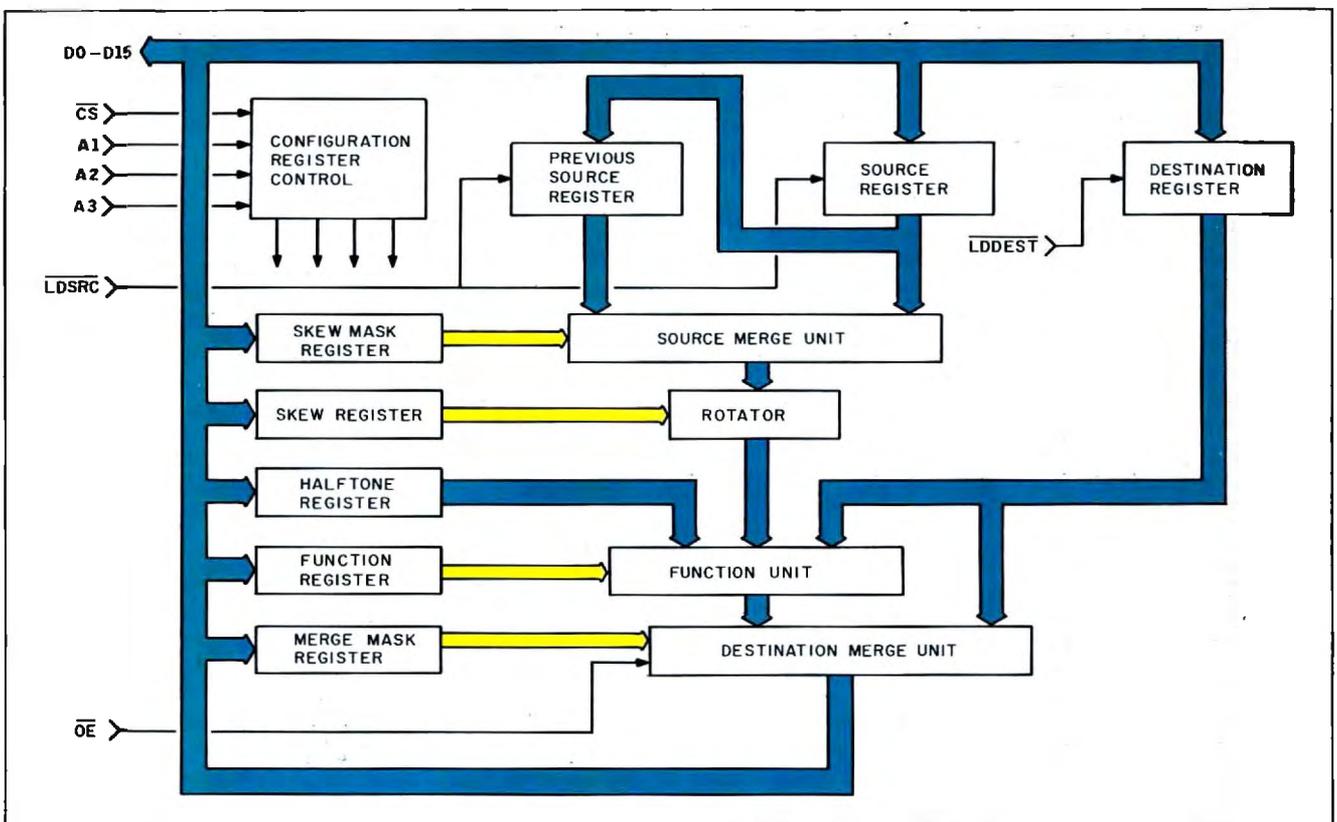


Figure 3: PMR 96016 functional block diagram.

Powerful MS-DOS™ Software.

For the IBM®-PC, XT, AT & compatibles with MS-DOS/PC-DOS 2.0 or higher.

Only **\$39.95** Each

UTAH COBOL™

ALL NEW! We believe this is the fastest COBOL compiler on any micro; for example, we have compiled 4500 statements per minute on an IBM-AT. Utah COBOL is based on ANSI-74 standards with powerful level 2 features, including compound conditionals & full CALL CANCEL. Speed and simplicity are certain to make it a favorite in the classroom as well as with professional programmers. Package includes diskette, 165-page manual, many examples & 16 complete COBOL source code programs. **\$39.95.**

COBOL Application Package, Book 1: \$9.95.

UTAH PASCAL™

Has many advanced features including: 14 digit precision, BCD math (no round-off errors), floating point + 63 -64, TRACE debugging, Arrays up to 8 dimensions, 64K strings, External procedures & Dynamic Module loading. Package includes diskette & 134-page manual. **\$39.95.**

UTAH PILOT™

Written by Prof. J. Starkweather, the language's creator, Utah PILOT exceeds all PILOT-73 standards. And it has an integrated full-screen text editor for easy program development. Ideal for classroom instruction, business training & home study. Package includes diskette, 129-page manual & 10 sample programs. **\$39.95.**

UTAH EDIT™

A full-screen, video-display text editor designed specifically for computer program text preparation. Completely user-changeable, it can be configured to almost any terminal & takes only 12K disk space. Package includes diskette & 58-page manual. **\$39.95.**

UTAH **BASIC™** \$39.95
Package includes diskette & 239-page manual.

BIGPRINT™ DISKETTE \$19.95
Great for making signs. Requires 132-print position printer.

UTAH software requires 128K RAM (i.e., 90K user RAM) an IBM-PC, XT, AT, PCjr, or compatible (16-bit) microcomputer with MS-DOS or PC-DOS Operating System, Rev. 2.0 or higher. For 8-bit CP/M-80 systems, ask about our **NEVADA** Software Series.

MS is a trademark of Microsoft Corp. IBM is a registered trademark of International Business Machines, Corp. Utah COBOL, Utah BASIC, Utah PASCAL, Utah PILOT, Utah EDIT, BIGPRINT, & Ellis Computing, Inc. are trademarks of Ellis Computing, Inc. ©1985 Ellis Computing, Inc.

SATISFACTION GUARANTEED. If for any reason you're not completely satisfied, just return the Utah package within 15 days—in good condition, with the sealed diskette unopened—and we'll refund your money. **There's absolutely no risk to you, so why wait?—order today.**

Please send me these UTAH Software packages
(IBM-PC diskette):

- | | | |
|---------------------------------|--------------------------------|-----------------------------------|
| <input type="checkbox"/> COBOL | <input type="checkbox"/> BASIC | <input type="checkbox"/> EDIT |
| <input type="checkbox"/> PASCAL | <input type="checkbox"/> PILOT | <input type="checkbox"/> BIGPRINT |

Send me ____ (how many) software packages: TOTAL \$ _____

Utah COBOL Application Book 1; BIGPRINT: _____

California residents add sales tax (6% or 6½%) _____

HANDLING/SHIPPING: no shipping charge within U.S.;
Overseas add \$10 for first package, \$5 each additional. _____

- Check VISA MasterCard

Checks must be
in U.S. Dollars,
drawn on a U.S. bank.



(Sorry, no C.O.D.s.)

Enclosed: TOTAL \$ _____

Send my UTAH order to:

CARD NO. _____ EXP. _____

SIGNATURE _____

SHIP TO NAME _____

STREET _____

CITY/STATE/ZIP _____

COUNTRY _____

Order now from:

ELLIS COMPUTING, INC.
3917 Noriega Street
San Francisco, CA 94122

Phone **(415) 753-0186**



SINCE 1977

ELLIS COMPUTING™

RASTER OPERATIONS

hardware) the functions that consume the most time in a software-only implementation of BitBlt—namely, shifting, masking, and Boolean combination.

As shown in figure 3, the Blt chip consists of two Source registers, a Destination register, a data path, and five configuration registers that control the data path. All data-path elements are 16 bits wide. The three data-path registers are the most frequently used and therefore are controlled by dedicated interface pins. These registers are described below.

The Source register holds a word of source pixels. It is loaded from the data bus using the LDSRC- pin.

The Previous Source register holds the former contents of the Source register so that two adjacent words of source pixels are available in the device at one time. This register is loaded from the Source register whenever the Source register is loaded.

The Destination register holds a word of destination pixels as they appear prior to modification. This

register is loaded from the data bus using the LDDEST- pin.

The configuration registers control the operation of the data path. The CS- interface pin causes the configuration register addressed by A1–A3 to be loaded from the data bus. Except where otherwise specified, all configuration registers are 16 bits wide.

The Skew Mask register controls the source merge unit, which forms one word from portions of two source words. For each of the 16-bit positions, a "1" selects the corresponding bit of the Previous Source register, while a "0" selects the corresponding bit of the Source register.

The Skew byte, bits 3–0, specifies a left-rotate amount for the rotator. For example, Skew = 2 moves bit positions 0-2, 1-3, . . . , 15-1.

The Halftone register contains the row of halftone region appropriate to the current row of destination. If used, the Halftone register is rewritten at the beginning of each row.

The Function byte, bits 7–0, specifies the Boolean function for combining the rotated source word, Halftone

register, and Destination register. Each of these eight bits specifies the desired result (0 or 1) for one of the eight possible combinations of source, halftone, and destination. There are 256 possible functions.

The bits of the Merge Mask register specify the portion of the destination word to be modified. For each of the 16-bit positions, a "0" selects the corresponding bit of the function unit output, while a "1" selects the corresponding bit of the Destination register (i.e., leaves that bit unmodified).

The pin-out of the PMR 96016 is shown in figure 4.

THE PMR 96016 IN A MICROPROCESSOR-BASED SYSTEM

During BitBlt operations, the PMR 96016 acts as an accelerator for a controlling microprocessor. The BitBlt algorithm for which the Blt chip design is optimized operates in scan-line order. It can be viewed as two nested loops, with the outer loop moving from one scan line to the next and the inner loop moving from one word to the next along a scan line. Setup of the Blt chip configuration registers is done outside of the inner loop. In fact, most of the configuration registers need be written only once for the entire BitBlt.

Four different types of cycles are used to access different portions of the Blt chip circuitry. All cycle types use the same 16-bit data bus. The cycle type is specified by asserting one of four control pins. The CS- pin is used to access configuration registers, while the other three control pins access portions of the data path. All four cycle types are summarized below.

The CS- pin controls loading or writing one of the configuration registers (specified by A1–A3) with the data on the bus.

The LDSRC- pin controls loading the Source register with the data on the bus and simultaneously transfers its previous contents to the Previous Source register.

The LDDEST- pin controls loading
(continued)

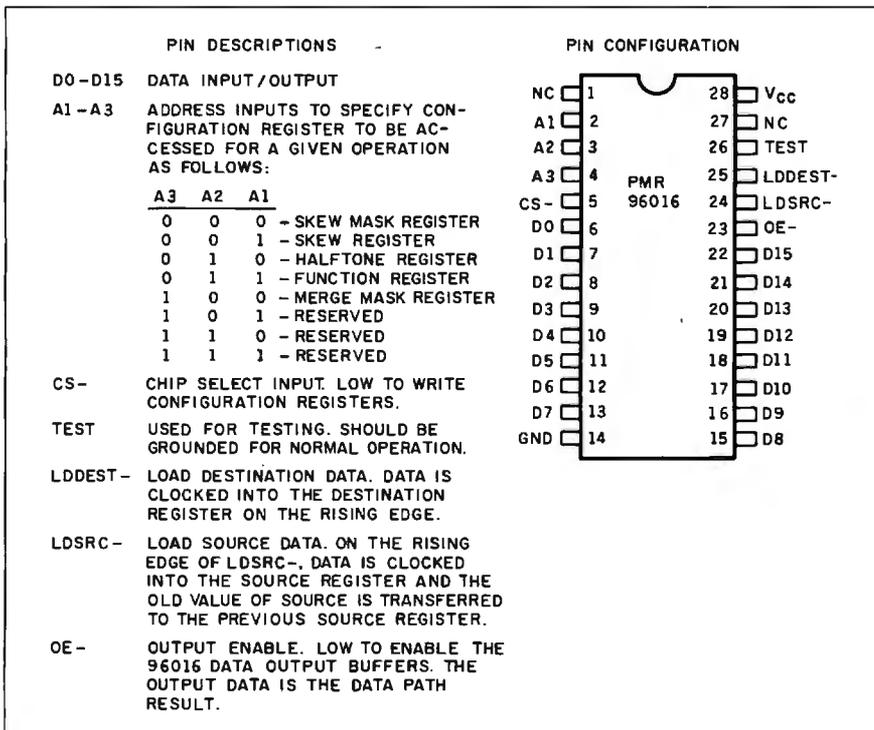


Figure 4: PMR 96016 pin-out.

We have over 1000 Software and hardware items in stock. Shipments on almost all items within 24 hours!



FREE SOFTWARE!
With every \$100 purchase you will receive a free diskette for your IBM PC with label maker, checker game and banner program.

Call for programs not listed

Technical & Other Info. (602) 246-2222

TOLL-FREE ORDER LINE 1-800-421-3135

SOFTWARE

SOFTWARE

HARDWARE

---DATA BASE MANAGERS---

Alpha Data Base manager	.....	\$165
Clout 2	.....	129
Condor III	.....	299
Fox and Geller Quickcode	.....	139
Fox and Geller Quickreport	.....	139
Friday	.....	159
Knowledgeman	.....	225
K Paint	.....	60
K Graph	.....	135
K Text	.....	105
K Report	.....	135
Nutshell	.....	55
PFS: File	.....	78
Power Base 2.1	.....	249
RBase 5000	.....	339
Think Tank	.....	98
Tim IV	.....	219

---WORD-PROCESSING---

Easy (Micro Pro)	.....	Call
Leading Edge w/Merge	.....	85
Microsoft Word	.....	225
Multimate	.....	Call
Oasis Word Plus	.....	85
Peachtext 5000	.....	145
PFS: Write	.....	78
Random House Spell Checker	.....	36
Samna III 3.0	.....	265
Volkswriter Deluxe	.....	139
Word Perfect 4.0	.....	195
Wordstar	.....	170
Wordstar Propac	.....	239
Wordstar 2000	.....	238
Wordstar 2000+	.....	285

---SPREADSHEETS---

Microsoft Multiplan	.....	110
PFS: Plan	.....	78
Supercalc II	.....	145
Supercalc III 2.1 (New)	.....	169

---ACCOUNTING---

BPI Accounts Payable	.....	299
BPI Account Receivable	.....	299
BPI General Accounting	.....	299
BPI Payroll	.....	299
Cyma	.....	Call
Dollars and Sense	.....	95
MBSI	.....	Call
Tobias Managing Your Money	.....	95

TCS. Big Four equivalent of Peachtree Series 4 - Specially augmented and customized for your IBM PC Terminal and Printer - GL, AR, PA, AP, CP/M-80, CP/M-86 for PC XT, DOS 1.1, 2.0.
Each Module \$65 For All Four \$249

---INTEGRATED---

Enable	.....	Call
Smart Software	.....	Call

---TRANSFER PROGRAMS---

Crosstalk XVI	.....	90
Hayes Smartcom	.....	88
Move-It	.....	79
Remote	.....	99

---GRAPHICS---

Chartmaster	.....	\$220
Dr. Halo	.....	65
Energraphics w/o Plotter	.....	170
Energraphics w/Plotter	.....	220
Fontrix	.....	99
Graphwriter/Combo	.....	310
Microsoft Flight Simulator	.....	32
PC Paint Brush	.....	69
PFS Graph	.....	78
Signmaster	.....	145

---LANGUAGES---

Concurrent PC/Dos	.....	179
CP/M 86	.....	Call
Fortran 77	.....	208
Lattice C Compiler	.....	245
Lattice Run C Interpreter	.....	89
Microsoft C Compiler	.....	239
Microsoft Fortran	.....	209
Microsoft Macro Assembler	.....	89
Microsoft Pascal Compiler	.....	179
Microsoft Quick Basic	.....	65
Multi Halo	.....	140

---PROJECT MANAGEMENT---

Harvard Project Manager	.....	199
Microsoft Project	.....	150
Total Harvard Project	.....	245

---UTILITIES---

Copy II PC	.....	22
Copywright	.....	45
Norton Utilities 3.0	.....	52
Prokey 4.0	.....	75
Superkey	.....	36

HARDWARE

BUYS OF THE YEAR

Expansion Board 0 to 576K	... \$69
KB5151 Keyboard Equivalent	.. 89
Hercules Graphic Board w/Par Port Equivalent	... 118
1 Year Warranty - 30 Day Return Priviledge.	

---MODEMS---

Anchor Express	.....	245
Hayes 1200	.....	Call
Hayes 1200B w/Software	.....	Call
Hayes 2400	.....	605
Promodem 1200B w/Software	.....	265
Promodem 1200	.....	309

---RAM---

64K 150NS Chips (Set of 9)	.....	6.50
256K Ram Chips (Set of 9)	.....	35

---BOARDS---

AST Advantage	.....	385
AST Sixpack	.....	Call
Hercules Color Card	.....	145
Hercules Graphics Card	.....	275
Paradise Five Pak w/64K	.....	155
Paradise Modular Graphics Card	.....	249
Quadram Board with Par/Ser and Game Port	.....	199
Quadcolor I	.....	185
Sigma Maximizer Multifunction	.....	169
Sperry 512K Expansion w/128K	.....	145

STB Chauffeur Board	.....	\$255
STB Mono Board	.....	155
AB Print Switch	.....	75

---COMPUTERS---

Sperry PC Mono 256K Dual Drive Serial Port, Clock, MS/DOS 2.11
..... 1650

IBM PC-AT	.....	Call
ITT Computers PC Compatible 256k Dual Drive, Mono, MS/DOS	.....	1395
Zenith 158	.....	Call

---PRINTERS---

FREE! PRINTER SET SOFTWARE

Purchase an Okidata, Epson, Gemini, Citizen or Toshiba printer and receive at no charge a menu driven program to set print characteristics or to make your computer function as a correcting typewriter. Retail value \$35. Available for most disk formats.

CITIZEN		
MSP-10	.....	259
MSP-15	.....	359
MSP-20	.....	329
DAISYWRITER 2000	.....	795
EPSON - Call on all models		

JUKI		
Juki 6100	.....	349
Juki 6300	.....	685
Juki Tractors	.....	120

NEC		
3550	.....	989
8850	.....	1299
P5 Parallel	.....	Call

OKIDATA - Call on all models		
PANASONIC		
1091	.....	239
1092	.....	349
1093	.....	429
KXP3151	.....	410

SILVER REED		
EXP 400P	.....	205
EXP 500P	.....	279
EXP 550P	.....	389
EXP 770P	.....	689

STAR MICRONICS		
SG-10	.....	Call
SG-15	.....	369
Call for prices on other models		

TOSHIBA		
1340	.....	540
P351	.....	1020

---MONITORS---

AMDEK	.....	Call for price
Taxan 420	.....	399
Taxan 121 Green	.....	125
Taxan 122 Amber	.....	134
Princeton HX-12	.....	445
Princeton Max 12	.....	170
Sansung TTL, Amber	.....	119

TERMS: Prices include 3% cash discount. Add 3% for charge and C.O.D. orders. Shipping on most software is \$5.00. AZ orders +6% sales tax. Personal check - allow ten (10) days to clear. Prices are subject to change.

TOLL-FREE ORDER LINE 1-800-421-3135

WAREHOUSE DATA PRODUCTS

2701 West Glendale Ave. • Phoenix, AZ 85021



Inquiry 383

RASTER OPERATIONS

the Destination register from the data bus.

The OE- pin controls reading the data-path result to the data bus.

The sequence of actions that constitute the body of the inner loop, and that therefore must be performed the most frequently, is as follows:

1. Read a word from the source region in memory and load it into the Source register using LDSRC-
2. Read a word from the destination region in memory and load it into the Destination register using LDDEST.
3. Use OE- to obtain the new destination word and write it to the same memory address that was read in step 2.
4. Increment both the source and destination memory addresses so that they point to the next word along the scan line.

It is possible to design the Blt chip into a system in such a way that all of the actions in steps 1 through 4 above

can be performed with a single microprocessor instruction. If the microprocessor has a special instruction for moving a string of words, the entire inner loop becomes one string move.

The system components relevant to BitBlt operation include a microprocessor, a PMR 96016 Blt chip, dynamic RAM, and a RAM controller. Whether or not the RAM has a second port for generating video to refresh a raster display device has little effect on the portion of the design described here. All data buses are 16 bits wide, although the microprocessor might have 32-bit-wide data paths internally. Figure 5 is a block diagram of a typical application showing the relationship of these components and the primary buses interconnecting them.

The microprocessor serves as the BitBlt controller in addition to its task as CPU (central processing unit) for the system. It accesses the Blt chip configuration registers directly as in-

dividual words in its I/O (input/output) address space (that might be memory-mapped). The three types of Blt chip data-path access cycles, however, are implemented as side effects of accessing memory within certain address ranges. We will call this type of memory cycle, further described below, Blt-Special.

BLT-SPECIAL READ AND WRITE CYCLES

In a typical application, the 96016 performs its task by intercepting data transferred from memory on Read cycles (Blt-Special Read) and substituting its own data on Write cycles (Blt-Special Write). The memory controller participates in this task by causing BitBlt memory Write cycles to be converted into Read-Modify-Write (RMW) cycles.

The Read portion of the RMW cycle reads the previous destination contents. During the Write portion of the

(continued)

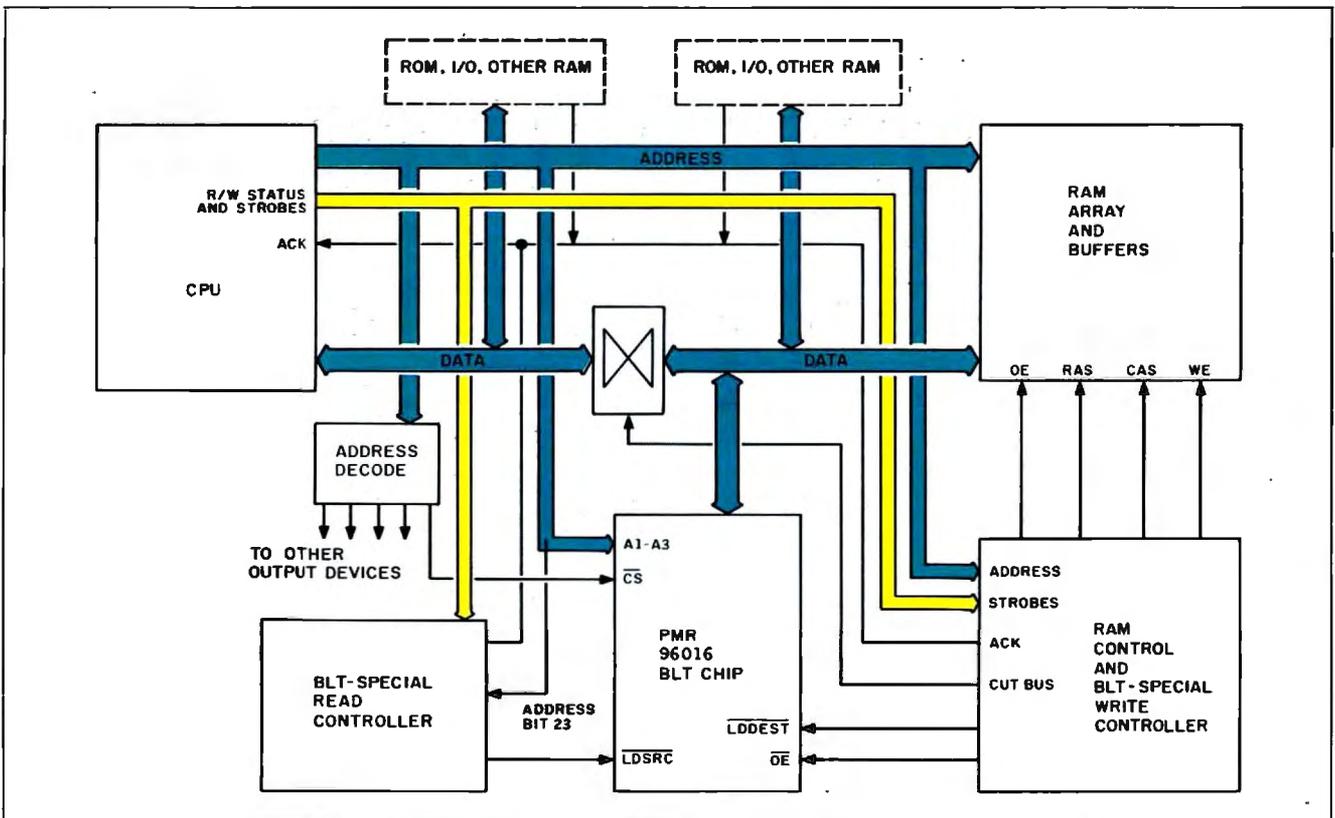


Figure 5: Block diagram of a typical PMR 96016 application.

Blt-Special cycles are cycle-by-cycle context-switching.

cycle, the 96016 outputs the new destination contents. The host processor is used as an address generator and for initial setup. The result is that a horizontal row of pixels can be read from the Source, combined with the Destination and Halftone, and written back to the Destination, all requiring only two bus cycles per 16 pixels, plus a small amount of setup time.

Previously, we outlined the sequence of memory and Blt chip cycles that occurs most frequently during a BitBlt operation and therefore should execute as fast as possible. The sequence involves two memory addresses, one for a source word and one for a destination word, and these addresses must be incremented before the next loop iteration. Most microprocessors can generate this type of alternating sequence of addresses rather quickly, using either a single string-move instruction or a sequence of move instructions where both source and destination addressing modes are register auto-increment (address registers are automatically

incremented at the end of each iteration).

Outside the microprocessor, at the bus level, this type of instruction manifests itself as a Read cycle followed by a Write cycle, with both cycles addressed in appropriate ranges to cause the cycles to be Blt-Special.

By using these Blt-Special cycles, we are able to transfer data between memory and the Blt chip in a single bus cycle. By encoding this special type of cycle in the address, we get a sort of cycle-by-cycle context switch between Blt-Special and normal bus cycles.

In this example we will assume a microprocessor that generates a 24-bit address (for example, an MC68000) and we will use the highest-order address bit, A23, as a Blt-Special indicator. This divides the 16-megabyte address space into two 8-megabyte spaces. The lower half is allocated among memory-mapped I/O, ROM, and RAM, including RAM used for program and data storage and any dual-ported RAM used as video frame buffers. The upper half is then used to access the same resources, but with Blt-Special action. Blt-Special action is not appropriate for all system resources, but it is not necessarily limited to frame-buffer memory.

A Blt-Special Read cycle is identical to a normal Read cycle except for the side effect of asserting LDSRC- so that the Read data from memory will be loaded into the Blt chip Source register. The resource addressed (regardless of A23) might be RAM or might be ROM containing fixed images. The circuitry to generate LDSRC-, known as the "Blt-Special Read Controller" (BSRC), need only look at the CPU's Status or Strobe, address bit 23, and the Acknowledge or Ready line to the CPU. The timing of LDSRC- should be such that its rising edge occurs at the time when the CPU captures the Read data. This is shown in figure 6.

A Blt-Special Write cycle is quite different from an ordinary Write cycle. It is orchestrated by a Blt-Special Write

(continued)

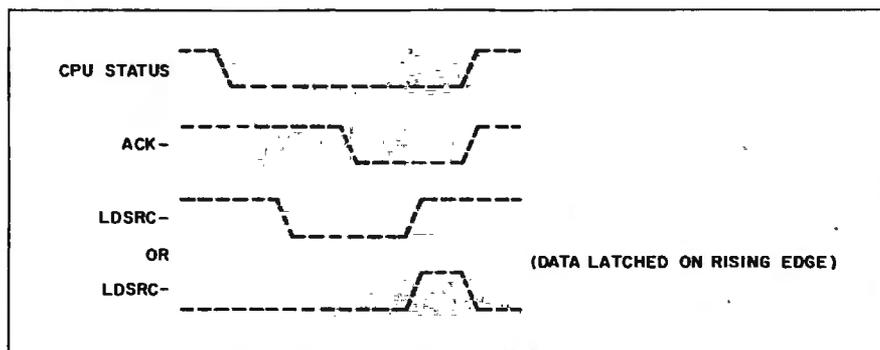


Figure 6: Timing diagram of a Blt-Special Read cycle.

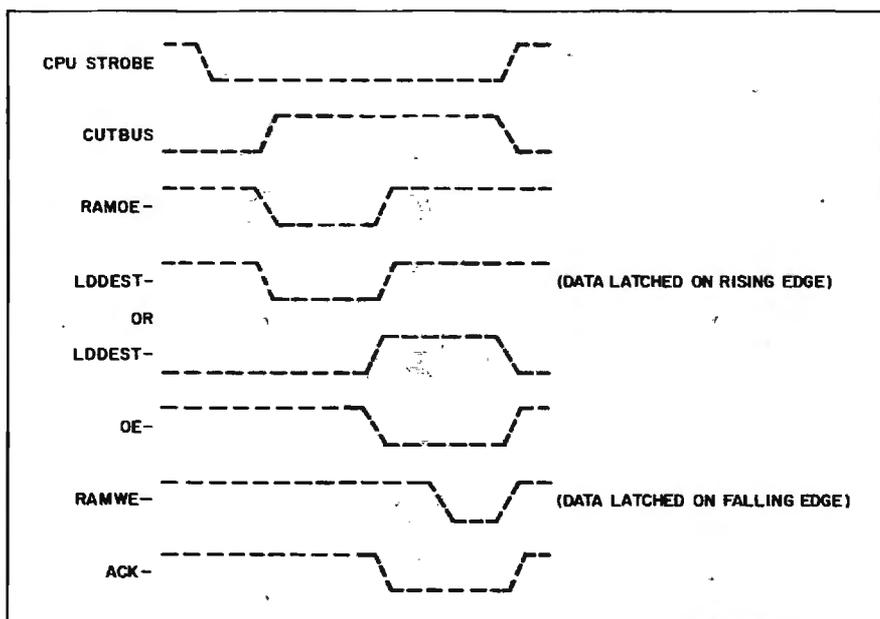


Figure 7: Timing diagram of a Blt-Special Write cycle (Read-Modify-Write).

QUANTEK

QUALITY AND TECHNOLOGY



QUANTEK 2000 AT

FEATURES AND SPECIFICATIONS

- IBM — AT compatible motherboard with:
 - 6MHz 80286 CPU
 - 640Kb Main Memory
 - ROM Bios
 - Eight I/O expansion slots (six with 62 and 36 pins, two with 62 pins only)
 - CMOS clock/calendar with battery back-up
 - Socket for 80287 math co-processor
 - Seven-channel direct memory access (DMA)
 - 16 level interrupts
 - Three programmable timers
- 192 Watt Power Supply
- Fixed and Floppy Disk Controller
- 1.2Mb/360Kb Diskette Drive
- IBM-AT compatible Key-board
- Security Key Lock
- Options
 - Serial and Parallel Port
 - 3Mb RAM Memory
 - 20Mb Fixed Disk Drive
 - 40Mb Fixed Disk Drive
 - 20Mb or 60Mb Tape Drive
 - 360Kb Diskette Drive
 - Color Monitor with adapter
 - Monochrome Monitor with adapter

QC is a registered trademark of QuanteK Corporation
IBM is a registered trademark of International Business Machines Corporation



QUANTEK CORP.
17975 MAIN STREET
IRVINE, CALIFORNIA 92714
(714) 250-1909

RASTER OPERATIONS

```

#define          BLT__BASE          0x100000 /* Implementation Dependent !!! */
/* Address Definitions */
/**** Bit Chip Registers: ****/
#define          SKEW                *(short*) (BLT__BASE) /* W Only */
#define          SKEWMASK            *(short*) (BLT__BASE + 0x2) /* W Only */
#define          HALFTONE            *(short*) (BLT__BASE + 0x4) /* W Only */
#define          BLTFUNC              *(short*) (BLT__BASE + 0x6) /* W Only */
#define          MERGEMASK           *(short*) (BLT__BASE + 0x8) /* W Only */
typedef struct form {
    short *bits;
    short width; /* in pixels */
    short height; /* in pixels */
} FORM;
short rightmasks[17] = {0x0000, 0x0001, 0x0003, 0x0007, 0x000f,
                       0x001f, 0x003f, 0x007f, 0x00ff,
                       0x01ff, 0x03ff, 0x07ff, 0x0fff,
                       0x1fff, 0x3fff, 0x7fff, 0xffff};
#define BLTSPECIAL 0x400000 /* byte address bit A23 */
bitblt(sourceform, destform, htonebits, sourcecx, sourcecy, destx, desty,
        width, height, combrule)
FORM *sourceform, *destform;
short *htonebits;
short sourcecx, sourcecy, destx, desty, width, height;
short combrule;
{
    register wordcount, junk;
    register short *srcptr, *dstptr;
    short *srcbits, *dstbits;
    short srcraster, dstraster, skew, mask1, mask2;
    short preload, nwords, srcdelta, dstdelta;
    short startbits;
/* Compute skew and first/last word masks. */
/* Dest/Src first word address */
/* and width (in words) */
    dstbits = destform -> bits;
    dstraster = ((destform -> width + 15) / 16);
    srcbits = sourceform -> bits;
    srcraster = ((sourceform -> width + 15) / 16);
    skew = (sourcecx - desbx) & 15; /* skew = # bits to rotate from */
    SKEW = skew; /* src word to dest word */
/* skew mask = select bits to rotate */

```

Figure 8: C-language code for implementing a complete BitBlt operation.

Controller (BSWC) that may be combined with the dynamic memory controller in some systems. Upon detecting that the microprocessor has initiated a Write cycle with a Bit-Special address, the BSWC in fact performs a Read-Modify-Write cycle. First, the CPU data buffer is turned off in order to keep the CPU's Write data from being driven onto the bus on which the Blt chip resides, and the memory is accessed for reading. When the Read data becomes available, LDDEST⁻ is asserted to load it into the Blt chip Destination register. Finally, the Blt chip OE⁻ pin is asserted and the datapath result is written to memory at the

current address. The microprocessor Ready (or Acknowledge) line is used to stretch the bus cycle until the Read-Modify-Write process is complete.

The Write data provided by the microprocessor in a Bit-Special Write cycle is not used. The only reason that the cycle is a Write is because that is a convenient way to indicate that the address is a destination address and therefore requires a different type of interaction between the memory and the Blt chip. Figure 7 shows the actions of the BSWC during a Bit-Special Write (Read-Modify-Write).

Clearly Bit-Special Write cycles are

available only within RAM that has this special kind of controller. If possible, it is desirable to have this type of control for more RAM than just the frame buffer. This allows images to be built in nondisplayed memory and then transferred to display memory later.

Figure 8 shows simplified but functionally correct code for implementing the complete BitBlt operation. For clarity of presentation, this version does no clipping and operates from top to bottom and left to right. The full version of the code clips to account for different-sized rectangles and rectangles that go outside of their

RASTER OPERATIONS

```

SKEWMASK = (skew == 0) ? 0 : rightmasks[16 - skew];
startbits = 16 - (destx & 15); /* # of bits in first dest word */
mask1 = rightmasks[startbits];
mask2 = rightmasks[15 - ((destx + width - 1) & 15)];
nwords = ((width - startbits + 15) / 16) + 1;
/* Calculate starting addresses, word increment between lines. */
/* Check if need 2 words of src */
/* to store the first dest word */
preload = (skew != 0 && skew <= (sourcex & 15));
/* Calc starting addresses */
srcptr = srcbits + BLTSPECIAL + sourcey * srcraster + (sourcex / 16);
dstptr = dstbits + BLTSPECIAL + desty * dstraster + (destx / 16);
/* Calc scanline offsets */

srcdelta = srcraster - nwords;
dstdelta = dstraster - nwords;
if (preload) srcdelta -= 1;
/* Copy one row at a time */
BLTFUNC = combrule;
while (height -- > 0) { /* copy one row */
    if (htonebits) { /* setup halftone row */
        HALFTONE = htonebits[desty & 15];
        desty += 1;
    }
    if (preload)
        junk = *srcptr ++; /* preload previous word */
    wordcount = nwords;
    MERGEMASK = mask1; /* copy first word */
    *dstptr ++ = *srcptr ++; /* BLTSPECIAL read, BLTSPECIAL rmw */
    if (-- wordcount > 0) {
        MERGEMASK = 0x0000; /* copy full words */
        while (-- wordcount > 0)
            *dstptr ++ = *srcptr ++; /* BLTSPECIAL read, BLTSPECIAL rmw */
        MERGEMASK = mask2; /* copy last word */
        *dstptr ++ = *srcptr ++; /* BLTSPECIAL read, BLTSPECIAL rmw */
    }
    srcptr += srcdelta; /* calc address of next row */
    dstptr += dstdelta;
}
}

```

bit maps. It also correctly handles overlapping source and destination rectangles for operations such as scrolling down and/or to the right.

Reads with the Blt-Special bit (address bit 23) set cause the Blt chip to load the data (from the memory location addressed by the other address bits) into its Source register. The previous source word is transferred to the Previous Source register. A Write operation with the Blt-Special bit set results in a Read-Modify-Write operation to the memory location addressed by the other address bits. The previous contents of the memory word are loaded into the Blt chip's

Destination register; the new destination word is computed combinatorially by the Blt chip and is written to the same memory location.

The Halftone register is written once per scan line with a word from a 16-by-16-pixel bit map.

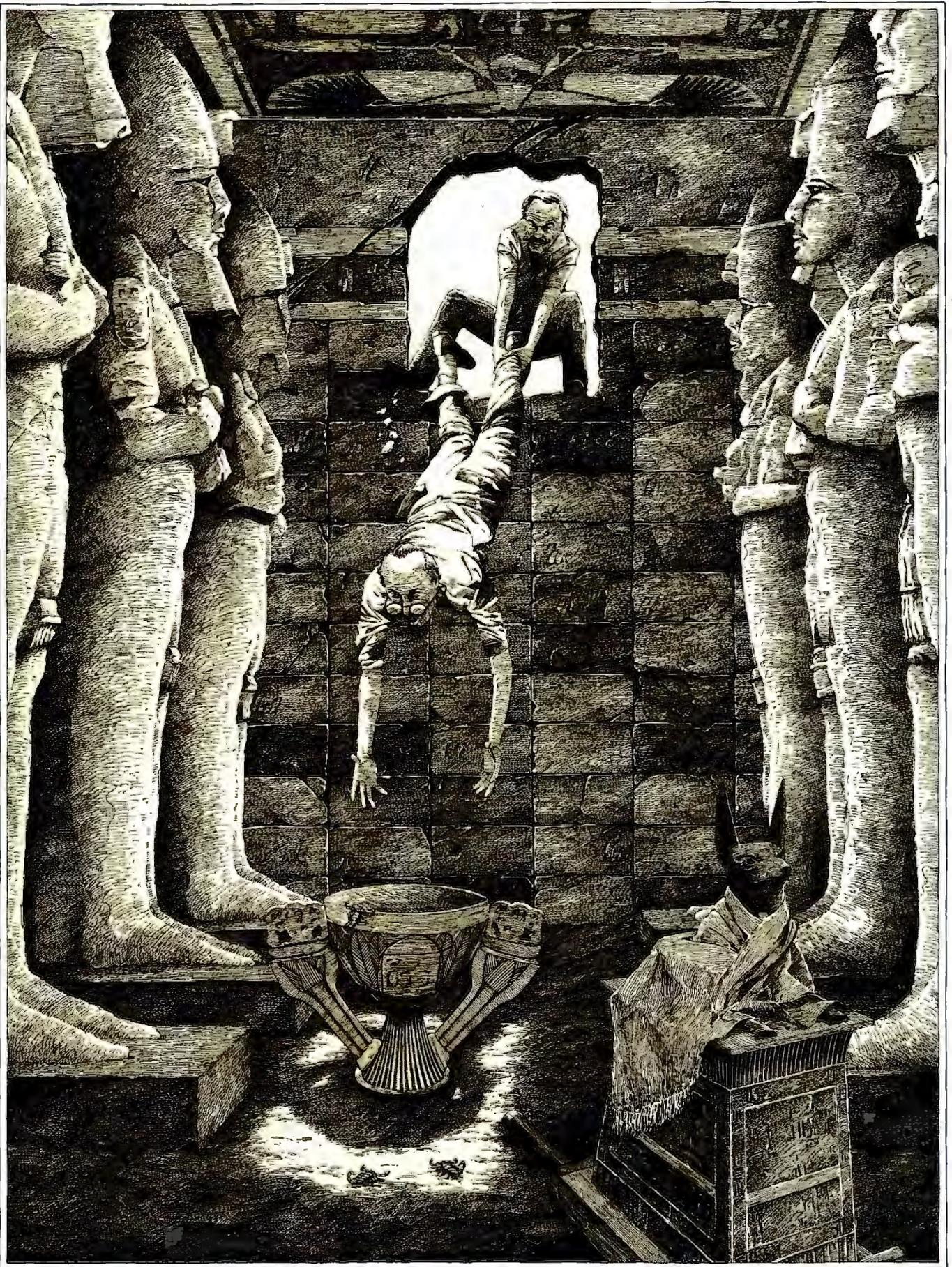
Further optimization is possible—for example, unrolling loops or creating dedicated code for special cases including the design of small rectangles, such as characters.

WHAT LIES AHEAD

Encouraged by our success with the Blt chip, we are turning our attention to an application area in which the

BitBlt operation provides little help: fast display of vectors. By employing some of the same techniques used in the development of the Blt chip, such as operating on as many pixels as possible concurrently and optimizing inner loops with cost-effective hardware support, we anticipate low-cost vector emulation on raster displays that competes effectively with the highest performance display technology available.

Much work remains to be done, and it will require a great deal of effort. But the problems involved and the potential rewards are both significant. ■



COMMON SENSE IN DATABASE MANAGEMENT
NUMBER FOUR IN A SERIES.

IT DOESN'T MATTER HOW GOOD IT IS IF YOU CAN'T GET YOUR HANDS ON IT.

Buried deep in your company, there's an incredible source of wealth. People have spent thousands of hours creating it, one painstaking step at a time.

Then they store it in places where it'll never see the light of day. As you know, we're talking about data.

Because in most companies, the information you need to build a database is locked up in the corporate mainframes, minis and micros. Stored on hundreds of tapes and floppy disks. In a dozen different programs. And with most database software for PCs, the only way to put all this information together is to key it in stroke by stroke. Or write a different program for every data transfer. Unless you've got R:base™ 5000.

ing data that's already been keyed in somewhere else. But R:base 5000 has a FileGateway™ feature. Which lets you transfer information from all the programs listed in this chart. Automatically, without programming. Without even defining a file structure. All you do is follow a simple menu.

As a result, you can build a database with thousands of records in about the same time it takes to copy a disk.

And once you've got all that data in R:base 5000, you can really put it to good use. Because it lets you develop applications ten times faster, runs 60% to 150% faster, and gives you a much more sophisticated report writer than dBASE III.

SEE FOR YOURSELF:
1-800-547-4000.

If you believe in common sense as much as we do, you'll want to try it out and see for yourself. So for only \$9.95 (plus shipping) we'll send you a mini-version of the product that lets you build real applications.

Just call 1-800-547-4000 and ask for Dept. 826. From Oregon, or outside the U.S., call 1-503-684-3000, Dept. 826. We'll send your copy right out. If you'd like to see R:base 5000 today, head straight for a leading software store or computer dealer.

And see what it's like to get your hands on a little satisfaction for a change.



ACCESSIBLE DATA

Using R:base 5000, it's possible to transfer data from any of the following popular programs and files. Instantly. Using dBASE III,™ it's not nearly as easy.

Automatic Data Transfer From:	R:base 5000	dBASE III
Lotus 1-2-3®	Yes	No
pfs:file*	Yes	No
dBASE II*	Yes	Yes
Multiplan* (Syk)	Yes	No
Visicalc* (Dif)	Yes	No
ASCII (delimited and fixed files)	Yes	No

AUTOMATIC DATA TRANSFER. ONLY WITH FILEGATEWAY.™

With some DBMS software, you have to spend 90% of your time copy-

R:BASE 5000 FROM MICRORIM

IT ALL COMES DOWN TO COMMON SENSE.

**RUNTIME VERSION
NOW AVAILABLE.**

Zenith makes the best compatible, AB makes them the best value!

More than just price, we will not be undersold!



- | | | |
|--|--|---|
| 1 2 DS/DD 360K Disk Drive
384 RAM Memory, Amber 20 MHz Monitor P13
Built in ROM Diagnostics, 1 Expansion Slot
CZF-148-42BU 1,350 | 4 New Advance Technology PC IBM PC/AT Compatible
Single DS/DD 1.2 Meg Disk Drive
512K RAM, Serial Parallel
Amber 20 MHz Monitor (P13)
Expandability for up to 12 simultaneous users
CZF-241-81 2,995 | 6 Portables Zenith Quality IBM Compatible
Back Lit Screen 8 MHz
2 Standard DS/DD/360K Drives
640 x 200 Dot Graphics
14.3 Lbs, 250K RAM
CZ171-42 1,995 |
| 2 One Plus
7 Expansion Slots
CZF-158-42BU 1,850 | 5 Four Plus
Hard Disk System
Same as above including 40 Meg Hard Disk
CZW-241-82BU 4,795 | 7 Trans Portable
2 DD 380K Drives
8 MHz Clock, 128K RAM
24.2 lbs.
CZF-138-21 1,299 |
| 3 One Plus
Hard Disk System, 20 Meg Winning 1/DS/DD 360K
384 RAM Memory, 8 MHz with 7 Expansion Slots
CZW-158-42BU 2,429 | | |

Canon
Laser Beam Printer
Many Advantages over HP,
No Additional Cost, Quantity Discounts
IBM Parallel Interface
It can THINK! It's a Diablo 630
4 Resident Fonts
Downloadable Fonts
Choose number of copies from keyboard
or software
For BEST PRICE Call

Canon A-40
Impact Dot Matrix Printer
Near letter quality 23 x 18 matrix
140 cps
3 kinds of Graphic Image
Selectable Linefeeding
IBM Printer Compatible
Push Feed Adjustable Tractor
Fanfold Single Sheet &
Multipart Copy Paper Usable
Many More Features Only \$259

Multifunction Card
PRICE BREAKTHROUGH
2 Serial Ports
Game Port
Printer Port
Real-Time Clock-Calendar
Ram Disk
Print Spooler
With 384 RAM \$229
3 or more \$199

UNIVERSAL PRINTER STAND
Reg. \$169.
REDUCED TO \$99.99

SOFTWARE
for IBM, Macintosh, Apple
All Major Brands
25% - 40% Off
Call for pricing.
Corporation users' volume
purchase contracts available.
Call for money saving details

USI
Hi Res. Metal Cabinet
1-9 79
10-19 70
20 up 68
Large Qty. Call

BUILD YOUR OWN P.C.

PC-XT Mother Board IBM™ Fully Compatible 8088 Micro-Processor with 8087 Math Pns Socket, 8 I/O Slots, 256K On Board Memory Assembled & Tested Board & All Components 1 - \$229 3-4 \$219 4-10 \$200 Over 10 Call <small>IBM is a trademark of International Business Machines</small>	PC Case with Hinged Top Easy, Quick Access Fits IBM PC/XT Mother Board Hardware for Mounting 2 - 4 Drives Quality Case — All Metal 1 - \$79 2-3 \$75 4-10 \$70	Enhanced Keyboard for IBM PC Enlarged Return Key & Shift Key LED Indicators on Cap's Lock & Number Keys Fully IBM Compatible 1 - \$89 2-3 \$85 4-10 \$80
--	--	--

HARD DISKS

10 Meg	299
20 Meg	499
30 Meg	Call
85 Meg	Call
WD Disk Controller	190

MODEMS
Hayes ANCHOR
..... Call

AST

Six Pack Plus	239
I/O Plus II	139
Advantage - AT	399
Graph Pak	599
MonoGraph Plus	399
Preview Mono	299
PC Net Cards	379
5251/11 On-line	799

135 WATT Power Supply
4 Drives Power Plugs
Side Switch Model
like IBM
1 - \$109
2-3 \$105
4-10 \$100

PC PLUS™ Add-ons for IBM™ PC & Compatibles

- Disk Controller Card 69
- Disk I/O Card (2 Ser, Par, Click & Gnd) 149
- Parallel Printer Card 39
- Hi-Res Mono Card 79
- Serial Card 49
- Game Adapter 29
- Color Graphics Card 89
- Color Card/Parallel Port 119
- Mono Graphic Card/Printer Port 129
- Speaker 200
- I/O Plus Card 89

PC-XT Compatible Includes
640 K RAM, 2 - DS/DD Disks 360 K
135 Watt Power Supply
2-RS232 Serial Ports
1 Parallel Port
Real Time Clock - Cal Bat Backup
RAM Disk, Print Spooler
Assembled & Tested! Everything you need
except Monitor & Card
1 - \$1,059 2-3 \$1,000 4-10 \$975
20 Meg Version \$1,575

POWER DEVICES
Datashield backup power source
200 PC-200 watt 265
300 XT-300 watt 390
Trip 425 433
Brooks & Dattler-Surge Suppressor/
Noise Filter 54

QUADRAM

Quadport-AT	119
Quadmeg - AT (128K)	349
The Gold Quadboard	449
The Silver Quadboard	239
Expanded Quadboard	219
Quad 512+	229
Liberty	309
QuadSprint	499
QuadLink	399
Quadcolor 1	199
QuadLr Expansion Chassis	469
Expansion Chassis Memory	199
Quadmem Jr	199
Chronograph	79
Parallel Interface Board	64

OKIDATA
82, 83, 84, 92, 93, 182, 260, 2410,
Okimate-20 Call
Okimate (Specify C64 or Atari) 199

star

SG10/SG15 (120 cps)	239/399
SD10 (160 cps)	359
SD15 (160 cps)	479
SR10 (200 cps)	499
SR15 (200 cps)	639
PowerType Letter Quality	319

GMON

Printer 7500	219
Printer 8510P	299
Printer 1550P	469

EPSON

RX-100, LX-80	Call
FX-85+, FX-185+	Call
LQ 1500, JX80 Color	Call
Homeprinter 10	Call
NEW! LX-90, SO-2000, DX-10, DX-20, HS-80	Call

MicroFazer Printer Buffers

ME parallel Epson	8K 135 16K 145
	32K 165 64K 195
MP parallel	8K 145 16K 155
	32K 175 64K 205
MSP ser-parallel	8K 165 18K 175
	32K 195 64K 225
MSS ser-serial	8K 165 18K 175
	32K 195 64K 225
MPS par-serial	8K 165 18K 175
	32K 195 64K 225

ZENITH

ZVM 122/123	79
ZVM 124 IBM Amber	149
ZVM 130 Color	269
ZVM 131 Color	249
ZVM 133 RGB	429
ZVM 135 RGB/Color	459
ZVM 138 RGB/Color	589
1220, 1230, 1240	Call

Hercules

Modular Graphics Card	279
Multi Display Card	299
Five Pack C.S.	169

PARADISE

Graphics	319
Color	169

AMDEK

300 Green/Amber	129, 149
300 Color/Audio	259
310 Amber IBM-Plug	189
Color 500 Composites/RGB	389
Color 800 Hi-Res(840x240)	439
Color 700 Hi-Res(720x240)	499
Color 710 Long Phosphor	579

DISK RIOT
DS/DD AS LOW AS
99¢
AB DISKETTES with Media Mats
Amaray Disk Library

Media Mate	8.95
Zip N File 25	18.50
Zip N File 50	22.95

TAXAN

115/118 12" Grn/Amb Mono	99
121 Green TTL	139
122 Amber TTL	149
210 Color RGB	239
400 Med-Res RGB	319
415 Hi-Res. RGB	399
420 Hi-Res. RGB (IBM)	429
440 Ultra Hi-Res. RGB	589

PAPER

9 1/2" x 11" Keen Edge	29
9 1/2" x 11" Standard	27
14 1/2" x 11" Standard	38
20 lb - other weights available	
2700 sheets per case	

ORDERING INFORMATION: Order by check, Mastercard or VISA. Personal checks take 15 days to clear, no waiting on certified checks or money orders. Add 3% shipping and handling on all orders (minimum \$2.00) Mail, APO/FPO. Air may require additional charges. PA residents add 6% sales tax. MA residents add 5%. All items subject to availability. Prices subject to change. Additional discounts available to qualified educational institutions. Requests for bid on volume requirements invited.

AB SATISFACTION GUARANTEE
Every product sold by AB Computers is factory packed and comes with the manufacturer's warranty. However, if an item is defective when received, you may return it to us within 15 days for repair, adjustment or replacement at our option. Returns must be accompanied with copy of your invoice, letter detailing defect, blank warranty card and all original factory packing. To expedite handling, please call for return authorization number. (Sorry, no return on computer software once opened.)



Since 1976
Use our TOLL FREE Order Line Mon-Fri 9am-6pm EST
800-822-1211
In PA: 215-822-7727

We support Apple,
Macintosh,
Commodore,
IBM & compatibles



Customer Service
215-822-7727

252 BETHLEHEM PIKE, COLMAR, PENNSYLVANIA 18915

MOVING PICTURES

BY STEFAN DEMETRESCU

Designing systems for real-time graphics performance

WHY IS IT difficult and expensive to generate moving images on a computer screen in real time (that is, 30 times per second)? After all, drawing lines and filling polygons is a very simple operation. The problem, of course, is that these simple drawing operations must be repeated thousands to millions of times per second, since even simple images consist of many hundreds of lines and polygons that must be redrawn 30 times per second.

If we analyze the overall architecture of high-performance graphics systems, we see that a major performance problem is the organization and access methods used for the image memory. This is the memory that stores the image picture elements (pixels) as the image is being drawn and displayed. Because of limitations in their image-memory architectures, currently available inexpensive systems can't achieve real-time performance (that is, they can't redraw the image 30 times per second).

To solve this performance problem, I have developed a new kind of VLSI (very-large-scale integration) graphics chip that provides a significant speed improvement over conventional

graphics systems and promises to make real-time inexpensive display systems a reality.

REAL-TIME GRAPHICS SYSTEM ORGANIZATION

For our purposes, a real-time graphics system is one that can draw moderately complex images very fast. If these images are being displayed on a screen, they appear as though they are changing continuously. For example, the system might display an image of a building and rotate it smoothly to show it from different perspectives. If the image is to appear to be moving continuously, the system must be able to recalculate and redraw the image 30 to 60 times per second (a standard TV-monitor refresh rate).

Figure 1 shows a block diagram of a typical graphics system. Initially, the application program must create the image description (known as a "display list"). This is a list of graphical primitives (e.g., lines, polygons, and cubes) described in the three-dimensional coordinates (or "world coordinates") of the object being drawn. This description is usually created once and modified very slowly. For

example, if an architect is designing a building on a CAD (computer-aided design) system, he may make minor modifications to it (such as moving a wall). Since the majority of objects in the display do not move, this type of change is not difficult. Changing the vantage point, however, requires redrawing all the objects in different places, 30 times per second—a much more difficult task.

To do this, the rest of the graphics system must take the relatively static description of the image in the display list and display it on the screen. Because the vantage point is changing 30 times per second (to give the illusion of smooth motion), the rest of the pipeline must meet very stringent performance requirements. In the geometric transformation stage, the vertices of the graphical primitives are converted from the three-dimensional

(continued)

Stefan Demetrescu (Lasergraphics Inc., 17671 Cowan Ave., Irvine, CA 92714) is a doctoral candidate at Stanford University, where he developed the SLAM graphics chip. He is vice president for computer systems at Lasergraphics, where he develops high-performance rasterizers for laser and other printers.

*With double buffering,
the system displays
one image while
it is erasing and
redrawing the other.*

model in the display list (x,y,z) to their proper position on the screen (X_{SCREEN}, Y_{SCREEN}). The transformation formulas are:

$$X_{SCREEN} = (AX + BY + CZ + D)/W$$

$$Y_{SCREEN} = (EX + FY + GZ + H)/W$$

$$W = IX + JY + KZ + L$$

This transformation, which performs scaling, translation, rotation, and perspective, involves 20 floating-point operations (9 additions, 9 multiplications, and 2 divisions) for each 3-D vertex.

After the graphical primitives have been converted to two dimensions, they are "clipped" against the edges of the screen; that is, objects or parts

of objects that are beyond the edges of the screen are not displayed.

At this stage, the original 3-D image has been converted to a set of 2-D commands in the coordinate system of the screen (e.g., a line from pixel 200,450 to 300,210). The image is still far from complete. The polygons and the lines must be converted into colored dots (pixels) in the image-raster memory. This step, called rasterization, is perhaps the simplest step in the procedure to understand.

The process of coloring all of the pixels inside a polygon from a list of vertices is shown in figure 2. First, the vertices are sorted from top to bottom. Then the polygon is filled one horizontal line (scan line) at a time. The system calculates the intersection of the polygon's edges with the scan line to give the first and last pixels on the scan line that are inside the polygon (X_{LEFT} and X_{RIGHT}). It then modifies the pixels that lie between these extremes to a new color.

Figure 3 shows a block diagram of this rasterization scheme. The scan-line processor accepts 2-D polygons described by their vertices. It then processes these polygons into a se-

quence of horizontal line-fill commands that specify, for each scan line intersected by the polygon, which pixels are to be modified. These commands are sent to the horizontal-fill processor, which modifies all the selected pixels.

After all the graphical primitives have been converted into a raster, the image is represented as an array of colored pixels. This image can then be displayed on a TV monitor or printed on a printer. In low-cost systems such as personal computers, which cannot update the image quickly, the image memory is displayed repeatedly, and you can see the graphical primitives being redrawn. If you want to draw a new image 30 times a second, you normally use two image memories. In this scheme, called double buffering, the system displays one image while it is erasing and redrawing the other. This way, only complete images are displayed and the viewer perceives a smoothly changing image.

In the following sections, we will look at each of the major subsystems in the typical graphical-display system and describe alternative ways to implement them. We also estimate the

Table 1: Performance times for various methods of transforming an image with 2000 vertices.

Method Used	Floating-Point Multiplication Time	Floating-Point Addition Time	Floating-Point Division Time	Time to Transform 1 Vertex	Time to Transform 2000 Vertices	Achievable Images per Second
Software Only (8086)	1600 μ s	1600 μ s	3200 μ s	35,200 μ s	70,400 ms	0.015
Floating-Point Coprocessor (8087)	19 μ s	17 μ s	39 μ s	402 μ s	804 ms	1.25
Floating-Point Multiplier Chip	0.2 μ s	0.2 μ s	0.8 μ s	5.2 μ s	10.4 ms	96

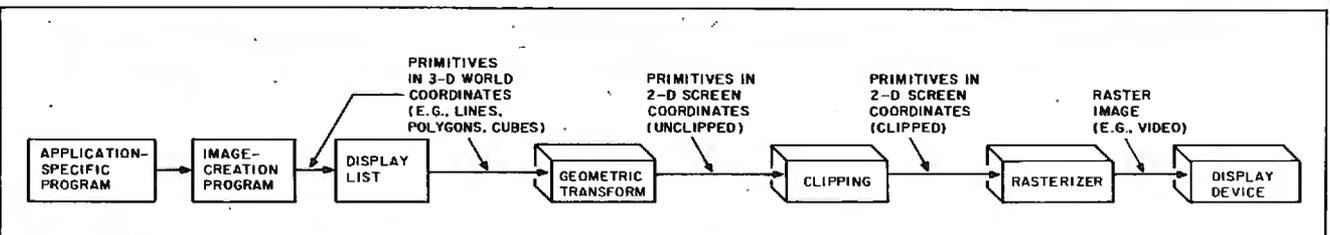


Figure 1: A typical graphical-display system, including the major steps of geometric transformation and rasterization.

performance of the alternatives using a "typical" image with approximately 1000 polygons, with an average size of 100 by 100 pixels. We'll assume the number of vertices to be 2000 since many vertices are shared among polygons.

TRANSFORMATIONS AND CLIPPING

A graphical-display system must invoke the transformation formulas mentioned earlier for each vertex of the image. There are three principal ways to calculate these formulas: software in the main processor (e.g., the Intel 8086), software with the floating-point coprocessor (e.g., the Intel 8087), special-purpose floating-point hardware-multiplier chips (e.g., the AMD Am29325 and the Weitek WTL 1032).

Table 1 summarizes the performance of these methods. Note that to transform 2000 vertices 30 times per second (with 20 floating-point operations per transformation) requires 1,200,000 floating-point operations per second (flops) or 0.8 microsecond (μs) per operation. Unfortunately, the inexpensive methods, using microprocessor software, are 2000 times too slow, and even with the floating-point coprocessor the performance is 20 times too slow.

Over the last few years, however, a number of semiconductor companies have begun to offer very fast floating-point calculation chips (see the last entry in table 1), with performance levels in the 5,000,000 flops range. These chips are ideal for performing such geometric transformations and are reasonably priced (in the \$100 range).

Clipping calculations are more complex, and I will not discuss them here. Suffice it to say that most of the graphical primitives are either completely inside the screen or completely outside, so they require no processing. Consequently, the time spent for clipping is usually a small fraction of that used for transformation.

Geometric transformations and clipping are computationally demanding but well within the grasp of today's technology. This is because even a complex image consists of only a few thousand vertices and hence only a few thousand transformations.

RASTERIZATION

Rasterization is computationally much more difficult than transformation or clipping. Even the simplest image

consists of hundreds of thousands of pixels, each of which must be accessed at least once during the rasterization process. For example, assume that the display image consists of 1000 polygons, with an average size of 100 by 100 pixels. This translates into 10 million pixels per image, which must be redrawn 30 times per second, resulting in 300 million pixels per second to be drawn (i.e., accessed and modified). This means a rasterization system must spend less than 3.3 nanoseconds (ns) per pixel (1/300,000,000) on the average to perform in real time. Unfortunately, the average microprocessor execution time is 2000 ns (2 μs) per instruction.

The simplest rasterization system is *(continued)*

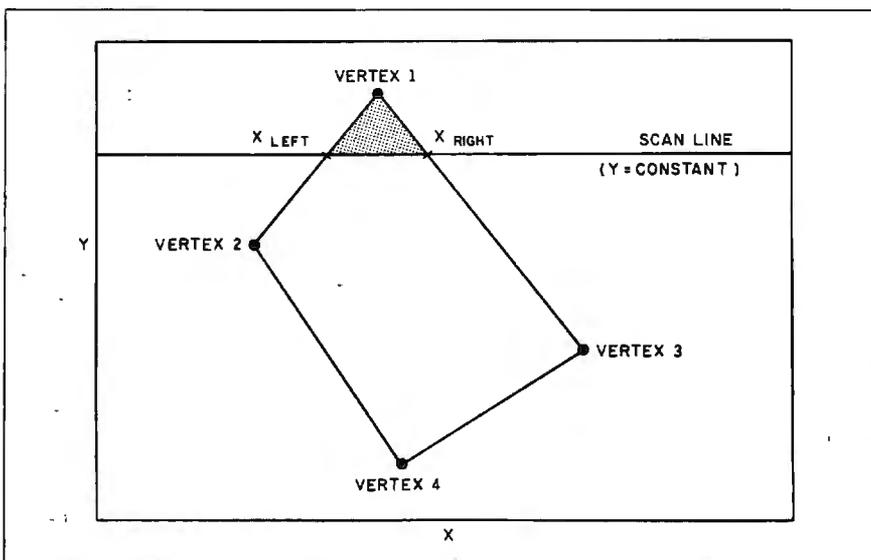


Figure 2: Rasterizing a four-sided polygon involves repeatedly determining where the polygon's edges intersect a moving scan line and modifying the pixels between those points to a specified color.

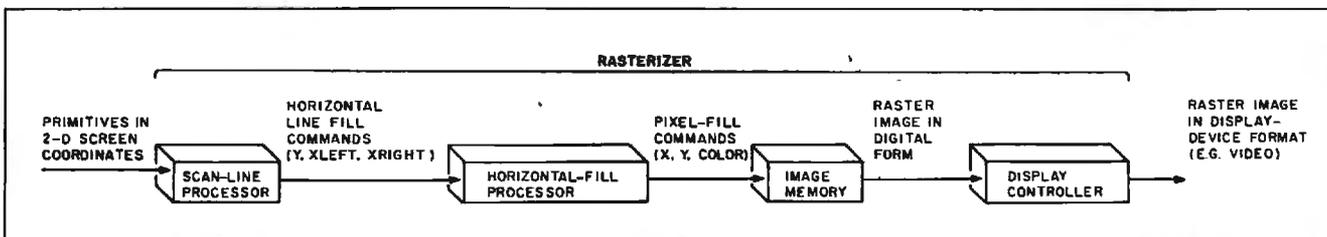


Figure 3: The process of rasterization depicted in figure 2. The scan-line processor converts the vertices of the 2-D polygons into horizontal line-fill commands. The horizontal-fill processor modifies the pixels between X_{LEFT} and X_{RIGHT} to the appropriate color.

Table 2: Performance times for various methods of rasterizing an image with 1000 polygons of 100 pixels by 100 pixels (10 million pixels total). Note: For real-time performance a system must be able to rasterize 30 images, or 300 million pixels, per second. These are estimated optimum times for systems where memory is the limiting factor. The number of achievable images per second assumes that these are double-buffered systems; that is, the memory is not being displayed at the same time as it is being rasterized.

	Pixels per Memory Cycle	Average Time to Access 1 Pixel	Average Time to Rasterize 10 Million Pixels	Average Time to Rasterize 300 Million Pixels	Achievable Images per Second
Software Only (1 pixel/byte)	1	2000 ns	20 sec	600 sec	0.05
Graphics Processor (1 pixel/byte)	1	800 ns	8 sec	240 sec	0.125
Software Only, Bit Map (16 pixels/16-bit word)	16	125 ns	1.25 sec	37.5 sec	0.8
Graphics Processor (16 pixels/word)	16	20 ns	0.20 sec	6 sec	5
Graphics Processor and SLAM Chip	1 to 1024 (typically, 100)	0.2 ns to 200 ns (typically, 2 ns)	0.02 sec	0.6 sec	50

shown in figure 4. In this system, each pixel of the image is represented by a byte in the computer's memory. The content of each byte indicates the pixel's color. Most of the color-graphics boards available for the IBM PC and others operate on this principle. The display controller reads the pixels and displays them through a second port of the memory.

Assuming that we make the optimistic estimate that the software in the microprocessor can modify one pixel every instruction, it takes 20 seconds (10 million pixels times 2 μ s per pixel) to rasterize all the polygons (table 2). This is 600 times too slow.

To speed up the accesses to memory, some semiconductor vendors have introduced special graphics processors. Perhaps the best known one is the NEC 7220 chip. A system using such a chip is shown in figure 5. The central processing unit sends the geometrically transformed graphical primitives to the graphics processor, which then accesses the individual pixels. The graphics processor itself still accesses pixels one at a time, but

at a somewhat faster rate of 800 ns per access. Rasterizing the 100 polygons would take 8 seconds (800 ns times 10 million pixels), still 240 times too slow for real-time performance (see table 2). Again, the problem is that pixels are only being modified one at a time. Furthermore, many of these processor chips place severe constraints on the kind of graphical primitives that they can draw. For example, the NEC 7220 only fills polygons if they are rectangles aligned with the *x*-axis.

When the display is black and white, the system needs only one bit per pixel. As a result, it can store 16 pixels in one 16-bit word and access all of them simultaneously with one instruction (figure 6). This method is usually known as a bit map and is used by the Apple Macintosh. When filling large polygons, this allows for a performance improvement of 16 times over the 8-bits-per-pixel frame buffer, at the expense of color.

Nevertheless, as table 2 indicates, such a system is still 37 times too slow for real-time performance. This

estimate is actually too optimistic since bit-map systems must spend a lot of time at the edges of polygons to determine which of the 16 bits are in and which are out. For small polygons, this "edge tweaking" dominates the rasterization time.

AMD has recently announced a graphics processor that offers the advantage of accessing 16 pixels simultaneously while still allowing for a color display (i.e., multiple bits per pixel). AMD calls this chip (promised to be available by the middle of next year) the Am95C60 Quad Pixel Data-flow Manager, or OPDM. This processor can access the display memory up to 16 pixels of 4 bits each at a time in 300 ns (figure 7). Even this large improvement does not allow for real-time imaging and is in fact 6 times too slow to draw 1000 polygons in real time (30 images times 0.02 second per image) as shown in table 2. It also suffers from overhead due to edge tweaking and can only fill triangles, so other polygons must be broken up into triangles by the host processor. Lastly, the wide data path

MOVING PICTURES

(64 bits) is expensive in terms of packaging (the QPDM has more than 100 pins) and interface electronics.

As you can see, getting the required pixel bandwidth to memory (that is, getting pixels in and out of memory) is very difficult. Systems that can rasterize fast enough for real-time drawing do exist, but they are extensions of the architectures described above. These systems use very fast

graphics processors that access many pixels at a time (for example, 64). These processors are also very expensive, and the systems end up costing many hundreds of thousands of dollars, so they are not practical for the average user.

SCAN-LINE ACCESS MEMORIES

The rasterization problem can be summarized as follows: Graphics sys-

tems need to access many pixels simultaneously to rasterize polygons and fill areas quickly, but wide bandwidth to the memories is very expensive.

The best place to access many pixels at once is as close as possible to the memory that stores the pixels. Consider for a moment the internal structure of a conventional 64K-bit

(continued)

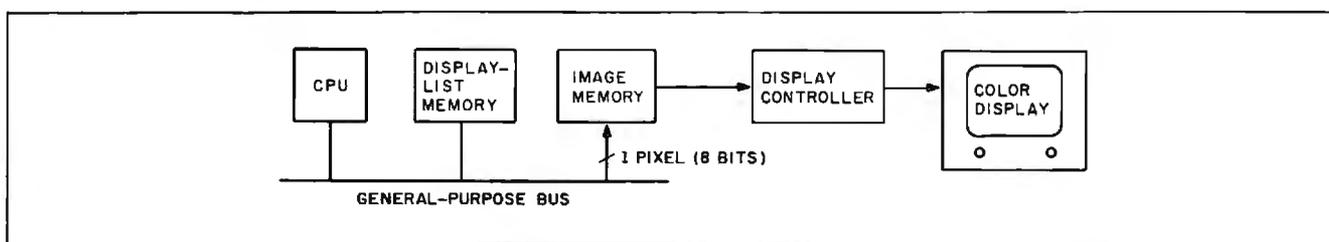


Figure 4: A typical software-driven frame-buffer system for rasterization.

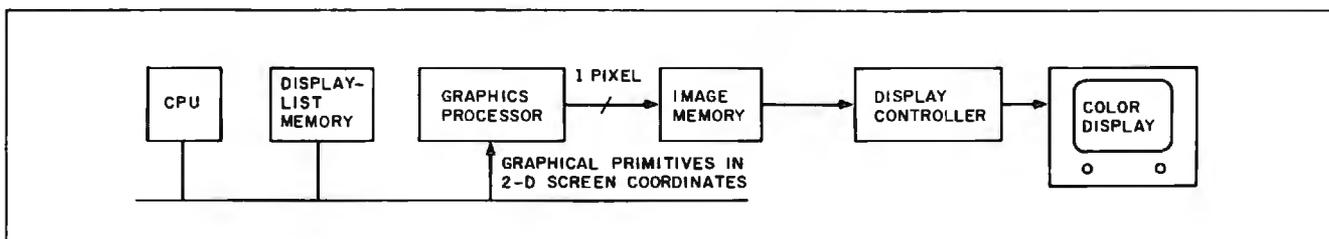


Figure 5: A typical graphics-processor-driven frame-buffer system for rasterization, such as used by the NEC 7220 chip.

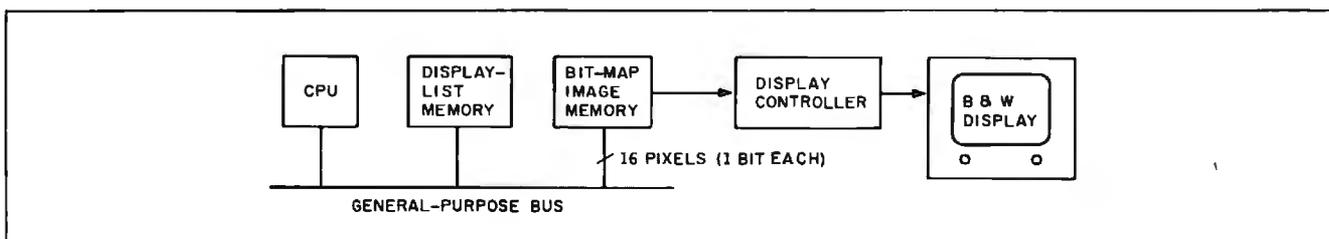


Figure 6: A typical software-driven bit-map system for rasterization, such as used by the Apple Macintosh.

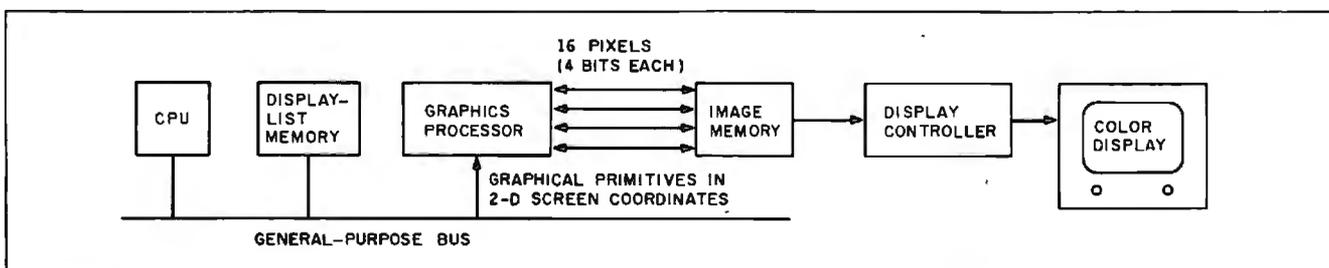


Figure 7: A typical graphics processor with multiple-pixel access to the image memory. Such a system is being developed by AMD for its QPDM chip.

MOVING PICTURES

dynamic RAM (random-access read/write memory) chip. This kind of chip is used as the basis of virtually all image memories. Externally, the memory appears as 64K locations of 1 bit each. Each memory access refers to only 1 bit. As figure 8 indicates, the memory is a closely packed array of memory cells in a square grid of 256 rows and 256 columns. The first 8 bits of the address select a row of the memory location

to be accessed. Then all 256 bits of the selected row make their way up to the top of the array, where one of the 256 bits is read or written and all 256 bits are then written back into the selected row.

When used as an image memory, each row of the RAM can be made to represent a horizontal scan line and each bit of each row to represent a pixel on that line. Thus, each RAM represents a portion of an image buf-

fer that is 256 lines tall and 256 pixels wide. Many such chips can be used to represent a larger image with many bits per pixel.

In a conventional image buffer, each time a pixel is modified the whole scan line is recalled, but only one of the 256 pixels makes it off the chip. It would be impractical to allow all 256 bits of the memory to be accessed simultaneously off the chip, since each chip would end up with more than 256 pins! However, the scan line is available *inside* the memory chip. You can add a special-purpose processor (right above the memory array), which can modify large parts of the scan line without ever having to move the pixels off the chip.

This concept is the basis of my research of fast rasterization architectures done at Stanford University. I have called this "smart memory" chip a SLAM, for "scan-line access memory." Figure 9 shows the external view of a SLAM chip. The SLAM chip executes commands that it receives over the 19-bit bus shown. SLAMs are capable of directly executing the horizontal line-fill commands that form the basis of the polygon-fill function.

The fill operation is accomplished through the use of four SLAM commands. Figure 10 shows the effect of this operation on the image buffer. The first command specifies the scan line that is to be filled (LOAD Y). The second command specifies a 16-bit pattern that will be used to fill all pixels that will be modified. The third command specifies the X_{RIGHT} coordinate and directs the SLAM to read the selected scan line from the memory array. Finally, the fourth command specifies the X_{LEFT} coordinate and directs the SLAM to modify all pixels in the range $[X_{LEFT}, X_{RIGHT}]$ and to write the scan line back into the memory array.

A system of SLAM chips can modify from one to many thousands of pixels simultaneously since the whole scan line is accessed at once and any part of it may be modified in one memory cycle. Nevertheless, the commands

(continued)

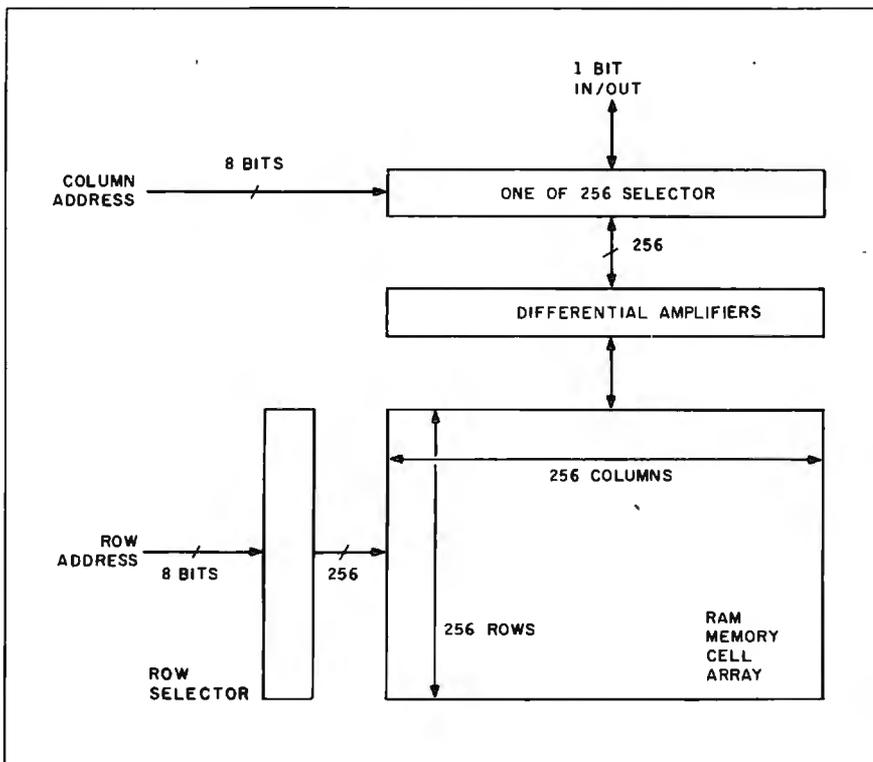


Figure 8: Internal structure of a conventional 64K-bit dynamic RAM.

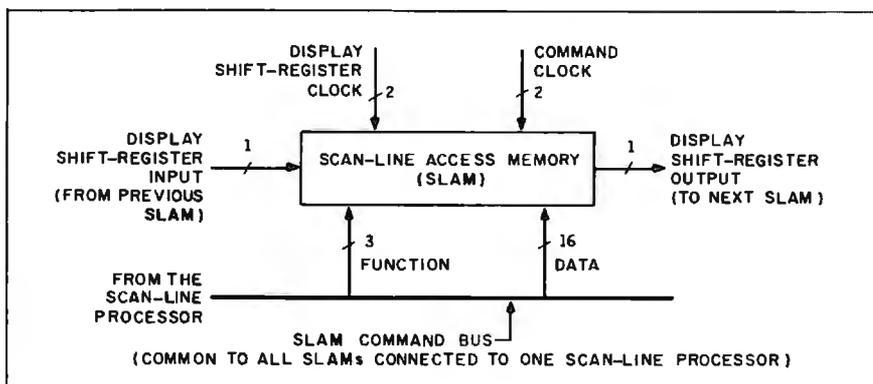


Figure 9: External view of the SLAM chip.

CHAIRMAN OF THE BOARDS

THE 2400 bps MODEM FOR IBM-PCs & COMPATIBLES.

Plug the new USRobotics Microlink 2400™ modem board into any slot in your IBM PC or compatible—to give your computer full 2400 bps data communications capability.

The Microlink 2400 can communicate twice as fast as 1200 bps modems. (It transmits a double-spaced page of text in as little as 7 seconds!) Faster communication means lower phone bills and increased productivity. The modem can even redial busy numbers until it gets through—freeing you for other tasks.



Microlink 2400 displays call status and length on your screen, as well as operational parameters, including the command set and S-register settings. The modem's auto-answer feature automatically adjusts from 2400 bps to 1200 or 300 bps to match the speed of incoming transmissions.

What's more, a powerful equalizer assures peak performance on every call.



Help Screens

The Microlink 2400 is CCITT and Bell compatible, and responds to the full AT command set. You can use it with any of the popular telecommunications software packages including Telpac™ by USRobotics, Crosstalk™, PC Talk™ and Smartcom™. In

addition to the features you'd expect, our new, improved Telpac enhances Microlink 2400's performance with such features as easy-to-use windows, multilevel security, and log files to monitor your outgoing calls.

Microlink 2400's low chip count results in exceptional reliability—backed by a full 2-year manufacturer's warranty. But

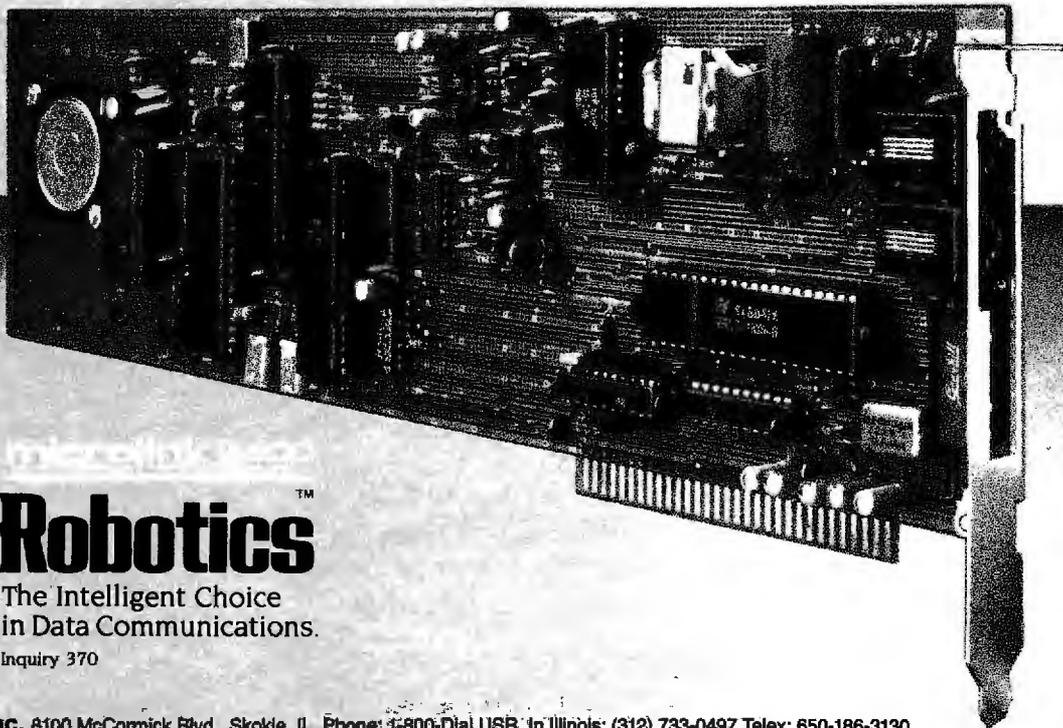
best of all is the price—only \$699! And if you prefer an external modem, our new Courier 2400™ will deliver the same superior performance at the same affordable price.

We set out to build the best modems on the market. Now, they're ready. Microlink or Courier.

Being faster is important. But being best was our goal.



Courier 2400™



USRobotics™

The Intelligent Choice
in Data Communications.

Inquiry 370

MOVING PICTURES

are very short and can be sent over a narrow bus (19 bits). Thus, the SLAM chip converts low-bandwidth commands into a high-bandwidth result inside the VLSI memory chip where the bandwidth is inexpensive.

Figure 11 shows a block diagram of a 16K-bit prototype version of the SLAM chip, while photo 1 is a micro-photograph of the prototype chip that I have built at Stanford. Note that the "smart" part of the smart memory

(everything but the conventional RAM array) is only a small fraction of the total chip area. Thus, the expected cost of such a chip will be close to that of conventional memory.

The SLAM chip consists of six main sections:

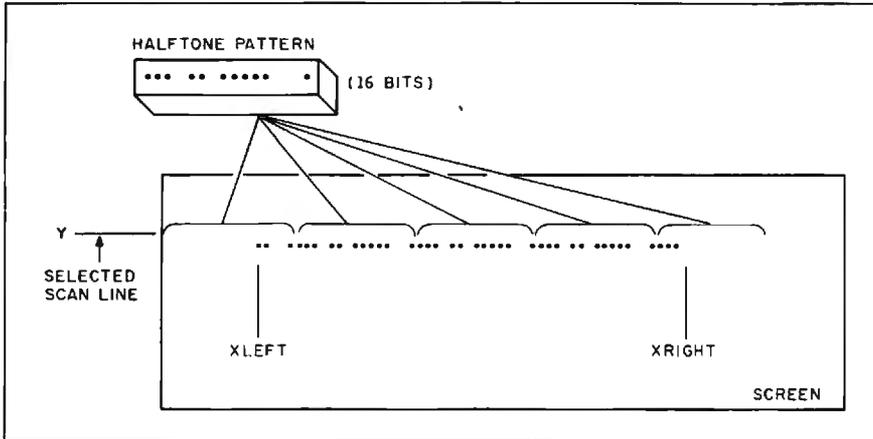


Figure 10: The SLAM chip performs the horizontal line-fill operation by simultaneously filling a specified scan line, between the X_{LEFT} and X_{RIGHT} coordinates of the line, with a specified 16-bit pattern.

- The memory array is a conventional dynamic RAM array.
- The halftone ALU (arithmetic and logic unit) performs Boolean operations on the incoming halftone pattern before it is used (its use will not be discussed here).
- The parallel comparator accepts the X_{LEFT} and X_{RIGHT} values and generates a 1 bit for each of the 256 horizontal bit positions that lie in the range $[X_{LEFT}, X_{RIGHT}]$ and a 0 bit for all the others.
- The scan-line ALU determines what values are to be stored back into the memory array as determined by the the parallel comparator and the halftone bus.
- The Y control and row selector enable the proper row of the memory when given the Y scan-line number.
- The display shift register latches a selected scan line so it can be displayed independently of the rest of the SLAM chip.

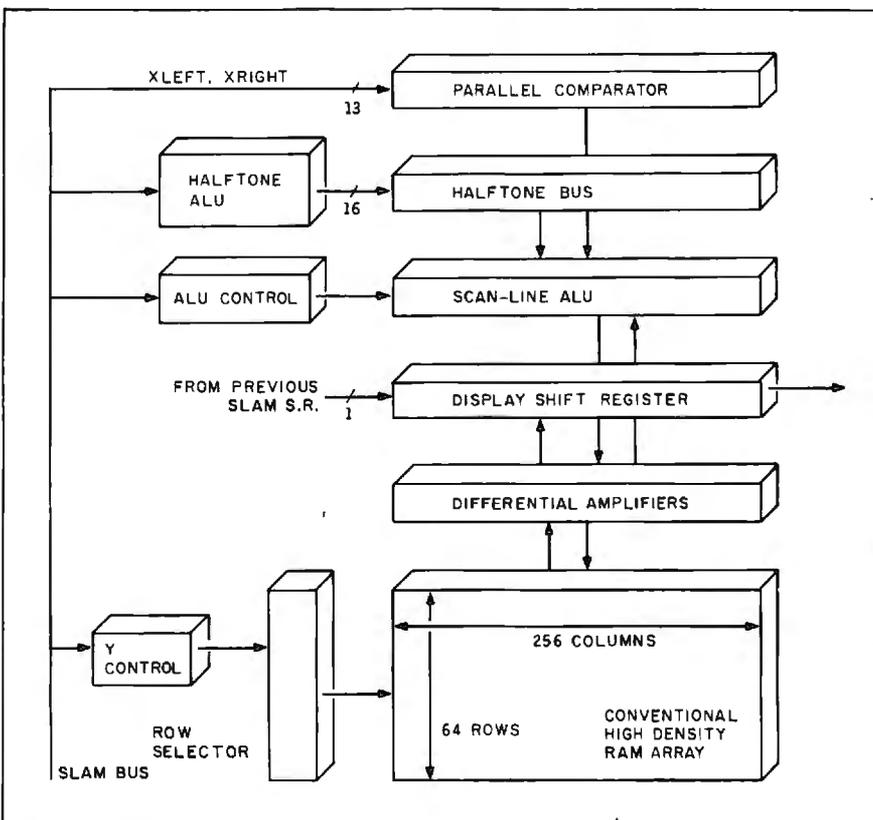


Figure 11: Internal structure of the SLAM chip.

A very simple SLAM system is shown in figure 12. This system is as simple as the simplest of the conventional (graphics-processor-driven) systems (figure 5), except the conventional DRAMs are replaced by the SLAM memory chips. Because the SLAM chip can modify any part of one scan line in one memory cycle (currently 200 ns), it can rasterize a 100- by 100-pixel polygon in 100 memory cycles (one for each scan line), a total of 20 μ s (200 ns times 100 cycles). As a result, the SLAM system can rasterize the 1000 polygons in 20 milliseconds and can rasterize 50 screen images per second, well over the number required for real-time performance (table 2).

The SLAM chips are capable of rasterizing lines and characters as well as polygons, but space limitations do not allow me to describe these features in detail. It is possible to build

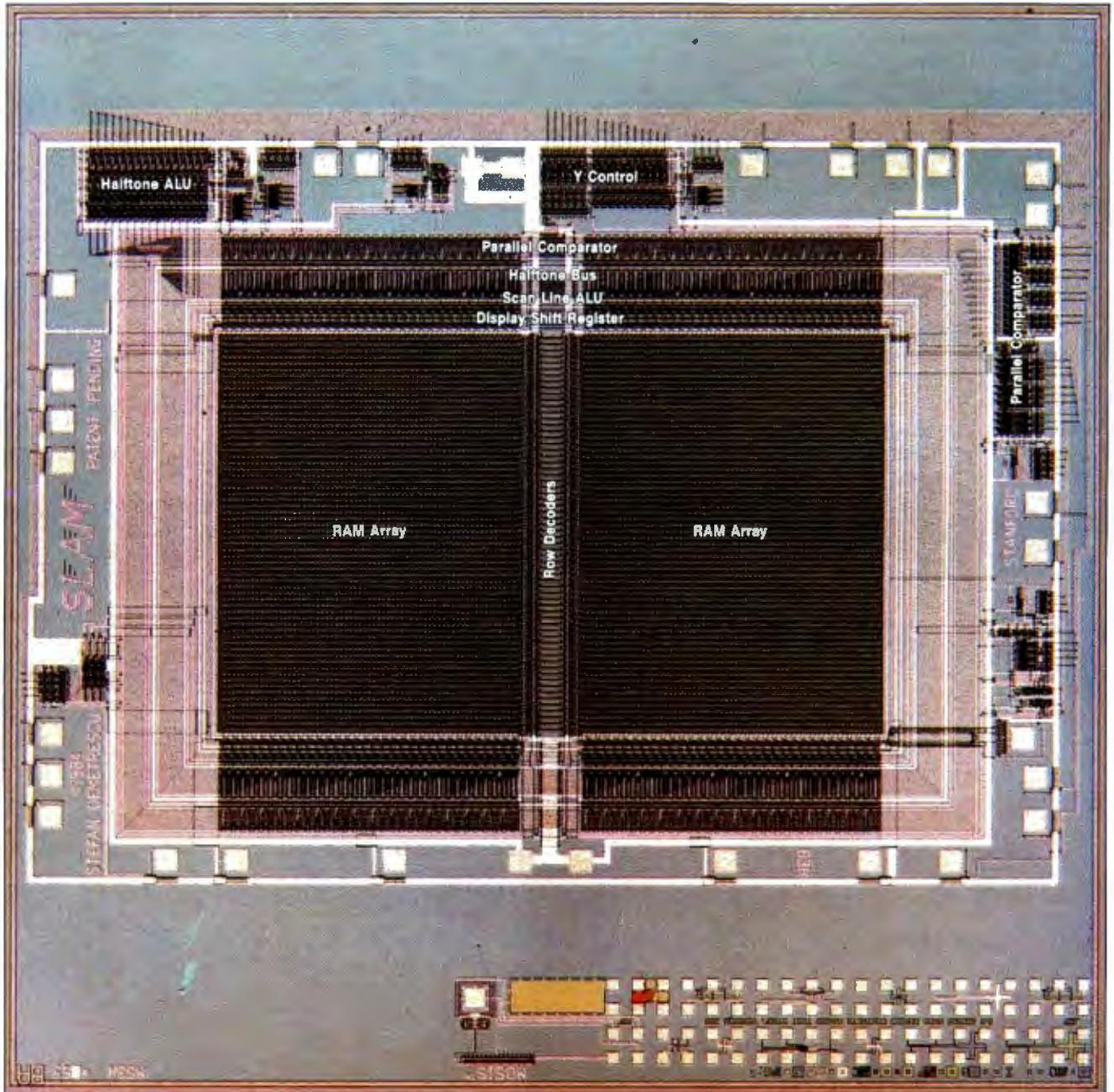


Photo 1: The SLAM chip. (Reprinted from the 1985 Chapel Hill Conference on Very Large Scale Integration, H. Fuchs, editor, with permission of the publisher, Computer Science Press Inc., 1803 Research Boulevard, Rockville, MD 20850.)

even higher performance SLAM systems by using many SLAM chips in parallel.

At present, the SLAM chip is only a research tool and is not available commercially, but there are strong indications that a SLAM chip will be developed soon by a major semicon-

ductor vendor, under a patent license from Stanford University.

THE DISPLAY SYSTEM

So far, we have assumed that the image memory can be used exclusively for rasterizing the image primitives. This is accurate if the image memory

is double buffered, that is, one image memory is being displayed while the other image memory is being updated. As stated, double buffering is essential if the image is to appear to be changing smoothly. Otherwise, the observer would see glimpses of half-

(continued)

MOVING PICTURES

completed images as one is erased and the next is drawn. The problem with double buffering is that it requires twice the memory. This can be significant for a display of 1000 by 1000 pixels at 8 bits each (1 megabyte for each of the two buffers).

In lower-performance systems, where images are not changing quickly, one image memory is displayed and modified simultaneously. This introduces another major performance problem: Both the display and the rasterizer must contend for the same memory bandwidth. This results in a severe degradation of rasterization performance.

For example, the Macintosh display memory (refer to figure 6) is busy with updating the screen 50 percent of the time. Only 50 percent of the time is available for all other accesses to RAM (even nongraphics accesses).

This reduces the performance by a factor of 2.

As another example, the NEC 7220 display processor (refer to figure 5) only allows changes to the image buffer during horizontal and vertical retrace times of the TV display (50 percent of the total time).

In general, we can safely assume that at least 50 percent of the image-buffer bandwidth is required by the display if the system does not use double buffering.

Recently, a number of memory makers have begun to offer special memory chips designed to alleviate this problem. These chips are often referred to as "video RAMs" or "dual-ported RAMs" and are available from Texas Instruments (64K by 1 bit), NEC (64K by 4 bit), and AMD (64K by 4 bit).

As figure 13 shows, the video RAMs

are conventional RAMs (refer to figure 8) with a 256-bit shift register added. When a row of memory (i.e., a scan line) is to be displayed, the video RAM accesses the entire row and stores the information into the shift register. The data can then be shifted out independently of the memory-fill rasterization operations (that is, the shift register is a "second port" out of the memory). This effectively reduces the number of display accesses from 256 to 1 for each scan line, and the display contention is reduced to practically nothing.

These video RAMs can be thought of as primitive forms of SLAMs. They can access scan lines, but only for the purpose of displaying the memory contents. Video RAMs cannot perform any useful polygon-fill operations on the scan lines.

Much has been made about these

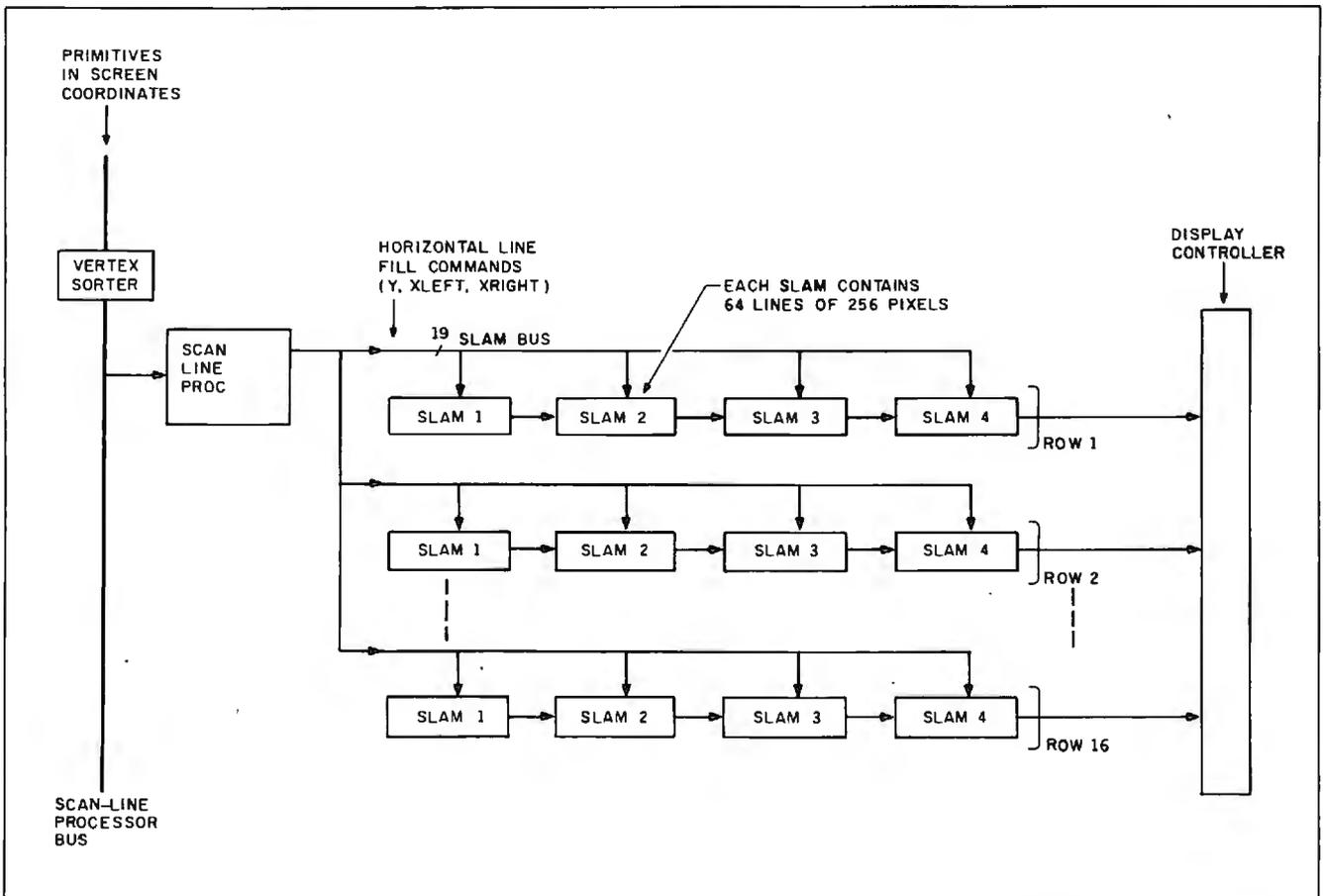


Figure 12: A simple SLAM system of 1024 by 1024 pixels, in which conventional dynamic RAMs are replaced by SLAM chips.

video RAMs as *the* solution to the raster-graphics performance problem. However, the preceding analysis indicates certain limitations. If the system is double buffered, these chips offer little or no advantage, since the image being displayed is on a different image memory from the one being filled, and there is no memory contention. If the system is not double buffered, they do offer, on the average, a doubling in performance because they eliminate contention for the image memory, but they do absolutely nothing to improve the rasterization problem (that is, they increase the bandwidth out of the memory but do nothing for the bandwidth into the memory).

While an improvement in performance by a factor of 2 is not insignificant, the major performance bottleneck occurs when the memory is being filled. It is there that systems can get performance increases on the order of 100 times to 1000 times or more, rather than 2 times. These performance improvements can be achieved by increasing the bandwidth to the memory (through the use of SLAMs, for example).

LASER PRINTERS AND OTHER RASTER PRINTERS

In the end, no matter how beautiful images on a TV screen are, you need to take the image from the screen and generate a hard copy.

At first glance it would seem that laser printers and high-performance graphics displays have nothing in common. In fact, many of the rasterization techniques described above are used to rasterize images for laser printers. It is common to find printers that have a higher pixel rate than 30-hertz TV displays.

For example, a 512-by 512-pixel TV image contains 262,144 pixels and has a pixel rate of 8.1 megahertz. A 60-page-per-minute laser printer with a resolution of 300 dots per inch contains 8,415,000 pixels and has a pixel rate of 8.4 megahertz. Furthermore, each page imaged by a laser printer is usually different from the previous one. Compare this with displays that

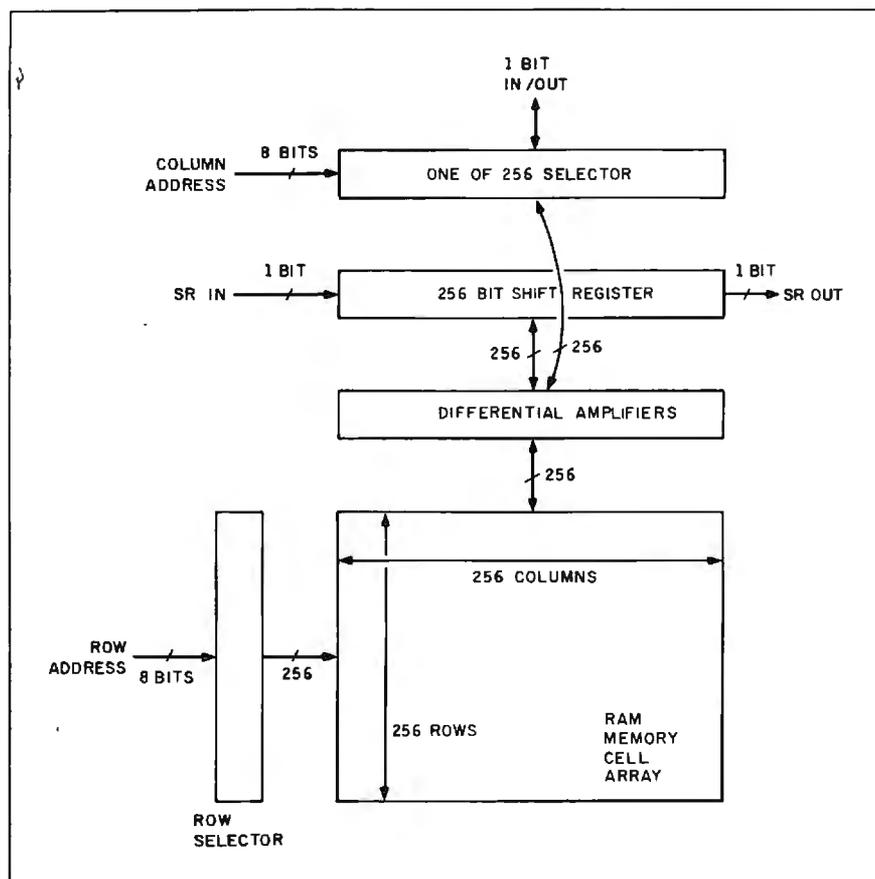


Figure 13: Internal structure of a 64K-bit video RAM, similar to the conventional dynamic RAM, with the addition of a 256-bit shift register.

often show the same image for many hundreds of frames (a few seconds).

Fast rasterizing architectures are as important for raster printers as they are for displays. Many times controllers for laser printers are slower than the printer that they drive because they cannot rasterize fast enough. For example, Apple's recently introduced LaserWriter is advertised as printing 8 pages per minute. Indeed, the printer engine is capable of printing 8 pages per minute, but the controller cannot rasterize images that fast. Thus, the effective throughput is 2 or 3 pages per minute for pages of moderate complexity. Some pages of higher complexity take minutes to calculate and print.

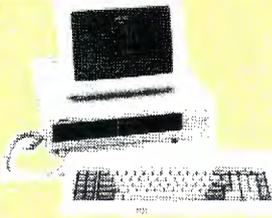
SUMMARY

The process of generating a raster image (for display or printing) is com-

posed of many stages, each of which can be a potential bottleneck of performance. The step of converting graphical objects into pixels (rasterization) appears to be the most difficult to perform quickly and inexpensively. A new smart memory called a SLAM promises to ease this bottleneck by accessing hundreds to thousands of pixels simultaneously and thus proposes to provide a substantial performance improvement over conventional architectures. Combined with moderate cost, these new highly parallel graphics architectures built in VLSI could allow real-time graphics performance for personal computers in the near future. ■

Editor's note: Readers interested in further details are encouraged to write the author for a reprint of a scientific paper describing the SLAM concept in more detail.

NEW!
Z Fox



The Quick ZFox Jumps Over the big blue clones.

More Speed: The ZFox runs virtually all software for the IBM-PC at 8 Mhz -1.7 times faster, but will slow down to IBM'S speed at the flick of a switch.

More Storage: The ZFox will store 800K on its "B" drive more than twice as much as other PC's. Plus the ZFox comes with 640K of RAM, more than twice the industry standard.

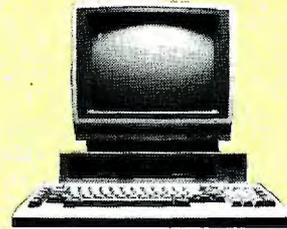
More Software: Each ZFox comes with MS-DOS 2.11, GW BASIC, MyWrite, Mail Track, Spell, MyCalc, and FILEBASE. And should you require additional software you can choose from the entire PC compatible library.

Local Service: The feature the others don't talk about. Should you have a problem with the basic system it will be fixed on your site during the first 90 days*, in any of 250 cities. And after the warranty period you can call any of over 500 service centers nationwide.

Plus you get serial and parallel ports, RGB and monochrome outputs, and your choice of an amber or green monitor. If you're looking for a low-priced compatible, with extra features, quality, and local service call us at Scottsdale systems.

ZFox \$1498

And other Zenith Systems discounts start at 27% off
*on site service excludes D drive, memory above 256K.



Drop Your Sox and grab a Fox Less than an empty MS-DOS Box

Our Fox system is more than the only complete 16-bit, 8088 computer for less than \$1,000. The Fox includes more storage, more extras, and more software than systems costing twice as much.

1.6 Megabytes! Dual Drives with 800K storage on each, yet the Fox is nimble enough to read and write to standard 160K, 320K, and 360K formats.

All the Extras that cost extra on other machines are included in our price. You get a full 12", 25x80, green display monitor, plus RGB color output, a printer port, a better keyboard, and a full 256K of RAM.

Free Software All the software most people will ever need including: MS-DOS 2.11, HAGEN-DOS, DOS Tutor, WordStar 3.3, EasyWriter, Spell, Mail Track, FILEBASE, CalcStar, games, graphics, utilities, and a graphics BASIC.

Strictly speaking the Fox isn't IBM compatible, but will run hundreds of the same programs including dBASE II, Multiplan, and Turbo Pascal. Because the Fox is born on a totally automated assembly line in Japan we can back it with a full one year limited warranty. For a free booklet explaining why the Fox is your best buy call 1-800-FORAFox and leave your name and address after the beep.

The Fox \$995

(Video RAM board to run Lotus 1 2 3 & more \$159)

Altos



High-performance, Xenix-based, multi-user systems from Altos-world leaders in multi-user systems and applications software.

As part of TRW's marketing support group we can have your Altos system installed on your site (Additional charge). Altos systems are easy to expand and with shared printers and hard disks are cost competitive with multiple single user systems. Call for additional pricing and availability.

486-20	\$4599
586-40	\$7249
986-40	\$8829
Altos Acc't	\$2779

AT & T



Comparable PC's with something more. From the 8Mhz., 8086-based 6300 series to the new 7300 Unix PC's. AT&T is the choice for those who've got to be right. Complete systems start at under \$2,000 call for prices.



INTRODUCING THE ATARI 520ST

Imagine the power of a Macintosh for less than the price of a used Apple II. Imagine a 32-bit 68000 based color system with a 300K drive, 512K of RAM, and the GEM operating environment for under \$1,000. Atari's new systems promise to radically alter price/performance benchmarks, and we promise to have all the latest information on these exciting new systems.

Atari 520 ST	1999 call
Atari 520 ST RGB	2999 call

PRINTERS

YOUR CHOICE:

Star SG-10, Epson LX-80, or Okidata 182
\$219

Epson, Oki, Star	call
Panasonic 1091	\$269
Toshiba 1340	\$539
Toshiba 351P	\$1129
DataProducts 8050	\$1099
Juki 6100	\$388
NEC ELF 370	\$395

OLYMPIA



To quote PC magazine, "The (NP) printer is a sure thing ..." If you're considering the purchase of an Okidata 92, or an Epson FX-80 give us a call before you spend \$50 to \$100 more for an inferior printer. Let us send you an actual print sample from the NP, and additional information on the features that make the Olympia NP the best value in dot matrix printers.
\$295

ITT, Televideo



Closed for the Holidays
December 21 thru January 5

Scottsdale Systems

A Division of Albrizzi Enterprises, Inc.

617 N. Scottsdale Road, Suite B, Scottsdale, Arizona 85257



(602) 941-5856



Call 8-5 Mon.-Fri.



We participate in arbitration for business and customers through the Better Business Bureau of Maricopa County.

SINCE 1980

TELEMARKETING ONLY: If you plan to stop by please phone ahead. Prices listed are for cash. P.O.'s from Fortune 1200 companies and universities with good credit add 2% / Mastercard and Visa add 3% / Arizona residents add 6% sales tax / Shipping extra / All items are new with manufacturer's warranty / Returned merchandise subject to 20% restocking fee / Personal or company checks take up to 3 weeks to clear / No COD's or A.P.C.'s. Prices and specifications subject to change / Product subject to availability. Trademarks: Silver Fox, MyWrite and MyCalc, Software Toolworks, Apple II and Macintosh, Apple Computer Inc., Atari by Atari Corp., HAGEN-DOS, and Jackintosh, Scottsdale Systems, Ltd., Wordstar and CalcStar, Micropro International, MS-DOS, and Multiplan, Microsoft Corporation; FILEBASE, EWDP Software, Inc.; dBASE II, Ashton-Tate; IBM-PC DOS, and IBM-PC, International Business Machines.

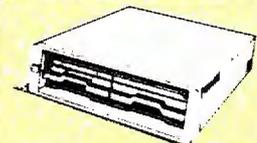
Houston Instruments

DMP-40	\$769
DMP-29	\$1795
DMP-41	\$2340
Other models	call

STB Boards

Graphics Plus II	\$249
Mono Plus	\$169
Chouffer	\$279
RIO Plus II (64K)	\$209
SIO II	\$139

BERNOULLI



The Bernoulli Box™

- Hard disk capacity and performance
- Removable cartridge economy
- Cartridge convenience
- Flexible disk economy
- Winchester capacity
- Unparalleled reliability

10 Mb	\$1839
20 Mb	\$2489
5 Mb/Mac	\$1379

1200 BPS Modems

Volkmodem 12	\$199
Password	\$209
Prometheus	\$339
Hayes 300/1200	call

TERMINALS

ADDS 3A +	\$429
Gume VT101	\$298
Wyse 50	\$449

HIGH-RESOLUTION PRINTER GRAPHICS

BY MARK BRIDGER AND MARK GORESKY

You can address the individual dots used to generate dot-matrix characters

ONE OF THE GREATEST frustrations in doing graphics on a microcomputer is the rather low resolution of the usual microcomputer monitor. The standard IBM Personal Computer color-graphics adapter and monitor display a maximum screen size of 640 by 200 pixels (picture elements); other computers and configurations do somewhat better, perhaps as much as 720 by 350 pixels. It is difficult to draw horizontal lines fast enough to keep the image from flickering. And there are limits to the amount of screen memory available on standard graphics boards.

Many dot-matrix printers are capable of printing individual dots at a much higher resolution than the typical CRT (cathode-ray tube) screen can display them. The Epson FX-80 and the IBM graphics printer are capable, for example, of printing 240 dots per inch horizontally (1920 dots per line) and 216 dots per inch vertically—the latter by printing a line of graphics, advancing the paper one-third of a dot, printing another “interlaced” line of graphics, etc. Other printers can perform similar feats. To use this

capability you need to figure out how to “fire the pins,” and you need enough extra memory to record where all the dots are to go. This article will show you how to draw some lines and curves on your printer with a resolution of up to 1600 by 640 dots.

SETTING UP THE “PRINTER SCREEN”

The first problem is memory. If you think of a dot as being either on or off, to use an analogy with the screen display, then encoding 1600 by 640 dots, or 1,024,000 points, requires that many *bits* of information. If you divide by 8 to convert bits to bytes, then the process requires 128,000 bytes, or nearly 128K bytes of memory. Somehow, you must set aside that much memory to record this image. Unfortunately, this is not easily done in BASIC, so we must look elsewhere.

The most widely used microcomputer language that allows fencing off this much memory is Pascal, and because Turbo Pascal lets you point to nearly all available memory without having to give explicit addresses,

it is the easiest language to use.

Let's set up two 64K-byte memory areas that represent the even lines and the odd lines of a picture. Each of these areas is represented by the following Pascal data type:

```
Type data__type = array[0..1599,
0..39] of char;
```

This type of variable is a doubly indexed 1600 by 40 array of characters; since one byte represents each character, this multiplies to about 64K bytes.

Now let's declare the variables that are to reserve this space:

```
Var Evenmap, Oddmap:
^data__type;
```

(continued)

Mark Bridger and Mark Goresky are associate professors of mathematics at Northeastern University. Mark Bridger has a Ph.D. from Brandeis University; Mark Goresky holds a Ph.D. from Brown University. Mark Bridger can be reached at Bridge Software, 31 Champa St., Newton Upper Falls, MA 02164. Mark Goresky can be reached at the Mathematics Dept., Northeastern University, 360 Huntington Ave., Boston, MA 02115.

The '^' defines a pointer. When you actually create these variables during program execution, using the command `New`, the computer sets aside two blocks of free memory and automatically reserves them for your use. Each of the variables `Evenmap` and `Oddmap` "points" to the beginning of one of these blocks, and you need never concern yourself with exactly where in memory these blocks reside.

HOW A DOT-MATRIX PRINTER DRAWS DOTS

The print head of a dot-matrix printer normally has seven or more wires, arranged vertically; the most common

number is nine. (Eight are used to draw most of the characters, while the ninth is used to draw the bottoms of the `g` and `y` characters and to underline.) When typing letters, the printer receives the ASCII code of the character—a number between 0 and 255. As the print head moves across the page, it extends certain wires, depending on the pattern stored in the printer's memory for that character, and the head strikes them against the paper. Usually from 9 to 12 such columns of dots are needed to make a character.

You want to be able to tell the printer directly which wires to fire; in

other words, you want to bypass that part of the printer's memory that stores the patterns for the printing of usual characters (letters, numbers, etc.)—you want to do *bit-mapped* graphics. Most printers support this; it is usually called graphics mode. Let's try to address a particular dot on the page.

First, since the wires on the print head are not that close together, you can make use of tiny partial linefeeds to double the number of vertical dots. Table 1 contains a diagram of how it works. The characters represent dot positions on the page; the 1s represent the dots that you actually want to draw and the 0s represent the dot positions you want to skip. To get maximum resolution, you want the dots to be as close to each other as possible, both horizontally and vertically. Getting them close horizontally is accomplished by means of a simple printer command. To get them close vertically, you must divide the picture into the even rows (0, 2, 4, etc.) and the odd rows (1, 3, 5, etc.), as shown in table 2.

When the printer is in graphics mode, the printer prints, for each byte you send it, any pattern of eight vertical dots you specify. The strategy in table 2 is to do the following:

1. Send the printer the 10 bytes that specify the 10 columns represented by the even rows.
2. Instruct the printer to do a carriage return plus a linefeed of one-half a vertical dot.
3. Send the printer the 10 bytes that specify the 10 columns represented by the odd rows.
4. Instruct the printer to do a carriage return plus a linefeed of 7½ vertical dots, preparing it to draw more sets of even and odd rows if there are any.

In more ambitious applications you can have as many as 1600 columns across instead of just these 10. The array pointers `Evenmap` and `Oddmap` store this information for the printer. Each represents 1600 columns; each column is 40 bytes or 320 dots high. Looked at another way, there are 320

(continued)

Table 1: This table shows the dot positions on the page. The 1s represent dots that you actually want to draw; the 0s, dot positions you want to skip over.

0	1	0	0	0	0	0	0	0	0	0
1	0	1	0	0	0	0	0	0	0	0
2	0	0	1	0	0	0	0	0	0	0
3	0	0	0	1	0	0	0	0	0	0
4	0	0	0	0	1	0	0	0	0	0
5	0	0	0	0	0	1	0	0	0	0
6	0	0	0	0	0	0	1	0	0	0
7	0	0	0	0	0	0	0	1	0	0
8	0	0	0	0	0	0	0	0	1	0
9	0	0	0	0	0	0	0	0	0	1
10	0	0	0	0	0	0	0	0	0	1
11	0	0	0	0	0	0	0	0	1	0
12	0	0	0	0	0	0	0	1	0	0
13	0	0	0	0	0	0	1	0	0	0
14	0	0	0	0	0	1	0	0	0	0
15	0	0	0	0	1	0	0	0	0	0

Table 2: This table shows the distribution of the various print dot positions between even and odd rows.

Even:	0	1	0	0	0	0	0	0	0	0	Odd:	1	0	1	0	0	0	0	0	0	0
2	0	0	1	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	
4	0	0	0	0	1	0	0	0	0	0	5	0	0	0	0	0	1	0	0	0	
6	0	0	0	0	0	0	1	0	0	0	7	0	0	0	0	0	0	0	1	0	
8	0	0	0	0	0	0	0	0	1	0	9	0	0	0	0	0	0	0	0	1	
10	0	0	0	0	0	0	0	0	0	1	11	0	0	0	0	0	0	0	0	1	
12	0	0	0	0	0	0	0	1	0	0	13	0	0	0	0	0	0	1	0	0	
14	0	0	0	0	0	1	0	0	0	0	15	0	0	0	0	1	0	0	0	0	

You were smart to buy Turbo Pascal™ back then. Now you'd be smart to sell it.

AND HERE'S YOUR CHANCE. TRADE IN YOUR TURBO PASCAL AND GET THE MODULA-2 SOFTWARE DEVELOPMENT SYSTEM (M2SDS) FOR JUST \$50.88.

How can you get the latest in programming efficiency? Simple. Just send us your Turbo Pascal diskette*—whether it's IBM format or not—and we'll send you M2SDS for just \$50.88. That's \$30 off the regular price.

Why switch? Because Modula-2 was specifically designed by the developer of Pascal, to replace the Pascal language. So you already know the language basics that will help you start programming right away.

And when you combine the power of Modula-2 with all the features of M2SDS, you'll be programming faster than ever—in virtually no time at all.

Just look at all the extras M2SDS includes. And how it outperforms Turbo Pascal in independent studies.

So now that you're wise to Turbo Pascal, why not trade it in? And trade up to the programming efficiency of the future. Get M2SDS for just \$50.88 when you send us your Turbo Pascal diskette. Or, order M2SDS for just \$80.88 without the trade.

Either way, it's one of the smartest moves you can make in programming. And now, it's the best deal going.

*Turbo Pascal is a trademark of Borland International. *Diskette will be destroyed immediately upon receipt, so that your Borland license agreement is not violated.*

	M2SDS	TURBO 3.0
COMPILE SPEED (MIN:SEC)		
30 LINES	0:09.00	0:02.00
360 LINES	0:25.00	0:05.00
EXECUTION SPEED (MIN:SEC)		
SIEVE	0:13.92	0:15.26
FIBONACCI	0:53.49	1:49.74
30X30 MATRIX (8087)	0:08.84	0:19.28
FP OPERATIONS	0:52.12	0:31.75
FP OPERATIONS (8087)	0:01.97	0:06.21
SYNTAX CHECKING EDITOR	YES	NO
MULTIPLE WINDOW EDITING	YES	NO
EDITOR FILESIZE LIMIT	MEMORY SIZE	64K
COMPILE ERROR CALLS EDITOR	YES	YES
LINKER	YES	NO
PRODUCES .EXE FILES	YES	NO
EXECUTABLE CODE SIZE LIMIT	DISK SPACE	64K
DOS ACCESS FROM EDITOR	YES	NO
DOS ACCESS FROM PROGRAMS	YES	LIMITED
8087 SUPPORT STANDARD	YES	NO
COPY-PROTECTED DISK	NO	NO
COST WITH 8087 SUPPORT	\$80.88	\$109.90

Trade in your Turbo Pascal for M2SDS today. Or, order your copy by completing this coupon.

Enclosed is my Turbo Pascal diskette and a check for \$50.88, plus \$4 shipping and handling.

Enclosed is my Turbo Pascal diskette. Apply charges to the credit card indicated below.

Please send me M2SDS for \$80.88, plus \$4 shipping and handling. My check is enclosed.

Please send me M2SDS for \$80.88. Apply charges to the credit card indicated below.

VISA/MasterCard/American Express.
(Circle One)

Credit card # _____

Expiration Date _____

Name _____
(Signature required for credit card orders.)

Address _____

City _____

State/Zip _____

Price does not include shipping and handling. Texas residents add 6.125% sales tax. International orders add \$30.

INTERFACE TECHNOLOGIES CORPORATION
3336 Richmond, Suite 200 Houston, TX 77098

Source: Software Resources, Inc.
Sieve program from BYTE, January 1983.
Fibonacci program from Dr. Dobb's Journal, February 1985.
Matrix program from BYTE, October, 1982.
FP Operations program from BYTE, May 1985.
Turbo Pascal without 8087 uses only 6-byte accuracy for type REAL; M2SDS with or without 8087 uses 8-byte accuracy.
Programs compiled with all checking options on.
All tests conducted on a standard IBM-PC/XT with 512K of memory and an 8087 math coprocessor.

 **INTERFACE TECHNOLOGIES**

3336 Richmond Ave., Suite 200
Houston, Texas 77098

1-800-922-9049
(In Texas, call 713/523-8422) Telex: 322127
Modula-2 Bulletin Board: 713/523-7255

even rows and 320 odd rows. Each row is 1600 dots wide, and the printer will print eight even or eight odd rows in each pass. Note that these rows form a natural unit totaling 16 rows; let's call such a unit a printer line.

HOW TO LOCATE A DOT ON THE PAGE

Let's write a procedure—`Pset(x,y,color)`—that draws a point of coordinates `x` and `y` in the proper place in one of the two arrays. The coordinates `x` and `y` denote the point's column and row (measured from the upper left-hand corner), respectively. The variable `color` can be equal to either 0 or 1: 0 means erase any point existing at that location; 1 means insert a point there. [Editor's note: All programs shown here are available for downloading on BYTEnet Listings. Before November 1 call (617) 861-9774. Afterwards, call (617) 861-9764.]

See listing 1 for the procedure `Pset`. Start at the line that reads `color := color mod 2`. First the procedure ensures that `color` is in the correct range by applying a mod 2 to it. (When `K` and `N` are whole numbers, `K mod N` finds the remainder you get when you divide `K` by `N`. When you divide by 2, you can get a remainder of only 0 or 1, depending on whether `K` is even or odd, respectively.) Next, you determine which printer line you're in by dividing the row number by 16 (`y div 16`). When you know this line number, you can determine which vertical dot within that line you're in; this is *height*. Finally, `y mod 2` tells you whether your dot is in an even or an odd row.

For example, suppose you want to print a dot in column 1173, row 554. Then `x` equals 1173 and `y` equals 554. `554 div 16` equals 34, so you are in the 34th printer line. `554 mod 16` is 10 and `10 div 2` is 5, so the height of the dot within the printer line is 5; since 554 is even, you are in the array pointed to by `Evenmap`. The program now calls on the procedure `Change` to insert this point into the correct position in memory.

The problem now, and the reason `Change` is so complicated, is that

(continued)

Listing 1: Epson FX-80 procedures in disk file Printpak.pas.

```

const
  across = 1599;    (** replace with 1249 for Prowriter **)
  down   = 39;

type
  data__type = array[0..across, 0..down] of char;
  mask__array = array[0..7] of byte;

var
  Evenmap, Oddmap: ^data__type;
  M, R: mask__array;

procedure Init__mem;
var I, J: integer;
begin
  new(Evenmap); new(Oddmap);    {sets aside space in memory for arrays}
  for J := 0 to down do
    for I := 0 to across do
      begin
        oddmap^[I,J] := chr(0);    {initializes both arrays}
        evenmap^[I,J] := chr(0)   {all bytes = 0}
      end
    end;
end; {Init__mem}

procedure Printout;    {Output to EPSON FX-type printer.}
var n_lo, n_hi: byte;  {See listing 2 for Prowriter Printout.}
    i, j: integer;
begin {Printout}
  n_hi := (across + 1) div 256;    {Part of number of graphics bytes coming}
  n_lo := (across + 1) mod 256;   {Rest of number of graphics bytes coming}
  for J := 0 to 39 do
    begin
      write (Lst, chr(27), 'Z', chr(n_lo), chr(n_hi));
                                          {Enter graphics mode; give # bytes coming}
      for I := 0 to across do write(Lst, evenmap^[I,J]); {print even row}
      write(Lst, chr(13));                {carriage return}
      write(Lst, chr(27), '3', chr(1));    {set linefeed for 1/3 dot down}
      write(Lst, chr(10));                {do linefeed}
      write (Lst, chr(27), 'Z', chr(n_lo), chr(n_hi));  {graphics mode again}
      for I := 0 to across do
        write (Lst, oddmap^[I,J]);        {print odd row}
      write(Lst, chr(13));                {carriage return}
      write(Lst, chr(27), '3', chr(2));    {start next line 2/3 dots down}
      write(Lst, chr(10));                {linefeed}
    end
  end; {Printout}

procedure PixelMasks;
var I: integer;
begin
  M[7] := 1;
  for I := 6 downto 0 do M[I] := 2 * M[I + 1];
  for I := 0 to 7 do R[I] := 255 - M[I]
end; {Pixelmasks}

procedure Change (var Char__byte: char; color, height: integer);
{changes given byte from present value to given value = color}
var old: integer;
begin
  Old := ord(Char__byte);
  case color of
    1: old := old OR M[height];    {insert set bit in correct place}
    0: old := old AND R[height]    {using appropriate pixel masks}
  end
end;

```

(continued)

Introducing the first IBM™ AT Compatible Kit!

Building your own AT is as easy as it looks.

Now, it's easy to have the IBM AT that you want by building your own from ADTEK's SERIES 286AT™ compatible, board-level kit. Choose from a complete kit (chassis, motherboard, cables, disk controller, keyboard and enhancement boards) and add your own monitor and disk drives. Or buy just the parts you need for your project. Either way, all series 286AT products are hardware and software AT compatible.

But you won't be on your own. The ADTEK SERIES 286AT comes with illustrated, step by step instructions that even a beginner can follow. (Some basic knowledge of electronics will be helpful.) With just a few simple household tools you can put your new computer together in a Saturday afternoon. And you'll feel confident about your SERIES 286AT because every ADTEK product is protected by a full, one year factory warranty.

And amazingly frugal.

If you're ready for AT power and speed, but don't want to pay IBM's premium price, rest easy. A complete ADTEK SERIES 286AT kit is priced significantly less than a comparably assembled IBM AT. That's engineering excellence at a real bargain! Call or write today for a detailed brochure and price list on the SERIES 286AT and other fine ADTEK products.

**IBM-XT
Compatible Kits
now available.**
Call for price list.



Fully assembled SERIES/286AT



AT compatible disk controller handles 2 floppies, 2 Winchester.



192 Watt switchable AT compatible power supply.



AT compatible keyboard with IBM configuration or LEDs on cap, num lock keys.



6 or 8 MHz 80286 motherboard, 640K standard memory, upgradable to 1M, clock calendar, fully compatible.



Fully AT compatible chassis with LEDs and lock. Mounts standard floppy and fixed disk drives.

\$1998

Basic AT kit includes 640K motherboard, disk controller and cables, power supply, keyboard, case, documentation and warranty.



IBM compatible name brand floppy or Winchester drives available at discount prices.



Wide selection of AT compatible I/O expansion, memory and multifunction cards.



Fully tested RGB and monochrome monitors in stock.



High res color and monochrome video controllers are fully interfaced with system.

Telex: 73364 KPSASI DAL Attn:89T

3706 Realty Road Dallas, Texas 75244 (214) 241-5811

ADTEK

IBM is a registered trademark of International Business Machines Corporation and SERIES 286AT is a registered trademark of ADTEK Corporation.

```

(.....
For the Prowriter these last two lines should be replaced by
1: old := old OR M[7 - height];
2: old := old AND R[7 - height]   {See text for details.}
.....)
end;
Char_byte := chr(old)
end; {Change}
procedure Pset (x,y,color : integer);
{Writes the dot at position (x,y) into memory arrays}
var l,line,height : integer;
begin {Pset}
  Plot(x * 2 div 5, y * 5 div 16, white); {draw dot on screen}
  { .....
  This multiplies x by the ratio of screen width to printer width,
  multiplies y by the ratio of screen height to printer height.
  For the Prowriter this last line should be replaced by:
  Plot(x div 2, y * 5 div 16, white);
  ..... }

  color := color mod 2;
  Line := Y div 16;           {vertical position of pixel consists of a line}
  height := (Y mod 16) div 2; {number between 0 and down; and a height }
                               {between 0 and 15, divided into}
                               {even-odd groups}
  if y mod 2 = 0 then change(evenmap^ [x,line],color,height)
    else change (oddmapped [x,line],color,height)
end; {Pset}

```

turning on a point involves changing a single bit within a byte. Computers are generally not equipped to do this easily. Remember that each byte controls eight vertical dots, and you want to change *only one* of them. This is most quickly done with bit masks and the logical operations AND and OR. See the text box on bit manipulation, "Bits AND/OR Pieces," on page 225. (Note that in the PixelMasks procedure, the leftmost bit in a byte is called the zeroth bit, while the rightmost bit is the seventh.)

If you want to insert a 1 in the third bit, you use the mask M[height], where height equals 3, with the logical OR operation. The code that inserts this 1 into the byte Old is simply:

Old := Old OR M[height]

M[height] is a byte made up of all zeros except for a 1 in bit height. If Old is 01000010 and height is 3, then Old becomes the byte (01000010 OR 00010000) = 01010010.

If you want to insert a 0 into this same byte, you use the mask R[height] together with the logical AND operation:

Old := Old AND R[height]

Here, R[height] is a byte made up of 1s except for a 0 in bit height. If Old is 01111101 and height is 7, then Old becomes the byte (01111101 AND 11111110) = 01111100.

Note that you write to printers using Pascal's Write and WriteLn procedures, and these procedures expect to be given a character. This is why you should set up your arrays as character arrays and why the last command in the Change procedure converts the byte into a character.

SOME PRINTER DIFFERENCES

The eight vertically arranged print pins on most printers correspond to the eight bits in a byte. On the Epson FX-80 and many other printers, the high-order bits—those in the left half of the byte—correspond to the upper pins; the low-order, or rightmost, bits correspond to the lower pins. Thus, the byte 10000010 causes the top pin and the next-to-the-bottom pin to

Listing 2: Printout procedure for Prowriter.

```

procedure Printout;           {for Prowriter}
var wrd : packed array [1..4] of char;
    a,b,i,j,k : integer;
begin {Printout}
  writeln (lpt1, '          '); {clear printer buffer}
  writeln (lpt1, '          '); { = 50 bytes}
  writeln (lpt1);             { + carriage return}
  a := across + 1; l := 4;    {a = number of graphics bytes}
  repeat
    b := a mod 10; a := a div 10; {get next digit (= b)}
    wrd [l] := chr(b + ord('0')); {insert as a character in string: wrd}
    l := l - 1
  until l = 0;
  writeln (lpt1, chr(27),'P'); {wrd = digits of across}
                                {set pitch for proportional spacing -
                                the highest horizontal density}

  for J := 0 to down do
    begin
      write (lpt1, chr(27),'S',wrd); {enter graphics mode}
      for l := 0 to across do
        write (lpt1, evenmap^[l,J]); {print even rows}
      writeln (lpt1, chr(27),'T','01'); {start next line 1/2 dot down}
      write (lpt1, chr(27),'S',wrd); {graphics mode again}
      for l := 0 to across do
        write (lpt1, oddmap^[l,J]); {print odd rows}
      writeln (lpt1,chr(27),'T','15'); {start next line 7/2 dots down}
    end
end; {Printout}

```

make dots on the paper. On the other hand, for the Prowriter and several other printers, the exact opposite is true—the *leftmost* bit causes the *bottom* pin to fire. Thus, if you want to insert a 1 in the third bit for a Prowriter, you OR with M[7-height] where height equals 3. To avoid confusion we have indicated the corrections necessary to handle the Prowriter properly (see listing 2). If you have a different printer, you should check your manual for the correct pin assignments. (The Prism printer, for example, uses only seven pins.)

Another important difference between printers is in how close you are allowed to print the dots horizontally and vertically. In the Epson quadruple-density graphics mode, available only on the FX, RX, and IBM models, the printer prints 240 dots per inch or 1920 dots across an 8-inch page. Because of restrictions on the size of arrays (64K-byte maximum), the examples in this article draw only 1600 dots. (We can draw more, but at the expense of some vertical rows.) The older Epson MX prints only 960 dots across the page. For the Prowriter, the highest density possible is in proportional mode, where you can get 160 dots per inch or 1280 per line—we use 1250 in our examples.

Each dot on a dot-matrix printer is approximately 1/72 inch in diameter. The Epson FX-80 permits linefeeds of 1/2 dot, which results in a theoretical vertical density of 216 dots per inch. The Prowriter allows 1/2-dot linefeeds, or a vertical density of 144 dots per inch. In the examples in this article, we use the Epson 1/2-dot linefeeds as if they were 1/2-dot; this works fine, undoubtedly due to the inherent inaccuracy of paper advance.

Once again, you must consult your printer manual if you have a different printer. The Prism does not seem to support fractional linefeeds at all, while the Mannesmann Tally achieves them by raising or lowering the actual print head 1/2 dot.

ECHOING ON THE SCREEN

We now have the complete setup for drawing a dot in "printer" memory.

Returning to listing 1, note the call to the procedure Plot. Plot is a Turbo Pascal procedure that draws a dot on the actual screen for each point you draw in memory. However, the scale for the printer is different from the scale for the screen: 1600 by 640 dots for the printer (1250 by 640 dots for the Prowriter) versus 640 by 200 dots (pixels) for the screen. For the Epson

FX-80 you rescale by multiplying the column and row, respectively, by 640/1600 (2/5) and 200/640 (5/16). For the Prowriter you multiply by 640/1250 (approximately 1/2) and 200/640 (5/16). Since real-number multiplication is time-consuming (unless you have an 8087 chip) and since Plot requires integer parameters anyway, you

(continued)

BITS AND/OR PIECES

Suppose you have two bytes, each represented as eight binary bits: Byte1 = 10111010 and Byte2 = 00110011. To make calculation simpler later on, let's call the first bit on the left of each byte the zeroth bit; the next is the first, then the second, etc. Thus, the zeroth bit of Byte1 is 1, the first is 0, and the seventh, or rightmost, bit is 0. When you OR Byte1 and Byte2 together, you produce a new byte, Byte3. If either of the corresponding bits, for example the zeroth bits of Byte1 and Byte2, is a 1, then you make the corresponding bit of Byte3 a 1; otherwise, it is a 0. Thus, the zeroth bit of Byte3 is a 1 since Byte1 has a 1 in the zeroth position. The first bit of Byte3 is a 0 since neither Byte1 nor Byte2 has a 1 in that position.

```
Byte1 = 1 0 1 1 1 0 1 0
Byte2 = 0 0 1 1 0 0 1 1
Byte3 = 1 0 1 1 1 0 1 1
Byte3 = Byte1 OR Byte2 =
        10111011.
```

If you perform an AND on the two bytes, the process is similar, except that you put a 1 in Byte3 only if *both* corresponding bits are 1. Let's let Byte4 = Byte1 AND Byte2.

```
Byte1 = 1 0 1 1 1 0 1 0
Byte2 = 0 0 1 1 0 0 1 1
Byte4 = 0 0 1 1 0 0 1 0
Byte4 = Byte1 AND Byte2 =
        00110010
```

Suppose now that you have a byte B = 10011001 and you want to change the second bit from a 0 to a 1. If you have a byte M2 that is all 0s except for a 1 in this second position (i.e., third place from the left), then you can execute

```
B OR M2 = 10011001 OR 00100000
        = 10111001
```

This accomplishes your purpose. You need eight different masks of this type to handle each possible bit position. Note that M2 = 00100000 (binary) = 20 (hexadecimal) = 32 (decimal); also, $32 = 2^{(7-2)}$. All other such masks are powers of 2 also. This explains how M, the array of eight different pixel masks, is constructed in the procedure PixelMasks (see listing 1).

To turn off the fourth bit of B (i.e., change it from a 1 to a 0), you can AND it with a byte R4 that is all 1s except for a 0 in the fourth position (the reverse type of mask from M2):

```
B AND R4 = 10011001 AND 11110111
        = 10010001
```

In this case R4 = 11110111 (binary) = F7 (hexadecimal) = 247 (decimal). The procedure PixelMasks also constructs the array R of eight different reverse masks. The relation between the masks of the two types is easy to see. For example, consider M[3] = 00010000 = 16, and R[3] = 11101111 = 239. Then $R[3] = 11101111 = 11111111 - M[3] = 255 - M[3]$

Thus, you get the reverse pixel masks from the normal pixel masks by subtracting the normal ones from 255.

One great advantage of pixel masks is that they are fast. Once created, you can use them over and over without any time-consuming computation. You can use pixel masks in regular screen graphics also; if you use color, you will need several other sets of masks that do two bits at a time, since a choice of one out of four colors requires two bits.

can do this quite neatly using integer multiplication and div:

```
Plot(x * 2 div 5, y * 5 div 16, white)
```

For the Prowriter:

```
Plot(x div 2, y * 5 div 16, white)
```

This is still somewhat wasteful since it draws some dots on top of others, but it is sufficient for this example.

HOW TO PRINT THE DOTS

In theory all we have to do is send these bytes to the printer. However, many printers are fussy and don't like to be in graphics mode—in fact, they'll only stay there for one line at a time. Furthermore, each time you invoke graphics mode you have to tell them how many graphics bytes to expect on that line; if you send them more, they start printing regular characters.

Let's do a brief rundown on the Epson FX-80 graphics Printout procedure (see listing 1). Lst is Turbo Pascal's name for the printer. The Epson FX-80 instruction to enter quadruple-density graphics mode is Escape (chr(27)) followed by Z (on the MX, replace Z with L). Then the

printer needs to receive the number of graphics bytes it should expect as a sequence of two characters, which are determined as follows:

```
Byte #1 = "n_lo"
          (# of bytes mod 256)
Byte #2 = "n_hi"
          (# of bytes div 256)
```

(This information should be easy to obtain from your printer manual under "Graphics Mode.")

Procedure Printout has two nested loops; the big one controls the printer lines, while the smaller sends out the character bytes within each printer line. Recall that a printer line consists of one even and one odd group of 1600 bytes. For each of these we must, as just mentioned, reenter graphics mode and give the byte count. The command write(Lst, chr(13)) is simply a carriage return.

The only other lines of interest are the paperfeeds. The Epson FX-80 won't do a linefeed of 1/2 dot but rather works in multiples of 1/2 dot. Since even Epson disclaims any great accuracy for such a tiny linefeed, we tried various combinations such as 1/2

and 7/8, 3/4 and 7/8, etc. The best image seemed to result from using 1/2 and 7/8 (22/3).

Now let's take a look at the Prowriter graphics Printout procedure (see listing 2), since the Prowriter works a little differently. First, you should clear out the 50-byte printer buffer by writing 50 blanks—we've never seen the necessity of this, but it is suggested as a precaution. Next, you should report the number of graphics bytes the printer is to expect (= across + 1) by sending a string whose characters are the *decimal* digits of this number. These are computed by the small loop (from a:= across + 1 through until l = 0;). The rest of the code is the same as the Epson FX-80's except for the different printer instructions (escape sequences).

THE TESTCURVE PROGRAM

To demonstrate how these procedures work, listing 3 contains a driver program that sketches the simple parabola $y = x*x$ (see figure 1). The heart of this program is the procedure Plotcurve, which illustrates the scaling and coordinate manipulation necessary to draw "computer pictures." Since the origin is in the upper left-hand corner and the y -coordinate is measured downward, you are essentially plotting $y = 639 - (x - 25)*(x - 25)$. x should go from 0 to 50; since the width of the screen is across (1599 or 1249), you round across to the nearest 50 (width:= across - (across mod 50)) and let l go from 0 to width. The scale factor scaler is width/50 and x equals l/scaler or (l/width)*50. Thus, when l equals 0, x is 0; when l equals width, x is 50. Then you use Pset to graph your points:

```
Pset(l, trunc(639 - (l/scaler - 25)*
(l/scaler - 25)), 1)
```

Note that you must truncate (trunc) since Pset requires integer parameters.

CONNECTING THE DOTS

The procedure Plotcurve draws a curve by computing each point sepa-

(continued)

Listing 3: Program to test printing procedures. It draws a parabola: $y = x*x$. Note the \$I directive to include the routines in Printpak.pas (see listing 1).

```
Program Testcurve;
{$I printpak.pas}      {Include printer procedures listed above.}
var ch: char;

  Procedure Plotcurve;
  var l, width: integer;
      scaler: real;
  begin {Plotcurve}
    width:= across - (across mod 50);
    scaler:= width/50;
    for l:= 0 to width do
      Pset(l, trunc(639 - (l/scaler - 25)*(l/scaler - 25)),1)
    end; {Plotcurve}

  begin {Testcurve}
    Init_mem;
    PixelMasks;
    HiRes; HiResColor(7); {draw in 640- by 200-dot mode}
    Plotcurve;
    write("Continue (y/n)? ");
    readln(ch);
    if ch = 'y' then Printout;
    TextMode(BW80)
  end. {Testcurve}
```

What every Apple II+ and IIe user should ask before buying the "Sider" 10 MB hard disk:

When a company offers a superior quality 10 megabyte Winchester hard disk for only \$595, it's bound to raise a few eyebrows... and a lot of questions. The fact is, you're probably already wondering "Can I really get a 10 megabyte hard disk that's *reliable* for only \$595?" The answer is: ABSOLUTELY...when you choose the Sider from First Class Peripherals.

What's so great about the Sider?

For starters, the Sider lets you boot your *Apple II+* or *IIe* directly off the hard disk—unlike some other Winchester subsystems. Rebooting is also trouble-free. And the disk is partitionable, allowing you to allocate space to four operating systems on the same disk. The Sider supports: Apple DOS 3.3; Pro DOS™; Apple Pascal; and CP/M®.

What's more, a small "footprint" lets you incorporate the compact Sider into your existing computer set-up with ease.

In addition, with the Sider, you not only pay far less for the subsystem, you also save money on installation. Because, unlike other 10 MB systems that require the purchase of expensive "extras," the Sider is *plug and play*. Everything you need is provided, including cables, host adaptor, installation software and manual.

What makes it so reliable?

To start, the Sider is manufactured, and sold exclusively, by First Class Peripherals, an innovative computer company which is backed by Xebec. The computer industry's leading manufacturer of disk controllers, Xebec has over a decade of experience serving customers like IBM, Toshiba, Texas Instruments and Hewlett Packard. It's this kind of expertise that helps assure the Sider's performance.

Special design features further enhance reliability. The Sider's controller is the field-proven, industry standard Xebec SI410A. And Xebec's 3200 drive tester, the



"Only \$595?"

October 1, 1985 through December 31, 1985

toughest in the industry, ensures that the Sider will operate reliably. One more assurance of the \$595 Sider's quality: it's UL Approved and FCC Class B rated.

But why is it only \$595?

You pay less for the Sider than for other 10 MB hard disks simply because you're paying for the superior quality components inside the unit, not for a lot of retail overhead costs. Since First Class Peripherals sells direct, you avoid dealer and dis-

tribution expenses, and pay only for the product.

What about a guarantee?

Like many experienced Apple users, you may be reluctant to buy a hard disk priced at only \$595 without first seeing for yourself how it performs. That's why First Class Peripherals offers you a reassuring, money-back guarantee that eliminates any risk on your part. Simply order the Sider and use it for 15 days. Then, if you're not entirely satisfied, return it and receive a full refund—no questions asked.

The Sider also comes with a full one-year limited warranty. Plus, there's a convenient, toll-free hotline you can call anytime you have a technical or service question, or need help.

Don't delay. Order the Sider now.

To receive the Sider 10 megabyte Winchester hard disk subsystem for only \$595, simply order using the coupon below. For faster service, order by phone and charge to your VISA, MasterCard or American Express. (You can also call us if you have any questions or technical concerns about the Sider. We'll see you get the help you need.) Call toll-free:

1 800 538-1307
Extension 205

Yes, please send me the Sider, including half-height 10 megabyte Winchester hard disk drive, Apple adaptor board, cable, complete installation software and documentation.

I prefer to pay as follows:

- I've enclosed my check or money order for \$595* + \$15 shipping and handling, payable to First Class Peripherals.
- Please bill the following credit card account for \$595* + \$15 shipping and handling:
- VISA MasterCard American Express

Card # _____

Exp. Date _____

Signature _____

* Residents of CA, NV and PA, please add appropriate sales tax.

Name _____

Address _____

City _____

State _____

Zip _____

Telephone (area code) _____

Mail to:

FIRST CLASS PERIPHERALS

3579 Highway 50 East
Carson City, NV 89701

205

Apple and Pro DOS are trademarks of Apple Computer, Inc.
CP/M is a registered trademark of Digital Research, Inc.

Only Toshiba printers combine the beauty of the daisy with the speed of the dot.



Graphic and this type
printed on a Toshiba
3-in-One printer.

The Toshiba 3-in-One™ printers.

Toshiba's 3-in-One printers are the IBM PC-compatible printers that give you the best of everything.

Because their 24-pin printhead gives you beautiful letter-quality type like a daisy. Combined with the quiet speed and perfect graphics of the matrix.

In the world of business printers this combination makes Toshiba the leader in the letter-quality matrix category. And our 3-in-One printers a breed apart. So your printouts stand apart from the crowd.

Toshiba's 3-in-One 136-column printers also give you both downloadable type fonts and plug-in type font cartridges for an almost unlimited number of ways to express yourself.

For more information, call 1-800-457-7777, Operator 32. And tell us you'd like to see the beauty of the daisy and the speed of the dot.



In Touch with Tomorrow

TOSHIBA

TOSHIBA AMERICA, INC. Information Systems Division

HI-RES PRINTER GRAPHICS

rately and then plotting it. Although this sufficed for a simple demonstration, it has two major shortcomings. First, it can skip points. For example, suppose y equals 5 when x is 1, and y equals 10 when x is 2. Then there is a vertical gap of four dots between

the points (1,5) and (2,10). (This didn't happen on the parabola graphic because x went from 0 to 50 in 1599 steps, so each step represented an x change of about 0.03. Thus, even at the steepest part of the curve, y

(continued)

Listing 4: Bresenham's line-drawing algorithm. (The Pascal implementation is courtesy of Professor Richard Rasala of Northeastern University.)

```
Procedure Pixel_Line(x1,y1,x2,y2:integer);
var x, y, z, a, b, dx, dy, d, deltap, deltaq: integer;
begin
  dx := abs(x2 - x1);
  dy := abs(y2 - y1);
  If dy <= dx then {Slope <= 1}
  begin
    x := x1; {initialize x}
    y := y1; {initialize y}
    z := x2; {set sentinel in x-direction}
    {Now set x-increment}
    If x1 <= x2
    then a := 1 {x increases}
    else a := -1; {x decreases}
    {Now set y-increment}
    If y1 <= y2
    then b := 1 {y increases}
    else b := -1; {y decreases}
    {Initialize decision function and its deltas}
    deltap := dy + dy;
    d := deltap - dx;
    deltaq := d - dx;
    {Locate and plot points}
    Pset(x,y,1); {First point}
    while x <> z do begin
      x := x + a;
      if d < 0
      then d := d + deltap
      else begin
        y := y + b;
        d := d + deltaq;
      end; {else}
      Pset(x,y,1);
    end {while}
  end {Case: if dy <= dx}
else {dx <= dy so view x as a function of y}
begin
  y := y1; {initialize y}
  x := x1; {initialize x}
  z := y2; {set sentinel in y-direction}
  {Now set y-increment}
  If y1 <= y2
  then a := 1 {y increases}
  else a := -1; {y decreases}
  {Now set x-increment}
  If x1 <= x2
  then b := 1 {x increases}
  else b := -1; {x decreases}
  {Initialize decision function and its deltas}
```

(continued)

The Toshiba P351 printer. The ultimate in 3-in-One™ technology.

The perfect business printer. Engineered to combine letter-quality printing, superb graphics and reliability with high speed. Plus a long list of sophisticated features. So you get three printers for the price of one.

Speed: 100 characters per second — letter quality; 288 characters per second (12 cpi) — draft quality.

Dual Emulation: Qume Sprint II and IBM Graphics Printer (standard).

Reliability: In-use tests show the Toshiba 3-in-One printer can operate without fail for up to 7.7 years of normal workdays.

Durability: The 24-pin printhead lasts twice as long as nearest competitors'.

Compatibility: Toshiba's 3-in-One printers are compatible with major software packages.

Interchangeability: Our parallel and serial interfaces make the 3-in-One series compatible with all micros. Today — and tomorrow.



In Touch with Tomorrow

TOSHIBA
TOSHIBA AMERICA, INC. Information Systems Division

Inquiry 367

CopyWrite

BACKS UP IBM PC SOFTWARE

Hundreds of the most popular copy-protected programs are copied readily. CopyWrite needs no complicated parameters. It needs an IBM Personal Computer, or an XT or an AT, 128k bytes of memory, and one diskette drive. CopyWrite will run faster with more memory or another drive.

CopyWrite is revised monthly to keep up with the latest in copy-protection. You may get a new edition at any time for a \$15 trade in fee.

CopyWrite makes back up copies to protect you against accidental loss of your software. It is not for producing copies for sale or trade, or for any other use that deprives the author of payment for his work.

To order CopyWrite, send a check for \$50 U.S., or call us with your credit card. We will ship the software within a day.



Quaid Software Limited

45 Charles Street East
Third Floor
Toronto, Ontario M4Y 1S2
(416) 961-8243

Ask about ZeroDisk to run copy-protected software from a hard disk without floppies.

HI-RES PRINTER GRAPHICS

```
deltap:= dx + dx;  
d      := deltap - dy;  
deltaq:= d - dy;  
{Locate and plot points}  
Pset(x,y,1); {First point}  
while y <> z do begin  
  y:= y + a;  
  if d < 0  
  then d:= d+ deltap  
  else begin  
    x:= x + b;  
    d:= d + deltaq  
  end; {else}  
  Pset(x,y,1);  
end {while}  
end {else}  
end; {Pixel_line}
```

changes only about 1.5 dots per change in x —hardly visible at over 200 dots per inch.)

Second, this point-by-point calculation takes time. Even when the curve is smooth or nearly straight, every point must be calculated. For curves from simple functions this doesn't produce too much overhead, but for complicated mathematical equations or for curves produced by rotating images, this "overcalculation" is unacceptably slow.

The solution to both of these problems is to compute fewer points and to join the points computed with simple, easy-to-calculate curves. For most purposes these simple curves can be taken to be straight lines. If you only compute every fifth point and you connect the points by lines, there is a considerable time savings if point computations are reasonably complex and the line-drawing algorithm is fast. Furthermore, this solves the problem of gaps, since, in the example above, the points (1.5) and (2.10) would be joined by a small line segment "filling in" the missing four points.

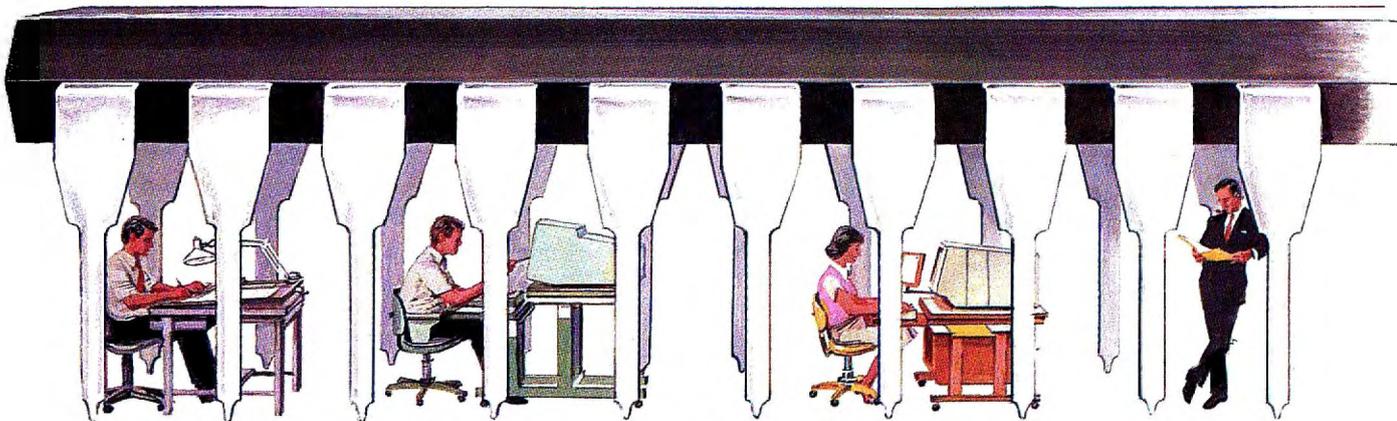
The problem, then, is finding a fast line-drawing algorithm. Trying to find the equation of the line joining two points and then plotting it requires a considerable amount of real-number (decimal) arithmetic. This kind of arithmetic, especially multiplication and division, is quite slow in com-

parison with whole-number manipulation. Furthermore, since the coordinates of points on the screen (or printer page) are always integers—column and row numbers—you would naturally hope for a whole-number algorithm. Fortunately, there is one, called the Bresenham Line Algorithm (named for its inventor, J. E. Bresenham). It not only computes the points on the line connecting any two screen points, using whole-number arithmetic, but it accomplishes this feat *without using either multiplication or division!* Listing 4 contains a Pascal implementation of it. The procedure call is `Pixel_line(x1,y1,x2,y2,color)` where $x1,y1$ and $x2,y2$ are the endpoints of the line. For an easy-to-read description of the theory behind `Pixel_line`, see *Fundamentals of Interactive Computer Graphics* by James D. Foley and Andries Van Dam (Addison-Wesley, 1982).

Sometimes, when speed is even more important and points are very time-consuming to compute, you must cut down radically on the number of points calculated. Joining the points by straight lines will usually produce a figure that is too polygonal in appearance. In figure 1, the points are joined by curved pieces called *splines*, for which there are now very fast computational algorithms. There is some discussion of splines in Foley and Van Dam's book, but the

(continued)

Avocet puts you in the chips!



Now you can use your PC to develop software for virtually any microprocessor. Quickly. Easily. Inexpensively.

THE AVOCET CROSS-ASSEMBLER FAMILY.

Avocet Cross-assembler	Target Micro-processor	CP/M*-\$0	CP/M-86 IBM PC, MSDOS**
XASMO4	6804	\$250.00	\$250.00
XASMO5	6805	200.00	250.00
XASMO9	6809	200.00	250.00
XASM18	1802/1805	200.00	250.00
XASM48	8048/8041	200.00	250.00
XASM51	8051	200.00	250.00
XASM65	6502/65C02	200.00	250.00
XASM68	6800/01,6301	200.00	250.00
XASM75	NEC 7500	500.00	500.00
XASM85	8085	250.00	250.00
XASM400	COP400	300.00	300.00
XASMF8	F8/3870	300.00	300.00
XASMZ8	Z8	200.00	250.00
XASMZ80	Z80	250.00	250.00
NEW!			
XASM6811	68HC11	250.00	250.00
NEW!			
XASM180	HD64180	250.00	250.00
XMAC682	68200	595.00	595.00
XMAC68K	68000/68010	595.00	595.00

* Trademark of Digital Research

** Trademark of Microsoft

Avocet cross-assemblers, simulators, emulators and EPROM programmers will help put your design ideas into more chips than any other software development system on the market. You don't need a mainframe, or even a dedicated system. All you need is a PC, a good idea...and Avocet. It's as simple as that.

Avocet has been creating tools for software development since 1979 to help design engineers find easier and more productive ways to develop software for virtually any microprocessor—without

switching development systems.

Our customers turn ideas into real products. From data entry through assembly, debugging and final EPROMs, Avocet has everything you need to transform your personal computer into a fully integrated development system.

Cross-assembler capabilities.

No matter what the application, our family of cross-assemblers runs on any computer with CP/M* or DOS and processes assembly language for most microprocessors.

Taking the bugs out.



Avocet's new debugging tools will eliminate "crash and burn" from your vocabulary in two ways.

First, AVSIM software simulator/debuggers allow you to test program modules on your PC. No special hardware is required for executing your target code interpretively in a crash-proof, interactive environment. AVSIM's full screen display lets you see at a glance what your program is doing.

When you're ready to test your program in a working model, Avocet's TRICE in-circuit emulators allow you to examine target memory and register, set break-points, single-step, trace and more. A standard serial interface lets you control emulation and download code from your PC.

And best of all, TRICE costs less than \$500.

Progressive EPROM programming.

Avocet AVPROM programmers work with over 37 different devices including EPROMs through 27512, CMOS and E² PROMs, and MPU/EPROM combos using fast "adaptive" algorithms. These intelligent, self-contained units work with any personal computer using Avocet's GDX driver software.

Made to order.

You don't have to come to Maine to get Avocet products (unless, of course, you want a really great lobster dinner). Just call, toll-free,

1-800-448-8500

(in the U.S. except Alaska and Hawaii)

and we'll rush out your order, send out more information, or, if you want, talk about some of your great ideas. Avocet Systems Inc., P.O. Box 490-B8, Rockport, Maine 04856. (207) 236-9055. Telex: 467210 AVOCET CI

AVOCET SYSTEMS INC.™

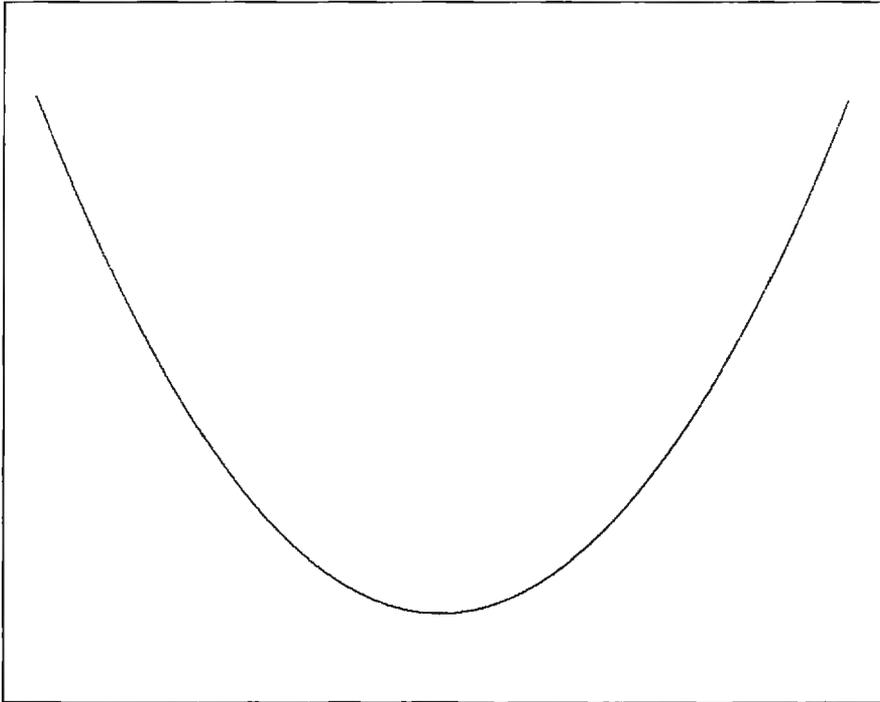


Figure 1: High-resolution plot of a parabola ($y = x*x$) created on an Epson FX-80 printer.

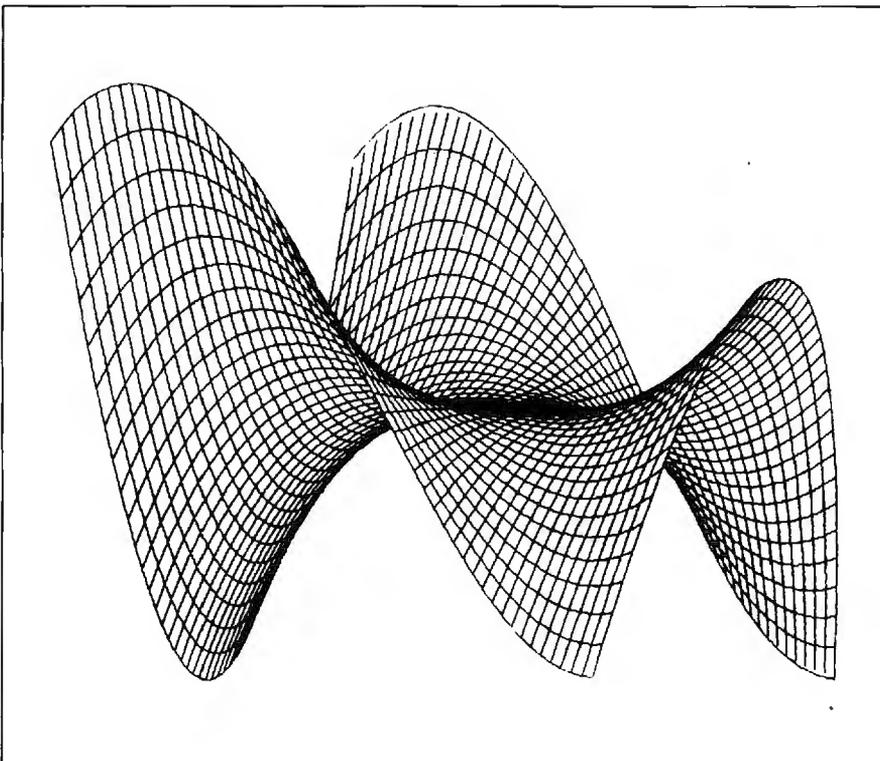


Figure 2: High-resolution plot of the surface $z = x^3 - 3xy^2$ (1600 by 640 dots prepared using the Epson FX-80 printer and the Bridge Software Math Utilities).

There are clever ways of getting even more speed out of the line drawing—especially for lines of small slope—by exploiting block moves of bytes.

most efficient algorithms are to be found in the current technical computer science journals.

FURTHER APPLICATIONS AND EXTENSIONS

Armed with procedures for drawing points and lines on the screen and on the printer, you can implement procedures for making very complex high-resolution pictures. It is possible, given enough memory, to set aside more pairs of arrays to increase further the image size you can print. This is the reason to use dynamic variables, the ones with the “^”:

It is also possible to print your picture sideways, but this requires a restructuring of the procedure Change so that it addresses the points correctly.

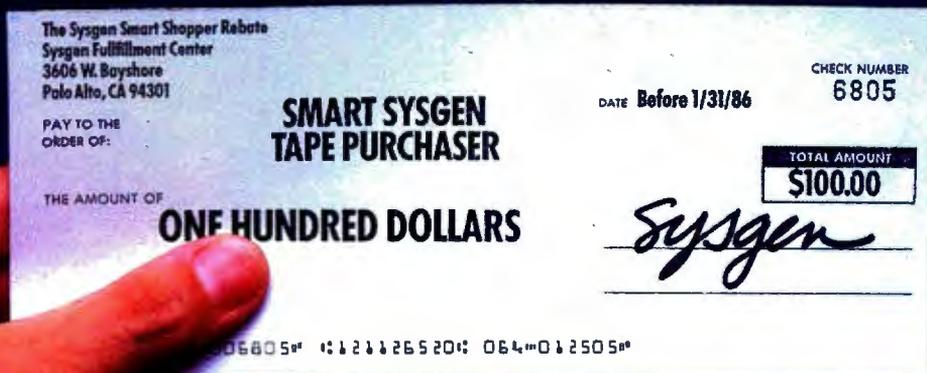
Finally, you can use pixel masks to draw points on the graphics screen as well as the printer. The point and line-drawing procedures included in BASIC and Turbo Pascal, for example, are implemented by combining color and monochrome pixel masks with some version of Bresenham line drawing. There are clever ways of getting even more speed out of the line drawing—especially for lines of small slope—by exploiting *block* moves of bytes.

Figure 2 shows a surface plotted by an Epson FX-80 printer with a resolution of 1600 by 640 dots. It indicates the complexity of drawing possible with this method of printer addressing. ■

IF YOU THINK 60 MBYTE AUTOMATIC TAPE BACK-UP IS AN INCREDIBLE VALUE AT \$1395,



WAIT UNTIL SYSGEN SENDS YOU THE \$100 REBATE.



Sysgen™ has made its already bestselling tape back-up for your PC, XT, AT,™ or compatible an even smarter buy.

Automatic Back-up. Painless Data Protection.

Now you also get Sysgen's exclusive *automatic* tape back-up, as easy to program as a VCR! Set it once, and your Sysgen *automatically* backs-up your hard disk. No system demands less time or returns more consistent data security.

The new Smart QIC-File™ gives you the terrific Sysgen quality and technical support you expect. And Sysgen gives you the QIC-24 industry standard tape data format. A must. Plus automatic back-up. All this for an incredibly low price: \$1395—internal or \$1495—external.

*Program begins October 1, 1985 and concludes January 31, 1986. Sales receipts dated by Jan. 31 will be honored if postmarked no later than February 28, 1986. Mail to: SYSGEN REBATE OFFER, Sysgen Fulfillment House, 3606 W. Bayshore, Palo Alto, CA 94303. Certain restrictions apply. Trademarks: Sysgen, QIC-File, Smart QIC-File—Sysgen, Inc.; AT—International Business Machines Corporation. Registered Trademarks: IBM, PC DOS—International Business Machines Corporation.

47853 Warm Springs Blvd., Fremont, CA 94539
(415) 490-6770, Telex 4990843

Buy the Smart QIC-File before Jan. 31, 1986 and Sysgen will sweeten the deal with a \$100 rebate.

Simply return your completed warranty card with proof of purchase to the Sysgen Fulfillment Center at the address below, and we'll send you a check for \$100.*

The Sysgen Smart QIC-File is IBM® PC compatible—including all versions of PC DOS® It copies disk data file-by-file in automatic mode and also includes an option for manual file-by-file and mirror image back-up.

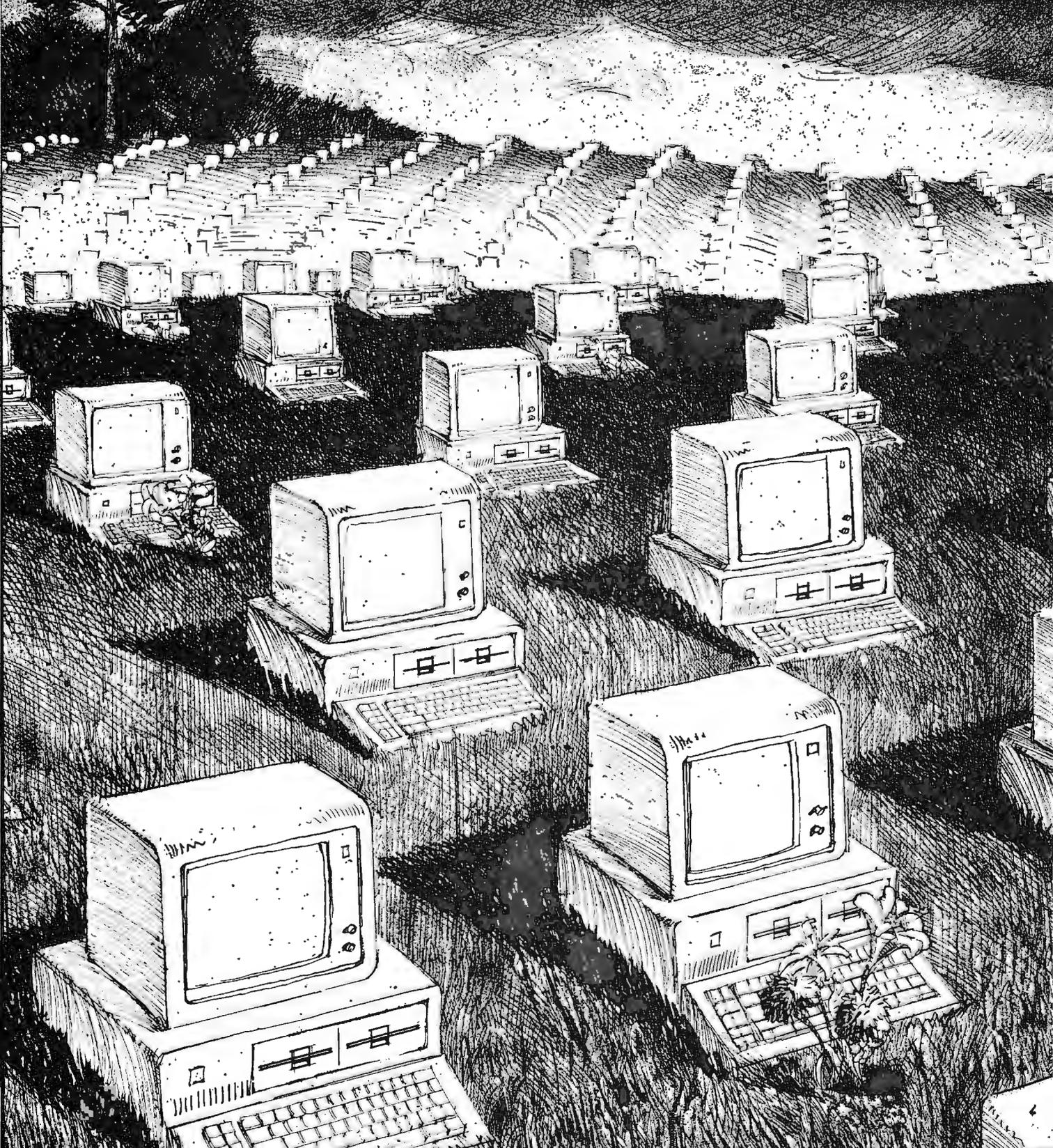
Act before Jan. 31, 1986.

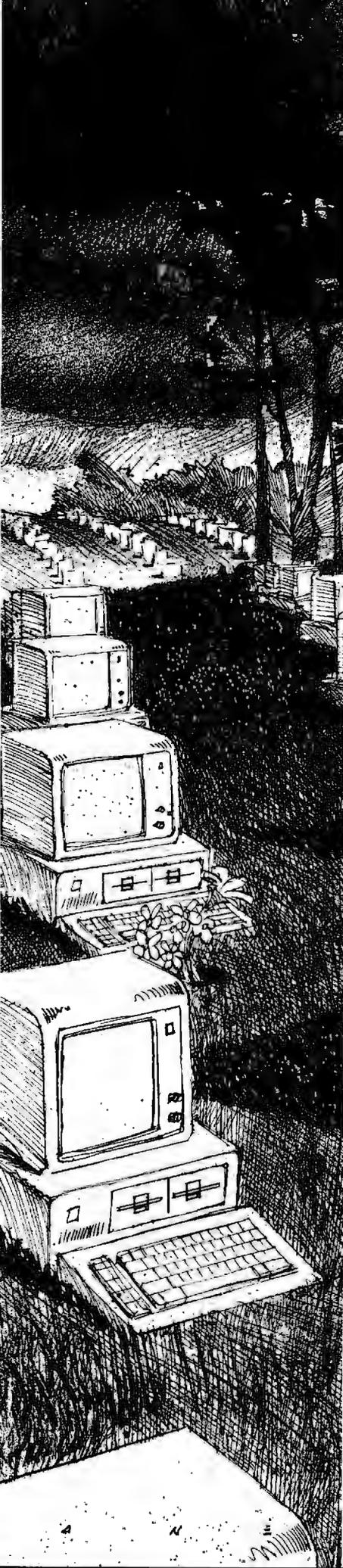
Don't miss out on the best deal in town for automatic tape back-up! For more information on Sysgen's superb line of hard disk and tape back-up products or the Sysgen dealer nearest you, call **1-800-821-2151.**



SYSGEN
INCORPORATED

Hardcard can save
2,500,000 PCs
from an untimely end.





It's a grave situation.

Millions of IBM PCs and compatibles can no longer handle the growing needs of the business world.

Because users like you are demanding more and more storage space.

For bigger programs. Like marathon spreadsheets and Olympic-sized memos. Or for new applications like downloading from the mainframe to the micro.

Which is why a lot of PCs are being replaced with expensive XTs.

But now you can save your PC. And save yourself (or your company) lots of money.

With Hardcard.™

A 10 megabyte hard disk drive on a card that instantly transforms a PC* into an XT. In fact, the only difference is that Hardcard is faster than the XT's built-in drive.

Hardcard also saves you installation time. Because everything is compressed onto a single card that quickly plugs into any expansion slot inside the PC. With no cable connections. No external power supply. No adapter cards to buy.

And with our special installation software, you can load the operating system and be ready to install your programs in minutes.

Hardcard also saves the money

you've invested in software. Because it runs all the most popular business programs exactly like an XT would. With no extra fuss or modification. And its built-in Hardcard Directory program lets you easily access your most valued files and programs at the touch of a key.

Plus Hardcard is the only add-on drive that lets you keep both your floppies up and running.

As for reliability, there's simply less to go wrong. In fact, Hardcard has fewer parts than any other drive. Which makes it twice as reliable as the XT's built-in drive.

Because of this superior reliability, we can offer you a warranty that goes well beyond the usual 90 days. We give you a full year. Should anything go wrong within the year, take it to your nearby authorized service center, and you'll get a replacement Hardcard the same day.

Best of all, Hardcard is affordable enough to save all the PCs. Including yours.

And it's available now at computer retailers nationwide. For the one nearest you, write Plus Development Corp., 1778 McCarthy Blvd., Milpitas, CA 95305. Or call (408) 946-3700.

But do it right now. Because the end is near.



*Hardcard is compatible with IBM PC, IBM PC XT, Compaq Portable, Compaq Plus, AT&T PC 6300. Plus and Hardcard are trademarks of Plus Development Corporation. IBM, IBM PC and IBM PC XT are trademarks of International Business Machines Corporation. Compaq Portable and Compaq Plus are trademarks of Compaq Computer Corporation. AT&T PC 6300 is a registered trademark of AT&T Information Systems, Inc.

Hardcard
from Plus

Lowest Prices Ever On Diskettes

Certified 100% error free
Covered by a Lifetime Warranty
Manufactured with Reinforced hubs
Supplied with White Tyvek sleeves
Supplied with User ID labels
Meet or exceed all industry standards: ANSI ECMA IBM ISO

We sell the same diskette that major software publishers, computer manufacturers and diskette marketers buy calling them their own. Why pay more when you can pay less.

Digital Disk brand diskettes. Special Value Savings On...

Digital Disks diskettes are for use on these famous brand computers such as IBM PC, XT, AT Compaq, AT&T, Zenith, Tandy, Cannon PC, Atari, Commodore, Corona, Columbia, Eagle, Tava.



**5-1/4 Soft-Sectored,
Single Sided/Double density floppy disks**

Bulk quantity shipment of

20 items **\$.79** each 50 items **\$.76** each 100 items **\$.73** each



**5-1/4 Soft-Sectored,
Double Sided/Double density floppy disks**

Bulk quantity shipment of

20 items **\$.89** each 50 items **\$.86** each 100 items **\$.83** each

Floppy Diskettes for the IBM/AT and compatible 1.6 megabyte diskettes

Dysan VHR-2

Box of 10 **\$48.75**

Brand name diskettes at these most attractive prices

Dysan

SS/DD Box of 10 **\$19.95**

DS/DD Box of 10 **\$24.95**

3M

DS/DD Box of 10 **\$17.95**

XIDEX

SS/DD Box of 10 **\$10.95**

DS/DD Box of 10 **\$13.95**

Special Offer Packaging on Our Digital Disks Name Brand Diskettes

Digital Disks Ten Plus Pac \$12.95

10 Double sided diskettes in an attractive plastic library case

Digital Disks Fifty Plus Pac \$50.00

50 Double sided diskettes in an attractive plastic library case

Large Volume Discounts To Corporate Buyers

Terms:

Prepaid checks, money orders, VISA, MasterCard or approved company purchase orders are accepted. No surcharge for the use of VISA or MasterCard. Due to our low, low prices and assurance that all merchandise is new, unused product, all sales are final.



How to order:

Call Toll Free **1-800-336-DISK**

Shipping:

Add \$3.00 per each 100 or fewer diskettes.

Illinois residents add 6.5% sales tax.

Hours:

Monday thru Friday
8:00—5:00 Central Standard Time

In Illinois **312-789-0645**

10 East 22nd Street
Lombard, Illinois 60148

DigitalDisks

More Memory for your Money

THE μ PD7281 PROCESSOR

BY TOM JEFFERY

*A non-von Neumann chip designed
for high-speed parallel processing of images*

THE TRADITIONAL COMPUTER, as formalized by John von Neumann, has a central processing unit (CPU) that accesses instructions residing in the memory with the data. But fetching an instruction from memory, decoding the instruction, fetching data from memory, and storing results, over and over, instruction after instruction, pixel by pixel, slows a system down. For image processing, the fact that similar operations are repetitively performed on all the data suggests some kind of parallel solution. Several processors could be set to work, each handling a part of the problem. But experiments in this direction tend to run into the same bottlenecks: memory access for instructions and data. Furthermore, the additional hardware and software overhead required to control and synchronize the processors may even slow the system down.

These bottlenecks are called the von Neumann bottlenecks: an unfitting tribute to the father of the digital computer. They can be stretched, but they can't be avoided. Computer theorists have begun looking outside the bottle. Two "non-von Neumann" strategies for getting out are *pipelining* and *data-flow architecture*.

NEC Electronics has developed a microprocessor chip based on these principles, the μ PD7281. Designed primarily as an image-processing chip, the μ PD7281 uses pipelining and data-flow architecture to allow processing of image data (such as enlarging, shrinking, and enhancing images) at high speed—5 million instructions per second (MIPS).

INTO THE PIPELINE

Pipelining increases throughput by using a processor's resources more fully. In a pipelined system, the processor starts working on the next step of the problem before it has finished with the last step. To some degree, many von Neumann-style processors use pipelining. For example, prefetch registers are a form of pipelining. At the same time as one instruction is being executed, the next instruction can be brought into the CPU from memory. Now, the additional time required to fetch an instruction is effectively zero; that operation takes place while the CPU is busy elsewhere.

The μ PD7281 is thoroughly pipelined, inside and out. Inside, the μ PD7281 is basically a pipeline with a loop in it (figure 1). The loop con-

sists of several "blocks," or working areas. As soon as a block completes its work, it passes the results to the next block and takes more data from the previous block. The loop allows data to pass through the system as many times as necessary. Like an assembly line, each station is always busy; an individual product may take all day to be built, but the factory doesn't wait for one product to be finished before starting the next.

When μ PD7281s are used together, they are arranged in a straight pipeline (figure 2). Data goes in one end and comes out the other. Each chip passes its output directly to the input of another chip. There is no interface hardware at all. Each μ PD7281 has a module number, which identifies the particular data that it processes.

The delay between entering a set of figures and getting the answer for those figures depends on the problem. However, once the pump has been primed, if the pipeline is kept full (i.e., if you continuously input data), you can get an answer every 200

(continued)

Tom Jeffery is a technical writer for NEC Electronics Inc. (401 Ellis St., Mountain View, CA 94039).

nanoseconds (ns) at 10 megahertz (MHz).

DATA-FLOW ARCHITECTURE

The second and really radical innovation for the μPD7281 is its data-flow architecture. Von Neumann architecture is program-driven and runs on more or less sequential instructions that manipulate data. Conversely, data-flow architecture is data-driven and runs on "tokens," which are packages containing both instructions and data. In the μPD7281, a token consists of 16 bits of data (plus sign and control bits) and a varying amount of identification (ID) and instructions. These packages flow into the μPD7281 and along the pipeline. They do not have to be fetched. In general, they can be input in any order because they contain their own ID and operational information. The pro-

cessor performs operations when all the necessary data is present.

For a simplified example, think of adding two numbers. In most computers (von Neumann architecture), you write a program that says "Add A to B and put the result in C." To execute the program, the computer gets the first instruction, which tells it to get A. The next instruction tells it to get B. The next tells it to add them. The next tells it where to store the result. That's four instruction fetches: two data fetches, one addition, and one data store.

In a data-flow machine, your program says the same thing, "Add A to B and put the result in C." The host processor puts the A data in a token marked "A," puts B in a token marked "B," and sends these to the data-flow machine whenever it wants, in whatever order it wants. The answer will be

output, labeled "C." No instruction fetches, no data fetches. And the pipeline spits out answers as fast as you can shove in the data.

Data-flow "programs" are easily represented as flow graphs, in the same way that conventional, sequential programs are represented by flowcharts. In a flow graph, the lines—"arcs" or "links" in mathematical terms—represent the flow of tokens, and the boxes, or "nodes," represent operations on the tokens. As you can see from figure 3, flow graphs express the non-sequential, parallel nature of the data-flow concept. Operations are performed as tokens arrive along links at a node. The order in which the operands arrive does not matter.

These concepts may be easier to explain by looking at the chip in more detail (refer to the block diagram of the μPD7281 in figure 1). The μPD7281 is connected to the outside world by two 16-bit buses, an input and an output bus. Behind these buses are an input controller and an output controller. The input controller puts two 16-bit words together into a single 32-bit token. It then checks the token to see if it is addressed to this μPD7281. Each μPD7281 has a 4-bit address or module number. Each input/output (I/O) token has a module number, the address of the μPD7281 it wants to go to. If the module number on the token is different from the module number of the present μPD7281, the input controller passes the token unchanged straight to the output controller. This takes only one clock cycle, making the μPD7281 practically transparent to a token that is not addressed to it. The input and output controllers are analogous to the doors of a hospital. The "In" door and the "Out" door are close together, so if you are in the wrong building, you can go right on to the next one.

The μPD7281 uses a two-line handshaking system. When a processor wants to output a token, it signals on its \overline{OREQ} (output request) line. If it can accept, the receiving processor signals on its \overline{IACK} (input acknowledge) line. The input controller uses

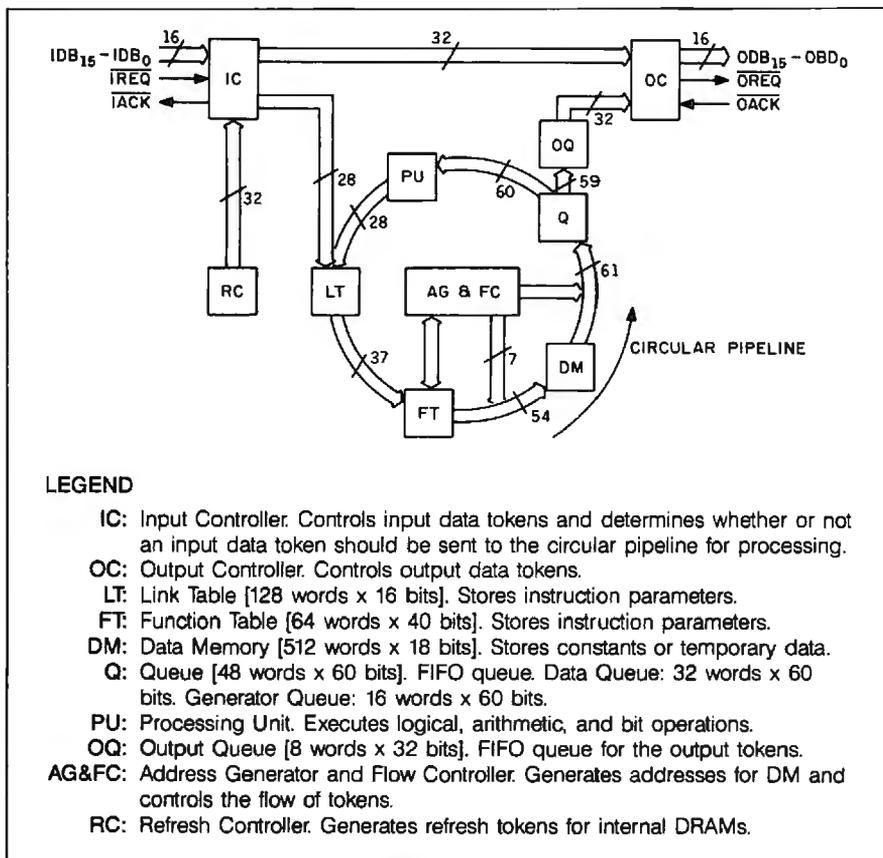


Figure 1: The internal architecture of the μPD7281, a pipeline with several blocks, or working areas, in a loop. The numbers represent the bit width of the path between blocks.

the handshake signals to control access to the μPD7281. If the internal pipeline is full, it holds back until there is a place for a new token.

Tokens that are accepted by the input controller are stripped of their module number, now unnecessary. A token undergoes many format changes as it passes through the μPD7281, as you can see by looking at the changing width of the pipeline bus and the token formats in figure 4.

The first block in the pipeline is the link table, a 128- by 16-bit RAM (random-access read/write memory). The contents of the link table are downloaded from the host system. They are part of the μPD7281 "program"; specifically, they represent the links in the data flow graph. The ID field of the token addresses a location in the link table. The contents of that location are an address in the function table. This address, a new ID, and a

few stray bits of code are attached to the data, and the new token is clocked into the next block, the function table.

The function table is a 64- by 40-bit RAM. The contents, accessed by the function-table address from the link table, are the other part of the μPD7281 program. They represent the nodes of the flow graph. Here the token picks up 40 bits of instruction

(continued)

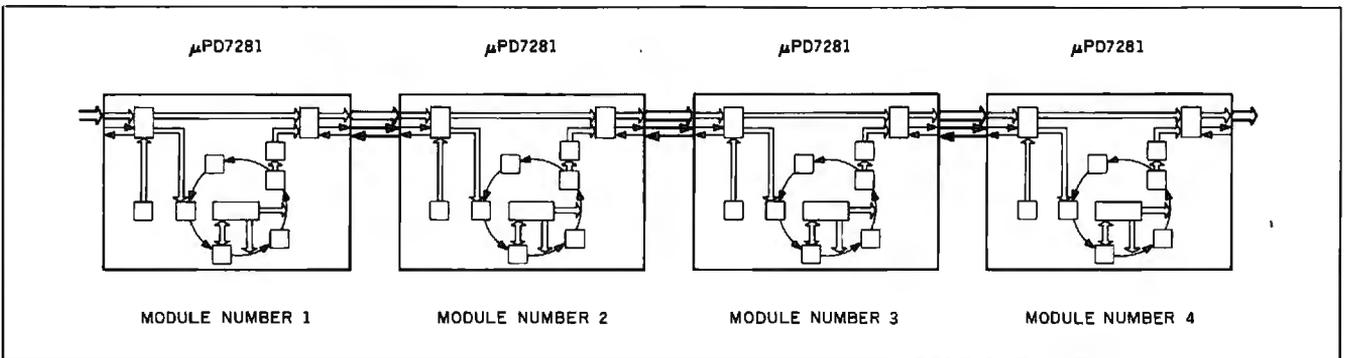


Figure 2: When several μPD7281 chips, each with an internal pipeline, are connected together, they form a larger pipeline. Data, in the form of tokens, flows into the input of the first μPD7281, circulates through the internal pipeline, then passes out to the next μPD7281. This four-stage pipeline may work on up to 28 different tokens at a time.

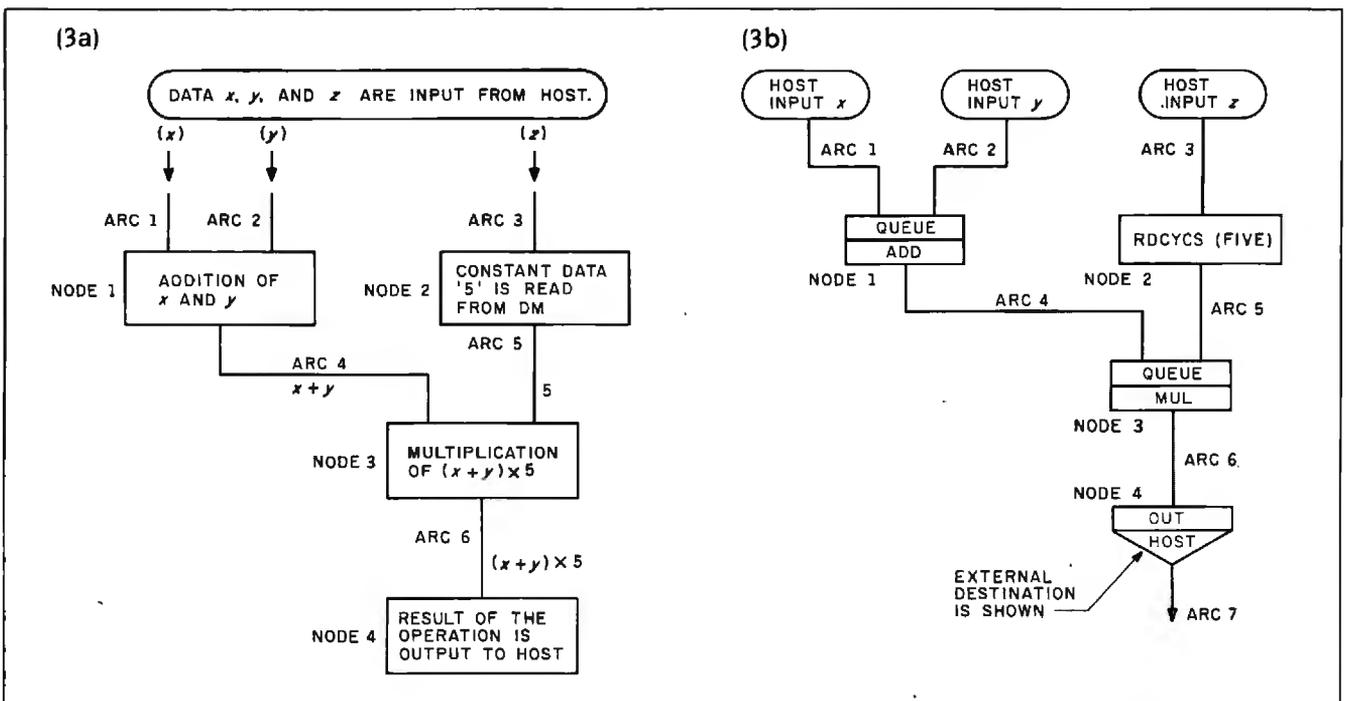


Figure 3: A flow graph (3a) of the operation $5(x + y)$ as shown in 3b. When more than one token is expected at a node (as in NODE1 and NODE3), the node queues the first token until the second token arrives.

codes, in the form of a function-table left field (processing-unit code), function-table right field (address-generator-and-flow-controller code), and function-table temporary field (counters and miscellaneous).

To continue the hospital analogy, the link table is akin to the receptionist. (Picture yourself in the role of patient-token.) It takes your ID and tells you who to see in the function table. The function table acts as the doctor who prescribes your operation. At the function table you get your orders for treatment to carry to the next blocks.

The address generator and flow

controller comes into play if the operation to be performed, as determined by the function-table right field, involves more than one token. It acts as the back office, the secretary who knows where everything is. This block allows tokens to read from or write to sequential blocks of data memory (address-generator functions). And it queues tokens that are waiting for a second operand to perform their operation (address-generator-and-flow-controller function). That is, it tells you where to wait, where to get what you need, and where to leave your specimens.

The data memory is a 512-by 18-bit

RAM that holds the first operand of a two-operand function until the second arrives. It also acts as general-purpose temporary storage and an I/O buffer. It operates under the control of the address generator and flow controller. The data memory is the hospital's files. You pick up or leave data about your case here. The address generator and flow controller will keep track of it. Then you go to the queue. The queue is the waiting room.

The queue is 48 by 60 bits of RAM configured as two first-in/first-out queues. The data queue, 32 tokens

(continued)

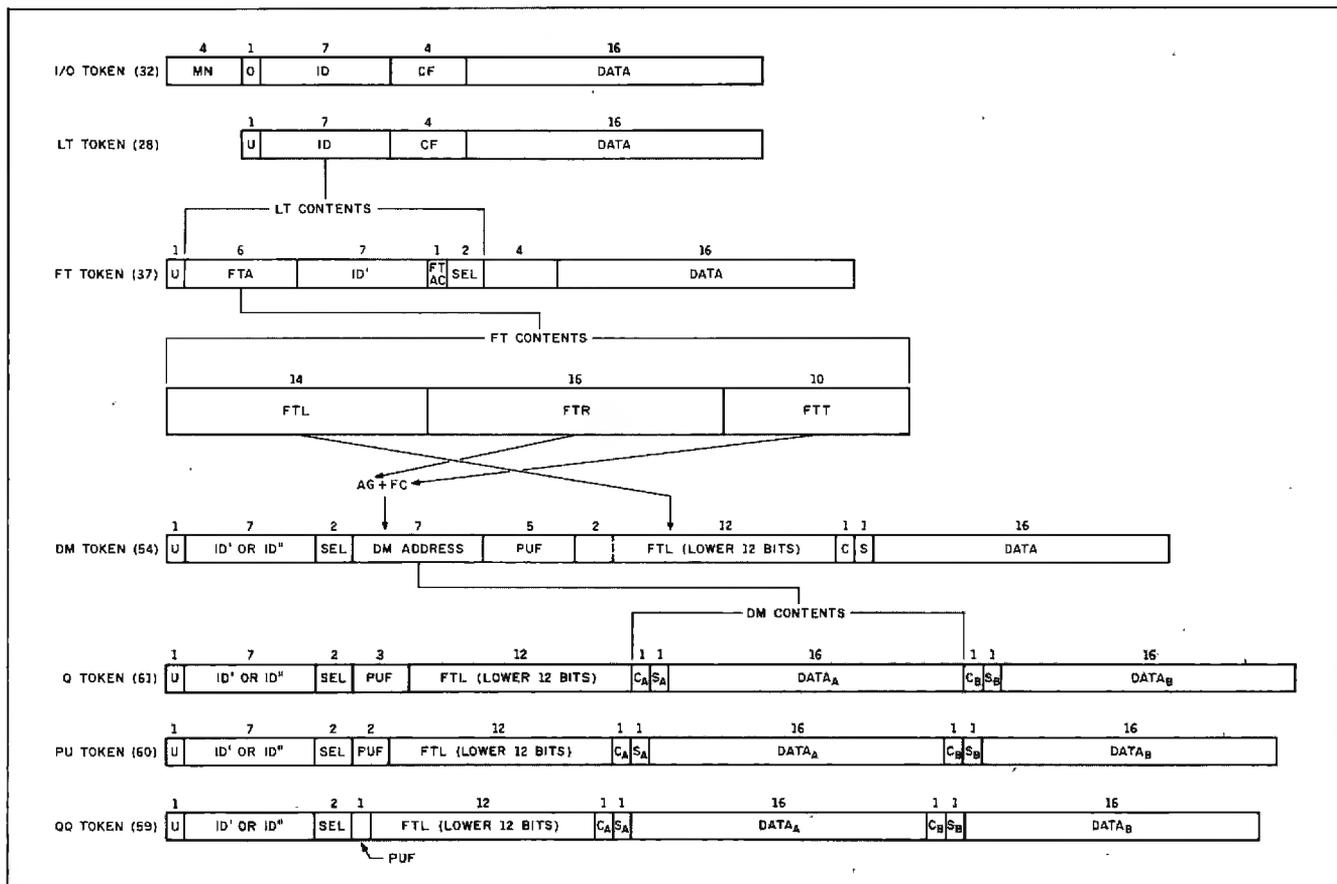


Figure 4: As a token flows through the blocks of a μPD7281, its format changes. An I/O token has a module number, an ID, a control field, and 16 bits of data. At the link table, the module number is discarded, and the ID is expanded into a function-table address (FTA), a new ID (ID'), a function-table right control (FTRC) bit, and a select (SEL) bit. At the function table, the FTA expands into a function-table left field (FTL), a function-table right field (FTR), and a function-table temporary field (FTT). The FTL controls the processing unit. The FTR controls the address generator and flow controller (AG&FC). The address generator and flow controller supplies a data-memory (DM) address, which accesses another 18 bits of data, such as another token from the data-memory queue. The processing-unit field (PUF) specifies either a refresh token (in a queue token), a read/write token (in a processing-unit token), or neither (in an output queue token), and decreases accordingly in size.

CompuPro has great memories at tomorrow's prices.

BOARD	DESCRIPTION	OLD PRICE	NEW PRICE
RAM 23/64, RAM 23/128 RAM 22	64 Kbyte static RAM, S-100 128 Kbyte static RAM, S-100 256 Kbyte static RAM, S-100	\$ 395 \$ 695 \$1250	\$ 250 \$ 350 \$ 595
MDRIVE/H-.5	512 Kbyte disk emulator, S-100	\$ 695	\$ 495
MDRIVE/H -2	2 Mbyte disk emulator, S-100	\$2450	\$1095
SPUZ/64	8 MHz Z80H slave processor w/64 Kbyte RAM, S-100	\$ 395	\$ 295
SPUZ/256	8 MHz Z80H slave processor w/256 Kbyte RAM, S-100	\$ 795	\$ 395
MDRIVE/H10 1	1 Mbyte disk emulator for CompuPro 10 Plus	\$1350	\$ 795
MDRIVE/H10 4	4 Mbyte disk emulator for CompuPro 10 Plus	\$4500	\$2100

Remember the Volkswagen bug? It's an enduring symbol of the way products should be: economical, highly capable and reliable. One of yesterday's great memories.

With RAM prices going down fast, tomorrow's memories are economical too. As the chart shows, CompuPro memory serves you well — by offering tomorrow's RAM prices today. Now you can increase working memory, enhance disk-intensive performance and operating speeds or add slave processing support to your system for less money than ever before.

See how well performance, dependability and durability can still be put together in an economical package.

VIASYNTM

The CompuPro People

Where Computers Grow

26538 Danti Court, Hayward, CA 94545-3999

Call 800/VIASYN-1. In CA, 800/VIASYN-2. TWX: 510-100-3288 VIASYN CORP

CompuPro is a registered trademark of Viasyn Corporation.

long, holds tokens bound for the processing unit or the output. The 16-token generator queue holds tokens to be copied. The queues provide slack in the pipeline. Since the processing unit takes longer to process some instructions than others, the queues are necessary to keep slower operations from excessively backing up the processor pipeline. They do not release tokens to the output queue or the processing unit until these blocks are free. A subtle algorithm controls their operation. The data queue has priority over the generator queue if there are eight or more tokens in the data queue. This restricts the generator queue tokens, which are more dangerous because they in turn create more and more tokens and thus have the greater potential for causing pipeline overflow. The data queue has a restrict/inhibit mode to inhibit the input controller from accepting new tokens when the data queue has more than 24 tokens.

When one or two tokens are ready in the queue, they get passed to the processing unit. This is like the ALU (arithmetic and logic unit) of a von Neumann microprocessor, with a very rich instruction set. It performs the usual logic, arithmetic, and compare functions, including the 200-ns 17-bit signed multiply or divide, and many extras, such as a barrel shift (1- to 16-bit shift in one 200-ns cycle) and double-precision adjust. It also performs the token-generating functions, which make copies of a token. These operations are specified by the contents of the function-table left field. Since they are specified separately, a token can have both address-generator-and-flow-controller instructions and processing-unit instructions. These instructions are listed in table 1.

After your operation in the processing unit, you go back into the pipeline at the link table. You now have a new ID, specifying a new course of treatment. You keep going around until the link-table contents specify a function-table address whose contents in turn call for the token to be output, that

(continued)

Table 1: The μPD7281's instruction set. A single token may include address-generator-and-flow-controller instructions and processing-unit instructions.

Address-Generator-and-Flow-Controller Instructions

Mnemonic	Instruction
QUEUE	queue
RDCYCS	read cyclic short
RDCYCL	read cyclic long
WRCYCS	write cyclic short
WRCYCL	write cyclic long
RDWR	read/write data memory
RDIDX	read data memory with index
PICKUP	pick up data stream
COUNT	count data stream
CONVO	convolve
CNTGE	count generation
DIVCYC	divide cyclic
DIV	divide
DIST	distribute
SAVE	save ID
CUT	cut data stream

Processing-Unit Instructions

Mnemonic	Instruction
OR	logical OR
AND	logical AND
XOR	logical EXCLUSIVE-OR
ANDNOT	logical INVERT first operand then AND [A AND B]
NOT	invert
ADD	add
SUB	subtract
MUL	multiply
NOP	no operation
ADDSC	add, shift, and count
SUBSC	subtract, shift, and count
MULSC	multiply, shift, and count
INC	increment
DEC	decrement
SHR	shift right
SHL	shift left
SHRBV	shift right with bit reverse
SHLBRV	shift left with bit reverse
CMPNOM	compare and normalize
CMP	compare
CMPXCH	compare and exchange
GET1	get one bit
SET1	get one bit
CLR1	clear one bit
ANDMSK	mask a word with logical AND
ORMSK	mask a word with logical OR
CVT2AB	convert two's-complement to sign-magnitude
CVTAB2	convert sign-magnitude to two's-complement
ADJL	adjust long (for double-precision numbers)
ACC	accumulate
COPC	copy control bit

Generate Instructions

Mnemonic	Instruction
COPYBK	copy block
COPYM	copy multiple

(continued)



**BUY THE
WORLD'S #1
PRINTER
FROM THE
WORLD'S #1
SOURCE!**

It's an unbeatable combination.

We're the nation's largest-mail order source for everything in computing. Epsoms are the nation's best-selling family of printers... and for good reason.

Epsoms are unmatched in speed, versatility, letter and correspondence quality, choice of fonts, and are backed by the strongest local service network in the nation. So we stock them in tremendous volume, ready for immediate shipment... at the kind of prices that helped make us #1. Epson printers, as well as 30,000 other products are priced at Wholesale + 8%.

Also, when you join the Network you get our 600 page catalog, our own quarterly newsletter, a vast software rental library, free phone consultation, our 10 day money-back guarantee and more!

Watch your benefits stack up.
Join PC Network today!

CALL TOLL-FREE 1-800-621-S-A-V-E
B3YE

In Illinois Call (312) 280-0002

PC NETWORK
GET THE NETWORK ADVANTAGE!!!

SETCTL	set control field)
Output Instructions	
Mnemonic	Instruction
OUT1	output 1 token
OUT2	output 2 tokens

Listing 1: *Assembly-language listing of the flow graph in figure 3. Lines 1 through 4 constitute the declaration field; lines 5 through 15, the instruction field.*

```

1  EQUATE      HOST = 0;
2  MODULE     EXONE = 8;
3  INPUT      ARC1, ARC2, ARC3;
4  OUTPUT     ARC7;

5  LINK        ARC4 = NODE1 (ARC1, ARC2);
6  LINK        ARC5 = NODE2 (ARC3      );
7  LINK        ARC6 = NODE3 (ARC4, ARC5);
8  LINK        ARC7 = NODE4 (ARC6,     );

9  FUNCTION    NODE1 = ADD, QUEUE (QUE1, 1);
10 FUNCTION    NODE2 = RDCYCS  (FIVE, 1);
11 FUNCTION    NODE3 = MUL (Y), QUEUE (QUE2, 1);
12 FUNCTION    NODE4 = OUT1   (HOST, 0);

13 MEMORY     QUE1 = AREA (1);
14 MEMORY     QUE2 = AREA (1);
15 MEMORY     FIVE = 5;

```

is, until your new ID says you are cured. At this time, a token goes to the output queue from the queue, instead of to the processing unit. The token is then fitted up with its module number and ID, and it leaves the μPD7281, in exactly the same format as it entered, via the output controller.

Because the output tokens have the same format as the input tokens, interfacing μPD7281 to μPD7281 is simplicity itself. The 18 output lines from one processor go to the 18 input lines of the other (ODB₀ through ODB₁₅ to IDB₀ through IDB₁₅, OREQ goes to IREQ, and OACK goes to IACK). The only additional hardware required is a 4-bit module-number register for each μPD7281 to set the module number at RESET.

The interface to memory is a little more difficult. The concept of external memory addresses is alien to data-flow architectures. The configuration shown in figure 5 requires a

memory-bus interface to deal with the world outside the pipeline. This arrangement makes the memory look like a special kind of μPD7281 that accepts tokens addressed to it and passes others back to the beginning of the pipeline. Now the pipeline has looped back on itself, like the internal pipelines. Wheels are thus contained within wheels. To the memory, the interface should look more like a DMA (direct memory access) controller. It could also control a display processor and handle the host CPU interface. NEC has plans for just such a memory interface, called the MAGIC (memory address generator and interface controller) chip.

The μPD7281 pipeline is not designed to operate independently. It requires a host system, but it is designed to run somewhat loosely linked to the host. Nominally, the host is required to download the software into the link and function tables and

to start the processing. It should be able to monitor the results, probably with an interrupt system. Although we haven't discussed error handling, the host system can read the system state on an error condition. These concepts are built into the μPD7281 and are easily implemented.

Now that we have our multiprocessor system, composed of a host, memory, and a few μPD7281s, how do we program the μPD7281s? What language do we use? No high-level language is suited to deal with this kind of architecture. NEC has no equivalent of Occam, the language for INMOS's multiprocessing Transputer. The μPD7281 assembler, however, is really quite simple.

The assembler is based on the flow-graph concept. Listing 1 shows an assembly-language program based on the flow graph in figure 3. The EQUATE statement simply assigns a constant to a variable; in this case, the host address to 0. The MODULE statement assigns this section of code to a given μPD7281. The input tokens (ARC1, ARC2, and ARC3) and output token (ARC7) are declared in the INPUT and OUTPUT statements. Look at the flow graph and you can see the connection.

The LINK statements show what node (or function) every arc in the graph comes from and which arcs went into the node. For instance, the statement LINK ARC4 = NODE1 (ARC1, ARC2); means that the link ARC4 is the result of the the function NODE1 operating on links ARC1 and ARC2.

LINK statements generate link-table entries. The statement above puts the address of function NODE1 as the function-table address and the address of ARC4 in the ID' section of link-table addresses ARC1 and ARC2.

The FUNCTION statements show what instructions make up each function on the flow graph. So FUNCTION NODE1 = ADD, QUEUE (QUE1, 1) means that the node NODE1 performs an addition and uses the queue QUE1 to hold whichever operand comes first until the second one ar-

(continued)



Doesn't your IBM PC deserve IBM service?

You chose an IBM Personal Computer for lots of good reasons. And now that you depend on it to help keep your office running smoothly, doesn't it make sense to help protect your investment with blue chip service from IBM?

No matter what IBM PC you have, blue chip service is more than just expert repair.

Blue chip service offers the choice of service that's right for you at the price that's right for you. It means we'll exchange your monitor, for example, at your place or at any of our Service/Exchange Centers.

And blue chip service means a lot of things you don't see. Quality. Speed. Commitment. And IBM experience. Every year IBM invests many hours of training to keep its service representatives current on technologies that never stand still.

As an IBM customer you deserve blue chip service. It's the best thing you can do for your IBM Personal Computer.

For more information, use the coupon or call 1 800 IBM-2468, Ext. 104, and ask for the Service/Exchange Maintenance Department.

Blue chip service from **IBM**[®]

IBM Direct			104-11-85
Service/Exchange Maintenance Dept.			
One Culver Rd.			
Dayton, NJ 08810			
<input type="checkbox"/> Please send me more information on IBM PC service.			
Name _____		Title _____	
Company _____		Phone _____	
Address _____			
City _____		State _____	Zip _____

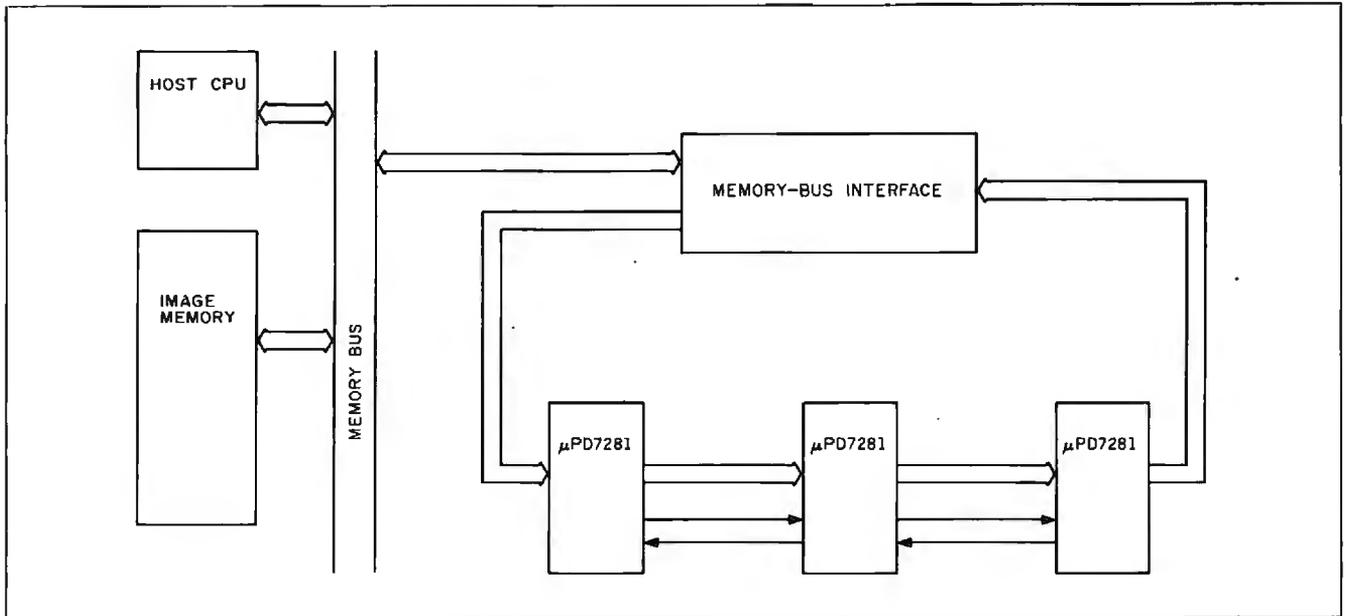


Figure 5: Three μPD7281s in a pipeline loop with a memory-bus interface to external memory.

rives at the node.

These statements become function-table entries. The ADD instruction goes in the function-table left field, and the QUEUE instruction goes in the function-table right field.

Data memory is allocated by the MEMORY statements. The area QUE1 is defined as an area to queue one operand. The location FIVE is set to 5.

That's pretty much it. The code is not particularly readable, of course. It looks a little like a string of declarations, and you wonder where the action is. The tokens supply that. The problem is that the program is a one-dimensional listing of the flow graph. Once you have the flow graph, the assembler is a snap, but no one would think of writing the assembler first, in the way that you might write a BASIC program without a flowchart.

Writing a program for more than one processor is a little more difficult. When I first comprehended the idea, I thought, "To program like that, you'd have to have more than one brain."

First of all, you must break the problem up between the processors. There are two ways to do this. One way is to break up the data. For example, in image processing, a 512- by 512-pixel image could be broken up into four

quadrants of 256 by 256 pixels. Each quadrant would be worked on by a separate μPD7281, each with the same program. Since the processors are working independently, the processing time will be cut to a quarter of the time required by one μPD7281.

The other choice is to partition the algorithm. Since the link table, function table, and data memory are small, it isn't hard to imagine a program too large (more than 128 links and 64 functions) to fit on one μPD7281. A program of this size must be split up and put on different chips. For example, one μPD7281 shifts images, one sizes them, and one rotates them.

Routine partitioning is a little more tricky than data partitioning. The processes on each chip must be fairly well balanced, or the most heavily loaded chip will slow down the system. Of course, in the data-partition method the data must be partitioned equally. But if you are going to partition your program, you should do a simulation to ensure the balance.

This isn't the only problem you can run into when partitioning a problem among processors. When an early chip's routines run faster than a later chip, the tokens can pile up in the

slower chip's data memory. This should be handled by routine balancing, but if it can't be avoided, a synchronizing token can be passed by the later μPD7281 back to the earlier to start and stop it.

Are there limits to the speed to be gained by adding processors? Of course. The fact that there are only 14 valid module numbers is one limit. Another is the memory bus. When a routine performs simple operations on many pieces of data, the memory bus is being used more than the μPD7281s. Adding more processors will fail to increase processing speed. This results in a state known as "bus neck." The system becomes memory-bus-bound, just like a von Neumann machine. The way to find the maximum number of effective processors is through simulation.

New software design techniques for this chip remain to be worked out. The most obvious would be a graphic assembler that codes directly from a flow graph.

It may even be possible to make a C or Pascal compiler for the μPD7281 that would translate your algorithm into the data-flow domain and optimize it for the best number of chips. ■

\$699 Computer Breakthrough

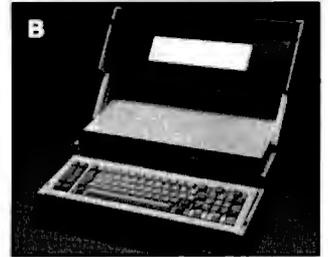
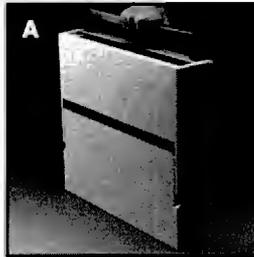
IBM compatible computer with 128K memory and two disk drives is more than a bargain.



A It carries like a briefcase.

B With LCD lid open.

The Visual Commuter sells for only \$699. The IBM monochrome monitor is optional.



It's a new concept. And if my hunches are correct, the new Visual Commuter will take years for others to copy.

By Joseph Sugarman, President

First, it is a tremendous bargain. At \$699 nothing even comes near. Secondly, it's powerful. You get 128K memory that's expandable to 512K. And finally, it's totally IBM compatible. It will even run the Flight Simulator program and Lotus Symphony™. But there's more.

The unit can be used as a stand-alone office computer as shown above or it can be packed up and used as a portable—but without all the weight. There's an optional 16-line x 80 character LCD display that pops up to replace the heavy CRT monitor. Unlike the smaller portable computer keyboards, the Commuter keyboard is a full-size replica of the IBM with its ten function keys and numeric key pad. And the Commuter uses 5 1/4" disks so you have full access to all the popular IBM software.

It's lighter (only 18 lbs), flatter (only 3 1/2" thick) and carries like a briefcase. In short, the Visual Commuter is a combination of all the good features of a portable computer (size, weight, portability), all the good features of a traditional desktop computer (full-size keyboard, 5 1/4" disks, full power) and none of the disadvantages of either.

USE IBM PROGRAMS

Even if you have another computer but miss some of the IBM programs, for only \$699 and an IBM compatible monitor, you've got a complete MS/DOS system.

It was also made modular so you can select just those components that you need for your particular application. For example, you may not need the 16 line x 80 column LCD display which adds 2 lbs to the unit's weight (a blank lid comes with the unit). Or you may not need a monitor because your other computer may already have one. But you may want more power—256K or 512K—so you order just what you need.

For all you technical people, listen to these specs. There's a 16-bit 8088 processor, 128K memory with parity, parallel printer port, serial ASYNC RS 232C port, Din connector RF modulator or composite video output for TV and composite video input monitors, RGB/direct drive output for high resolution monochrome or color monitors, IBM compatible color graphic support, support logic for 80x25 or 40x25 character display and LCD display, connector to IBM expansion unit, disk controller

supporting two 5 1/4" disk drives, ANSI standard ROM-based terminal emulation, and ROM-based extended diagnostics. The dual disk drives are double sided-double density (360 Kbytes). The Commuter runs at the same clock speed as the IBM PC (4.77 MHz) but because of its new design, it runs between 8 to 10 percent faster.

ATTRACTIVE CASE

There's an attractive carrying case made by American Tourister that holds your software, your power cord, your documents and even our optional 1200 baud modem. The compatible Maxwell modem lets you communicate with other data banks. Made by the world's largest modem manufacturer, Racal-Vadic, it is normally a \$500 value but our price is only \$249 which includes a complete communications software package. There's also a toll free, on-line warranty service and a customer hotline to answer any of your technical questions.

You may have recently heard of Visual Technology Incorporated. They are innovators in the design and manufacture of smart alphanumeric terminals and some of the finest graphic terminals in the country.

The Visual Commuter was scheduled to sell for over \$2500 with the LCD display. And even at that price, when compared to the IBM system, it was a good value. But JS&A and Visual (in a joint venture with SGD Holding Corp.) saw the opportunity of having just one customer. Together, by selling directly to you, we've eliminated the distributors, dealers and all the sales, administration and advertising costs and have passed the savings on to you. But there are a few catches.

JUST A FEW THOUGH

Once we install the memory, you'll have to send the unit back to us to add more memory. So we ask that you estimate, in advance, the maximum power that you'll require for your needs. 128K memory is plenty for most applications but if you want to run Lotus Symphony, you'll need all 512K. Secondly, we ask that you act quickly. Although we have most of the product in stock right now, there's always the chance that we'll run out.

The Visual Commuter measures only 3 1/2 x 15 1/2 x 18" wide and comes complete with power cord (it only operates on standard AC current), the operating system (Micro-Soft's MS/DOS ver. 2.1) complete with basic and utilities, two beautifully written manuals, lid (without LCD display) and a limited 90-day warranty. There are service centers throughout the United States set up to service the unit in addi-

tion to the service-by-mail facility at Visual's home office near Boston.

I urge you to give the Visual Commuter a test. Order one from JS&A and use it for 30 days without risk. Plug in your IBM monitor and load any of the IBM software you currently have. See how the large keyboard matches the IBM perfectly and how its handle makes a perfect hand rest while typing or a comfortable handle for carrying the unit. See how convenient the unit is to take home or bring with you on a trip with its fold open LCD monitor. If you don't feel that the Visual Commuter is more than you expected, pack it up and ship it back within 30 days for a prompt and courteous refund including the \$25 postage charge. You can't lose.

PERSONALLY USED

I have personally used the Visual Commuter. I have taken it with me on trips, set it up as a stand alone by plugging in my IBM monitor. I have run everything from Symphony™ to Wordstar®—from 1-2-3® to the Flight Simulator program. I strongly recommend the system.

To order, send your check or money order to the address below listing the items and order numbers (shown in parentheses) and order by credit card using our toll free number below.

Thanks to the latest in technology and a direct-to-consumer marketing program, this system can be yours at a tremendous value. Order your Visual Commuter at no obligation, today.

Visual Commuter with 2 Disk Drives and 128K Memory (6105) \$699
 16 x 80 LCD Alphanumeric Display (6106) 299
 IBM 12" Green Monitor (6107) 229
 Zenith 12" Amber Monitor (6114) 99
 Expansion to 256K (6110) 199
 Expansion to 512K (6111) 399
 Maxwell 1200 Baud Modem (6112) 249
 Carrying Case (6115) 69
 Add \$25 postage and handling per system.
 IBM is a Trademark of International Business Machines Corporation.

JS&A PRODUCTS THAT THINK

Dept. B Y, One JS&A Plaza
 Northbrook, IL 60062

QUESTIONS ONLY: (312) 564-7000

ORDERS ONLY: 800 228-5000

IL residents add 7% sales tax. ©JS&A Group, Inc., 1985

Discover what 60,000

Discover the finest peripherals available in terms of features, reliability and price/performance. Corporations like IBM, General Motors and Exxon buy peripheral equipment from Qubie', and have for years. Check some of your old back issues of PC -- we've been satisfying PC owners since 1982.

Discover low prices, with service and support unparalleled in the microcomputer industry. Our 30 day No Risk Guarantee and 48 Hour Turnaround on warranty repairs is proof our products are first rate. We stand behind what we sell. We also offer our exclusive Preferred Customer Plan with 24 hour repairs and 24 months of coverage.



Discover money-saving prices that are the total prices. No small print telling you to add up for credit card charges or shipping and handling. Our prices include surface UPS charges and insurance. In a hurry? 2-day air UPS service is available.

Then discover it takes more than a low price to keep customers satisfied. We answer your questions and concerns before and after you buy.

The Staff of Qubie'

HARD DISK SUBSYSTEMS

PC20 (Internal) \$599

PC20E (External) \$749

With Spooling Tape Backup, Add \$400

20 Megabyte Capacity • Boot From The Hard Disk -- No Software Patches Or Drivers To Install • Runs All The Popular Software--DOS 2.0 Or Later • Low Power Consumption • 5 1/4" Controller Card • High Reliability And Durability -- Specially Plated Drives • Faster Access Time

NEW



AT ENHANCEMENT KIT

BT44 Hard Drive & AT4X4Plus (512K) \$1495

44 Megabyte Drive • Runs All The Popular AT Software • 28 msec. Access Time • Voice Coil Driven Heads with Closed Loop Servo Positioning • Full-Height Unit • No Extra Chips Needed

Than XT -Changeable Interleave Value • Full-Height and Half-Height Bezels • Includes Cables, 1 DIR "Visual Shell" and **ZYINDEX** "Info Searcher" Software

External Model (PC20E) Includes Case And Power Supply • Auxillary Power Supply For Internal Model (PCPWR) Available



PC owners now know.



NEW

AT MULTIFUNCTION CARD

AT4X4Plus (128K) \$395

AT4X4Plus (512K) \$495

Memory Sockets For Adding Up To 4 Megabytes • 1 Standard and 3 Optional Serial Communications Ports • Parallel Printer Port • Game Port Option

300/1200 BAUD MODEMS

PC212A/1200 (Internal) \$179

212A/1200E (External) \$199

Auto-Dial, Auto-Answer, Bell 103/212A Modems • Fully Hayes Compatible, Runs Crosstalk, Sidekick, Etc. • Internal Modem Includes External RS232-C Serial Port And PC-TALK III Software • External Has Eight Status Indicators Lamps

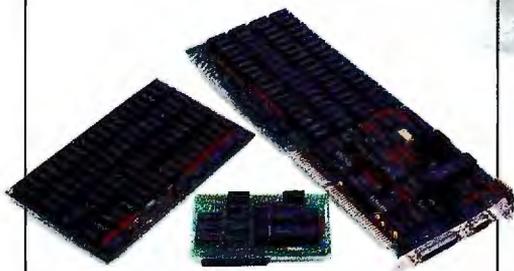
NEW



And Front Snap Hatch For Quick Switch Access • Both Include Instruction Manual And Modular Phone Cord • Shielded Cable For External Modems \$19 (Specify Type)

No Risk Guarantee

If you are not completely satisfied with your purchase you return it within 30 days of purchase for a complete refund, including the cost to send it back. If you can get any dealer or competitor to give you the same No Risk Guarantee, buy both and return the one you don't like.



PC MULTIFUNCTION CARD

BT6Plus (64K) \$147.50

BT6Plus (384K) \$197.50

Memory Sockets For Adding Up To 384K • Parallel Printer Port • Asynchronous Serial Communications Port • BTPak Software (Disk Emulation and Printer Spooling) • Battery-Powered Clock/Calendar • Optional Game Port • Includes Dual Mounting Bracket



RGB & MONOCHROME MONITORS with Tilt/Swivel Base!

RGB Color HR31-200 \$399

RGB for EGA HR31-350 \$499

Mono. Green HR39 \$139

Mono. Amber HR134 \$149

RGB Color Monitors Feature .31mm Dot Pitch And Large 14" Screen • HR31-200 Compatible With IBM Color Graphics Adapter (640x200) • HR31-350 Compatible With Enhanced Graphics Adapter (640x350) • Monochrome Monitors Have IBM Compatible 720x348 Resolution On 12" Diagonal Screen.

For fastest delivery, send cashier's check, money order, or order by MasterCard/Visa. Personal checks allow 18 days to clear. Company purchase orders accepted, call for prior authorization. California residents add 6% sales tax.

Hours: M - F 8 am - 5 pm PTZ
Sat 8 am - 12 pm PTZ



London (01) 223-4569
Paris (01) 321-5316
Sydney (02) 579-3322
Canada (403) 434-9444



Outside California
800-821-4479
Inside California
805-987-9741

QUBIE'

Department B
4809 Calle Alto
Camarillo, California 93010



Reviews

REVIEWER'S NOTEBOOK <i>by Glenn Hartwig</i>	253
THE DATA GENERAL/ONE <i>by Wayne Rash Jr.</i>	254
SANYO MBC-775 <i>by Bruce Roberts</i>	266
FIVE C COMPILERS FOR THE MACINTOSH <i>by Tim Field</i>	275
MAGIC/L <i>by Michael W. Gilbert and Albert S. Woodhull</i>	337
IBM'S PROFESSIONAL GRAPHICS SYSTEM <i>by Rik Jadrnicek</i>	355
JUKI'S 6300 DAISY-WHEEL PRINTER <i>by Wayne Rash Jr.</i>	361
REVIEW FEEDBACK	367

THIS MONTH'S FIRST REVIEW features the Data General/One. Initially announced on the November 1984 cover of *BYTE*, this computer has undergone some interesting changes and updates in the past 12 months. Its LCD screen was the focus of most of the first year's tinkering. Planned, but unavailable at the time of our product description, was the expansion chassis that lets you directly run 5¼-inch disks and add memory or other special-purpose cards. It also gives you the option of attaching a full-size, stationary CRT screen as part of an office "base system." Also changed was the system's basic memory configuration. It originally came with 128K bytes of RAM—now its standard memory is 256K bytes and that figure can go as high as 512K bytes. How well does it all work together? Reviewer Wayne Rash takes a close look at the Data General/One and comes to some interesting conclusions.

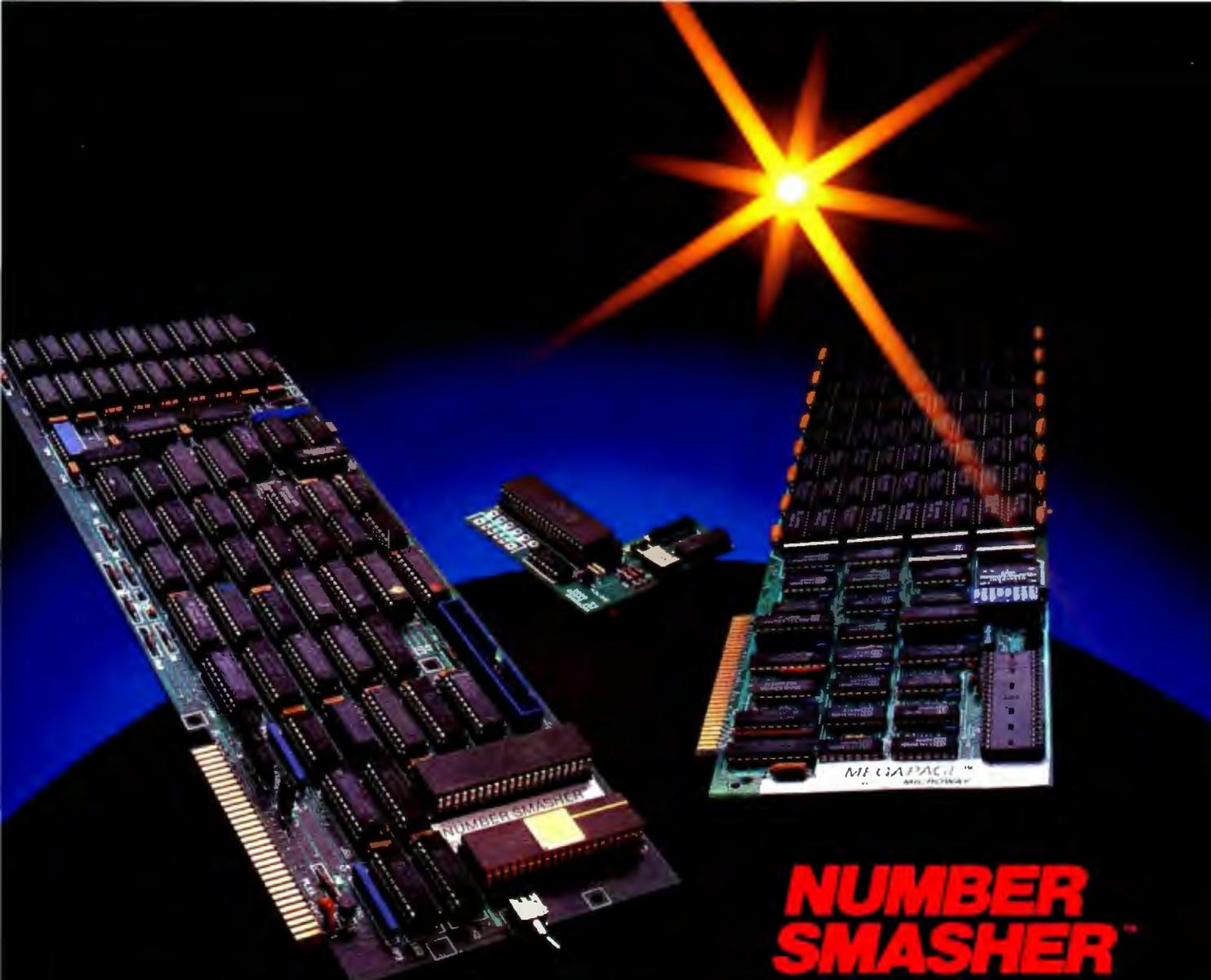
Next, Bruce Roberts looks at a versatile IBM PC work-alike, the Sanyo transportable MBC-775. Like the IBM Portable PC, the MBC-775 features two 360K-byte disk drives, 256K bytes of RAM, a color-graphics adapter, about the same number of expansion slots and peripheral connectors, and a detachable keyboard. Differences do exist, most noticeably in the Sanyo's color CRT (the IBM has a monochrome monitor) and its price, version of BASIC, design, and placement of physical components.

Our first software review of the month is an expansive look at five C compilers for the Apple Macintosh. Reviewer Tim Field concentrates on packages expressly designed for professional program-development applications, which narrows his choices to contenders from Manx Software Systems (Aztec C), Hippopotamus Software (Hippo-C), Consulair (Mac C), Megamax (Megamax C), and Softworks Ltd. (Softworks Macintosh C). Field tested each version of C eight different ways, relying for some tests on the *BYTE* benchmarks contained in the August 1983 issue on C. Which compiler you choose depends on how well the candidates score in the areas most important to you.

Magic/L from Loki Engineering is a descendant of FORTH and has recently been adapted for CP/M systems. Reviewers Michael Gilbert and Albert Woodhull report that the new language takes advantage of the fact that hardware constraints are much less confining now than when FORTH was newly introduced. What this means is that Magic/L can be more "wasteful" of memory to get around such idiosyncrasies of FORTH as the requirement for reverse Polish notation. Using forward notation makes a Magic/L definition look more like a program written in Pascal or C, and programmers who already know a conventional language could find Magic/L easier to learn than FORTH.

A fascinating product for designers and graphic artists is the IBM Professional Graphics System (controller card and display CRT). With this system you get 640- by 480-pixel graphic images in 256 colors, with a total palette of 4096 colors available. Reviewer and contributing editor Rik Jadrnicek applies his familiarity with computer-aided design to provide an in-depth look.

Finally, reviewer Wayne Rash puts in a second appearance looking at the Juki 6300 daisy-wheel printer. Rash comments that the Juki 6300 is a better clone of the Diablo 630 than the earlier Juki 6100; that product was merely plug-compatible, while the new unit uses the same ribbons and print wheels as the Diablo. Print quality is also high.



NUMBER SMASHER™

Triple your PC speed for only \$799!

8087 Upgrades™

MicroWay is the world leader in 8087 support. Our 8087 development software has been in use since 1982. By 1984 we had become Intel's 97th largest OEM account. When you buy from us, you can be confident that you will receive the 8087 chip designed for your PC and that our unique diagnostics will instantly verify that your processor works correctly as installed. Call for current prices.

287Turbo™

This card plugs into the 80287 socket on your AT or COMPAQ, doubling the 80287 clock from 4 to 8 Mhz. It does not change the 80286 clock speed or affect your warranty. The card comes with an 8 Mhz 80287 and has provisions for faster crystals as better 80287s become available. It also has a reset button and circuit that provide a hardware alternative to CNTRL-ALT-DEL. 287Turbo with Diagnostics and Reset **\$395**

Number Smasher™

Number Smasher gives you AT speed and 100% compatibility with all PC software and hardware. It comes with a 10 Mhz 8086 and 512K of no wait state RAM. Most are shipped with an optional matched 10 Mhz 8087 and 128K daughterboard. The card runs programs a factor of 2.5 to 4.0 faster than the PC, XT or compatibles it runs in. Other features include FASTROM, a Ram Disk, Print Spooler and Disk Cache. Revision 2 of the Smasher is designed and manufactured by MicroWay in the U.S.A. and has the best service and support of any accelerator card.

MegaPage™

MicroWay's "Lotus/Intel" extended memory card has all the features of the others plus one: it uses low power, cool running CMOS DRAM. Ask for our pamphlet "Extended vs Expanded Memory" and learn why MegaPage is the right card for you. MegaPage with 2 Megabytes CMOS **\$549**

**Micro
Way**

Inquiry 264

The World Leader in 8087 Support

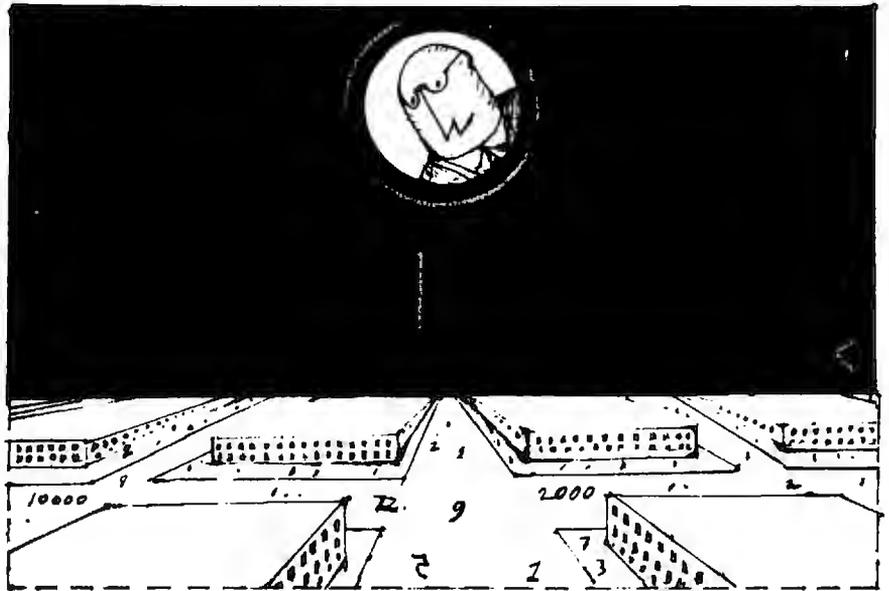
P.O. Box 79, Kingston, Mass. 02364 USA (617) 746-7341
Tempo House, London, U.K. call 01-223-7662

Number Smasher, MegaPage and 287Turbo are trademarks of MicroWay, Inc. MicroWay is a registered trademark of MicroWay, Inc.

The Smartwriter laser printer from QMS Inc. of Mobile, Alabama, has much the same general profile as others built on the Canon engine. Outside dimensions and the configuration of such things as interface connections for most of these units fall pretty much in the same places from vendor to vendor in spite of minor cosmetic differences. You wind up being in danger of thinking they're more alike than they really are.

The Smartwriter seems very capable in the preliminary look we've taken. Aside from a black streak down the long axis of the printed page that may be the result of a defective cartridge, the print quality has been up to usual laser-printer standards. The font selection is as broad as or broader than any we've seen so far. However, a lot of the type styles are actually duplicates. What I mean is, if you want a particular font to print across both the 8½-inch dimension and the 11-inch dimension of a regular letter-size page, you need a copy of that font for each direction.

We ran into problems getting the Smartwriter to change fonts and orientation in its Epson-emulation mode. It would print a status message saying that the font we wanted was installed and ready for use but would obstinately refuse to produce print in any style but the factory-set default font. A call to the company informed us that the printer changes fonts with a lot less trouble if you use its ANSI X3.64-emulation mode for the change-over. I don't think this is the way the machine was designed to operate, since there's no mention of it in the manual. It can cause a lot of frustration until somebody sets you straight, but it's really more of an annoyance than a fatal flaw since it seems fixable with a bare minimum of information.



The documentation is otherwise good. You get lots of step-by-step instructions on which buttons to push and what you're supposed to be seeing in the status window at just about every turn. Additionally, the documentation was complete enough to give me the proper RS-232C pin assignments when I had to make a serial interface cable.

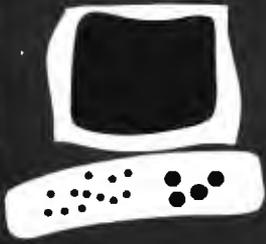
This printer and other representatives of the genre that we now have, or have on order, are going to bear close scrutiny in the months ahead.

Another relatively new arrival here is the Atari 520ST, and since a closer look (eventually a full review) is under development, I'm not going to anticipate the reviewer's comments to any significant degree. The almost total lack of applications software at this point is an obvious drawback, but we'll withhold judgment on that front until and unless Atari and the software developers start to show their wares. At the very least, however, putting almost completely naked hardware out in front of the public would seem to indicate that the company has a fairly high degree of faith in its users' curiosity and enthusiasm.

The GEM screen interface, graphics, and mouse are familiar elements to a fairly broad community by this time. The user interface seems to be through the mouse or the cursor-control keys. A good deal of thought seems to have gone into making the machine as fast as possible in responding to the user. You're not stuck in limbo while the machine grinds away, and you don't waste a great deal of time and energy in impatient fidgeting.

The keyboard has a full-feature design with cursor keys, numeric pad, and 10 function keys. Individual keys provide a greater-than-normal degree of resistance—requiring a harder-than-normal push for touch-typists. The external 3½-inch floppy-disk drive is quiet and, like the system itself, provides very fast response times. The 520ST lets you eject a disk at any point and has an ejection button on the front of the drive for that purpose. All in all, the 520ST has the look of a good machine. At the current low prices from both the manufacturer and the retailers, this computer could arouse significant interest at many levels.

—Glenn Hartwig, Technical Editor, Reviews



The Data General/One

A capable
11-pound
portable

BY WAYNE RASH JR.

The Data General/One is both more and less than what I expected it to be. On the one hand, I expected it to be a capable clone of the IBM Personal Computer. On the other hand, I expected it to fit into a briefcase, operate on batteries, and function in nearly any environment. When considered on its own terms, the DG/One is an excellent machine, but it is not and cannot be all things to all users.

The single greatest point of contention regarding the DG/One is the LCD (liquid-crystal display) screen that Data General chose for the machine (see photo 2). While some people will complain simply because it is not a CRT (cathode-ray tube) unit, the screen is often difficult, and occasionally impossible, to use. On the other hand, the screen has been improved several times now. If you take its limitations into account, you might come to think that it performs adequately.

Despite this computer's vast physical differences from the IBM PC, it's very compatible with it. There are areas where compatibility is out of the question, of course. You will never get IBM PC expansion boards to work inside a machine like this, simply because there isn't room. Likewise, the 3½-inch disk drives will not take a disk from an IBM PC. However, both of these capabilities are available with the DG/One's optional expansion chassis discussed later.

Software compatibility is nearly complete, at least for business programs. If you want to run 5¼-inch disks, you will need the optional external 5¼-inch disk drive. I had some problems running Ashton-Tate's Framework due to incompatibilities between keyboards. Microsoft's Flight Simulator seems to run, but the screen display is rather strange. The benchmarks show the DG/One to run a little more slowly than the IBM PC, but the differences are not very noticeable, except in the spreadsheet benchmarks (see the "At a Glance" pages). Loading the test file using the DG/One version of Multiplan took three

times as long as the same operation on the IBM PC.

HARDWARE

The computer measures 13½ by 11½ by 3 inches and should fit into a 4-inch thick briefcase with a little room to spare. The screen is built into the keyboard cover and will hold up to 80 columns by 24 lines of text.

You open the cover by pressing two latches at the front of the computer. When open, the cover reveals the keyboard, space for a function-key template, and the power switch. The screen itself is a frosty gray plastic that yields slightly to the touch. Even a light touch results in ripples of rainbow iridescence that follow your finger as it moves.

Although offered originally with a minimum of 128K bytes of RAM (random-access read/write memory), the DG/One now comes with 256K bytes of RAM as standard, expandable to 512K bytes.

The standard disk drives are double-sided quad-density 3½-inch units. Each one of these drives holds about 720K bytes of data, twice that of an IBM PC disk. Both drives are mounted on the right side of the machine.

You can get a DG/One with one or two drives. You can also add a third drive externally or in the expansion box. This external drive is a 5¼-inch unit, so you can transfer information to or from other computers. You should buy the dual-drive DG/One if at all possible. Backing up data on a single-drive system is inconvenient, especially when the drive holds 720K bytes. As of this writing, a hard disk is not available for the DG/One.

The rear of the machine has a cover that is hinged on the bottom of the computer and swings down to allow access to a pair of RS-232C serial ports, a modem connector, a pair of power connectors, and the connector for the expansion chassis. When the rear cover is opened, it locks into position

Wayne Rash Jr. is a member of the professional staff of American Management Systems (1777 North Kent St., Arlington, VA 22209). He consults with the federal government in areas concerning microcomputers.

to form a stand for the rear of the machine. This props up the computer in a correct typing position.

THE KEYBOARD

Frequently some compromises are made with portable computer keyboards, and the DG/One is no exception. In this case the keyboard is slightly smaller than that normally found on a desktop computer. The numeric keypad is superimposed on the keyboard itself, so some of the keys can have three functions. The keys are in their traditional locations, so touch-typists should be able to adjust. The smaller size takes some getting used to, however.

All of the special function keys from the IBM PC are present, although they appear along the top of the keyboard. Two keys not on the IBM keyboard are the Cmd key and the unlabeled key below it. Some programs, including Ashton-Tate's Framework, make use of these keys. In addition, pressing the Cmd key with the PgUp or PgDn keys adjusts the contrast of the screen.

Since the function keys are located at the top of the keyboard, the templates that accompany some IBM PC software will not work with the Data General machine. Someone anticipated this possibility, however, and special templates are available with software sold specifically for the DG/One. The templates are also designed so that you can pencil in your own information.

THE SCREEN

The LCD screen that allows the DG/One's great portability has also been its feature most complained about. Early models of this screen were difficult to use under the best of conditions. In less than the best of conditions, they were unusable. The screen has undergone several upgrades and now is vastly improved.

You can tilt the newer screen to achieve a comfortable viewing angle and to minimize reflections. A new matte surface also reduces reflections considerably. The

proper lighting is still important, however, and you may find circumstances where viewing is difficult. I found that a light suspended directly above the computer produced excellent results.

In normal use, the text on the screen appears as dark letters on a gray background, the opposite of usual displays. Generally, this makes no difference, but with some programs the results can be odd. Microsoft's Flight Simulator, for example, does not look good reversed.

Data General took the trouble to preserve the aspect ratio of the IBM PC's screen, so your programs will appear as you expect them to. You don't have to worry about egg-shaped pie charts when you run Lotus 1-2-3, for example.

(continued)



Photo 1: The Data General/One portable computer.

Early computers with LCD screens were plagued with slow response times. Often, the screen would lag behind the keyboard by a few characters. I did not notice this on the DG/One. The programs I tried seemed to work at normal speed.

USING THE DG/ONE

Once you get used to the placement of the keys and the disk drives, the DG/One operates like any other floppy-disk-based IBM PC-compatible. To start the system, you place a disk containing the operating system into the front disk drive and turn on the machine. Inserting the disk locks the drive closed automatically.

You have to wait for a few seconds while the machine runs the diagnostic routines in ROM (read-only memory), and then the operating system boots from the disk. If you don't have a disk in the drive, the machine runs programs stored in ROM, including a

communications package, a text editor, setup routines, and the diagnostics I mentioned earlier. You can use the text editor to create messages for the communications package. (Unfortunately, the ROM communications cannot send or receive disk files, so its communications capability is little more advanced than that of a simple dumb terminal program.)

Once the machine starts running the operating system, you're using a standard IBM PC-compatible computer running MS-DOS 2.11. You will probably notice the increased disk space when you look at your directory. The 720K-byte disks are a real benefit to the floppy-disk user. In some cases, programs that you might have had to run on a hard disk will run on floppy disks on the DG/One.

The 3½-inch disks are a real convenience, especially while traveling. You can put them into your shirt pocket, toss them into your briefcase, or stack

a bunch of them up and then put a big rubber band around them (try doing that with 5¼-inch floppy disks).

EXPANDING THE DG/ONE

You have two options for expanding the DG/One. You can buy an external disk drive, or you can buy the expansion chassis (see photo 3), which also contains a disk drive. You cannot use both of these items at the same time. Of the two, the expansion chassis is the more useful. According to Data General, this chassis allows you to use circuit cards designed for the IBM PC. This would enable you to operate a color monitor, for example, or add memory or communications ports.

Inside the chassis, expansion cards are attached to a backplane with five slots (see photo 4). To the right is the disk drive; the power supply is behind that. One of the expansion slots is already taken by the disk-drive controller, leaving you four.

I found it difficult to insert IBM-compatible expansion cards into the slots. I had to bend the board's bottom locating tab to the rear with a pair of pliers to make the board go into the slot. The tiny screws that hold the boards in place are inadequate for the job. It is nearly impossible not to strip their threads when securing a board in place.

COMPATIBILITY

When a computer is as different from the IBM PC as the DG/One is and it's advertised as IBM PC-compatible, you tend to question the level of compatibility. The DG/One is highly compatible, but it is not completely compatible. Most programs that do not depend on special features of the IBM's keyboard or that work directly with the communications ports will run. IBM PC communications programs, such as PC-Talk, will not run on the DG/One. It appears that Data General has used a serial communications chip different from the one used by IBM and most of the makers of compatible computers. The implications of this for the traveler are significant. You can use WordStar to create

(continued)

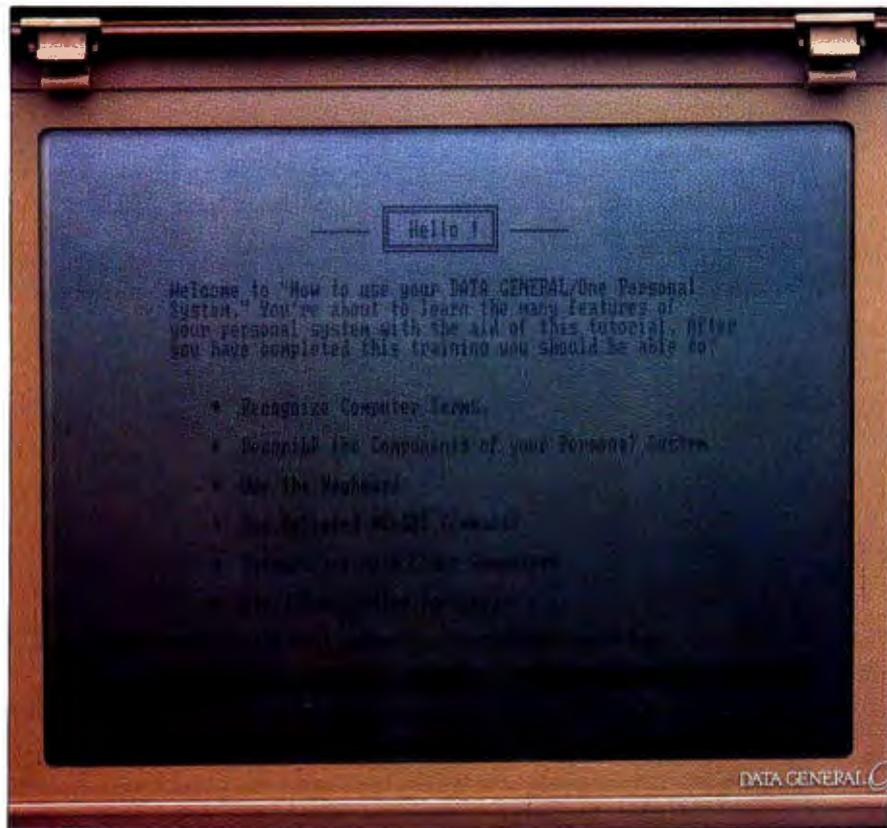


Photo 2: In spite of improvements, the Data General/One's LCD screen can be difficult to read in some settings.

AT A GLANCE

Name

Data General/One

Type

Portable computer

Manufacturer

Data General Corp.
4400 Computer Dr.
Westboro, MA 01580
(617) 366-8911

Size

13½ by 11½ by 3 inches;
11 pounds

Components

Processor: 80C88

Memory: 256K RAM

standard; expandable to 512K

Mass storage: One or two
720K double-sided quad-
density 3½-inch floppy-disk
drives

Display: 80 by 24; graphics
resolution of 320 by 200

Keyboard: Proprietary with
numeric keypad
superimposed

Communications

Two serial ports; built-in
modem optional

Software

MS-DOS 2.11

Options

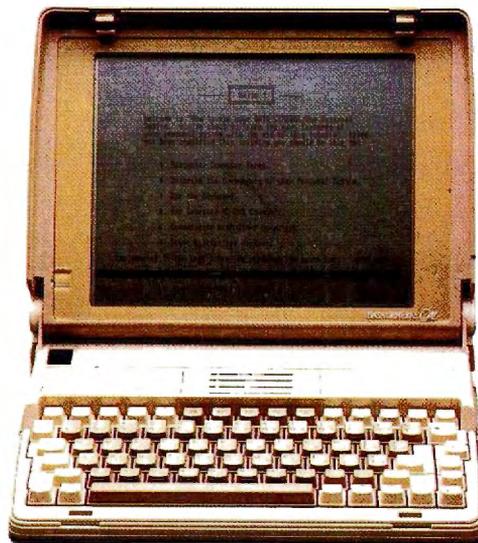
External 5¼-inch disk drive,
expansion chassis with disk
drive, built-in modem (300 or
1200 bps), battery, memory
expansion, carrying case,
thermal printer, GW-BASIC

Documentation

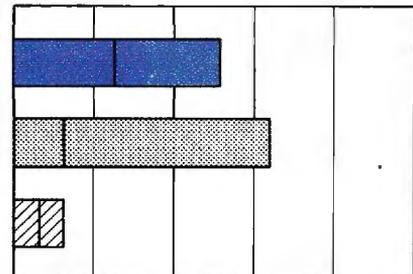
Owner's manual, pocket
reference guide

Price

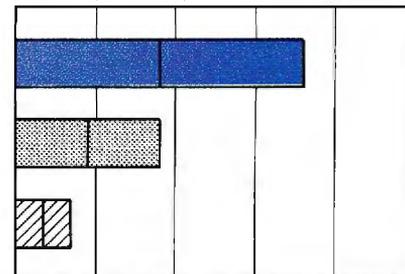
\$2995 (one drive)
\$3495 (two drives)



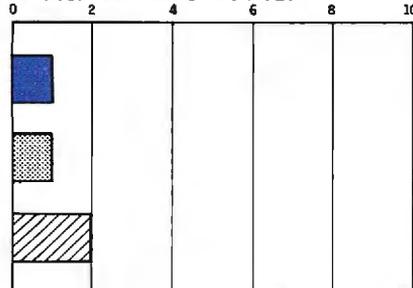
MEMORY SIZE (K BYTES)



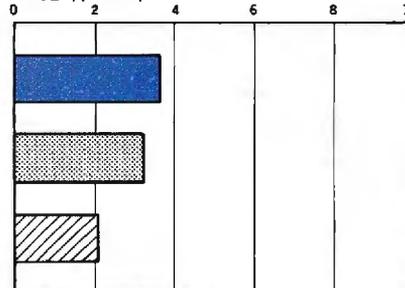
DISK STORAGE (K BYTES)



BUNDLED SOFTWARE PACKAGES



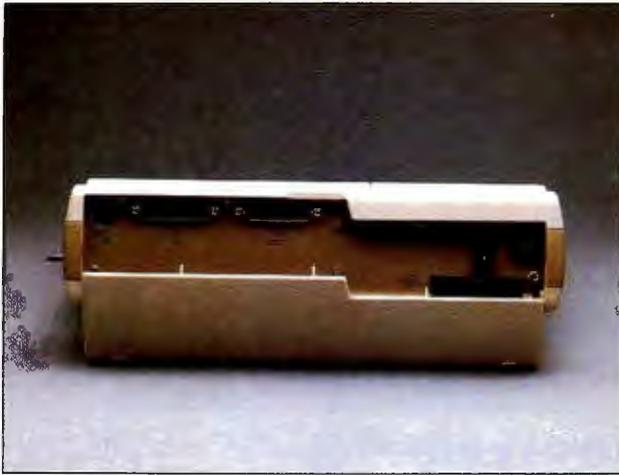
PRICE (\$1000)



■ DATA GENERAL/ONE ■ IBM PC ■ APPLE IIe

The Memory Size graph shows the standard and optional memory available for the three computers under comparison. The Disk Storage graph shows the highest capacity of one and two floppy-disk drives for each system. The Bundled Software Packages graph shows the number of software packages included with each system. The Price graph shows the list

price of each system with two high-capacity floppy-disk drives, a monochrome monitor, a printer port and a serial port, 256K bytes of memory (64K bytes for 8-bit systems), and the standard operating system and BASIC interpreter for each system. Note that the Data General/One's printer and communications ports are both serial ports.

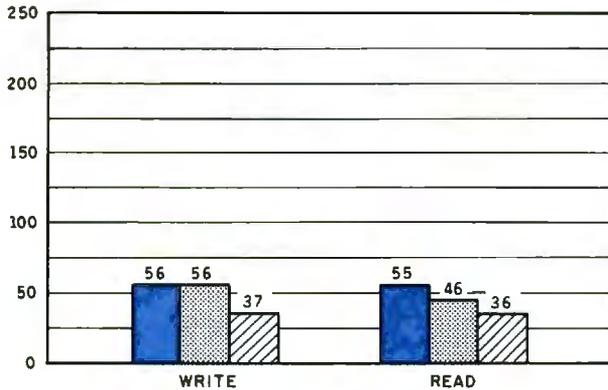


The rear of the DG/One contains the interface (right) for an optional 5 1/4-inch disk drive or expansion chassis.

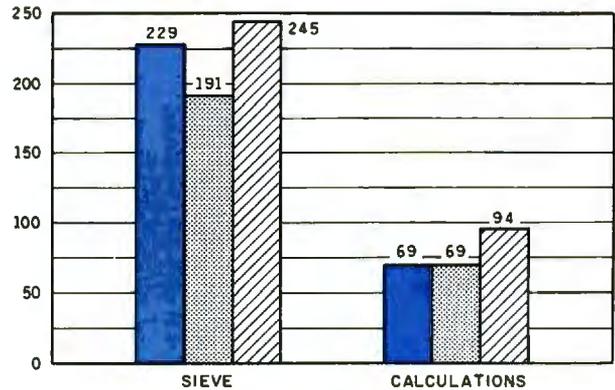


Removing the DG/One's keyboard reveals its drives and controllers (left) and memory-expansion box (top right).

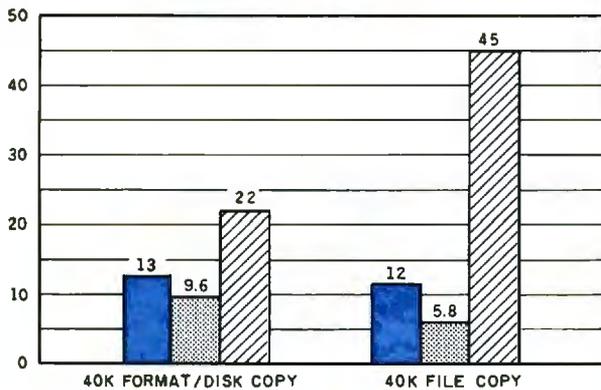
DISK ACCESS IN BASIC (SEC)



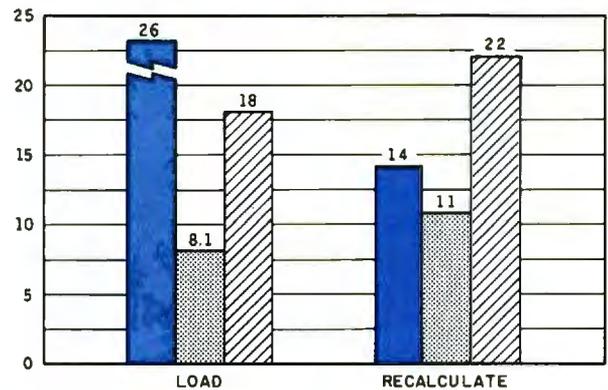
BASIC PERFORMANCE (SEC)



SYSTEM UTILITIES (SEC)



SPREADSHEET (SEC)



■ DATA GENERAL/ONE ■ IBM PC ▨ APPLE II E

The graph for Disk Access in BASIC shows how long it takes to write and to read a 64K-byte sequential text file to a blank floppy disk. (For the program listings, see the June 1984 issue of *BYTE*, page 327, and the October 1984 issue, page 33.) In the BASIC Performance graph, the Sieve results show how long it takes to run one iteration of the Sieve of Eratosthenes prime-number benchmark. In the same graph, the Calculations column shows how long it takes to do 10,000 multiplication and 10,000 division operations using single-precision numbers. The System Utilities graph shows how long

it takes to format and copy a disk (adjusted for 40K bytes of disk data) and to transfer a 40K-byte file using the system utilities. The Spreadsheet graph shows how long the computers take to load and recalculate a 25- by 25-cell Microsoft Multiplan spreadsheet where each cell equals 1.001 times the cell to its left. The tests for the Data General/One used MS-DOS 2.11 and GW-BASIC on 3 1/2-inch 720K-byte floppy-disk drives. The tests for the Apple IIe were done with ProDOS. The IBM Personal Computer was tested with PC-DOS 2.0 and BASICA.

files while you travel, but you will have no way to send them to your office unless you buy a disk-based communications package specifically for the DG/One.

This could also affect word processors or other programs if they access directly the serial ports. There is no parallel port on the DG/One, although I presume that you could add one to the expansion chassis.

Data General also made many compromises with the DG/One's keyboard. As a result, some programs that work directly with the PC keyboard will not operate properly on the DG/One. An example of this is the IBM PC version of Framework. If you want Framework to operate properly, you have to buy the Data General version from the company. I tried out this version of Framework and it performed as well as the IBM PC version.

Most other programs that I tried seemed to work properly, although you need to keep in mind problems with copy protection. The 5¼-inch expansion chassis and the external drive are not portable. Copy-protected software will have to remain at home while you travel, unless you buy it on 3½-inch disks. Since there is not a great deal of software available in this format yet, your choices can be quite narrow. Fortunately, some popular programs, such as MicroPro's WordStar, have avoided the scourge of copy protection.

Other than the problems I've mentioned, most business-oriented programs should run properly. The machine supports the same graphics as does the IBM. In addition, Microsoft's GW-BASIC is available for the DG/One. This should allow nearly any program written in BASIC for the IBM to run correctly.

SOFTWARE

At first glance, the DG/One's operating-system software looks like other IBM PC-compatible operating systems. It does have differences, however. For the most part, the differences reflect requirements of the machine that differ from those of the

(continued)

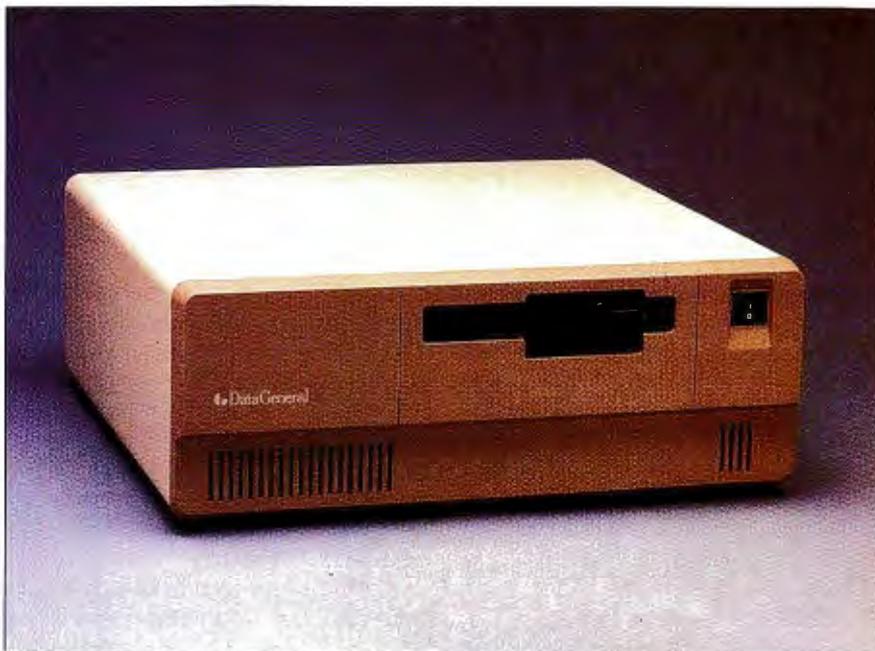


Photo 3: The Data General/One's optional expansion chassis, which includes a 5¼-inch floppy-disk drive.

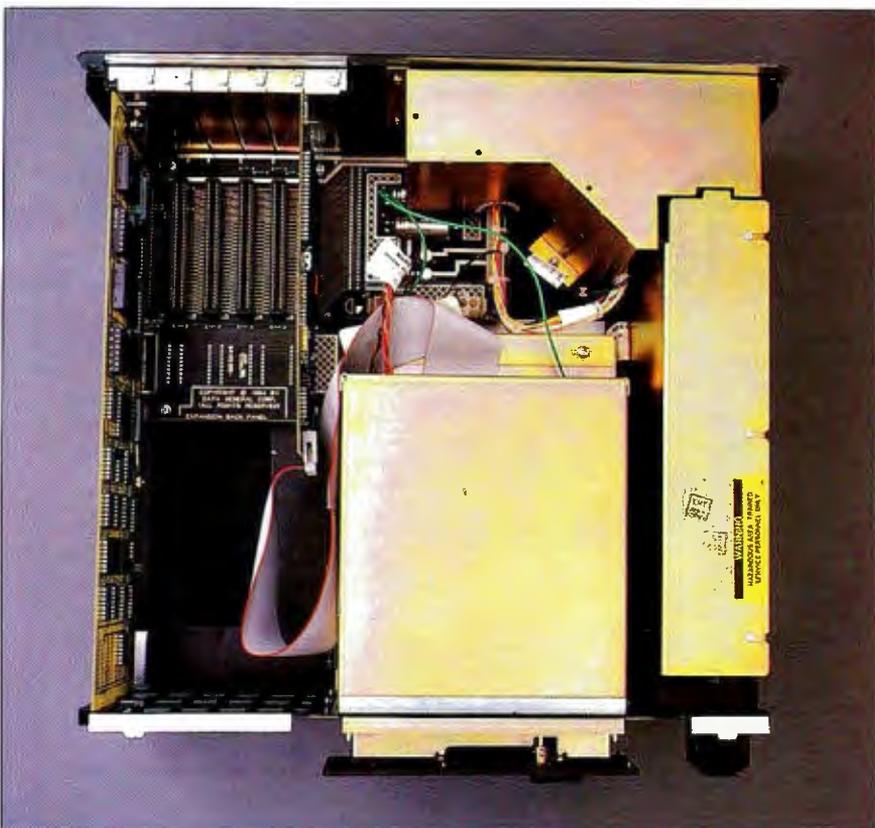


Photo 4: The expansion chassis has five slots, one of which is taken by the disk-drive controller.

IBM PC. The format command, for example, has provision for both 80-track and 40-track disks, but no provision for formatting a hard disk.

The system software also includes a RAM disk. This lets you assign a portion of memory as a virtual disk drive, which is especially useful if you have only one floppy-disk drive. You can accept the standard 180K-byte size of the disk, or you can specify some other size, depending on your needs and available memory. The virtual disk is loaded when the system boots. Since the memory has no battery backup, you need to make sure that you copy the contents of the virtual disk back to a real disk before you shut off the machine.

ACCESSORIES

Data General has a few items you can get with your DG/One that might make the machine more useful. You

can get it without these options, but in some cases you'd be making a mistake. The rechargeable battery is the most obvious of these items. This computer will operate for as long as eight hours on battery power.

The built-in modem could be almost as necessary had Data General made the communications ports IBM-compatible. As it is, the modem works well, and you now have a choice of 300 or 1200 bits per second internally. The modem is Hayes-compatible. If you want, you also can connect an external modem to one of the serial ports on the DG/One's back panel.

You can get a set of acoustic connectors for the modem. These connectors theoretically enable you to use communications in places where there are no modular connectors, such as in a hotel room. Unfortunately, I could not get the cups to work, despite repeated attempts and calls

to Data General.

You can use any serial printer with the DG/One. Of course, the size of most serial printers would seriously impair portability. For people who must print while traveling, Data General makes a thermal printer that is 12¼ by 4¼ by 3 inches—smaller than a box of tissues.

TRAVELING WITH THE DG/ONE

As a traveler's computer, the DG/One succeeds pretty well. It is small enough to carry on an airliner. I confirmed this by using a luggage gauge provided by Trans World Airlines, which showed it to be well within size limits. You may also be able to use it on the airplane, depending on which airline you choose.

You can put all of your accessories, some disks, and the manual in the DG/One's carrying case. This appears to be a sturdy case that will fit on nearly any conveyance. It should even fit under the window seats of a Boeing 727, usually a tight fit for luggage. There are two zipper compartments in the case. One compartment is fitted for the DG/One and the manual; the other holds the printer, some disks, the modem cups, and the power supplies. The case costs more than \$100, which is a little steep for cloth luggage; however, unless you have something better, you might as well get it if you plan much travel.

The ability to operate on battery power for several hours makes the DG/One a much more useful machine than many of its competitors. You do not have to search around for an electrical outlet. You can run the software that you are used to using instead of unfamiliar versions with reduced capabilities.

RELIABILITY AND SERVICE

At first, the DG/One worked well for me. Unfortunately, it stopped operating during the final days of this review. As I write this, I still don't know the reason for the failure, and it may not be an indication of the reliability of the DG/One.

The service policies of the company, *(continued)*

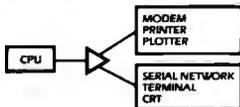
Get the Right Connection ... at Factory-Direct Prices!

Frustrated with plugging and unplugging cables and connectors? Select from our complete line of AB or X switches and let your computer system share data output between modems, printers, plotters, networks, disc drives, terminals, etc. at a touch of a button. You'll wonder how you ever got along without them!

Two typical examples are:

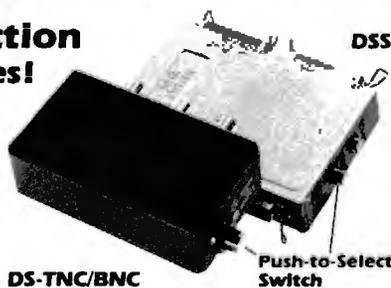
DSS (Serial) \$42.00 ea.

DSP (Parallel Version) \$49.00 ea.



RS232 applications where one computer can switch output between two serial devices. Commonly called an AB Switch.

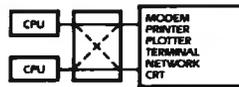
- DS-9 For MACINTOSH and others (Serial or Parallel) \$42.00 ea.
- DS-15 For Monitors and others (Serial or Parallel) \$42.00 ea.
- DSS-24 25-Pin Serial Switch \$55.00 ea.
- DS-TNC and BNC For WANG Coax (Serial) \$48.00 ea.
- DS-TNC or BNC Coax (Serial) \$42.00 ea.
- TWIN-AX For IBM 34, 36, 38 \$69.00 ea.
- DS-CAPS For IBM PC or any MS DOS System. Code-Activated/Self Powered/Software included. \$89.00 ea.



DS-TNC/BNC

XSP (Parallel) \$69.00 ea.

XSS (Serial Version) \$55.00 ea.



Commonly called an X Switch. Allows two computers to share parallel printers/plotters.

To get the RIGHT CONNECTION, call or write Via West today! We also offer a full line of cables and connectors. Custom orders are welcomed.

All units shipped freight collect. Add \$4.00/unit for postpaid delivery. Checks, VISA or MasterCard accepted. Quantity discounts available. AZ residents add 7%. Dealer inquiries invited.

VIA WEST, Inc.
"The Interface Company"

534 North Stone Ave. • Tucson, AZ 85705
(602) 623-5716
SEE US AT COMDEX BOOTH #4236.

IBM and IBM-PC — International Business Machines Corp. Macintosh — Apple Computer Inc. MS DOS — Microsoft Corp. Wang — Wang Laboratories Inc.

AMAZING DAISY

NOW! FULL FEATURE, 20 CPS, LETTER QUALITY AT ONLY \$374

If you have been searching for a letter quality printer you probably found the flood of claims and counterclaims were a real roadblock in your search. Not long ago, we were in the same position. We tried to determine which daisy wheel printer had all the features anyone could want, but would also appeal to the cost conscious buyer. Recently several manufacturers introduced printers that had features we were seeking. After a thorough assessment we eliminated all but one which precisely met our qualifications.

THE RESULTS ARE IN

We found the printer which has all the features anyone could want. We've named it the Arotek Daisy 1120, a real heavy-duty workhorse printing at 20 characters per second. The manufacturer is Olympic Co. Ltd., a highly respected Japanese firm.

FEATURES GALORE

This printer has it all. To start with, it has a front control panel with indicators for Pitch Selection which allows for 10, 12, or 15 characters per inch (CPI) or Proportional Spacing. There is a Select (Online) button (with indicator) and a Line Feed button. You can also set Top-of-Form or Form Feed with the touch of the TOF button. Other front panel indicators include Power and Alarm.

To load a sheet of paper, simply place it in the feed slot and pull the paper bail lever. The paper feeds automatically to a 1 inch top margin and the carriage aligns to the selected left margin. In this manner, each page can have identical margins.

You can continue to use your computer while the Daisy 1120 is printing.

The built in 2K buffer allows a page or two of concurrent printing and use of your computer for the next job. To really take advantage of your printer's optional features, the automatic Cut Sheet Feeder eliminates tiresome paper handling. Also available is the adjustable Tractor Feed option. *Compare our option prices!*

Best of all the Daisy 1120 is quiet: only 58 dB-A (compare with an average of 62-65 dB-A for others).

COMPLETE COMPATIBILITY

The Daisy 1120 uses Diablo® compatible printwheels. You can pop in a 10, 12, 15 pitch or proportional printwheel and use paper as wide as 14". At 15 CPI you can print 165 columns—a must for spreadsheet programs.

The Daisy 1120 uses the Diablo Hytype II® standard ribbon cartridges. Again universally available.

Not only is the hardware completely compatible, the control codes recognized by the Daisy 1120 are Diablo 630® compatible (industry standard). You can take advantage of all the great features of word processing packages and automatically use superscripts, subscripts, automatic underlining, bold-face (shadow printing) and doublestrike.

The printer has a set of rear switches which allow the use of standard ASCII as well as foreign character printwheels. Page length can be set to 8, 11, 12, or 15". The Daisy 1120 can also be switched to add automatic line feed if required.

THE BEST PART

When pricing a daisy wheel printer with all these features (if you could find

Inquiry 27 for End-Users.
Inquiry 28 for DEALERS ONLY.

one), you would expect to pay \$600 or \$700 dollars. The options would add much more, but our exhaustive research has paid off for you the computer user. We can now offer this printer for only \$374. Order yours today!

NO RISK OFFER

Try the Daisy 1120 for 2 weeks. If you are not satisfied for ANY reason we will refund the full price—promptly. A full 1-year parts and labor warranty is included. Another indication of quality and reliability.

THE BOTTOM LINE

Arotek Daisy 1120 (Order#1120) \$374 w/standard Centronics parallel interface, 2K buffer, ribbon and printwheel.

Options:

Auto Cut Sheet Feeder (#1110) \$199
Bidirectional Tractor Feed (#1112) \$84

Interfaces and Cables:

- 8' Shielded Cable for IBM PC® and compatibles (#1103) \$26
- Apple II, II+ & IIe (#1104) \$76
- Commodore (except Pet) (#1105) \$44

SEE YOUR LOCAL DEALER
OR ORDER TOLL FREE

(800) 962-5800 USA (8-5 PST)
(800) 962-3800 CALIF.

Or send payment to Arotek below:
Technical Information & Customer
Service: (805) 987-2454 (8-5 PST)

For Dealer locations in New England and
Upstate NY call: Computer Supplies, Ltd.
Boston (617) 254-0184

Shipping in cont. US is included. If you are in a hurry, UPS Blue (second day air) is \$20. Canada, Alaska, Mexico and Hawaii are \$25 (air). Other foreign is \$60 (air). California residents add 6% tax. VISA & MC welcome. We ship promptly on money orders, cashier's checks, and charge cards.

Allow 14-day clearing for checks. No C.O.D.'s. Payment in US dollars only.

©1985 AROTEK. All rights reserved.
Trademarks: Diablo, Hytype II,
630-Xerox Corp; Apple II, II+,
IIe-Apple Computer, Inc.;
IBM PC-IBM Corp.



**AROTEK**

1071-A Avenida Acaso, Camarillo, CA 93010

Instant-C™ **The Fastest** **Interpreter for C**

Runs your programs 50 to 500 times faster than any other C language interpreter.

Any C interpreter can save you compile and link time when developing your programs. But only *Instant-C* saves your time by running your program at compiled-code speed.

Fastest Development. A program that runs in one second when compiled with an optimizing compiler runs in two or three seconds with *Instant-C*. Other interpreters will run the same program in two minutes. Or even ten minutes. Don't trade slow compiling and linking for slow testing and debugging. *Only Instant-C will let you edit, test, and debug at the fastest possible speeds.*

Fastest Testing. *Instant-C* immediately executes any C expression, statement, or function call, and display the results. Learn C, or test your programs faster than ever before.

Fastest Debugging. *Instant-C* gives you the best source-level debugger for C. Single-step by source statement, or set any number of conditional break-points throughout your program. Errors always show the source statements involved. Once you find the problem, test the correction in seconds.

Fastest Programming. *Instant-C* can directly generate executable files, supports full K & R standard C, comes with complete library source, and works under PC-DOS, MS-DOS, or CP/M-86. *Instant-C gives you working, well-tested programs faster than any other programming tool.* Satisfaction guaranteed, or your money back in first 31 days. *Instant-C* is \$495.

Rational
Systems, Inc.

P.O. Box 480
Natick, MA 01760
(617) 653-6194

REVIEW: DATA GENERAL/ONE

*If your machine
fails, you have to
send it back to
Data General.*

however, do affect the owner of a DG/One, and they are disturbing. In short, if your machine fails, you have to send it back to Data General. As far as I was able to tell, there is no provision for local service. One Data General representative told me that if you needed your computer quickly, you could simply trade for another one; however, you still have to ship the faulty one back to DG in Massachusetts.

This means that if your computer breaks, you're probably going to be out of business for a while. Even if you get one-day turnaround from the factory and you use a 24-hour courier service to carry it both ways, you're going to be down for three days. If the computer happens to break at the end of the week or on the weekend, you can count on being without one for five days. In either case, you can expect to be out more than \$100 for shipping.

I should mention that the technicians who answered the phones at Data General tried to be helpful. They were certainly friendly, and they were concerned about the time I'd be without a machine. In spite of this, the only option for repair of a DG/One—until regional repair centers are established—seems to be sending it back to Data General.

DOCUMENTATION

The documentation is fairly limited, but what there is appears to be well done. Every DG/One comes with an owner's manual and a quick-reference guide. Both of these items are designed to fit into the carrying case with the computer.

The owner's manual, well written and well illustrated, describes completely the operation of the computer.

There are brief descriptions of the MS-DOS utilities, but little if any description of the internal workings of the computer. According to Data General, a complete guide to the operating system and an operating-system reference manual are available at extra cost. Also available at extra cost is a programmer's manual. None of these optional manuals were available for review.

Most users will find that the manual is sufficient, especially if they already have the MS-DOS reference books. I suspect that Data General felt that it would be pointless to ship a portable computer with enough documentation to reduce its portability. I still think that a more complete reference manual should be standard issue.

CONCLUSION

I really wanted to like the DG/One, but I found myself being slightly disappointed with it. The screen is a lot better than it was when it was introduced, and in some cases it's adequate, but it's still hard to read much of the time.

IBM PC compatibility just misses the mark, too. I realize that many compromises must be made in this sort of machine. These compromises reduce the level of compatibility. Whether or not the compromises made with the Data General/One are worth their cost depends very much on what you plan to do with the machine. The one compromise where the cost seems excessive is the change in the serial chip. This means that IBM PC communications software will not work with the DG/One. Since communications is an important function, especially the ability to send and receive disk files, you'll have to buy a package specifically for the DG/One.

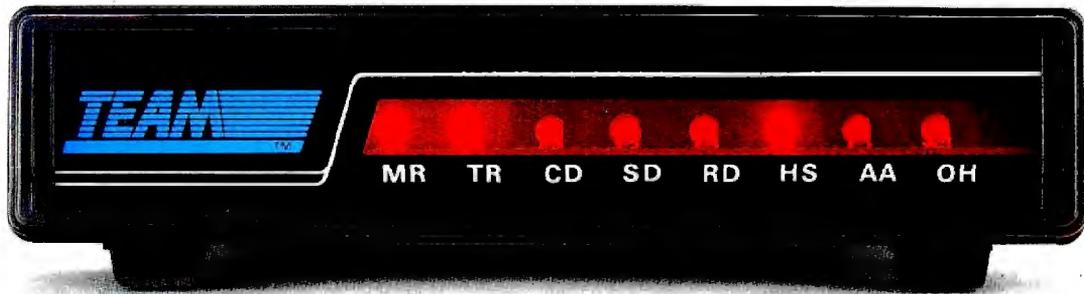
Finally, there's the cost. Configured like the unit I reviewed, the computer costs almost \$3700. That's a lot of money for a computer with only two floppy-disk drives.

In spite of its problems, the DG/One is a useful tool. Competitors on the horizon promise to be cheaper and better, but right now, this is the best choice I have seen for IBM compatibility in a laptop package. ■

Save at any speed

300/1200/2400

See the new 1986 model SmarTEAM 2400 at your dealer showroom today.
high performance — good looks — low sticker price
Special MITE+ software package optional



SmarTEAM 2400

- 0-300, 1200, 2400 bps. Bell 103, 212A. CCITT V22, V22 bis. Full duplex.
- Auto speed selection (among 0-300, 1200, 2400 bps), and auto fall-back.
- Auto dial, auto answer (tone and pulse), automatically switches between tone and pulse.
- Hayes 2400 commands compatible.
- Speaker with volume control.
- 8 status indicators.
- 6 self test modes.
- Call progress detection (ringing, dial tone, busy).
- MITE+ software optional.



\$599

SmarTEAM 2400B \$599

- Internal slot modem for IBM PC, XT, AT and compatible computers.
- 7.5 inches length with the same great features of SmarTEAM 2400.
- MITE+ software included.

SmarTEAM 1200B \$299

- Additional RS232C serial port plugs into IBM PC, XT, AT and all compatible.
- Auto speed selection (0-300 or 1200 bps)
- Auto dial, auto answer (tone or pulse)
- 0-300, 1200 bps. Bell 103, 212A
- Compatible with Hayes commands
- Speaker with volume control
- Self test and error free file transfer
- Powerful MITE Software included

SmarTEAM 103/202 \$249

- 0-300 bps full duplex, 600 bps, 1200 bps. half duplex
- Compatible with Bell 103, 202, CCITT V.21, V.23 includes 75 bps and 5 bps back channel.
- 10 switches, selectable for Bell or CCITT standard
- Auto dial, auto answer (tone or pulse)
- Auto line disconnected
- Compatible with Hayes commands
- Speaker with volume control
- Self test
- Call progress detection

SmarTEAM 103/212AT \$299

- Fully Hayes compatible support all 20 commands and 5 response. Option switches identical to Hayes.
- Auto dial, auto answer (tone or pulse), auto redial between two phone numbers.
- 2 self test modes (analog loop back and remote digital loop back test).
- Automatically switches between tone and pulse.
- Call progress detection (ringing, dial tone, busy).
- Auto speed selection (0-300, 1200 bps).
- 0-300, 1200 bps. Bell 103, 212A standard.
- 8 status indicators

OEM designs:

Send us your specifications. We will deliver a prototype in 30 days.



HEAD OFFICE:
TEAM TECHNOLOGY INC.
10F, 270, NANKING E. RD., SEC. 3, TAIPEI,
TAIWAN, R.O.C.
TLX: 19725 PETRCHEN ATTN TEAM
TEL: (02)7414270, FAX: (02) 771-2985

U.S.A.
**MORRISON & DEMPSEY
COMMUNICATIONS**
19209 Parthenia, Suite D, Northridge CA 91324
U.S.A.
TEL: (818)993-0195 ~ 97
TLX: 325524 MODEM NTGE

CANADA
BUDGETRON INC.
1320 Shawson Drive, Unit 1
Mississauga, Ontario
Canada L4W 1C3
TEL: (416)6737800
TLX: 06-968080

- ★ Hayes is a registered trademark of Hayes Microcomputer Products, Inc.
- ★ IBM PC, XT, AT are registered trademarks of International Business Machines Corp.
- ★ MITE is a registered trademark of MYGROFT LABS INC.

See us at
COMDEX/Fall '85
November 20-24, 1985
Riviera Hotel
Las Vegas, Nevada
Booth R-8135

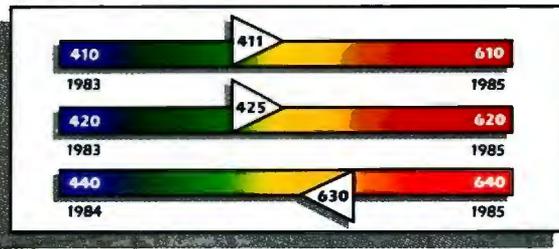
Inquiry 362

TAXAN 600 SERIES

Taxan 600 Series Monitors...

A Newly Developed, Scientifically Coated Super-High Contrast Tube Assures Maximum Brightness And Clarity.

TAXAN EVOLUTION

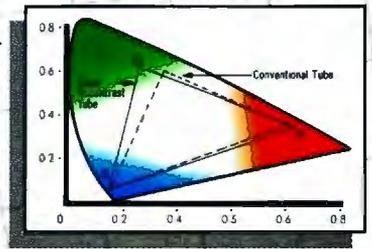


► The Evolution of a Higher Industry Standard!

Only Taxan offers a technologically advanced tube whose special coating increases color clarity by 15-20% more than any other monitor.

Taxan's new monitor series absorbs color impurities generated by the RGB wavelength, and eliminates them.

RGB WAVELENGTH



NEW 600 SERIES OFFERS SPECIAL CAPABILITIES! Multi Text Switching

- 610 & 620: Green, Amber, Reverse B&W, Reverse Green
- 630 & 640: Green, Amber, Reverse B&W, White on Blue Background.
- 610 & 620: 100% IBM Compatible
- 630 & 640: UPGRADE RESOLUTION for IBM
- 610 & 620: SPECIAL NON-GLARE DM COATING
- 630 & 640: FREE NON-GLARE POLARIZATION FILTER
- WIDE VARIETY OF USER FRIENDLY CONTROL ADJUSTMENTS
- OPTIONAL TILT-SWIVEL BASE AVAILABLE

610

Best Educational Choice!

Taxan goes to the head of the class, with this 100% compatible IBM®/Apple® medium resolution monitor. 510(H) x 200(V) Resolution - 0.47mm Slit Pitch 15.75Khz Scan Frequency \$465.00 Suggested Retail

620

Greater Versatility and Performance than the IBM Display—All at a \$100.00 Savings!

The new Taxan 620 High Resolution monitor is 100% compatible with IBM and Apple computers. It's the perfect monitor for all standard business applications!

640(H) x 200(V) Resolution - 0.37mm Dot Pitch 15.75Khz Scan Frequency \$580.00 Suggested Retail

FREE

Free Tilt Swivel Base With Purchase of New 600 Series!

\$50 VALUE



To help celebrate the excitement of the Taxan 600 Series, we are giving away a free tilt swivel base with a built in LCD Day/Date Clock, valued at \$50.00 retail.

Send your original sales receipt along with a check for \$10.00 for postage and handling to:

► **"600 SERIES SWIVEL OFFER"**
c/o Taxan Corporation, 18005 Cortney Court
City of Industry, CA 91748.

LIMITED OFFER. WHILE SUPPLIES LAST. LIMIT ONE PER CUSTOMER.

TAXAN 600 SERIES

Industry Standards Upgraded!

The Models 630 And 640 Create New Dynamic Standards In Text And Graphics Resolution!

A perfect upgrade/replacement for the standard IBM color graphics monitor and card, the Taxan model 630 and 555[®] create a higher resolution at a greater savings!

	
IBM Display	TAXAN 630
IBM CGA	TAXAN 555
Color Adaptor	SCG Board
\$924.00	\$890.00
PRICE/PERFORMANCE RATIO	

IBM	TAXAN
	
Screen Test —This actual unretouched photograph demonstrates the superior text resolution created by the TAXAN 630 monitor and 555 color card! For maximum resolution and ease of viewing, Taxan's the winner!	

630 Super High Resolution Text and Graphics.

Superior Text and Graphics Beyond IBM.

640(H) x 200(V) Resolution
(640(H) x 400(V) Non-Interlaced Resolution available!)

0.37mm Dot Pitch
24.75Khz Scan Frequency
100% compatible with IBM PC, XT, and AT[®] when used with the Taxan 555 board.
\$645.00 Suggested Retail



555

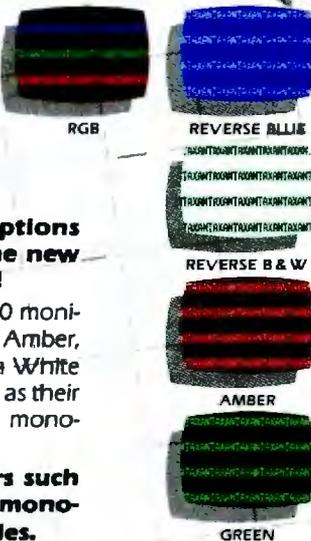


The Taxan 555 is basically equivalent to the IBM standard color board. This means that the 555 is 100% compatible with all IBM software!

COMPATIBILITY	IBM	TAXAN
Text Mode	16 Colors	16 Colors
320 X 200	4 Colors	4 Colors
640 X 200	1 Color	1 Color
Alphanumeric Text Resolution		
Character Set	8 X 8	10 X 16
Scan Frequency	15.75 KHz	24.75 KHz

► Compatible with AT&T 6300 Computer

RGB Color, and FOUR Monochrome Capabilities In One Monitor!



► No one else offers the monochrome options available with the new Taxan 600 series!

The Taxan 630 & 640 monitors offer Green, Amber, B&W Reverse, and a White on Blue Background as their total spectrum of monochrome options.

Only Taxan offers such a wide variety of monochrome capabilities.

Total CAD/CAM Compatibility 720 x 400 Resolution!

640

The Taxan 640 The Ultimate in Monitor Resolution.

640(H) x 400(V)
Non-Interlaced Resolution

4,000 Character Display Capability
0.31mm Dot Pitch
24.75Khz Scan Frequency



► Compatible with AT&T 6300 Computer

100% Compatible with the new generation of graphics boards Taxan (555), Persyst B.O.B.[®], Sigma 400[®],

Artist II[®], STB 400[®] and others for the IBM PC, XT, and AT.
\$745.00 Suggested Retail

SEE US AT COMDEX BOOTHS 116 & 120

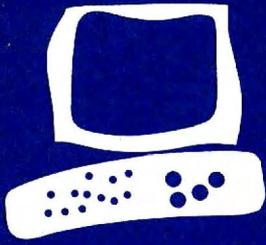


TAXAN CORPORATION

18005 CORTNEY CT., P.O. BOX 8698, CITY OF INDUSTRY, CA 91748

(818) 810-1291 ©1985 Taxan Corporation Inquiry 408 for End-Users. Inquiry 409 for DEALERS ONLY.

*IBM, IBM PC, XT and AT are registered trademarks of International Business Machines Corp., *APPLE is a registered trademark of Apple Computers Inc., *TAXAN 555 is a registered trademark of Taxan Corp., *PERSYST B.O.B. is a registered trademark of Emulex Corp., *SIGMA 400 is a registered trademark of Sigma Designs, *ARTIST II is a registered trademark of Control Systems, *STB 400 is a registered trademark of STB Systems, Inc.



S·Y·S·T·E·M R·E·V·I·E·W

Sanyo MBC-775

A portable
IBM
PC-compatible
with built-in
color monitor

BY BRUCE ROBERTS

Sanyo has probably carved out a larger piece of the American micro-computer pie than any other Japanese manufacturer. With the introduction of the Sanyo MBC-775 portable color computer (see photo 1), the company is tipping its hand as to the future direction of its computer products—full IBM PC compatibility, speed, low cost, bundled software, and color displays.

The MBC-775 is Sanyo's first transportable computer and appears quite compatible with the IBM PC. The portability of this system might be an issue, since it weighs close to 40 pounds.

Only one configuration is offered as compared to the many versions of Sanyo's MBC-550/555. The MBC-775 hardware includes two 360K-byte disk drives, 256K bytes of RAM (random-access read/write memory), a built-in 9-inch color monitor, and a detached keyboard (see photo 2). The system unit contains two IBM expansion slots and a parallel printer port.

The package price of \$2599 includes MS-DOS 2.11, GW-BASIC 2.02, EasyWriter II, EasyMailer II, EasyPlanner, and EasyFiler.

DISPLAY

The first striking difference between the Sanyo MBC-775 and other IBM PC-compatibles is the built-in color screen. You might think of this Sanyo as an IBM Portable PC with a color screen rather than the familiar monochrome display. They are similar except for the Sanyo's color display, faster processor, and lower price. Both have a color graphics adapter, 256K bytes of RAM, two half-height 360K-byte disk drives, and about the same number of expansion slots and peripheral connectors.

I like the positioning of the MBC-775's screen better, since it is centered above the keyboard instead of positioned on the extreme left of the computer. The 9-inch screen is quite legible, but remember that color displays usually aren't as crisp as monochrome displays and most software

does not make outstanding use of color displays.

I wouldn't recommend this color screen for full-time word processing because the characters are noticeably fuzzy and the screen is small. Although the Apple Macintosh has the same size screen, its higher resolution prevents eyestrain so you aren't distracted by the screen's size.

The Sanyo MBC-775 also suffers from a common portable computer ailment. If you set the unit on a desktop, the screen is much lower than your eyes so you tend to hunch over the keyboard and look down. You must reposition the computer to comfortably read the screen.

GRAPHICS CAPABILITY

Don't expect to have all 16 colors available at any time. Only the text modes let you display 16 colors. With medium-resolution graphics you get 200 rows of 320 pixels each in 4 possible colors. But those 4 colors include 1 that can be any of the 16 colors, plus either of two 3-color palettes, cyan/magenta/white or green/red/brown. This is why IBM's and Sanyo's BASIC demonstration programs tend to display these colors (see photo 3).

The 640- by 200-pixel high-resolution graphics mode is available only in black and white. Don't thank Sanyo; IBM is responsible for this design.

Sanyo says it has a 32K-byte video RAM, twice the 16K-byte memory of the IBM Color Graphics Adapter, but instructions on how to use it or the 6845 CRT (cathode-ray tube) controller chip were not included.

At the rear of the machine are three doors that pop open or close when you push on them. A DB-9 connector for an external RGB (red-green-blue) monitor and an RCA jack for a composite video monitor are provided behind the middle door, along with the horizontal- and vertical-hold controls.

Behind the right door (viewed from the rear) is the power-cord socket and the fuse. The power cord can be folded up into the

Bruce Roberts is a computer consultant who was formerly a technical editor for BYTE magazine. He can be reached at 84 Redfern Dr., Rochester, NY 14620.

recess behind that door. The other standard external connector (behind the left door) is the DB-25 connector for the parallel printer port. This is also where you find the connectors for the expansion boards.

You adjust the screen brightness with a slide control on the front of the machine. The power switch is conveniently located on the front panel and it's designed so you can't accidentally bump it.

The MBC-775 has retained IBM PC similarity to the point where the display flickers when you scroll, a common complaint due to the design of the IBM PC's color-display adapter. The glare from the screen can be overwhelming since the screen is not etched or treated to reduce reflections (I found myself darkening the room to read the screen easily).

The color-graphics capability of the MBC-775 is not immediately evident. When you first boot up the system there is no indication that the screen can display anything other than white characters on a black background.

The one BASIC demonstration program on the system disk only hints at the system's color capabilities and does not provide an introduction to the machine. It displays the Sanyo logo and the computer's name on a colored background then gives a few simple examples of characters, boxes, and line drawings in random colors. And Sanyo's minimal documentation contains no references to the demonstration program.

KEYBOARD

The keyboard layout mimics that of the IBM PC except for a few enhancements. All 10 function keys are there and the shift keys are still farther out to the sides than most touch-typists would like. The enhancements include LEDs (light-emitting diodes) in the Num Lock and Caps Lock keys. You will also find a second return key on the cursor/numeric keypad to make numeric data entry easier.

The keyboard is acceptable although the

keys don't have high tactile resistance. The speaker produces an audible click each time you press a key. No option exists to turn off the sound.

Since the detached keyboard plugs into the front of the computer, you can use the entire length of the cord and not have to unplug it when you pack up the computer for travel. The legs that prop up the back of the keyboard also latch the keyboard closed against the computer (this mechanism doesn't feel sturdy).

PROCESSOR

The Sanyo MBC-775 uses an 8-MHz 8088-2 processor chip that runs at nearly twice the speed of the IBM PC's 4.77-MHz 8088 chip. Many of the newer IBM PC-compatible systems use this faster chip and allow you the option of the standard 4.77-MHz rate for more compatibility.

In the processor-intensive benchmarks such as the Sieve of Eratosthenes prime-number generator, the numeric calculations,

(continued)



Photo 1: The Sanyo MBC-775 with built-in color monitor, keyboard, and two floppy-disk drives.

and the spreadsheet recalculation, the Sanyo's speed advantage is clearly demonstrated. The MBC-775 runs almost twice as fast as the IBM PC on most of the benchmarks in the "At a Glance" section.

The system boots up quickly because it has no memory test. At least none is apparent on the screen or mentioned in the documentation.

The Sanyo MBC-775 uses a separate processor board that is plugged into a small motherboard. The processor

board contains 256K bytes of RAM, the 8K-byte ROM (read-only memory), and the parallel port circuitry (the video and disk-drive controllers are on the motherboard).

The 8-MHz 8088-2 processor requires faster memory than the IBM PC, so if you upgrade the memory from the standard 256K bytes to the 640K bytes possible under MS-DOS, remember that Sanyo recommends 120-nanosecond chips in your add-on memory boards. RAM does not use

a parity bit as the IBM PC does, so fewer memory chips are needed (eight instead of nine for 64K bytes). Note that you add all extra memory with third-party multifunction boards.

For faster number processing (if your software recognizes the presence of an 8087), you can add the 8087-2 numeric processing chip, which also runs at 8 MHz.

EXPANSION

You can open the top of the MBC-775 to get to the card cage by removing two screws inside the doors on the back. The top then hinges forward and lifts off. Loosen the eight screws on the metal card-cage cover and it will slide off. The speaker mounted in the cover will still be attached to the processor board and can be unplugged (the disk-drive assembly can also be easily removed at this point).

There are three slots on the motherboard but the processor board occupies one, so only two are left for expansion. These are full-length expansion slots, so you should be able to add just about any board you want.

Probably one of the first things you'll want to add to this system is a multifunction board with more memory and a serial port. The machine has a space on the processor board below the parallel port that looks like it should have had a serial connector, but none is provided.

The Centronics-type parallel port is configured just like that of the IBM PC, so you can use IBM-compatible cables.

The Sanyo has one annoying quirk: If you don't turn the parallel printer on before turning on the computer, the computer won't recognize the printer.

DISK DRIVES

I took some time getting used to the floppy-disk drives in the MBC-775 as they are recessed into the faceplate of the computer and have a squeeze-type latch for opening and closing the drive. You have to push your floppy disks into the bottom of the recess and squeeze the latch closed over

(continued)



Photo 2: The keyboard of the Sanyo MBC-775. Note the LEDs in the Caps Lock and Num Lock keys and the second return key below and to the right of the numeric keypad.



Photo 3: Sanyo MBC-775 color display of a world map using magenta and white on a black background.

AT A GLANCE

Name

Sanyo MBC-775

Manufacturer

Sanyo Business Systems Corp.
Computer Division
51 Joseph St.
Moonachie, NJ 07074
(201) 440-9300

Size

System unit: 20½ by 16¼ by 8½ inches
Keyboard: 19½ by 7¼ by 1¾ inches
Weight: 39 pounds and 13½ ounces

Components

Processor: 16-/8-bit 8088 at 8 MHz

Memory: 256K bytes expandable to 640K bytes

Display: 9-inch color monitor, 80 columns by 25 rows; 4-color 320- by 200-pixel medium-resolution graphics; 640- by 200-pixel high-resolution graphics in black and white only

Keyboard: Detached 84-key, IBM-style QWERTY with 10 function keys and numeric/cursor keypad; LED indicators in Caps Lock and Num Lock

Mass Storage: Two 360K-byte 5¼-inch floppy disks

Expansion: Two IBM PC-compatible slots

I/O interfaces: Parallel printer port, composite video, and RGB

Software

MS-DOS 2.11, GW-BASIC 2.02, EasyWriter II, EasyMailer II, EasyFiler, EasyPlanner

Options

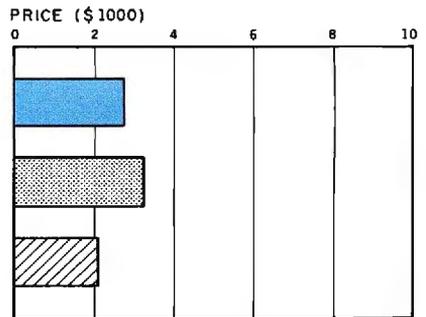
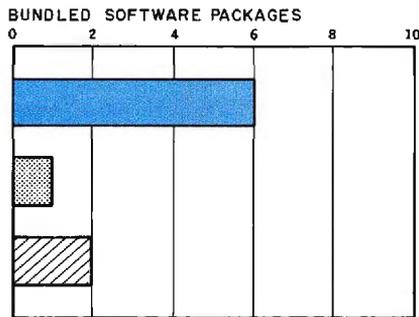
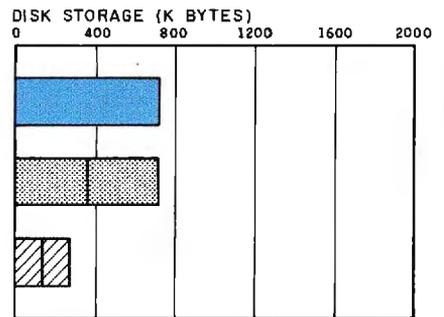
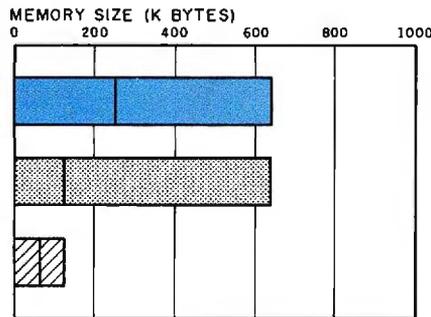
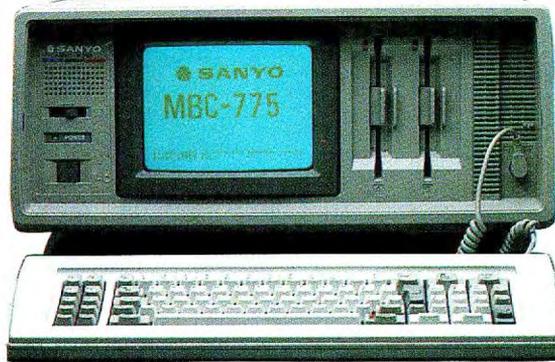
8087-2 (8-MHz) math coprocessor

Documentation

209-page operator's guide, 262-page EasyWriter/EasyMailer manual, 432-page EasyFiler manual, 223-page EasyPlanner manual

Price

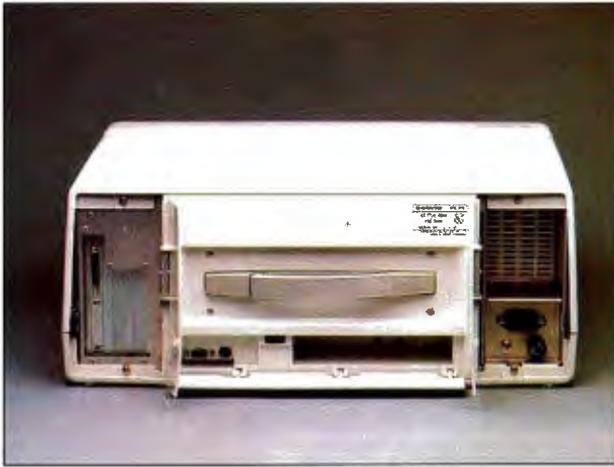
\$2599



■ SANYO MBC-775 ■ IBM PC ■ APPLE II E

The Memory Size graph shows the standard and optional memory available for the three computers under comparison. The Disk Storage graph shows the capacity of the MBC-775 in comparison with each of the other computers. Note that the MBC-775 does not have a single-disk option. The Bundled Software Packages graph shows the number of software packages included with each system.

The Price graph shows the list price of each system with two high-capacity floppy-disk drives, a printer port and a serial port, 256K bytes of memory (64K bytes for 8-bit systems), and a monochrome monitor (the MBC-775 is color only; no optional monochrome monitor is available). Prices include the standard operating system and BASIC interpreter for each system.

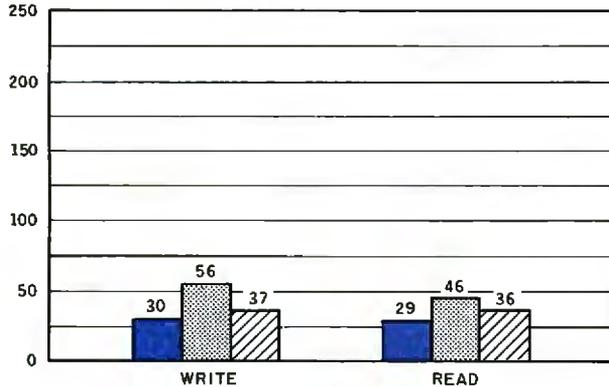


The rear of the Sanyo MBC-775 portable computer with its three doors open.

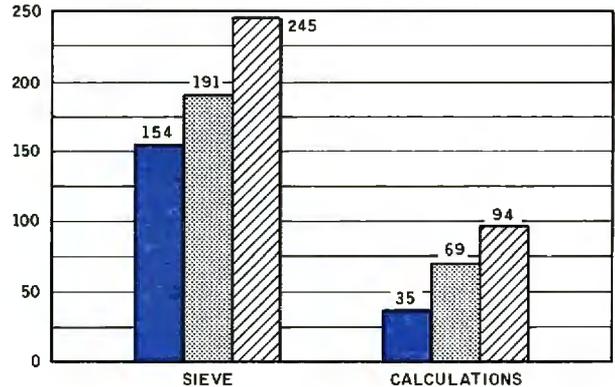


The inside of the Sanyo MBC-775. From left to right are the processor board and two expansion slots, disk drives, color monitor, and power supply.

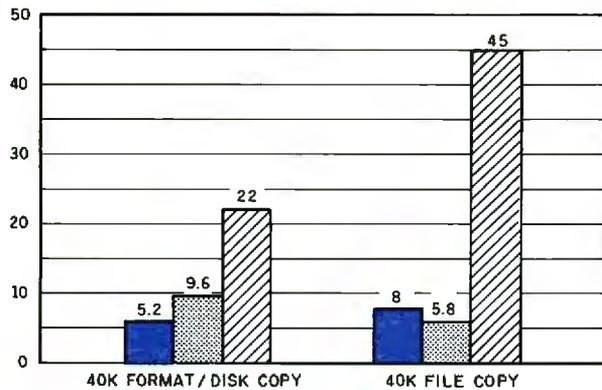
DISK ACCESS IN BASIC (SEC)



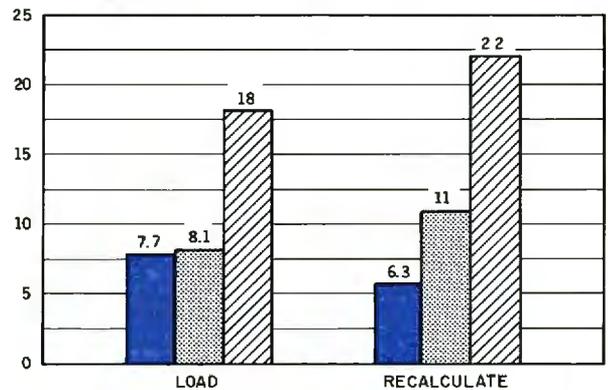
BASIC PERFORMANCE (SEC)



SYSTEM UTILITIES (SEC)



SPREADSHEET (SEC)



■ SANYO MBC-775 ▨ IBM PC ▩ APPLE II E

The graph for Disk Access in BASIC shows how long it takes to write and to read a 64K-byte sequential text file to a blank floppy disk. (For the program listings, see June 1984 BYTE, page 327, and October 1984, page 33.) In the BASIC Performance graph, the Sieve results show how long it takes to run one iteration of the Sieve of Eratosthenes prime-number benchmark. The Calculations column shows how long it takes to do 10,000 multiplication and 10,000 division operations using single-precision numbers. The System Utilities

graph shows how long it takes to format and copy a disk (adjusted for 40K bytes of disk data) and to transfer a 40K-byte file using the system utilities. The Spreadsheet graph shows how long it takes to load and recalculate a 25- by 25-cell Microsoft Multiplan spreadsheet where each cell equals 1.001 times the cell to its left. The tests for the MBC-775 used MS-DOS 2.11 and GW-BASIC 2.02. The tests for the Apple IIe were done with ProDOS. The IBM PC was tested with PC-DOS 2.0 and BASICA.

REVIEW: MBC-775

them. If you don't push your disk in far enough it will pop back out at you (at least you know the disk is seated properly before you can close the drive).

To open the drive, squeeze the latch again and the disk will pop out. It's a similar mechanism to some of the old 8-inch floppy-disk drives.

The drives are very quiet; you can't hear them over the cooling fan. I wish the fan were as quiet. It produces a loud humming noise that overshadows many of the machine's nicer features. I was tempted to disconnect the fan or try to replace it with a quieter one.

The MBC-775 has no room to install an internal hard-disk drive and Sanyo doesn't offer one. You can add external hard-disk drives by installing the hard-disk controller in one of the two expansion slots. [Editor's note: Sanyo says that an enhanced version of the MBC-775 will be available in the near future. Enhancements will include a speed-select switch to change the clock from 8 MHz to 4.77 MHz for increased IBM compatibility (communications programs are particularly speed-sensitive) and an optional internal 10-megabyte hard disk.]

SOFTWARE

Sanyo has included several software packages in the price of the computer, so you can start using it immediately without purchasing additional programs.

The software supplied includes the MS-DOS 2.11 operating system, the GW-BASIC 2.02 computer language, the EasyWriter II word-processing program with its companion EasyMailer II mail-merge program, the EasyFiler database, and the EasyPlanner spreadsheet program. Sanyo supplied WordStar and its affiliated programs with the MBC-550 dual-disk series machines and says this option will be available for the MBC-775 instead of the Easy packages, due to customer demand.

MS-DOS 2.11 is similar to IBM's PC-DOS 2.1. You can even boot up PC-DOS, but don't expect to run IBM PC BASIC; it requires the IBM PC BIOS (basic input/output system) in ROM in

order to function.

Microsoft's GW-BASIC does an excellent job of replacing IBM PC BASIC and runs IBM's demonstration programs (complete with sound and color) and other common IBM PC BASIC programs. GW-BASIC supports both disk drives (unlike the old Sanyo BASIC) but doesn't have Sanyo BASIC's SYMBOL, WINDOW, and VIEW extended graphics commands.

The Sanyo MBC-775 exhibits a high degree of compatibility with the IBM PC. Many popular programs for the IBM PC (Lotus 1-2-3, Symphony, dBASE III, Framework, SideKick, Flight Simulator) work fine. However, programs written specifically for the IBM monochrome adapter card and copy-protected software that relies on the IBM PC's processor or disk-drive speed will cause problems.

Maybe I'm too accustomed to other word-processing programs, but I found EasyWriter II awkward and not intuitively useful. The variety of modes (character, word, line, sentence, paragraph, block, and page) became overkill. You have to constantly switch between them and each responds differently.

I found myself using far more keystrokes to accomplish functions than I am accustomed to. The help facility is limited and usually didn't clarify problems; you end up going back to the manual for more information.

EasyWriter also has a file-folder/document/page approach that sounds nice for short letters but suffers when you deal with longer manuscripts. I found it especially annoying that EasyWriter does not list the available file folders it uses on the disk. Except for the default file folder you don't know what's on the disk and can't know unless you exit EasyWriter and get a directory. However, once you open a file folder, all its documents are displayed and you can select them easily.

EasyWriter's file folders are fixed-length random-access files that have a default size of about 20K bytes and use special coding so you can't type the DOS files out on the screen. The

(continued)

The FORTH Source™

The computer
language for
increased...

EFFICIENCY

reduced.....

MEMORY

higher.....

SPEED

Send for your
**FREE
CATALOG**

Largest selection
of FORTH...

Books

Manuals

Source Listings

Software

*Development
Systems*

Expert Systems

Circle reader service
number or write:

**MOUNTAIN VIEW
PRESS**

PO BOX 4656
Mountain View, CA 94040
(415) 961-4103

REVISED 2nd EDITION
THE MANUAL™
 ONLY \$14.95 EACH

THE MANUAL COVERS ALL THE PROGRAM'S COMMANDS, AND FUNCTIONS, AND FEATURES IN ALPHABETICAL ORDER.

LOTUS 1-2-3 • SYMPHONY
 FRAME WORK • dBASE II
 MULTIPLAN • WORDSTAR
 APPLE WORKS • JAZZ
 dBASE III • EXCEL

ALSO AVAILABLE FROM BOOKS

FROM \$14.95
 A SERIES OF HOW TO BOOKS FOR BUSINESS APPLICATIONS

LOTUS 1-2-3* • SYMPHONY*
 FRAME WORK • MULTIPLAN*
 WORD* • APPLE WORKS*
 CONSTRUCTION MANAGEMENT*
 FINANCIAL CALCULATIONS*
 SMART SOFTWARE
 *ALSO AVAILABLE BOOK WITH DISKETTE.

CALL TOLL FREE
1-800-MANUALS
 MIS • 1107 NW 14th • Portland, Oregon 97209
 Telephone (503) 222-2399

REVIEW: MBC-775

Sanyo has made some trade-offs on the MBC-775.

program doesn't have backup files (or an "undelete" function). As you switch from one page to another within a document, the last page is written to the file on the disk, saving your work. This slows you down in moving through the document, and dealing with text broken over page boundaries is cumbersome.

The fact that EasyWriter stores documents in its own format didn't bother me much since it lets you translate documents into ASCII (American Standard Code for Information Interchange) files and the reverse. However, this is an additional step when you need to share disks with other systems or send files via modem.

You can call EasyMailer from EasyWriter to merge mailing lists with form letters and include personalized information. You can use it as a simple database with sorting capabilities.

EasyPlanner didn't meet my expectations in many ways. It takes the row and column format too literally, such that it wants to work with whole rows and entire columns.

EasyFiler comes on four different disks for system, housekeeping, sample-data, and extract functions. It is complex to use, as is reflected in the size of its manual.

The nine disks that EasyPak comprises look like a substantial amount of software, but in the end it performed below my expectations.

DOCUMENTATION AND SUPPORT

Overall, I would rate Sanyo's documentation as poor. The system documentation is weak, with a brief introduction followed by lists of BASIC and MS-DOS commands. The skimpy technical reference section gives some pertinent I/O addresses, a memory map, interrupts, and BIOS calls.

There are no tutorials on disk to introduce you to the operating system,

DOS commands, or BASIC. The documentation does not contain "read this first" sections or quick introductions. Sanyo's approach is to have you read everything before using the system or the software. This is neither realistic nor interesting.

The rest of the software manuals have been hastily adapted from existing MBC-550 series manuals, referring to different keyboards and disk-drive configurations. The manuals and disks provide good introductions but are not comprehensive.

The general consensus seems to be that this machine does not offer an outstanding price/performance ratio; few dealers are stocking it, even those who carry the MBC-550 series. You will see it advertised mostly by mail-order houses.

Sanyo lists a warranty for one year on the memory and processor board and 90 days on all parts and labor. If you are not a dealer, calls to Sanyo are answered with a tape that refers all inquiries to your local Sanyo dealer. It is not surprising to find that many users groups have formed to provide the support that Sanyo does not.

SUMMARY

The Sanyo MBC-775 faces planned obsolescence since IBM is supporting the faster 80286 processor as the next chip of choice. Also, the new IBM Enhanced Graphics Adapter represents the next generation of video-display controllers with its 16-color graphics in both the 320- by 200-pixel medium-resolution and 640- by 200-pixel high-resolution modes.

Sanyo established a reputation for low prices and good bundled software with the 550 series, but it has made trade-offs in designing the MBC-775. The MBC-775 relies on its 9-inch color screen, improved speed, possible price discounting, and portability to distinguish it from the mass of IBM PC-compatibles. It does better than the average personal computer but does not excel in any special characteristics. [Editor's note: The Sanyo MBC-775 was supplied courtesy of Palmer T. Wolf of Richard Dean Associates Inc., Newburyport, Massachusetts.] ■

RUSH POSTAGE-PAID CARD FOR YOUR FREE CATALOG

- **COMPUTER ELECTRONICS** training prepares you to service and repair all computers as you build your own 16-bit IBM-compatible computer. Total system program includes disk drive, test equipment and NRI Discovery Lab.
- **TV/VIDEO ELECTRONICS SERVICING** includes training with 25" color TV, VCR, special lessons on videotape.
- **ROBOTICS** training features remote-controlled mobile programmable robot you build, experiment with and keep, along with other test equipment.
- **SATELLITE COMMUNICATIONS** training gives you the skills to repair and install everything from microwave antennas to satellite communications systems. Includes complete TVRO system with dish, receiver, and converter.
- **INDUSTRIAL ELECTRONICS** prepares you to service and maintain computer-controlled industrial systems. Training includes color computer, diagnostic equipment and NRI Discovery Lab.

**CHECK
✓ ONE**



- Computer Electronics
- Robotics Training
- Video Electronics Servicing
- Digital Electronics
- Electronics Design Technology
- Industrial Electronics
- Satellite Communications Electronics
- Data Communications
- Telephone Servicing
- Basic Electronics
- Small Engine Servicing
- Appliance Servicing
- Air Conditioning, Heating, Refrigeration & Solar Technology
- Locksmithing & Electronic Security
- Building Construction & Remodeling
- Automotive Servicing

Name

(Please Print)

Age

Street

City

State

Zip

For career courses approved under G.I. Bill Check for details.



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 10008 WASHINGTON, D.C.

POSTAGE WILL BE PAID BY ADDRESSEE

NRI Schools

McGraw Hill Continuing
Education Center

3939 Wisconsin Avenue
Washington, D.C. 20016-9973



With NRI training at home, you can...

Move up to a high paying career servicing computers



And you can start by actually building NRI's 16-bit IBM-compatible computer.

You can create your own bright, high paying future as an NRI trained computer service technician. The biggest growth in jobs between now and 1995, according to Department of Labor predictions, will occur in computer service and repair, where demand for trained technicians will double. There is still plenty of room for you to get in on the action—if you get the proper training now.

Total computer systems training, only from NRI

To learn how to work on computers, you have to get inside one. And only NRI takes you inside a computer, with total systems training that gives you hands-on experience with computers, peripherals, and software. You'll build a Sanyo MBC-550 series computer, which experts have hailed as the "most intriguing" of all the new IBM-compatibles. The Sanyo even surpasses the IBM PC in computing speed and graphics quality.

Even if you've never had any previous training in electronics, you can succeed with NRI training. You'll start with the basics, rapidly building on the fundamentals of electronics until you master advanced concepts like digital logic, microprocessor design and computer memory. You'll probe into electronic circuits, using the exclusive

NRI Discovery Lab® and professional Digital Multimeter, that you keep.

You'll assemble Sanyo's intelligent keyboard, install the power supply and disk drive, and attach the high resolution monitor—all the while performing hands-on experiments and demonstrations that reinforce your skills.

Learn to service today's computers

As you complete your Sanyo, you grasp the "secrets" that qualify you for a new career. You'll learn to program in BASIC and machine language. You'll use utility programs to check out the operation of the Sanyo's 8088 microprocessor (the same chip used in the IBM PC). And you also get over \$1,000 worth of software, including WordStar and CalcStar.

Most importantly, you'll understand the principles common to all computers. Only a person who fully understands all the fundamentals can hope to be able to tackle all computers. NRI makes sure that you'll gain the knowledge and skills to maintain, troubleshoot and service computers.

Learn at home in spare time

With NRI training, you'll learn at home on your own time. That means your preparation for a new career or part-time job doesn't have to interfere

with your current job. You'll learn at your own pace, in the comfort and convenience of your own home. No classroom pressures, no rigid night school schedules. You're always backed up by the NRI staff and your instructor, who will answer questions, give you guidance and be available for special help if you need it.

Let others worry about computers taking their jobs. With NRI training, you'll soon have computers making good paying jobs for you.

Send for Free NRI Catalog

Send the post-paid reply card today for NRI's 100-page catalog, with all the facts about computer training plus career training in Robotics, Data Communications, TV/Video Servicing and many other fields. If some other ambitious person beat you to the card, write to NRI at the address below.

NRI SCHOOLS

McGraw-Hill Continuing Education Center
3939 Wisconsin Avenue, NW
Washington, DC 20016

We'll Give You Tomorrow.

IBM is a Registered Trademark of International Business Machines Corporation.

XEROX

Three more firsts from the people who invented the wheel.

From day one, Xerox and Diablo have been known as the two best names in daisywheel printers. And now there are three more in the Xerox line to choose from.

The Xerox Advantage D-25 Diablo printer turns out letter quality documents quickly and quietly. And it does all that for the price of a dot matrix printer.

At 80 c.p.s., the D-80IF is the fastest daisywheel printer ever made by Xerox. It has a built-in double bin

sheet feeder. As well as the capacity to handle up to 16 computers at once.

Then there's the D-36. It's so reliable, it averages 4,000 hours of printing

between maintenance calls.

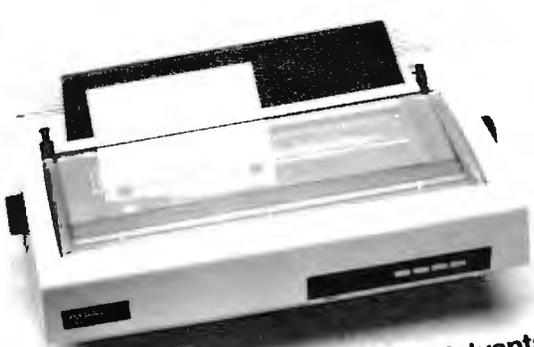
And each of these new printers is compatible with most computers on the market, including the IBM-PC.

So if you're looking for the latest in daisywheel printing technology, call 1-800-833-2323, ext. 25, your local Xerox office, an authorized Diablo or Xerox dealer or send your business card to Xerox Corporation, Dept.

25192, P.O. Box 24; Rochester, NY 14692.



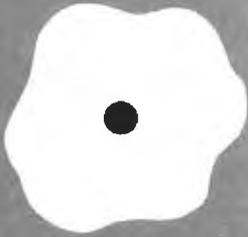
Xerox Advantage
D-80IF Diablo Printer



Xerox Advantage
D-36 Diablo Printer



Xerox Advantage
D-25 Diablo Printer



Five C Compilers for the Macintosh

Aztec C

Hippo-C

Mac C

Megamax C

Softworks
Macintosh C

BY TIM FIELD

Creating application programs for Apple's Macintosh is quite different from writing programs for more traditional microcomputers. This is due primarily to the fact that application programs have to be built up around the standard Macintosh user interface. This interface offers the mouse as the primary input device, using the keyboard only for text entry and "power user" command entry. Furthermore, full exploitation of such things as pull-down menus, multiple windows, dialog boxes, and icons are a must. Ironically, the effort required to shape an application program into the Macintosh user environment is often equal to or even greater than the development effort of the actual application solution itself.

Thanks to the rich complement of software tools available within the Mac's ROM (read-only memory) Toolbox, the Macintosh user interface can be efficiently supported by an applications programmer. It is very important that any Macintosh software-development system directly and completely support the facilities in the ROM Toolbox. What this means is that the portability of programs across a variety of machines (often an important topic to C programmers) becomes a virtual nonissue when compared with the need for complete support of the Macintosh ROM Toolbox.

You can think of each of the five compilers I review in this article as an entrant in a decathlon. My goal has been to put the compilers through a variety of tests, as well as objective and subjective evaluations, designed to spot strengths and weaknesses of each. My intent has been to judge them purely on merit and independently of how they may have performed in previous tests.

Let me note, however, that my evaluations and comments are intentionally biased in one respect. Rather than looking just for the best generic C compiler available for the Macintosh, I wanted to find the best development system for creating Macintosh application programs.

Some of the compilers come in two flavors, with one version for the "nonprofessional" C programmer and another more expensive and more capable version for the "professional" developer. Since my focus was on finding the best professional C-based development system for the Macintosh, I reviewed only the professional version of each compiler. In any case, I feel that the extra power offered by the professional versions more than justifies the extra cost, even for the nonprofessional C programmer.

THE COMPETITORS

The five compilers I compare are Aztec C from Manx Software Systems, Hippo-C from Hippopotamus Software, Mac C from Consulair, Megamax C from Megamax, and Softworks Macintosh C from Softworks Limited. Tables 1 and 2 summarize some of the characteristics of each compiler.

THE BENCHMARKS

Whenever I read a side-by-side comparison article such as this, I flip right to the benchmark test results. Let's go immediately to an overview of the benchmark process and the results, after which I will look at some of the individual properties of each compiler.

To test the raw performance characteristics of the five C compilers, I selected eight benchmark programs that I felt would offer opportunities for each compiler to show its stuff. I took some of these benchmark tests almost verbatim from the BYTE issue on the C language (August 1983). These test the standard facilities in each C compiler, such as how well it performs tight looping tasks or integer arithmetic. Another benchmark program was designed to test the efficiency of each compiler's interface to the Macintosh's ROM Toolbox.

All benchmarks were compiled and run on a 512K-byte Mac with two disk drives. While each of the compilers theoretically

(continued)

Tim Field (4321 Canyon Valley Rd., Diamond Springs, CA 95619) is an independent software developer/consultant working primarily with the IBM PC and the Apple Macintosh. He has an M.S. degree in computer science from Purdue University and a B.S. degree in electrical engineering/computer science from the University of California at Berkeley. His specialty is the low-level hardware/software interface.

REVIEW: C COMPILERS

Table 1: A quick comparison of the five C compilers reviewed, highlighting important features.

	Softworks C	Mac C	Aztec C	Hippo-C	Megamax C
Claims complete access to ROM	yes	yes	yes	yes	yes
Type of interface to MAC ROM	glue	direct	direct	glue	glue
Produces stand-alone Mac programs	yes	yes	yes	yes	yes
Direct support of desk accessories	no	yes	yes	no	yes
Source code for standard library	no	yes	yes	yes	no
Register variables	yes	no	yes	no	yes
Floating-point math	yes	no	yes	no	yes
Produces assembly code	yes	yes	yes	yes	no
In-line assembly	no	yes	yes	no	yes
Assembler included	no	no	yes	yes	no
Apple MDS assembler required	yes	yes	no	no	no
Form of user interface	Mac	Mac	UNIX-like shell	HOS (note 1)	Mac
Assembly-level debugging aids	yes	yes	yes	no	no
Library manager	no	no	yes	yes	yes
Intelligent linker	no	no	yes	no	yes
Copy-protected	no	yes (note 2)	yes	yes (note 2)	no

Notes:

1. See text for more information.
2. Unprotected version costs \$25 extra.

Table 2: A comparison of miscellaneous attributes of the C compilers reviewed.

	Softworks C	Mac C	Aztec C	Hippo-C	Megamax C
Size of CHAR	8 bits	8 bits	8 bits	8 bits	8 bits
Size of SHORT	16 bits	8/16 bits	16 bits	16 bits	8 bits
Size of INT	32 bits	16/32 bits	16 bits	32 bits	16 bits
Size of LONG	32 bits	32 bits	32 bits	32 bits	32 bits
Size of FLOAT	32 bits	n.a.	32 bits	n.a.	32 bits
Size of DOUBLE	64 bits	n.a.	64 bits	n.a.	64 bits
Size of POINTER	32 bits	32 bits	32 bits	32 bits	32 bits
Bit fields	no *	no	no	yes	no
Enumerated types	no	no	no	no	no
Automatic variable initialization	yes	yes	yes	yes	yes
Structure passing	no	no	no	no	yes
Structure assignment	no	no	yes	yes	yes
Extra support function (with source)	no	yes	yes	yes	no

* Manufacturer claims it works, but the assembler would not assemble code output from the compiler.

can be used with single-drive 128K-byte Macintosh systems, to attempt such a feat would be a serious mistake. Realistically, two disk drives are an absolute must, and a 512K-byte Macintosh is highly recommended, even if the program you are developing will ultimately run on a 128K-byte Mac.

The benchmark programs timed themselves as they executed, using the Macintosh ROM TickCount() timer function to get their starting and ending times from the system clock. Thus, these times are accurate to within one-sixtieth of a second. Table 3 shows the results of the benchmark tests.

The C source code for the benchmarks is available for uploading from BYTEnet Listings at (617) 861-9764. However, let's look at a capsule summary of each benchmark test.

FRAME: Do an empty for loop that cycles 10,000 times. Since several of the other benchmark tests use such a loop, the results of FRAME can be used to factor out the time involved in simple looping.

FIB: Calculate the twenty-fourth value in the Fibonacci sequence, which is defined as the sequence of integers starting <0, 1, 1, 2, 3, 5, 8, 13, 21, ... > such that the next number in the sequence is the sum of the two most recent numbers. Repeat this 10 times. The algorithm makes extensive use of recursion and tests the efficiency of function calling by each compiler.

FLOAT: Perform a number of multiplication and division operations on double-precision floating-point numbers. Repeat process 10,000 times. This tests the efficiency of floating-point support.

INTERFACE: Make repetitive calls to the Macintosh ROM GetNextEvent() operation. This tests the efficiency of C-to-ROM interface.

INTMATH: Perform a variety of integer math operations (+, -, *, /, <<). Repeat 10,000 times. This measures the efficiency of integer math operations.

QSORT: Create an array of 1000 ran-

dom long integers and use the Quicksort algorithm to sort the array. Repeat the procedure 10 times. Like SIEVE, this benchmark is commonly found in general benchmark tests, so the results can be used to compare against other machines. QSORT uses recursion to a considerable depth, so it tests the efficiency of both function calling and parameter passing.

POINTER: Using a pointer, march through an array of 128 characters, setting each character to the blank character. Repeat this 10,000 times. This measures the efficiency of pointer use for array access.

SIEVE: Use the now legendary Sieve of Eratosthenes algorithm to determine all the prime numbers from 0 to 8190. Repeat 10 times. Although this does help measure array and integer math operations, it is included primarily for historical reasons and to allow for comparisons of the Macintosh with benchmarks run on other systems.

While the major portions of the benchmark tests remained unchanged from compiler to compiler, small deviations were required in

(continued)

Table 3: The results of the benchmark tests and the sizes of the execution files produced.

	Execution Times (in seconds)				
	Softworks C	Mac C	Aztec C	Hippo-C	Megamax C
FRAME					
Normal	0.13	0.13	0.10	0.25	0.10
Register	0.08	n.a.	0.05	n.a.	0.05
POINTER					
Normal	24.33	26.60	25.50	33.23	30.02
Register	11.15	n.a.	13.15	n.a.	18.93
INTMATH					
Normal	30.05	5.10	5.03	15.93	5.05
Register	26.73	n.a.	2.70	n.a.	2.78
SIEVE					
Normal	8.83	7.98	6.20	12.65	6.20
Register	4.73	n.a.	3.88	n.a.	4.17
QSORT					
Normal	157.08	63.92	68.43	test failed	93.38
Register	93.72	n.a.	50.87	n.a.	70.80
FLOAT					
Normal	332.77	n.a.	268.22	n.a.	334.32
FIB					
Normal	28.60	31.67	24.72	47.22	25.97
INTERFACE					
Normal	59.18	71.40	56.22	78.47	72.00
	File Sizes (in bytes for "normal" [non-register] runs)				
FRAME	32,000	10,496	8537	20,992	6544
POINTER	32,000	10,496	8571	21,044	6586
INTMATH	32,512	11,008	9109	21,948	7128
SIEVE	40,448	10,752	16,897	21,318	6768
QSORT	36,608	11,008	13,113	test failed	7226
FLOAT	32,256	n.a.	9205	n.a.	7256
FIB	32,256	10,496	8751	21,304	6810
INTERFACE	32,256	10,496	8697	21,230	6700

AT A GLANCE

Name	Aztec C version 1.06C	Hippo-C Level 2	Mac C version 1.07 and Mac C Toolkit	Megamax C Compiler version 2.0	Softworks Macintosh C
Type	C compiler for the Mac	C compiler for the Mac	C compiler for the Mac	C compiler for the Mac	C compiler for the Mac
Manufacturer	Manx Software Systems Box 55 Shrewsbury, NJ 07701 (800) 221-0440 (201) 780-4004	Hippopotamus Software Inc. 1250 Oakmead Parkway, Suite 210 Sunnyvale, CA 94086 (408) 738-1200	Consulair Corp. 140 Campo Dr. Portola Valley, CA 94025 (415) 322-2757	Megamax Inc. POB 851521 Richardson, TX 75085-1521 (214) 987-4931	Softworks Limited 607 West Wellington Chicago, IL 60657 (312) 975-4030
Documentation	More than 600 pages in two binders, no index	Approximately 200 pages in 3-ring binder, index included	135-page manual, no index	More than 160 pages in 3-ring binder, index included	Stapled 5-page Mac-specific instructions plus 200-page generic Whitesmiths Ltd. C programmer's manual, no index
Price	\$499	\$399.95	\$425 plus Apple MDS (purchased separately, Mac C is \$295 and Mac C Toolkit is \$175)	\$299.95	\$395 plus Apple MDS

order to accommodate the idiosyncrasies of individual compilers. For example, the global declaration `INT DUMMY = 0` was added to the top of each program for the Softworks C compiler since it requires at least one initialized global variable in any program it compiles. I made such changes with great deal of care to ensure that the benchmark results were not affected to any significant degree.

Both Aztec C and Hippo-C can, at the programmer's option, create programs that run in either their unique program-development environments (discussed later) or as stand-alone programs that can be executed from the Macintosh Finder. The other three compilers always produce stand-alone programs. To be fair in the benchmark competition, I required each compiler to produce programs that could run as stand-alone Macintosh programs. While this did not affect the running times of the Aztec C or Hippo-C tests,

it did increase the size of each of their programs.

BENCHMARK RESULTS AND COMMENTS

As you can see in table 3, the overall winner of the speed portion of the tests was Aztec C. It placed first in almost every test and never finished worse than second. In the file-size portion of the benchmark contest, Megamax C placed first, with Aztec C and Mac C close behind.

I set up special versions of the FRAME, POINTER, INTMATH, SIEVE, and QSORT programs to test the efficiency of the register variables as offered by three of the compilers. Notice in table 3 the tremendous speedup of these versions of the programs as compared to the standard versions. Obviously, the omission of register variables in the Mac C and Hippo-C compilers is a real handicap for them. Mac C and Hippo-C also had to drop out of the FLOAT contest,

as neither offers true floating-point support.

The only unexpected failure for any of the benchmark tests was the QSORT program when it was compiled and run using Hippo-C. The program ran out of stack space before it could finish, and Hippo-C offers no documented method of increasing its run-time stack.

A potentially controversial aspect of the benchmark testing procedure concerns the integer size used by the different compilers. The Aztec and Megamax compilers use 16-bit integers. The Softworks and Hippo compilers use 32-bit integers. Meanwhile, Consulair's Mac C allows the user to select between 16- and 32-bit integer sizes.

When setting up the benchmark tests, I had to decide whether to let each compiler use its native integer size (effectively favoring those with 16-bit integers for benchmark programs using a large proportion of in-

teger operations) or force all the compilers to use 32-bit long integers (this time handicapping those with the 16-bit integers).

The natural pointer size for the Macintosh is determined by the 68000 microprocessor's hardware as 32 bits. However, 16-bit integers are usually sufficiently large to handle the vast majority of integer operations, and 16-bit integer operations can be accomplished two to four times as fast as 32-bit integer operations. And the availability of 32-bit long integers in C can handle the remainder of the integer operations that will not fit within the 16-bit range limitations.

Makers of Macintosh compilers face the dilemma of compromising the performance of integral operations in favor of supporting the widespread use of a poor programming style by many C programmers. Aztec C and Megamax C chose to support the better-performing 16-bit integers. Softworks C and Hippo-C went the route of 32-bit integers. Mac C wisely decided to sit on both sides of the fence and give the programmer the choice.

For the benchmark testing, I reasoned that since one of the primary goals of C programs is maximum performance, it was unfair to handicap the compilers that offer the faster 16-bit integer sizes by forcing them to use 32-bit integers. Thus, I ran all the tests for Mac C, Aztec C, and Megamax C with 16-bit integers. However, in the interest of fairness (and to satisfy my own curiosity), I subsequently reran all the benchmark programs through Aztec C using long integers; I found that Aztec C still handily beat Hippo-C in every test and lost to Softworks C only in the POINTER program (and then just barely).

Some of you may be wondering why I didn't even things out by running Softworks C and Hippo-C with their 16-bit short integers. This would not have helped since C specifies that all integral operations should, if possible, be carried out in the compiler's natural integer size. For example, if you add two short integer values

together using Softworks C, Softworks converts the two 16-bit values to 32-bit values, performs a 32-bit addition, and then converts the result back to a 16-bit value if appropriate. Consequently, 16-bit short operations in Softworks C take as long or longer than similar 32-bit integer operations.

COMPILE TIMES

In order to time the compilation process for each of the compilers, I set up a trivial program composed of four separately compiled modules, each containing one function. I then timed how long it took the five compilers to compile and assemble each of the four modules, link them together, and begin program execution. For each system, I used the manufacturer's recommended setup on my 512K-byte Mac with its two drives and any tools

(such as batch files) that accompanied the compilers.

Table 4 shows the results of the compile-time tests. With the exception of Aztec C running on its RAM (random-access read/write memory) disk, the Macintosh compilers performed abominably. (Only Aztec C came with a RAM disk.) With times ranging from more than 4 minutes to almost 8 minutes (this is for a very trivial program), the level of frustration becomes very high as you work through the cycle of implementing and debugging your programs. With a 128K-byte Mac or a single disk drive, you can expect even worse performances.

Table 4 also shows the time required to do the same process on a standard IBM Personal Computer using a

(continued)

Listing 1a: The "startup" include file, used by all the other programs for timing.

```
long time;
puts("Press any key to begin timed test: ");
getchar();
puts(" \nStarting \n");
time = TickCount();
```

Listing 1b: The "done" include file.

```
time = TickCount() - time;
printf("ticks = %ld \n",time);
printf("Press any key to return to FINDER: ");
getchar();
```

Listing 2: The FRAME benchmark.

```
/*      frame.c      */
#include "stdio.h"
#define COUNT 10000
main()
{
    int i;
    #include "startup"
    for (i = 0; i < COUNT; ++i) {
        ;
    }
    #include "done"
}
```

1	Exxon
2	General Motors
3	Mobil
4	Ford Motor
5	IBM
6	Texaco
7	E.I. du Pont
8	Standard Oil (Ind.)
9	Standard Oil of Cal.
10	General Electric
11	Gulf Oil
12	Atlantic Richfield
13	Shell Oil
14	Occidental Petroleum
15	U.S. Steel
16	Phillips Petroleum
17	Sun

**27
million
Americans
can't read.
And guess
who pays
the price.**

Every year, functional illiteracy costs American business billions.

But your company can fight back...by joining your local community's fight against illiteracy. Call the Coalition for Literacy at toll-free **1-800-228-8813** and find out how.

You may find it's the greatest cost-saving measure your company has ever taken.

**A literate
America is a
good investment.**

Ad Council  **Coalition for Literacy**

Listing 3: The FIB benchmark.

```

/* fib.c */
#include "stdio.h"
#define NTIMES 10 /* number of times to complete fibonacci value */
#define NUMBER 24 /* biggest one we can compute with 16 bits */

main ()
{
    int i;
    unsigned value, fib();

#include "startup"

    for (i = 1; i <= NTIMES; i++)
        value = fib(NUMBER);

#include "done"
    printf("\nPerformed fibonacci series %d times \n", NTIMES);
    printf("fibonacci(%d) = %u. \n", NUMBER, value);
    printf("Press any key to return to FINDER: ");
    getchar();
}

unsigned fib(x) /* compute Fibonacci number recursively */
int x;
{
    if (x > 2)
        return(fib(x-1) + fib(x-2))
    else
        return(1);
}

```

DeSmet C compiler. In this case, the DeSmet compiler finished in 1 minute and 20 seconds without using its RAM disk and needed only 18 seconds with its RAM disk. If you figure that a programmer will follow through the development cycle numerous times, you can see the great disadvantage of using a development system with a long cycle time.

I should note that the primary culprit here is the Macintosh disk drives. The drives were steadily grinding away throughout the compilation process for each of the compilers. As demonstrated by the difference in times of using Aztec C with and without its RAM disk, the compilation without the RAM drive spent about 83 percent of its time waiting on the disk drive.

AZTEC C

Aztec C from Manx Software Systems consists of a full C compiler, assembler, linker, and pair of text editors. Rather than follow the path of the Softworks, Consulair, and Megamax

compilers, which exclusively use the Macintosh user interface (that is, support multiple windows, menus, icons, and mouse), Aztec C creates a more traditional programming environment based on the UNIX operating system. (See the "User Interface" section later in this article.)

The basis for Aztec's UNIX-like environment is its "shell." This essentially replaces the standard icon-based Macintosh Finder with a command-line-oriented operating-system interface. All commands are entered to the shell via the keyboard; there are no menus, no desk accessories, and the mouse doesn't do anything.

You might wonder how you could use such an environment to create stand-alone programs that take advantage of the Mac user interface. The secret is that the shell, acting as an operating system, can run any standard Macintosh program. While this program is running, it works in exactly the same manner as if it had been started by the Finder. The only dif-

(continued)

The TeleVideo AT. The Performance AT.



The Performance AT™ is quite an appropriate name for TeleVideo's® new computer. Especially when you measure performance by what's most important—memory, flexibility and speed.

30% Faster.

The Performance AT is designed around the Intel 80286 running at 8Mhz—a third faster than the 6Mhz IBM® AT. A standard 640 Kbyte memory and eight expansion slots give you better configuration flexibility. And our AT has an edge with its 45-Mbyte hard disk and Personal Mini network compatibility.

You'll run the popular PC software library, as well

as hundreds of powerful mini computer and multi-user programs. And the TeleVideo AT offers optional graphics with remarkably enhanced 640 x 400 display resolution.

Starts at \$3395.*

Innovative design brings you these significant performance advantages at a price that's a good deal less than the IBM AT.

And this could be the least expensive AT-class computer to own. Because the quality of its components promises better reliability and less costly down time.

Should you need it, the Performance AT carries a complete warranty and easy TRW service around the world.

Call toll-free (800) 521-4897. Or, in California, (800) 821-3774. Ask to see the Performance AT. A computer with the power to save you hundreds of dollars.

IBM is a registered trademark of International Business Machines.

*Monitor not included.



ference is that exiting the program returns you to the shell UNIX environment rather than to the Finder.

The programmer has three options for creating application programs using Aztec C: programs that run only under the Aztec shell (that is, they cannot be activated by the Finder); programs that run entirely on a stand-alone basis (can be started from the Finder or shell and use only standard Macintosh operations to receive input from the keyboard and send output to the display); and programs that stand alone but need to use a special Aztec C "console driver" to interact with the user.

To make the shell an appropriate development environment, the Aztec C package includes a vast array of tools, utilities, and programs that help in the C development process. Most of these are fashioned after corresponding tools found in UNIX. For ex-

ample, the Aztec compiler, assembler, and linker are known as cc, as, and ln, respectively, and offer a fairly large subset of the options and features found in their UNIX counterparts.

The Aztec compiler supports floating-point data types and floating-point operations. It also supports up to six register variables, in-line assembly code, and a variety of compiler options. For example, one option is used to create an assembler source file in which the lines of C source are included as comments. This can simplify the task of associating your C source with the assembly code produced, making assembly-level debugging easier.

The assembler is a full macro assembler with options that allow you to perform peephole optimizations, create assembly listings, and so on. The Aztec linker is an intelligent linker: It recognizes the format of special

libraries of functions and includes only those modules containing functions actually used by the program being linked. This results in consistently small run-time files. Aztec C's other resources and tools, most of which offer flexibility through a host of options, are:

Text editor (Z): A powerful full-screen text editor (quite similar to UNIX's vi) used to create and edit C and assembly source code (or, for that matter, any sort of pure text file). In addition to all normal text-editing functions are some specifically aimed at the C programmer, such as operations to find the next or preceding C function, to find matching parentheses, and so on. Z also offers macro commands as well as string-searching capabilities.

EDIT: The Apple MDS text editor (see the text box "Apple's Macintosh

Only one word processing program links all kinds of computers.

Finally, there's a way to stop the proliferation of software in your word processing environment.

It's called WordMARC™—the single full-featured word processor that runs an *identical* program on some 35 different makes and models of computers.

And with its companion program, LinkMARC, WordMARC files created on a

personal computer can be transferred to and shared by your company's UNIX®-based and VAX™/VMS supermini computers. Or vice versa.

In addition to being compatible with all kinds of computers, WordMARC also gets along with all kinds of users.

Its documentation is written specifically for the computer system it will operate on. Its self-teaching



68000 Development System" on page 286). You can use this editor instead of Z if you favor the standard Macintosh user environment for text editing.

RAMDISK: Allows users of 512K-byte Macs to set aside all but 128K bytes of RAM for use as a RAM-disk drive, offering astounding speed improvements.

LIBRARIAN: Lets you add functions to and delete functions from the Aztec C libraries.

ARCHIVER: An archive is a large storage depot for the source code of many C programs. Aztec C lets you group these sources together so that they don't clutter disks with extraneous filenames yet are still accessible later when you "de-archive" them.

EXECUTIVE: A batch-processing or executive capability that lets you create a file of text commands pro-

cessed by the shell as if you were typing in the commands at the keyboard. This flexible facility will let you do variable substitutions using command-line arguments.

MAKE: Sophisticated program used to create and update any files created from other files. The standard application of MAKE is to have it look at each C and assembly source module that is required for creating a given application program, compile and assemble only those that have been changed since the last MAKE on this group, and then link everything, ready to run.

GREP: A powerful and flexible pattern-matching utility that searches through text files for occurrences (or lack thereof) of specified strings and patterns.

DIFF: Compares two source files.

RMAKER: Apple's MDS resource compiler.

Assorted debuggers: Various assembly-level MDS debuggers.

Included as part of the UNIX-like environment of the Aztec shell are many operations and features that make Aztec C a powerful development system. These include ls, which gets file directories; rm, cp, and mv to remove, copy, and rename disk files; cat, which looks at the contents of text files; redirection of standard input and output (for example, redirecting the output of cat from the display to the printer); full support of UNIX directories and subdirectories; and support of global * and ? characters when specifying filenames. You can even set up your own system prompt.

With all the features in Aztec C, good documentation is a must. Manx delivers. Aztec C comes with two binders containing more than 600

(continued)



guide helps novice users get quickly up to speed. And it's supported by a special "800" number hotline.

WordMARC's many versatile features include technical and scientific symbols, foreign language characters, a what-you-see-is-what-you-get screen, and menu-driven operation with convenient function keys. It's available for many different operating systems, including MS-DOS™ and

UNIX, and supermini proprietary systems including VAX/VMS.

And WordMARC can also be integrated with other popular applications software.

So put your word processing software resources back under control with WordMARC. The Uncommon Denominator.

Contact MARC Software for more information at 260 Sheridan Ave., Ste. 200, Palo Alto, California 94306.



MARC SOFTWARE INTERNATIONAL, INC.
1-800-831-2400. In California 1-800-437-9900.

WordMARC

The Uncommon Denominator

WordMARC is a trademark of MARC SOFTWARE INTERNATIONAL, INC. © 1985 MSI, INC.
UNIX is a registered trademark of AT&T Bell Laboratories VAX is a trademark of Digital Equipment Corp MS-DOS is a trademark of Microsoft Corporation.

pages of well-written documentation. Despite the lack of an index, I was able to find almost every piece of information I wanted.

Of great assistance to the Macintosh programmer are sections of the manuals devoted to Aztec C's specialized Macintosh functions (similar to the standard C library functions but

supporting special characteristics of the Mac) and the Mac Toolbox routines. Also helpful is a section entitled "Tech Info," a technical discussion of important topics including the Mac's memory organization and what actually happens when the Finder shell starts up an application program. The documentation even looks at the

Listing 4 The float benchmark.

```

/* float.c */
#include "stdio.h"
#define CONST1 3.141597E0
#define CONST2 1.7839032E4
#define COUNT 10000
main()
{
    double a, b, c;
    int i;
#include "startup"
    a = CONST1;
    b = CONST2;
    for (i = 0; i < COUNT; ++i) {
        c = a * b;
        c = c / a;
        c = a * b;
        c = c / a;
        c = a * b;
        c = c / a;
        c = a * b;
        c = c / a;
        c = a * b;
        c = c / a;
        c = a * b;
        c = c / a;
        c = a * b;
        c = c / a;
    }
#include "done"
}
    
```

issues involved in designing a Macintosh desk accessory using Aztec C. This discussion revolves around a real desk accessory that is included, source and all, with the system.

My one regret about Aztec C is that it's copy-protected. In fact, it is the only compiler of the group that does not come in a nonprotected version. Also, Manx chose to copy-protect the shell environment. The shell environment is so capable and well done that there are situations in which, were it not copy-protected, I would use it in place of the Macintosh Finder. In fact, I think Aztec C could successfully market its shell environment as a product by itself, providing a good alternative to the Finder.

Aztec C is the most comprehensive and professional package of the five compilers in our test group. It either

(continued)

MEMORY & LOGIC PROGRAMMERS & UV EPROM ERASERS

MENU	
PROMPRO-XP	\$1995.00
GANGPRO-8	\$995.00
PROMPRO-8	\$689.00
SHOOTER	\$395.00
UV ERASERS	
T8/2T	\$97.50
T8/1	\$49.95

Sweet deals on memory and logic programmers

Stand-alone, intelligent RS-232 units compatible with most computers or terminals; minimal or no interfacing

PROMPRO-8™...Programs virtually all +5V EPROMs, single-chip micros, and emulates EPROMs. ONLY \$689.00 (128K RAM version)

GANGPRO-8™...Programs 8 EE/EPROMs at once (supports most EPROMs.) ONLY \$995.00

UV ERASERS ...Start at \$49.95, and \$97.50 for timer versions. Production model \$149.95

AND MORE! ...Call for more info on PALPRO, SHOOTER, PP7, XP, and required options. Detailed literature and spec sheets available. IBM PC, Apple and other popular PCs support. PAL is a registered trademark of MMI.

TOLL-FREE 1-800-EE1-PROM

It's only Logical.

LOGICAL DEVICES, INC.

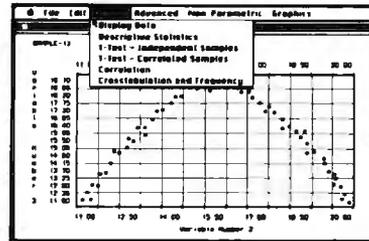
1321 N.W. 65th Place • Fort Lauderdale, FL 33309 • (305) 974-0967 • TELEX: 383142

BUSINESS • SCIENCE • EDUCATION

STATISTICAL PACKAGES

data-analysis software from: **STATSOFT**
— unbeatable power and flexibility
for unbeatable prices!

We developed complete, high-performance statistical packages for all computers:



- 1. **STATISTICAL SUPPLEMENT FOR LOTUS 1-2-3™** (number one statistical add-on for LOTUS™ and Symphony™, also reads files from many other programs, can be used as a stand-alone statistical package, runs on IBM™ and all compatibles, 256k, 2dd, 8087 support) **\$149**
- 2. **STATFAST** (the first stand-alone and still the most powerful statistical package developed for the Macintosh™ 128k or 512k, 1dd) **\$119**
- 3. **APP-STAT** (a complete statistical package for the Apple II™ family of computers, 1dd) **\$99**
- 4. **PSYCHOSTAT-3** (a complete statistical package, available for Kaypro™ and all CP/M™ computers, 1dd) **\$99**

All of these statistical packages are user friendly and super-easy to use. They include the full range of basic statistical analyses (descriptive statistics, t-tests, correlations, cross-tabulations, nonparametric statistics, and more) and advanced multivariate statistics (multiple regression, multifactor analysis of variance and covariance, repeated measures, contrasts, unbalanced designs, and more). All packages can handle **data files of unlimited size**, including flexible Data Editors, and can access data files from spreadsheets, data-bases, and mainframes.

If you are interested in statistical analysis on micro computers, call us! Our technical staff can advise you and recommend the best program for your needs.

Please add \$5 for shipping and handling. To place your order or talk to our technical staff for more information, call or write:



STATSOFT

2831 EAST 10TH STREET, SUITE 3, TULSA, OK 74104
(918) 583-4149



LOTUS 1-2-3, Symphony, IBM, Macintosh, Apple II, Kaypro, and CP/M are registered trademarks of respective companies.

APPLE'S MACINTOSH 68000 DEVELOPMENT SYSTEM

The Macintosh 68000 Development System (MDS) from Apple Computer provides a complete programming environment for assembly-language program development on the Macintosh. Since the Mac uses Motorola's MC68000 microprocessor, you can use any generic 68000 assembler for Macintosh assembly development. However, MDS is designed to help developers cope with the special difficulties involved in writing programs that conform to the user interface, such as the support of the mouse as an input device and appropriate use of icons, windows, menus, and desk accessories.

MDS is important to our C comparison article because four of the compilers reviewed currently make use of some or all parts of MDS. MDS consists of the following six components:

EDIT: A disk-based text editor. By disk-based, I mean that EDIT can work with text files that are larger than the available internal memory of the Macintosh. Since EDIT is designed primarily for entering and editing the text source of programs, many of the formatting features of word-processing programs such as MacWrite are omitted. Instead, EDIT strives to satisfy some of the unique needs of the programmer, offering specialized functions and added speed in place of the missing word-processing features.

EDIT fully supports the Macintosh user interface. One of EDIT's most important features is its ability to open as many as four separate text files at once, with each file having its own fully functional window. This allows the user to cut and paste between files, simultaneously create and edit separate modules of a program, or just refer to the contents of one file while working with another. The second star attraction of EDIT is its speed. For example, EDIT is significantly faster than MacWrite in text search/replace operations.

*MDS is designed
to help developers
cope with writing
programs conforming
to the user interface.*

Other features of EDIT include a choice of type font and size (although you cannot mix different fonts or sizes within a file), optional auto-indentation (very handy for creating easy-to-read source code), and full access to desk accessories, cut/copy/paste, and search/replace activities.

EDIT's combination of raw speed and support of the Mac user environment makes for a friendly and powerful programmer's tool. In fact, it is often quicker and easier to use EDIT instead of MacWrite for simple nonprogramming-related text-entry and editing tasks.

ASM: A macro assembler that translates assembly-language source files, such as those created by EDIT, into relocatable object modules ready to be linked into application programs that can be run. ASM supports all the MC68000 instructions and addressing modes, following the guidelines and syntax laid down in Motorola's 68000 reference manual.

ASM offers such features as macro expansion (in two variations), complex constant expression evaluation, constant string handling, and conditional assembly, as well as many other support operations. It also supports Macintosh source specifications.

RMAKER: In the Macintosh, a "resource" is a special grouping of data or code that defines some specific entity used by a program. For example, menus, fonts, and icons are common

data resources, consisting of special "descriptions" of the particular items. In the case of a menu resource, the description includes such things as the text for each item on the menu and which, if any, command-key shortcut can be used to invoke that item. When the program begins executions, it simply tells the ROM Toolbox's Menu Manager about this resource. The routines within the Menu Manager can then be used to create and display the menu title on the screen, handle the task of pulling down the menu, and report to the program any items selected by the user.

In effect, a Mac resource is a specially defined data structure used to formally group information in such a way that it can be shared easily by different parts of the program and ROM Toolbox managers. Being a data structure, it is possible to define resources within the assembly source of a program. In fact, ASM directly supports this. However, anyone who has sweated the details of making sure each element of numerous complex data structures is set up properly knows that this is a time-consuming job.

To ease the task of defining and using resources, RMAKER is included in MDS. RMAKER is a "resource compiler." It takes a text file (created by the user with EDIT) that describes a program's resources and converts the text into the appropriate data structures. **LINK:** Binds together one or more object modules that were created by ASM or RMAKER to produce an executable application program file. LINK supports the Macintosh notions of program segmentation and separate data and code "forks." LINK also offers traditional linking options, such as the ability to create a "map" of the resulting program.

LINK is not an intelligent linker. It blindly assumes that the user wants every last byte of every module included within the program. This is fine

and dandy unless a programmer wants to use only a few of the functions offered by a file that contains many commonly needed functions needed by the program.

EXEC: A primitive executive or batch-file processor. The task of creating an assembly program involves a cycle that begins with the use of EDIT to create and edit the assembly source, moves to ASM for assembly of one or more modules, heads on to LINK for the linking procedure, takes the program out for a test run, and then heads back to EDIT to make any corrections or changes necessary. EXEC offers a way to mechanize this development cycle, albeit in a very limited manner.

To use EXEC, you work with EDIT to create a special "job" file that specifies each step of the assembly cycle. For each step, you can include a string to be passed to the application (such as the name of a file to be assembled or linked), the application to be called if no error is found in the current step (usually EXEC, so the processing of the current job file will continue), and the application to be called when an error is found (usually EDIT, so you can fix the problem and start the loop again). EXEC then takes this file and moves you through the specified cycle.

Assorted Debuggers: MDS has several useful assembly-level debuggers, including one for a 128K-byte Mac, one for a 512K-byte Mac, and others for use with external stations, such as another Mac, a Mac XL, or a simple terminal attached via one of the Mac's serial ports. The capabilities of these debuggers vary, but all are helpful, giving the user the ability to display and change both memory and register values as a program executes, disassemble selected parts of memory, single-step or trace through a program, set breakpoints, selectively step over or trace into system ROM traps, and keep tabs on the size of the system and application heaps.

The debuggers are designed to keep out of the way of the application program being debugged. For example, if you use the version for the 512K-byte Mac, you can easily switch back and forth between seeing what your program is displaying on the screen and seeing the information offered by the debugger.

All in all, MDS is a capable assembly-language development system. Some or all of the components of MDS can be found in four of the C compilers reviewed. The most extensive use is by Softworks C and Mac C, both of which require that you purchase MDS separately. They both expect the programmer to use EDIT to create the C source-code files; then they convert the source code into assembly source code that is assembled and linked using ASM and LINK. This makes it very simple to mix C and assembly modules.

The Aztec C and Megamax C compilers use their own assemblers and linkers, but both packages currently contain EDIT and RMAKER for text editing and resource compilation. Since both also offer their own text editors, users of these two systems can select the editor of their preference. Aztec C also includes the various MDS debuggers for assembly-level debugging.

A final note: At the time of this writing, MDS is months overdue for release to the general public as a stand-alone product. However, Apple has allowed some companies to license and include all or part of MDS with their products. This is a big break for all purchasers of either Softworks C or Mac C since they get MDS for free with the purchase of the compiler. However, Apple reportedly plans to eliminate these licensing rights at the time that MDS is finally released for sale. Unless things change, new buyers of Softworks C or Mac C will then have to bear the cost of MDS.

dominated, tied, or came close to first in virtually every test and comparison. Furthermore, Aztec C offers numerous features and advantages that the others cannot begin to touch.

HIPPO-C LEVEL 2

Hippo-C Level 2 from Hippopotamus Software creates its own programming environment that uses a command line. It comes with a two-pass C compiler, a 68000 assembler, a linker, and an editor. The Hippo-C programmer can create programs that run only within the Hippo-C environment or, with minor changes, programs that run in both the standard Macintosh environment under the Finder and the Hippo-C environment.

The programming environment created by Hippo-C, called the Hippo Operating System (or HOS), is somewhat reminiscent of the command-line orientations of UNIX or MS-DOS but without the flexibility of either. I found it lacking in several areas, hampering my programming efforts more frequently than assisting them. One small example: I could not find any way to eject a disk and insert another one while using Hippo-C. This limited me to working only with the data and program files on the disks in my two drives when I started HOS. If I needed other files, I had to exit HOS back to the Finder, copy the files onto the mounted disks, and restart HOS.

Anyone who has used UNIX will find HOS confusing and frustrating. Many UNIX utilities such as ls, cp, mv, make, and grep are present in name but work differently than their UNIX namesakes. For example, make is just an ultra-simple batch-file mechanism without the ability to do variable substitution, much less handle the sophisticated operational inferences of the UNIX command of the same name.

The HOS utilities are not implemented very efficiently. For example, the cp file-copy command requires more than 20 disk accesses of both the source and the destination files to copy just a small file from one disk to another on a 512K-byte Mac. Even worse, the mv file-rename utility does

(continued)

YOU FORCED US TO MOVE!

...and We Love You For It!



Because of the tremendous response you've given to our FREE OVERNIGHT DELIVERY and \$10 OFF policies, our growth has been phenomenal! Even we did not project how rapidly we would expand. Quite honestly there were times when it seemed like the whole country was trying to place an order...at the same time!

We realize that some of you have had problems getting through (our phones simply could not handle the volume) and, yes, some have even gotten their shipments late (our shipping department has been on a 12 hour schedule)...to those of you, WE APOLOGIZE for the inconvenience and would like to say THANK YOU for your patience.

A one million dollar investment has allowed us to solve these problems...we've just moved into our new World Headquarters, beefed up our sales department, added a spanking new phone system and built a fully automated warehouse.

Oh, sorry, we almost forgot "Harold" (who's extremely fast, but very sensitive) our new 100 terminal computer system. He's designed to speed up order processing to get your shipments out the door...fast. Sorry Harold.

INTERNATIONAL ORDERS

EUROPE Announcing Logicsoft Europe!

Our European friends may now order directly through our Amsterdam Distribution Center, which carries the latest factory fresh versions of the most sought after IBM PC software and hardware. Now you can receive your order fast and still take advantage of the incredible savings that only mail order can offer. Please call or telex to confirm pricing & policies. Telex: 10759 Logic NL.

Call 020-834864 or mail orders to:
LOGICSOFT EUROPE BV
pb 9460, 1006 AL
AMSTERDAM, HOLLAND

CANADA

For our Canadian customers we've installed a special local number, 416-283-2354. Now you can get the biggest savings in mail-order for the cost of a local call. Or, if you wish, Telex 286905 Soft UR.

FAR EAST AND AUSTRALIA

Call 516-249-8440 and ask for our International Department. They're experts on export and you get to take advantage of our great mail order prices. Telex 286905 Soft UR. Please call or telex to confirm pricing & policies.

WE WILL BEAT
ANY PRICE BY

\$10

See Our Card for Details

FREE

Overnight Delivery

See Our Card for Details

**EVERYTHING YOU ALWAYS
WANTED TO KNOW ABOUT
BEATING A PRICE BUT WERE
AFRAID TO ASK...**

**or How I Learned To Save Money
Without Really Trying.**

We know there are still a few of you who have shied away from ordering from us (you know who you are) perhaps thinking our \$10.00 off and FREE overnight policies were a "gimmick" or a "come-on" to pressure you into something.

We'd like to tell you how simple it really is. Just pick up the phone and dial 1-800-645-3491, then tell your sales agent you'd like to beat a price (don't be embarrassed; he's not), the name and date of the publication and who you want us to beat. No gimmick, no come-on, it's that easy.

CONFUSED OVER ACCOUNTING SYSTEMS?



We don't blame you, that's why we invite you to give us a call. We've evaluated over 50 of them and just because you can save a lot of money buying mail order shouldn't mean you have to sacrifice service...We want to take the time to assist you before you buy. We realize that an accounting system can add up to a sizeable investment and helping you end up with the right package for your money is what doing business is all about.

ACCOUNTING SYSTEMS

	Information Unlimited (US)	Open Systems	Great Plains	Peachtree Series 8	State of The Art	Realworld (MBSI)	BPI
Accounts Payable	'299	'409	'499	'389	'479	'575	'395
Accounts Receivable	'299	'409	'499	'389	'479	'575	'395
Fixed Assets	---	'409	---	'389	---	---	---
General Ledger	'299	'409	'499	'389	'479	'575	'395
Inventory	'299	'409	'499	'389	'479	'575	'539
Job Costing	---	'409	'499	'389	---	---	'539
Material Management	---	'409	---	---	---	---	---
Order Entry/Processing	'299	'409	---	'389	'479	'575	---
Payroll	'365	'409	'499	'389	'479	'575	'395
Report Writer	---	'409	---	---	---	---	---
Sales Invoicing	---	---	---	'389	'479	---	---
Purchase Order Entry	---	409	---	---	---	---	---
TCS Client Ledger System	..... '1195						

JUST A PARTIAL LISTING OF ACCOUNTING SYSTEMS - CALL TODAY!

LOGICSOFT®

THE LOGICAL CHOICE
A Member of the Logic Group

110 Bi-County Blvd., Farmingdale, N.Y. 11735

1-800-645-3491

In New York State...516-249-8440 • In Canada...416-283-2354

Customer Service 1-800-431-9037

See following pages for Software, Hardware, Special Order Dept., Programmers Dept., PC Jr. Corner and our Computer Forms Division.

TEAR AND COMPARE! TEAR AND COMPARE! TEAR AND COMPARE! TEAR AND COMPARE!

LOGICSOFT INCREDIBLE
NEW SERVICE BREAKTHROUGH

FREE OVERNIGHT DELIVERY!

On Orders Totalling
over \$100... Shipped
UPS FREE If
Under \$100
(Within Continental
U.S.)

VIA...  Purolator
courier



PLUS...IF YOU CAN FIND A LOWER PRICE
We'll Beat \$10 It By....

THAT'S RIGHT! OUR LOWEST PRICE GUARANTEE IS STILL EFFECTIVE!
Tell us the advertiser and price of any software or hardware item on these pages currently advertised in any popular computer publication and we'll beat that price by \$10. This offer does not apply to items under \$100 or where the price is not lower than Logicsoft's. NO DEALER'S PLEASE!

SOFTWARE for IBM PC

DATA BASE MANAGEMENT

KNOWLEDGEMAN	\$259
Clout 2	146
Tim IV	109
R-Base 4000	265
R-BASE 5000	399
DB Master	475
d BASE III (New Release)	365
Quickcode III	159
CLIPPER (d Base III Compiler)	399
d Base II (New Release)	299
Condor II	349
Data Base Mgr. II (alpha)	175
Extended Report Writer	119
Friday	169
pts. file & pts. report	165
REVELATION	745
Powerbase	255
Easylier	99
GURU	Lowest Price

FINANCIAL

DOLLARS AND SENSE	\$115
Market Mgr. Plus (Dow Jones)	179
MANAGING YOUR MONEY	119

DATABASE

OB Master	\$125
Filevision	105
1st Base	105
Habadex	79
Helix	249
Mainstreet Filer	169
Megafile	135
MICROSOFT FILE	139
Ornis 2	155
Ornis 3	289
Overview	179
pts. File & Report	105
MacLion	245
Factfinder	65

GRAPHICS

Animation Tool Kit	\$39
Davinci Commercial Int.	\$149

GRAPHICS

CHARTMASTER	\$275
Signmaster	195
BPS Graphics	289
pts. graph	85
GRAPHWRITER	319
Graphwriter Combo Pak	485
Microsoft Chart	175
ENERGRAPHICS	259
Energraphics (w/plotter opt.)	329
PC Draw	295
Gem Draw (incl. Desk Top)	95
AUTOCAD	as low as 799

LANGUAGES/UTILITIES

Concurrent PC DOS w/windows	\$175
Pascal MT + (PC DOS)	349
PL/1 (DR)	489
Display Manager (DR)	359
Access Manager (DR)	289
LATTICE C COMPILER	305
C-Food Srmorgasbord	119
CIS Cobol 85 (DR)	479
Pascal Compiler (MS)	245
C Compiler (MS) (New Release)	305
Microsoft Sort	159

SOFTWARE for Macintosh

GRAPHICS (cont.)

Davinci Series	
(Buildings, Interiors, Landscapes)	99
Davinci Building Blocks	49
McPic	35
MICROSOFT CHART	85
Click Art Series	
(Graphics, Pub's, Letters, Effects)	125

LANGUAGES/UTILITIES

Basic Interpreter (MS)	\$85
MacForth (Level 1)	95
MacForth (Level 2)	149
Smoothtalker	115
Softmaker II	119
Softworks "C"	275
PC to Mac & Back	85
Hippo-C (Level 1)	199

LANGUAGES/UTILITIES (cont.)

Cobol Compiler (MS)	\$479
Business Basic (MS)	299
FORTHAN COMPILER (MS)	229
C86 C Compiler (Computer Innov'n's)	345
INTEGRATED/SPREADSHEETS	
LOTUS 1-2-3 (While they last!)	\$305
Enable	399
Smart Series	579
FRAMEWORK	355
Open Access	395
Electric Desk	229
SYMPHONY (Limited Quantity)	429
Supercalc 3	175
Multiplan	129
TKI Solver	279
pts. plan	65

PROJECT SCHEDULERS

MICROSOFT PROJECT	\$185
SuperProject (RUS)	245
Harvard Total Project Mgr.	285

WORD PROCESSING

Wordstar 2000	\$259
WORDSTAR 2000 PLUS	309

WORD PROCESSING (cont.)

Wordstar Pro Pac	\$265
Wordstar Pro Plus	345
WORD PERFECT (New Release)	245
Microsoft Word	245
MULTIMATE	249
Volkswriter Deluxe	165
Peachtex 5000	199
Easywriter II/Speller/Mailer	199
Edx & Wordx	255
FINALWORD	225
Samna III	325
Xy Write II Plus	255
Think Tank	125
pts. write	65

MISCELLANEDUS UTILITIES

PROKEY 4.0	\$89
Norton Utilities (New Release)	65
SHOCKER (unprotected)	65
Crosstalk XVI (New Release)	115
Sideways	45
Copy II PC	39
DESK ORGANIZER	65
Spotlight	55

MANAGEMENT/FINANCE (cont.)

Electric Checkbook	49
MacCalendar	49
General Financial Analysis	89
Real Estate Dev. (Comm. or Res.)	89

SPREADSHEETS/INTEGRATED

Jazz (While they last!)	\$399
Multipian	125
Microplanner	Lowest Price
EXCEL	239
Ensemble	185

WORD PROCESSING

MICROSOFT WORD	\$149
Think Tank (128k)	65
Think Tank (512k)	139
MacSpell +	49
Hayden. Speller	45
TECH (Linguist)	69
Megaform	185

SEE OTHER SIDE
FOR HARDWARE SAVINGS

*Prices and policies subject to change

Immediate Replacement on any Defective Product.

• NO SURCHARGE for VISA or MasterCard • No Sales Tax on Orders Outside N.Y. State • Purchase Orders
Welcome from Qualified Institutions NO SURCHARGE! (Please call for price verification) • Please add 2%
for handling and insurance (Int'l orders add 1) • Payment MasterCard VISA American Exp. C.O.D. Money Order or Check



National Sales
Hot Line

1-800-645-3491

Customer Service 1-800-431-9037

New York State...516-249-8440 Canada...416-283-2354 Domestic/International Telex 286905 Soft UR

LOGICSOFT

THE LOGICAL CHOICE
A Member of The Logic Group

110 Bi-County Blvd., Farmingdale, N.Y. 11735

WE WILL BEAT ANY PRICE BY

\$10

See Other Side for Details

NEW! Expanded Special Order Dept.
We know there are many products that simply cannot be found through mail order. We've solved that problem...just ask for our SPECIAL ORDER department...We've got the suppliers... still at low mail order prices!

FREE

Overnight Delivery
See Other Side for Details

GENERAL HARDWARE

PRINTERS*

DIABLO	
36**	\$1229
D25**	619
630-API	1529
630-ECS**	1799
EPSON	
L01500	\$1199
Parallel Interface	79
JX-80	599
LX-80**	265
LX-80 Tractor/Feeder	30
RX-100	399
FX-80 Plus**	379
FX-185 (New)**	569
JUKI	
6100	\$439
6300	799
MANNESMANN TALLY	
Spirit 80	\$279
160	579
180	849
NEC	
2030**	\$719
2050**	695
3530	1329
3550	1395
8850**	1949
Pinwriter P2**	675
Pinwriter P3**	895
OKIDATA	
182P	\$239
84-IBM	799
192-IBM	409
193P	559
2410P	2295
QUME	
Sprint 11/40**	\$1299
Sprint 11/55**	1595
Sprint 11/90**	2199
SILVER REED	
400	\$279
500	349
550	449
770	795
TOSHIBA	
P351 Tractor	\$165
P351	1375
1340	779
CITIZEN	
MSP10	\$315
MSP15	455
MSP20	465
MSP25	595

PRINTER/PLOTTERS*

HOUSTON INSTRUMENT	
PC Plotter	\$475

MONITORS*

AMDEK	
Color 300	\$255
Color 500	389
Color 600	479
Color 710	579
12" Green 300G	135
12" Amber 300A	145
12" Amber 310A	169

MONITORS* (cont'd.)

NEC	
JB 1201	\$159
JB 1205	149
JC 1215	239
JC 1216	399
PRINCETON GRAPHICS	
RGB HX-12	\$489
RGB SR-12	599
Scan Doubler Board (for SR-12)	185
Amber Max-12E	185
QUADRAM	
Quadchrome 12"	\$465
Quadscreen 17"	1595
Quadchrome II 14"	465
Amberchrome 12"	165
TAXAN	
100G	\$125
105A	135
121	149
122	149
210	259
420	409
440	699

VIDEO TERMINALS*

ADDS	
A-2 Green	\$465
A-3	465
ALTOS	
Smart II	\$695
QUME	
QVT 101-Green	\$345
QVT 101-Amber	375
QVT 103-Green	810
QVT 103-Amber	845
QVT 108-Green	445
QVT 108-Amber	515
TELEVIDEO	
800	\$1220
800A	975
910	420
910 +	555
921	445
922	750
924	635
925	695
925E	595
WYSE	
50	\$485
75	560
ZENITH	
Z-22	\$465
Z-29	595
Z-49	Lowest Price

MULTI-FUNCTION BOARDS

AST RESEARCH	
Six Pak Plus (64k)	\$259
Mega Plus II (64k)	275
Mega Pak (256k)	369
Advantage (128k)	429
I/O Plus II	135
ORCHID	
Blossom (0-k)	\$235
QUADRAM	
Quadboard (64k)	\$245

MULTI-FUNCTION BOARDS (cont'd.)

STB	
Super Rio (64k)	\$329
Rio Plus II (64k)	259
Rio Grande	375
Chaufeur	Lowest Price
TECMAR	
Captain (64k)	\$199

COMMUNICATIONS BOARDS

AST	
AST-5251-11	\$699
AST-SNA	\$699
AST-BSC	699
AST-3780	749

GRAPHICS BOARDS

AST	
Monograph plus	\$425
Preview	279
EVEREX	
Graphics Edge	\$375
HERCULES	
Graphics Card	\$325
Color Card	169
MA SYSTEMS	
Peacock Color Board	\$245
PARADISE SYSTEMS	
Multi-Display Card	\$215
Modular Graphics Card	289
Options A & B	Lowest Price

QUADRAM	
Quadcolor I	\$195
Quadcolor II	465
SIGMA	
Color 400	\$549
STB	
Graphics Plus II	\$315
TECMAR	
Graphics Master	\$459
TSENG LABORATORIES	
Ultra Pak	\$545

MODEMS

HAYES	
Smartmodem 300	\$205
Smartmodem 1200	445
Smartmodem 1200B	385
Smartmodem 2400	719
KENNSINGTON	
300 Baud Modem	\$95
MICROCOM	
MacModem	\$449
NOVATION	
Access 1-2-3	\$475
Smart-Cat Plus (Int.)	355
Professional 2400	635
Cat	\$375
PRENTICE	
Popcom X100	\$379
Popcom C100	355
PROMETHEUS	
Pro-modem 1200	\$375
Pro-Modem 1200B	319
Mac Pak	105
QUADRAM	
Asher	\$395
Quadmodem II	Lowest Price

MODEMS (cont'd.)

RACAL-VADIC	
Maxwell 1200 PC	\$395
Maxwell 1200 V	439
2400 PC	635
VEN-TEL	
PC Modem Half Card	\$379
PC Modem 1200	399
1200 Plus	399

BACK-UP DEVICES

ALLOY	
PC Quick Tape (60Mb)	\$1719
SYSGEN	
Image (10Mb)	\$835

MOUSE INPUT DEVICES

MOUSE SYSTEMS	
PC Mouse w/paintbrush	\$139
MICROSOFT	
Microsoft Mouse (Serial)	\$149
Microsoft Mouse (Buss)	139

SURGE PROTECTORS

KENSINGTON MICROWARE	
Master Piece	\$115
CURTIS	
Diamond	\$39
Emerald	49
Sapphire	59
Ruby	69

KEYBOARDS

ASSIMILATION	
Mac Turbo Touch	\$85
KEYTRONIC	
5150	\$159
5151 (Deluxe)	179
5152B	645

MEMORY CHIPS

64k (200ns)	\$35
256k (150ns)	69

DISKETTES

LOGICTRAK 5 1/4"-100% GUARANTEED	
Double side, double density, 10 per box	
20 + boxes per disk	\$2.35
10-19 boxes per disk	\$2.50
2-9 boxes per disk	\$2.99
1 box per disk	\$3.99

MAC DISKETTES

Maxell 3 1/2" (box of 10)	35
Memorex 3 1/2" (box of 10)	39
3M 3 1/2" (box of 10)	39

MISCELLANEOUS

ASSIMILATION	
Mac Daisywheel Connection	\$79
INTERMATIC	
Macphone	\$159
MICRON TECHNOLOGY	
Micron Eye	\$325
MICROSOFT	
Mac Enhancer	\$169
OPTIMUM	
Mac Tote	\$65

*Due to weight restrictions Printers and Monitors are shipped UPS...FREE

**Parallel interface req...Ask sales agent

NO SURCHARGE for VISA or MasterCard • No Sales Tax on Orders Outside N.Y. State • Purchase Orders Welcomed from Qualified Institutions • NO SURCHARGE! (Please call for price verification) • Please add 2% for handling and insurance (int'l orders add 1) • Payment: MasterCard, VISA, American Exp., C.O.D., Money Order or Check

National Sales Hot Line

1-800-645-3491

Customer Service 1-800-431-9037

New York State...516-249-8440

Canada...416-283-2354

Domestic/International Telex...286905 Soft UR

LOGICSOFT

THE LOGICAL CHOICE
A Member of The Logic Group

110 Bi-County Blvd., Farmingdale, N.Y. 11735

TEAR AND COMPARE!

TEAR AND COMPARE!

TEAR AND COMPARE!

TEAR AND COMPARE!

REVIEW: C COMPILERS

Listing 5: The INTERFACE benchmark.

```

/*      interface.c      */
#include "stdio.h"
#include "Events.h"

#define COUNT 10000

main ()
{
    int i, eMask1, eMask2, bool1, bool2;
    EventRecord eRcrd1, eRcrd2;

#include "startup"

    eMask1 = eMask2 = -1;
    for (1 = 0; i < COUNT: ++i) {
        bool1 = GetNextEvent(eMask1, &eRcrd1);
        bool2 = GetNextEvent(eMask2, &eRcrd2);

        bool1 = GetNextEvent(eMask1, &eRcrd1);
        bool2 = GetNextEvent(eMask2, &eRcrd2);

        bool1 = GetNextEvent(eMask1, &eRcrd1);
        bool2 = GetNextEvent(eMask2, &eRcrd2);

        bool1 = GetNextEvent(eMask1, &eRcrd1);
        bool2 = GetNextEvent(eMask2, &eRcrd2);
    }

#include "done"
}

```

not actually rename a file. Rather, it first copies the file from the old filename to the new and then removes the old file. Thus, due to the inefficiencies of cp, the simple task of renaming a file becomes time-consuming. To make matters worse, all the HOS utilities are disk-based and require multiple disk accesses for even the most trivial task. Given the Macintosh's terribly slow disk-drive interface, this results in the slow performance of HOS.

HOS does support the UNIX global replacement character * (but not its companion ?) for use with certain operations that need filenames, but it doesn't support it consistently and logically. Redirection of input and output is possible using the > and < characters, but output concatenation (>>) and use of standard Macintosh devices as the source or destination of such redirection is not allowed. HOS does not support hierarchical structure, such as UNIX directories or the Macintosh Finder's folders, so there is no way for you to organize disk files. Using ls, the directory-listing command, results in a display of the

entire contents of every mounted disk. This is a serious handicap for anyone using a hard disk with HOS.

HOS does have some nice features. For example, it always looks to both disks for any program that you request to be executed. This frees you from having to specify disks and search paths, although the ability to specify search paths is sometimes very useful. HOS also has a special MAKEMAKE command that helps automate the process of compiling, assembling, and linking one or more C modules into a program that can run.

The Hippo-C text editor bears a strong resemblance to Apple's MDS editor. It uses the normal Macintosh environment and allows up to eight separate text files to be opened at one time. It has a really helpful feature for tracking down compile-time errors. If you run the Hippo-C compiler and receive a list of errors, you can open the editor with an option specifying that you want the error messages placed into the C program immediately following the portion of the pro-

(continued)

Inquiry 56 for End-Users.
Inquiry 57 for DEALERS ONLY.



COMPLETE IBM COMPATIBILITY

STAY AHEAD OF THE GAME
WITH THE LOWEST IN TOWN!

TECH PC/AT \$2099

PRICE INCLUDES:

- 6MHZ 80286 CPU
- 512K
- ONE 1.2 MB FLOPPY DRIVE
- 8 EXPANSION SLOTS
- 195 WATT POWER SUPPLY
- COMPLETE MS DOS, PC DOS, XENIX COMPATIBILITY
- RUNS LOTUS 123, DBASE III FRAMEWORK AND ALL OTHER POPULAR AT SOFTWARE.
- ONE YEAR WARRANTY!!

OPTIONS:

- TECH PC/AT WITH 20MB HARD DISK **\$2499**
- TECH PC/AT WITH 20MB HARD DISK, MONOCHROME MONITOR, HERCULES® COMPATIBLE MONO/GRAPHICS CARD **\$2699**
- ALSO AVAILABLE WITH 6-8 MHZ SWITCHABLE CPU, TAPE BACKUPS, MODEMS, LARGER HARD DISKS, AND NETWORKING SYSTEMS.

TECH TURBO PC/XT \$1099

PRICE INCLUDES:

- 4 TO 7 MHZ SOFTWARE SWITCHABLE CPU
- 640K
- TWO 360K DS/DD FLOPPY DISK DRIVES
- 8 EXPANSION SLOTS
- 135 WATT POWER SUPPLY
- ONE YEAR WARRANTY!!

OPTIONS:

- TECH TURBO PC/XT WITH 20MB HARD DISK **\$1699**
- TECH TURBO PC/XT WITH 20MB HARD DISK, MONOCHROME MONITOR AND HERCULES COMPATIBLE MONO/GRAPHICS CARD **\$1950**

TECH PC/XT \$799

PRICE INCLUDES:

- 4.77 MHZ CPU
- 256K
- TWO 360K DS/DD FLOPPY DRIVES
- 8 EXPANSION SLOTS
- 135 WATT POWER SUPPLY
- ONE YEAR WARRANTY!!

OPTIONS:

- TECH PC/XT WITH 20MB HARD DISK **\$1449**
- TECH PC/XT WITH 20MB HARD DISK, MONOCHROME MONITOR, HERCULES COMPATIBLE MONO/GRAPHICS CARD **\$1649**

TELEX: 272006

Answer Back-TECH
FAX: 714/558-8325

VISA, MASTERCHARGE,
CHECK ACCEPTED

TECH PC PERSONAL COMPUTERS

714/754-1170

2131 S. HATHAWAY, SANTA ANA, CA 92705

©1985 TECH PC
Hercules is a registered trademark of Hercules Computer Technology.

IBM, IBM PC, XT, and AT are registered trademarks of International Business Machines Corp.

gram that caused each error. You can then easily work through the program, finding and fixing each error, after which you can ask the editor to remove the error messages from the file. Save the revised code file and you are ready to try to compile again.

The C compiler uses two passes to produce assembly code. If you are

using a 128K-byte Mac, the compiler can use the 20K bytes of RAM set aside for the screen display as part of its work space. This allows you to create larger C programs on a 128K-byte Mac than would be possible otherwise. The compiler itself is absolutely inflexible, offering no compile-time options. This is quite un-

fortunate, as demonstrated by Hippo-C's inability to run the QSORT benchmark program because of a shortage of stack space. Additionally, the compiler does not allow for in-line assembly code within C programs.

The assembler, like the compiler, is most noteworthy in its lack of flexibility. It has no assembly-time options. It allows very limited constant expressions (only addition and subtraction of numbers to labels) and has no macro-processing capabilities. The linker is adequate, but it is also limited in its features and offers no options. A simple librarian function works in conjunction with the linker, but the programs produced by Hippo-C are nonetheless excessively large.

Hippo-C's manual is almost, but not quite, adequate. The highlight is its index. The documentation is readable but provides little help in terms of creating stand-alone Macintosh applications. For example, the manual does not address the differences between the string formats of C programs and the Pascal-type strings expected by the Macintosh ROM routines.

The manual discusses how Apple's MDS RMAKER (resource maker) program can be used to add resources to a program made by Hippo-C, but RMAKER is nowhere to be found. The user is simply advised that RMAKER is available from Apple. Combine this with the inability of Hippo-C's assembler to directly support resources and Macintosh application developers are left high and dry as far as including resources in their programs.

Although Hippo-C does not directly support C floating-point operations, Hippopotamus devotes a chapter in its manual to describing how to take advantage of the Macintosh's built-in floating-point support. Using the techniques described in this chapter, the C programmer can do a fair number of floating-point operations (such as +, -, *, /, sin, cosine, etc.). In addition, a definition file provided on the Hippo-C disk can be included in C programs to set up typedefs for C floating-point types. Although the

(continued)

Tools for the Programmer from Blaise Computing

Save Up To \$130 On These Special Offers!

TOOLS & TOOLS 2

For C or Pascal

For a limited time, pick up both packages and save \$50 off our regular list price. The C version comes with libraries for the Lattice, Computer Innovations and Microsoft (version 2.03 and

3.00) compilers. The Pascal version supports IBM and Microsoft Pascal. **\$175.**

VIEW MANAGER With Source

All libraries are included. Please specify C or Pascal. Regular \$425. Save \$130. **\$295**

Blaise Computing provides a broad range of fine programming tools for Pascal and C programmers, with libraries designed and engineered for the serious software developer. You get clearly written code that's fully commented so that it can serve both as a model and also be easily modified to grow with your changing needs. Our packages are shipped to you complete with comprehensive manuals, sample programs and source code. None of the programs are copy-protected.

FOR C AND PASCAL PROGRAMMERS:

TOOLS ♦ \$125

Extensive string and screen handling, graphics interface and easy creation of program interfaces. Includes all source code.

TOOLS 2 ♦ \$100

Memory management, general program control and DOS file support. Interrupt service routine support. Includes all source code.

VIEW MANAGER ♦ \$275

General screen management. Create data entry screens that can be easily manipulated from your application program. Block mode data entry and retrieval with fast screen access.

VIEW LIBRARY Source ♦ \$150

Source code to the VIEW MANAGER library functions.

ASYNCH MANAGER ♦ \$175

Powerful asynchronous communications library providing interrupt driven support for the COM ports. All source code included.

FOR THE TURBO PASCAL PROGRAMMER:

Turbo POWER TOOLS ♦ \$99.95

Extensive string support, extended screen and window management, interrupt service routines, program control and memory management, interrupt filters. All source code included.

Turbo ASYNCH ♦ \$99.95

Interrupt driven asynchronous communication support callable from Turbo Pascal. ASYNCH is written in assembler and Turbo Pascal with all source code included.

PACKAGES FOR ALL PROGRAMMERS:

ERIC ♦ \$99

Program chaining executive. Chain one program from another even if the programs are in different languages. Common data area can be specified. Source code included. If you're a registered C TOOLS and C TOOLS 2 user.

SPARKY ♦ \$75

Run-time resident (or stand-alone) scientific, fully programmable, reverse polish notation calculator. No limit on stack size, variables or tape. Includes all standard scientific functions and different base arithmetic.

TO ORDER, call Blaise Computing Inc. at (415) 540-5441

♦ 2034 Blake Street ♦ Berkeley, CA 94704 ♦ (415) 540-5441



Hard to be Humble



\$149

\$199

Hayes™ compatible modems—Incompatible price

It's hard to be humble when IBM™ compatibility, excellent performance, and very low cost are among your products' hallmarks.

Sunnyvale Communications Company introduces the new 1200LC Modem, a true high performance—low cost complete modem unit. Whether you decide on our popular 1200TPC internal card design or its new standalone version you won't be disappointed.

IBM™ PC, AT, XT COMPATIBLE

We include all the hardware and cables needed to allow you to access data bases, send electronic mail, make simple user to user connections, and more!

MONEY BACK GUARANTEE!

At this price you wouldn't expect 1200/300 bps operation, Hayes™ compatibility, auto-dial and answer, auto speed and parity selection, tone or pulse dialing, *and* a built-in call monitoring speaker now would you? At Sunnyvale Communications Company we give you more! Coupled with our two year modem warranty is a 30 day money-back guarantee. Sound better all the time?

Place your order toll-free today, or write to us for more information.

NAME _____

ADDRESS _____

DAY PHONE _____

CHECK ENCLOSED

VISA/ACCT. NO. _____

MASTERCARD/ACCT. NO. _____

1200LC Modem

1200 TPC Modem Card

SIGNATURE _____

California residents add sales tax. All orders add \$4 per modem for shipping and handling. Additional freight charges will be added for Canadian and international orders. No C.O.D.s or purchase orders accepted. Allow four weeks for delivery.

**Sunnyvale
Communications
Company**

P.O. Box 3565 · Sunnyvale, CA 94088-3565
408/752-5095

800/ 835-9009 in Ca.
TOLL FREE ORDER LINES
558-5741 outside Ca.

EARTH LAUNCHES NEW STARS

EARTH COMPUTERS launches two of the "Hottest" new stars in the S-100 Universe. Both the **TURBOMASTER 8™** and **TURBOSLAVE I™** are Star performers, featuring high speed Z-80H CPUs.

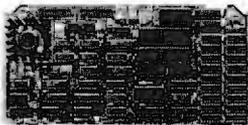
EARTH's new stars are fully compatible with the Multi-user TurboDOS operating system, and will operate in most S-100 systems, including pre-IEEE 696 systems.

TURBOMASTER 8

This outstanding new 8-Bit Single Board Computer offers features that are out of this world:

- On-board ST-506 Winchester Controller
- TurboDOS, CP/M, MP/M compatible
- 5-1/4" and 8" Floppy Controller
- Up to 256KB of memory • 2 Serial ports
- 8 MHz, Z-80H CPU • 1 Parallel port

TURBOSLAVE I



The perfect companion to the **TURBOMASTER 8** or other 8/16-Bit Master processor. This high speed slave utilizes an 8 MHz Z-80H CPU and offers extensive on-board diagnostics... an industry exclusive.

- No paddle boards
- S-100, IEEE 696 compatible
- 128KB of RAM
- 2 RS-232 ports, 50-38.4K Baud
- FIFO communications

EARTH COMPUTERS also manufactures a growing line of PC compatible stellar performers such as:

- **TURBOSLAVE PC™**—an 8 MHz



Z-80 single board slave processor that runs CP/M applications on a PC and is compatible with the TurboDOS multi-user operating system.

- **TURBOACCEL 286™**—a high performance 80286 accelerator that boosts PC performance up to five times.
- **EARTHNET PC™** and **EARTHNET S-100**, the low cost, ARCNET-compatible way to tie PC and S-100 systems together.

To put these stars to work for you, call or write EARTH COMPUTERS. **BE SURE TO ASK ABOUT HOW YOU CAN WIN A FREE Z-80 CO-PROCESSOR BOARD.**

EARTH COMPUTERS

"Building Blocks For The Super Micro"

P.O. Box 8067, Fountain Valley, CA 92728
TELEX: 910 997 6120 EARTH FV
PHONE: (714) 964-5784

REVIEW: C COMPILERS

Listing 6: *The INTMATH benchmark.*

```

/*      intmath.c      */
#include "stdio.h"
#define COUNT 10000
main()
{
    int i, j, k;

#include "startup"
    for (i = 0; i < COUNT; ++i) {
        j = 240; k = 15;

        /* test byte-byte combinations */
        j = (k * (j / k));
        j = (k * (j / k));
        j = (k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k);
        k = (j -k-k-k-k -k-k-k-k -k-k-k-k -k-k-k-k);

        /* test byte-word combinations */
        j = (j << 4); = (k << 4);
        j = (k * (j / k));
        j = (k * (j / k));
        j = (k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k);
        k = (j -k-k-k-k -k-k-k-k -k-k-k-k -k-k-k-k);

        /* test word-word combinations */
        j = (j << 4); k = (k << 4);
        j = (k * (j / k));
        j = (k * (j / k));
        j = (k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k+k);
        k = (j -k-k-k-k -k-k-k-k -k-k-k-k -k-k-k-k);
    }

#include "done"
}

```

Listing 7: *The QSORT benchmark.*

```

/* QSort.c */
/* sorting benchmark—calls random the number of times specified by MAXNUM to
create an array of long integers, then does a quicksort on the array of longs.
The program does this for the number of times specified by COUNT.
*/
#include "stdio.h"
#define MAXNUM 1000
#define COUNT 10
#define MODULUS ((long) 0x20000)
#define C 13849L
#define A 25173L
long seed = 7L;
long rrandom();
long buffer [MAXNUM] = {0};
main()
{
    int i,j;
    long temp;

```

(continued)

BOX.OFFICE HIT.



Most software companies would call it a stroke of luck if they designed a system so effective, it became the small business favorite.

We call it a stroke of genius.

CYMA
MCGRAW-HILL
800-292-CYMA

Your Best Buy

AB SWITCHING BOXES



RS232 SERIAL AB 2-Way DU-2500 \$59⁰⁰ All 25 leads Switched	Centronics Parallel AB 2-Way DU-3600 \$79⁰⁰ All 36 leads Switched
--	---

COMPARE FEATURES

- Indestructible Hi Impact Case
- Mil Grade Fiberglass P.C. Board
- Sealed-Push button Switches
- All 25 or 36 Lines Switched
- High Grade at economy prices
- 100% Satisfaction Assured!
- Distributor or Qty. prices available

DATA CABLES



- Lengths from 2.5 to 50 ft.
- Male-Male or Male-Female
- Shielded, Unshielded Cables
- RS232 or Centronics & Coax.

We carry over 500 std. cable items in stock. Including D-Sub 9, 15, 25, 37, Centronic, IEEE 488, Coaxial, Twinax, etc. Please call for price information and delivery.

TOP OF THE LINE



- Sturdy Steel Case-RFI Proof
- Gold Plated Switch Contacts
- LED Line Monitors (Optional)
- Harmonizing Light Tan Color
- 18 Std. Models To Choose from
- RS232, Centronics or Coax Types
- 2, 3, 4 Position & X Sw-Over
- Size: 7.25" x 5" x 2.25"
- Description & Prices On Request
- Immediate Delivery from Stock

More than 800 DP Essentials
Add \$4.50 Shipping & Handling

TO ORDER **800-343-1455**
TECHNICAL SUPPORT: 617-682-6936

Ecom DATA PRODUCTS
1755 Osgood St. Rte 125
No. Andover MA 01845

REVIEW: C COMPILERS

```
#include "startup"
printf("Filling array and sorting %d times \n",COUNT);
for (i=0; i<COUNT; ++i)
{
    for (j=0; j<MAXNUM; ++j)
    {
        temp = rrandom(MODULUS);
        if (temp < OL)
            temp = (-temp);
        buffer[j]=temp;
    }
    printf("Buffer full, iteration %d \n",i);
    quick(0,MAXNUM,buffer);
}
#include "done"
}
quick(lo,hi,base)
int lo, hi;
long base[];
{
    int i,j;
    long pivot, temp;
    if (lo<hi)
    {
        for (j=lo,j=hi,pivot = base[hi]; i<j; )
        {
            while (i<j && base[i] < pivot)
                ++i;
            while (j<i && base[j] > pivot)
                --j;
            if (i<j)
            {
                temp = base[i];
                base[i] = base[j];
                base[j] = temp;
                quick(lo, i-1, base);
                quick(i+1, hi, base);
            }
        }
    }
    long rrandom(size)
    long size;
    {
        seed = seed * A + C;
        return(seed % size);
    }
}
```

steps involved are tedious, this does give you a degree of floating-point functionality.

In my short time spent working with Hippo-C, I found several significant bugs and glitches that hampered my work. One example: When I interrupted the execution of a make batch file, I lost a great deal of the Macintosh's available memory. I suspect this is due to the memory not being released to the Macintosh's memory manager as it should have been.

Subsequent attempts to use the compiler often failed, informing me that not enough memory was available (even using my 512K-byte Mac) to compile the program. I had to perform a full system reset to correct the situation.

The bugs in Hippo-C can probably be explained by the fact that the version I received was one of the first production models.

The operative word for Hippo-C is
(continued)

limited. Despite some nice touches, the HOS working environment lacks the power needed for true professional software development. The compiler, assembler, and linker are all inflexible. The sum of the parts does not add up to a professional development system for the Macintosh.

MAC C

The Mac C compiler from Consulair is designed to be integrated into the Apple Macintosh 68000 Development System. The MDS text editor is used to create C source files from which Mac C produces assembly code. You then assemble and link this into an execution file with the MDS package. The combination of Mac C and MDS gives you a fully integrated C compiler/assembler/linker/debugger system that supports most of the standard C language and provides useful Macintosh-specific enhancements.

Optionally available from Consulair is Mac C Toolkit, a support library that would be useful to any serious Mac C user (either a Macintosh software developer or just an intensive C programmer). Also available is Mac C Examples, a disk of C source code demonstrating a variety of Macintosh interfacing techniques. This is a must for anyone starting down the difficult path of learning how to develop software for the Mac.

If you like Apple's MDS, you should enjoy Mac C. This friendly C compiler was created by Bill Duvall, who wrote MDS. It becomes apparent very quickly that the same philosophies are at work in these two products. The advantage to this is that the separate systems intertwine quite comfortably.

The documentation for Mac C comes in the form of a programmer's guide consisting of 135 pages, 52 of which are appendixes. The manual is

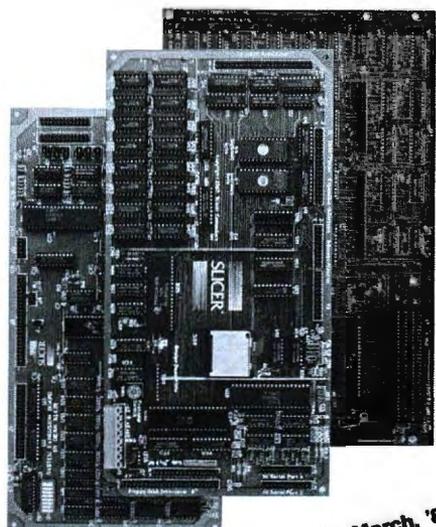
concise yet very informative. Despite an abundance of distracting spelling errors, I like the Mac C manual. It tells you what you need to know to use the compiler without extraneous information.

Consulair's Mac C Toolkit offers an array of tools fashioned especially for use in developing Macintosh applications. The Toolkit is a disk of some 120 routines and C functions. Best of all, the C source code is included for all the Toolkit operations, making it a breeze to modify them for your particular needs or learn how to work with the Mac more effectively.

The Toolkit offers high-level functions for support of the Macintosh environment and user interface (including input/output [I/O] operations such as disk-file or serial-port interaction, string-manipulation facilities, and memory-management features), as

(continued)

SLICER — THE SYSTEM THAT GROWS TO FIT YOUR NEEDS



see BYTE, March, '85
page 193

THE SLICER

Real 16 Bit Power on a Single Board — Featuring the Intel 80186 (C) Step CPU

- Complete 8 MHz 16-bit micro-processor on a 6" x 12" board
- 256K RAM, plus up to 64K EPROM
- SASI port for hard disk controller
- Two full function RS232C serial ports with individually programmed transmission rates—50 to 38.4K baud
- Software compatibility with the 8086 and 8088.
- 8K of EPROM contains drivers for peripherals, commands for hardware checkout and software testing
- Software supports most types and sizes of disk drives
- Source for monitor included on disk
- Bios supports Xebec 1410 and Western Digital WD 1002 SHD controller for hard disks

Fully assembled and tested only \$895

THE SLICER 1-MByte EXPANSION BOARD

For expanded memory, additional ports, and real time clock

- 1-MByte additional dynamic RAM
 - 2 RS232C asynchronous ports with baud rates to 38.4K for serial communication
 - 2 additional serial ports for asynch (RS 232) or synch (Zilog 8530 SCC) communication
 - Real Time Clock with battery backup
 - Centronics type parallel printer port
- Fully assembled and tested only \$750

SLICER/1MByte EXPANSION COMBO

The Slicer (without RAM or RAM controllers) with Full 1-MByte Memory Expansion

Kit form only

NEW

\$1295

THE SLICER PC EXPANSION BOARD

Gives your Slicer high performance video capability

- IBM compatible monochrome video
- Video memory provides 8 pages of text or special graphics capability
- 2 IBM type card slots for color video, I/O expansion, etc.
- IBM type keyboard port

Fully assembled and tested only \$600

All boards available in kit forms

The SLICER Bulletin Board (300/1200 baud)
612/788-5909

Runs MS DOS generic software; PC DOS program operation not guaranteed

Also available: The μ Slicer 188 \$700; 8087 Math Co-Processor Bd. (call); 10 MB Hard Disk \$700; W.D. 1002-SHD H.D.C. Bd. \$200; Enclosures, Power Supply, and Support Hardware.

CP/M 86 \$85, CCP/M \$250 (Digital Research, Inc.); MS DOS \$175 (Microsoft Corp.)

MasterCard, Visa, Check, Money Order, or C.O.D. Allow four weeks for delivery. Prices subject to change without notice.

QUALIFIED DEALER INQUIRIES INVITED



Slicer Computers Inc.
2543 Marshall St. N.E.
Minneapolis, MN 55418
612/788-9481
Telex 501357
SLICER UD

Revelation® is a classic case of 'you get what you pay for.' It costs a bit more than most, but it gives you the best there is.

— PC Magazine, September 4, 1984

If you think that dBASE III™ or R:base 5000™ is the solution to your information processing needs, consider for a moment the high expectations you and your company should have for your next database management system.

For starters, it needs to network.

Revelation is ready to network now, not "someday soon." You choose the best hardware and software for your unique needs, including IBM®'s PC Network or any networks running Novell NetWare.™

Network Revelation also locks data at the record level. That's a critical capability that means the difference between a working network and disappearing data.

Make sure that it has an excellent command of the language.

R/Design, Revelation's application generator is your ticket to the most powerful applications running on PC's. That's because R/Design steps you through the entire application generation process, from defining databases to writing the documentation. And when you're done, Revelation will compile your application in R/Basic source code, a complete, structured relational language.

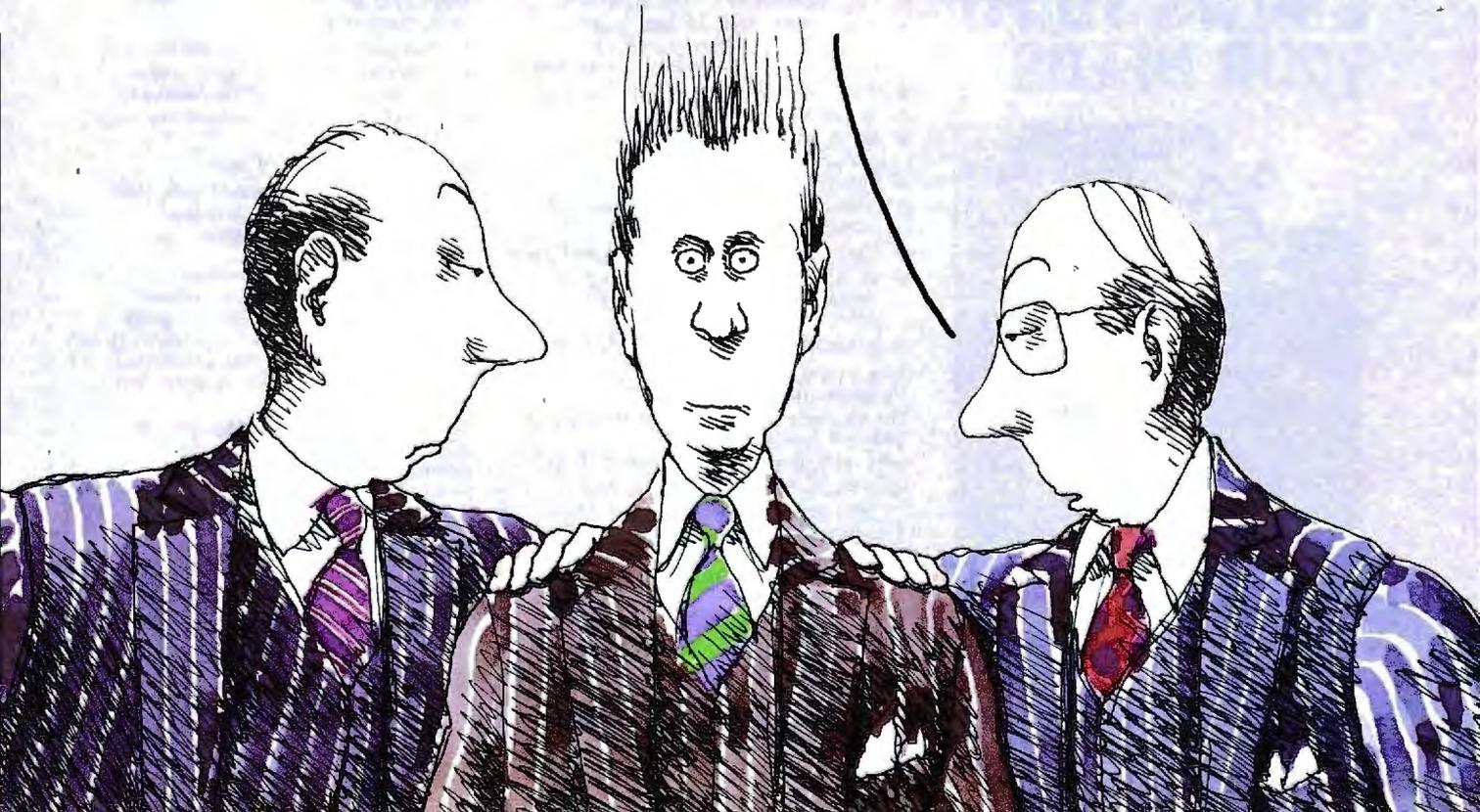
Find out how easily you can retrieve information.

With R/List, Revelation's query language, you ask questions in plain English. Simple sentences produce detailed reports in just about any format you can imagine.

And while you're at it, ask Revelation about its variable-length fields, unlimited files, and fields, data dictionaries, and high-speed compiler. You'll find all the tools you need for serious applications development. With prices starting at only \$1495* for a complete four-user system, Network Revelation gives you *more* than you paid for.

*Suggested U.S. price.

**IF YOU CHOOSE A WIMPY
DATABASE THAT'S UNABLE TO
KEEP PACE WITH OUR
GROWING COMPANY, YOU'LL
HAVE TO CHANGE YOUR NAME
AND MOVE TO PARAGUAY!**



A revealing comparison between R:base 5000, dBASE III and Revelation

	Revelation	R:base 5000	dBASE III
Maximum Characters/Record	65000	1530	4000
Maximum Fields/Record	65000	400	128
Relational Operators	9	6	6
Data Dictionary	Yes	Yes	No
Procedural Language	Yes	Yes	Yes
Variable-Length Fields	Yes	No	No
Report Writing Features:			
A) Access to Date/Time	Yes	Yes	No
B) Row or Column Formats	Yes	Yes	No
C) Accessible Tables	6000	40	10
Password Security	Yes	Yes	No
Definable Data Entry Rules	Yes	Yes	No
Pre-Defined Macros	Yes	Yes	Yes
Application Generator	Yes	Yes	No
Application Compiler ⁽¹⁾	Yes	Yes	No
Run-Time Module	Yes	Yes ⁽²⁾	Yes ⁽²⁾
Natural Language	Yes	Yes ⁽³⁾	No
Network Version	Yes	No ⁽⁴⁾	No

1) From original manufacturer; 2) Available soon; 3) Extra cost option; 4) Announced for late 1985. dBASE III is a trademark of Ashton-Tate. R:Base 5000 is a trademark of MicroRIM, Inc. MS is a trademark of Microsoft. IBM is a registered trademark of International Business Machines Corporation. NetWare is a trademark of Novell, Inc.

It's your choice: The vice presidency or Paraguay

Cosmos' worldwide network of sales representatives stand ready to show you the incredible power of Revelation. Call today to schedule a career altering demonstration or to request an evaluation copy.

Cosmos, Inc., 19530 Pacific Hwy. S.
Seattle, WA 98188, (206)824-9942,
Telex:9103808627 (Cosmos WA)



Inquiry 98

COSMOSTM

HOWEVER, IF YOU FIND ONE THAT CAN GROW AS WE GROW, EVEN NETWORK, YOU JUST MIGHT BE OUR NEXT VICE PRESIDENT! WHY ARE YOU SMILING?



well as low-level I/O functions that provide such things as "Teletype simulation windows" (to handle the Macintosh window creation and manipulation chores for programs that need simple text windows) and easy access to the Mac keyboard, serial ports, mouse, and disk files.

For accessing the Macintosh ROM

Toolbox routines, Mac C offers a direct interface without the use of any "glue code." The compiler recognizes ROM function calls and emits the proper code to set up parameters as required by the ROM routines. However, strings must be converted back and forth between C and Pascal string types as appropriate. (Mac C supplies

efficient functions that do these conversions.)

Unlike most compilers, which use the system stack to pass parameters to functions, Mac C uses the microprocessor's internal registers to hold the first seven parameters, while the stack gets any extras. Since most C functions have fewer than seven parameters, the stack is not often used for parameter passing. I suppose the idea is that passing parameters through registers results in faster execution time since less stack activity is required. In practice, this may not always work out since any function that wishes to make a number of other function calls itself needs to save its registers on the stack anyway. However, the QSORT benchmark function, which tests the efficiency of function calling and parameter passing, was Mac C's only first-place score. The negative side of the use of registers for parameter passing is that it precludes implementation of the register variable feature. Thus, even though Mac C won the standard QSORT benchmark, it was left in the dust when Aztec C kicked into high gear with the use of its register variables.

Mac C supports in-line assembly code. Additionally, the assembler programmer can use the full capabilities of the Apple MDS assembler and easily link pure assembly modules with modules generated by Mac C. In fact, since Mac C itself emits assembly source code that is subsequently assembled using the MDS assembler, it is possible for the programmer to directly modify the assembly file produced by Mac C.

The Mac C Examples disk is a real bargain at \$25. This disk includes source code for a variety of C programs that demonstrate different Macintosh program-development techniques. It covers creating desk accessories in C, using dialog boxes, icons, events, windows, ports, and even working with the sound-generating capability of the Mac. You will have to work a little at making the most of these tools since they are self-

(continued)

Swap diskettes with popular CP/M* computers!

Just \$69.95 turns one of your PC's floppy drives into a CP/M computer "look-alike" with UniForm-PC.

Imagine a software breakthrough that gives your IBM PC, PC-XT, PC-AT or compatible the ability to *directly* read, write and format diskettes from most popular CP/M computers—8 or 16 bit! Remarkable UniForm-PC actually reconfigures your floppy drive to emulate the selected CP/M format, allowing your applications programs and utilities to directly access data files that were previously out of reach.

Menu-driven UniForm-PC is easy-to-use and inexpensive. Simply load, select the proper diskette format and go! DOS procedures are unchanged when you use the CP/M diskette. You can even start a project on a PC at work and finish it on a CP/M machine at home without the need for additional hardware or modifications! At just \$69.95, CP/M compatibility never cost so little!

UniForm-PC is available now from your local computer dealer or Micro Solutions.

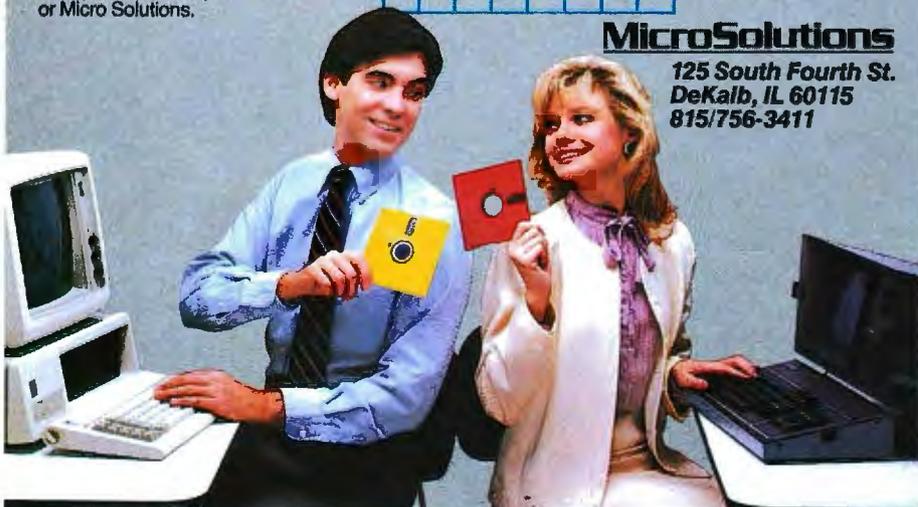


For CP/M computer owners, UniForm bridges the gap between non-compatible CP/M formats, as well as providing access to MS-DOS** files. It's also just \$69.95.

Trademarks:
*Digital Research
**Microsoft Corporation

MicroSolutions

125 South Fourth St.
DeKalb, IL 60115
815/756-3411



An Incredibly Good Buy, the...

PS Turbo 640

At PS Computers we look at the personal computer from a totally different viewpoint; yours.



When I learned to fly I considered it the ultimate challenge. That was before I tried to get my first IBM PC up and running, configured like I wanted.

I had decided that I wanted my PC to be 100% IBM. I soon found that though there were many IBM PCs advertised in the magazines at very attractive prices, the only thing about them that said IBM was the mother board, case and a poorly laid out keyboard. The other parts were made by third party vendors. In some cases these add on boards were by recognized companies and in other cases they were offshore knockoffs of inferior quality.

I chose instead to buy a bare bones IBM PC, put in the exact cards I wanted and possibly save some money. I compared features and prices of all the cards advertised in the major computer magazines, decided on my best buy and called in several orders. A week or so later the parts started to arrive. I opened up the case of my IBM and went to work. It was not a pretty sight. Three months and a hundred very frustrating hours later I had the system I wanted. It contained a 10 meg hard disk, maximum memory, modem, ports, a Key Tronic keyboard and a good video board. The computer ran alright and I was fairly happy with it.

Total time spent working on the PC, calling the board manufacturers for missing information and installing batch files and patches to use the new features? About as much time as I spent training to fly high performance aircraft. How much extra money? It's probably cheaper learning to fly.

It was with those seemingly endless hardware loops still fresh in my mind that I started PS Computers. Taking into consideration all the good and bad points of the IBM PC/XT we went out into the marketplace and purchased in volume the finest PC components at the best prices. We picked out a faster mother board, a more versatile multifunction card, a heavier duty power supply, a VLSI hard disk controller, the latest video board, and nice quiet drives.

Very carefully and with great attention to detail we install these proven components in a case identical in appearance to the IBM PC. We call this computer the Turbo 640.

COMPATIBILITY

If a program runs on the IBM PC, it will run on the Turbo 640. I use Dbase III, Lotus and Microsoft Word daily on my PS Turbo 640. In the turbo mode (selected with three keystrokes) the increase in program execution speed is immediately evident. Peter Norton's System Information program assigns the PS Turbo 640 a processing speed factor of 1.4 in comparison to an IBM PC. That's 40% faster

VIDEO

The video card and monitor decide what you will and will not see when you turn on your PC. Basically, the options are monochrome text, high resolution graphics and color graphics. Generally speaking, if a PC type computer has graphics capabilities the text will be displayed as fuzzy pixel generated characters.

The PS Turbo 640 is an exception. The 640 uses the hottest display card on the market - Paradise Systems' MGC II. The MGC II displays crisp monochrome text, high resolution graphics and color graphics on the 640's 12" TTL amber monitor. Color graphics (like Flight Simulator) are converted to 16 shades of amber by the MGC II; therefore, they appear sharper than when viewed on a color monitor. Though the MGC II is standard with every Turbo 640 you may never realize it's there. You don't have to set any switches and there are no software drivers to load. If you ever need to use a color monitor with the Turbo 640, you're in luck - the MGC II gives great color on any RGB monitor.

MEMORY

One of the most common PC upgrades is additional memory. It's purchased as little black ICs that are pushed into sockets on a circuit board. The maximum contiguous memory that a PC type computer can use is 640K - exactly the amount that comes already installed right on the Turbo 640 mother board. This means you'll never have to find out for yourself how easily the little leads of those chips bend over backwards and break off.

IO

The PS Turbo 640 system includes a multifunction card that will handle four disk drives, has two serial ports, a parallel port, a game port and a battery backed up clock. Two front panel LEDs indicate power on and high speed processor mode.

KEYBOARD

The Turbo 640 comes with a 5151 style keyboard. The dedicated arrow keys, numeric keypad and caps lock all have LED status indicators. Unlike the stock IBM PC keyboard, you don't need fingers like E.T. to effectively reach the return key.

MONITOR

The 640's monitor is a high resolution, TTL, nonglare amber display. The power cord plugs into the back of the computer allowing the entire system to be powered by one wall outlet and to be turned on with the

computer's power switch. The swivel base provides effortless adjustment of the monitor for best viewing angle.

TECH STUFF

The PS Turbo 640 uses the 8088-2 processor running at a keyboard selectable 4.77 or 7.50 MHz. The mother board is an extremely well constructed product of Japan. There are 2 buss extension points and 8 expansion slots (the floppy based system has two slots taken; the hard disk version has three taken). A socket is provided for the 8087-2 coprocessor chip. The 135 watt power supply is standard on all Turbo 640s, providing ample power for specialty add on cards.

The 5.25" floppy drives are manufactured by TEAC and the hard disk drives are from Seagate. Both are quiet and very reliable.

SOFTWARE

We want to be sure you can use your new computer the moment you take it out of the box, so the Turbo 640 system includes software.

RAM disk and printer spooling programs are provided as well as the PopUp Desktop from Bellsoft. PopUps are utility programs that provide you with memory resident functions like a calculator, notebook, clipboard, alarm clock, calendar and DOS commands. When you need any of these facilities, no matter how deep into your spreadsheet, database or document you might be, two keystrokes pop any of them up on your screen. When you're finished just hit the escape key; your program never knew you were gone.

IBM PC DOS 2.10 and the full DOS manual are included. The Turbo 640 runs Basic just fine, however Basic and Basica on the PC DOS disks are proprietary to IBM. PC DOS Basic will run only if your system contains IBM ROM Basic. We've chosen not to provide these extra ROMs with the Turbo 640 package. ROM Basic is available and can be installed in existing sockets on the 640's mother board.

Having three different Basics running around inside your computer at the same time borders on being an unnatural act. To save you the headache of figuring out which Basic to use when and for what; Turbo Pascal 3.0 from Borland International is packaged with every Turbo 640 system.

ORDERING

Our 800 numbers are available 24 hours a day for American Express orders. Mail orders are gladly accepted with cashier's check. Your unit will be shipped UPS ground the next business day. There are no additional charges for standard shipping and only orders shipped within California pay tax.

SATISFACTION

If for any reason you are not pleased with your PS Turbo 640, PS Computers will make a complete refund of the purchase price. Call us toll free within 7 days for pick up by UPS. A credit will be issued to your American Express account or a cashier's

check will be sent to you the same day we receive the computer.

SUPPORT

PS Computers maintains a 24 hour computer bulletin board service. Questions on the board are generally answered within an hour of being posted. Replies to inquiries made by phone or letter are sent the same day as received via MC! Mail. When you have a question about a product from PS Computers the answer you receive will be complete, correct and in writing.

WARRANTY

All PS Computer products are guaranteed for six months. If there's a hardware problem call us on the 800 line, we'll have UPS pick up the equipment. Repairs will be made and your unit shipped within 48 hours after we receive it.



PS Turbo 640 System
Two TEAC Floppy Drives
\$1,700

PS Turbo 640 System
20 Meg Internal & 1 Floppy
\$2,300

PS 286p
80286 Coprocessor Board by Phoenix
\$1,400

PS 086k
8086 Coprocessor Board by Kameron
\$800

PS 1200B Internal Modem
Hayes Type - Mite Software
\$225

PS 26 Tape System
26 Meg Volume or Image Backup
\$900

PS Juki 6100
Letter Quality Printer
\$400

PS Juki 5510
FX Compatible Dot Matrix
\$400

Canada & Export Line
619-325-4856

Modem Line 300/1200
619-323-4962

National Order Line
800-654-7650

California Order Line
800-231-8701



PS Computers

200 W. San Rafael Road
Palm Springs, CA 92262
Inquiry 315

The (really) fine print. Microsoft Word and Flight Simulator are trademarks of Microsoft. Lotus is a trademark of Lotus Development Corporation. Dbase III is a trademark of Ashton-Tate. Turbo Pascal is a trademark of Borland International. The PopUp series of software are trademarks of Bellsoft. Key Tronic Corporation is the manufacturer of the KB 5151 keyboard, our keyboard is similar but is manufactured abroad. Hayes refers to Hayes Microcomputer Products and Mite is a trademark of Mycroft Labs. IBM and PC DOS are trademarks of a company called International Business Machines.

I B M / P C

CROSS ASSEMBLERS

We've been selling these industrial-quality assemblers to the development system market since 1978. They are now available for the IBM PC.

FEATURES:

- Fully relocatable
- Separate code, data, stack, memory segments
- Linker included
- Librarian included
- Generate appropriate HEX or S-record formatted object file
- Macro capability
- CPM80, MPM, ISIS versions available
- Conditional assembly
- Cross reference
- Supports manufacturer's mnemonics
- Expanded list of directives
- 1 year free update

Assemblers now available

include:

Chip	Chip
1802/1805	NSC800
8051	FB, 3870
6500/01/02	Z8
6800/01/02	Z80
6803/08	9900/9995
6804	Z8000
6805	68000
6809	6301
6811	8048/49/50/42
8085	65C02/C102/C112

Take advantage of leading-edge technology. Get your own Relms assembler today. Use your Mastercard or order by phone: (408) 265-5411

Relational Memory Systems, Inc.
P.O. Box 6719
San Jose, California 95150
Telex: 171618

Prices subject to change without notice.
Software distributor inquiries invited.



REVIEW: C COMPILERS

Listing 8: The POINTER benchmark.

```

/*      pointer.c      */
#include "stdio.h"
#define COUNT      10000
#define ALLOTTED   128
main()
{
    char workarea[ALLOTTED], *ptr;
    int i;
#include "startup"
    for (i=0; i < COUNT; ++i) {
        ptr = workarea;
        while (ptr < (workarea + ALLOTTED)) {
            *ptr = ' ';
            ++ptr;
        }
    }
#include "done"
}

```

Listing 9: The SIEVE benchmark.

```

/*      sieve.c      */
#include "stdio.h"
#define TRUE      1
#define FALSE     0
#define SIZE      8190
char flags[SIZE + 1] = {0};
main()
{
    int i, prime, k, count, iter;
#include "startup"
    for (iter = 1; iter <= 10; iter++) {
        count = 0;
        for (i = 0; i <= SIZE; i++)
            flags[i] = TRUE;
        for (i = 0; i <= SIZE; i++) {
            if (flags[i]) {
                prime = i + i + 3;
                for (k = i + prime; k <= SIZE; k += prime)
                    flags[k] = FALSE;
                count++;
            }
        }
    }
#include "done"
    printf("\n%d primes.", count);
    getchar();
}

```

documenting (that is, the only way to figure out what is going on is to read through the comments in the source code itself), but there are some useful things here.

Mac C's major omission is support of floating-point numeric operations. It is possible for a skilled and determined programmer to set up typedefs

(continued)

YOU DON'T NEED A COMPUTER TO FIGURE OUT WHICH IS THE BEST WORD PROCESSOR.

	MultiMate™ v.3.30	Microsoft® Word v.2.0	Word Perfect v.4.0	WORDSTAR® 2000 PLUS v.1.01
Easy-to-remember Mnemonic Commands		✓		✓
Onscreen Tutor For Easy Learning	✓	✓		✓
Built-in Format Sheets For Easy Documents		✓		✓
"Undo" To Easily Restore Text		✓	✓	✓
Built-in Telecommunications				✓
Spelling Corrector	✓	✓	✓	✓
Mail List Manager				✓
Windows Onscreen		✓		✓
Four Function Math Built-in			✓	✓
Alphabetic And Numeric Sorting Within Document				✓
"Macros" For Recalling Often Used Command Sequences	✓		✓	✓
Supports Over 100 Printers	✓			✓
Experience With Over 1.3 Million Owners				✓

WORDSTAR™
2000
Now there are no limits.™

MicroPro.

This updates and corrects comparisons with MultiMate which appeared previously. For a complete comparison chart, write: MicroPro, Dept. 2000, 33 San Pablo Ave., San Rafael, CA 94903. Specifications are for the latest released versions of all products effective July 1985. MultiMate is a trademark of MultiMate Corp.; Microsoft is a registered trademark of Microsoft Corp.; WordStar and MicroPro are trademarks of MicroPro International.

to support float variable types and use the floating-point package supported within the Macintosh Toolbox; however, this is not a trivial task and is not documented or supported by Mac C.

Unfortunately, the things that have the greatest negative effect on Mac C are due to three elements over which

it has no direct control: the dreadfully slow Macintosh disk drives, the inherent disadvantages of the Macintosh interface as a development environment, and limitations of the MDS linker. Since Mac C is not the only compiler to suffer from these problems, I will not discuss them until later. There is a lot to like about Mac C.

It has a good manual, useful Toolkit routines, excellent interface to the ROM Toolbox, and copious amounts of documented source code. The system works as a unit to provide a willing and friendly assistant in the development process. However, Mac C has enough negative aspects to hamper the efforts of a serious application developer.

[Editor's note: Just prior to press time, Consulair announced a number of updates for its Mac C package. These include floating-point math, structure assignment, passing structures by value, enumerated types, improved code optimization, and others. The upgrade with floating-point math is \$50; the upgrade without is \$5. Contact Consulair for further information.]

Atron's PC/AT Bugbusters

Hardware-assisted Software Debuggers for Bullet-proof PC/AT-based Products

A BUGBUSTER STORY

Brad Crain, a project manager at Software Publishing (the people who developed both PFS:WRITE and PFS:FILE), relates the following: "On Friday, March 22, 1985, I was about to get on an airplane with Jeff Tucker, who was co-author of PFS:WRITE with me, and fly to IBM's Boca Raton, Florida facility. For a week, we had been unsuccessfully trying to isolate a bug in a new software product. In a last, desperation move, I set up an early-Saturday morning appointment with ATRON.

"Three of us walked through ATRON's door at 8:00 the next morning. Using ATRON's hardware-assisted debugging tools, we had the problem identified and fixed by 10:30AM."

Mr. Crain concludes: "We'd never have found the bug with mere

software debuggers, which have the bad habit of getting over-written by the very bugs they're trying to find. It doesn't surprise me that almost all the top-selling software packages were written by ATRON customers. Now that they've broadened their PC family of debuggers to include a PC/AT debugging tool, those of us seriously into 80286 development are greatly relieved."

ARE YOU TRYING TO DO SOMETHING SCAREY?

Like developing your AT-based software product in the dark? Without professional debugging tools?

Seven of the ten top-selling software packages listed by the *THE WALL STREET JOURNAL** were produced by ATRON customers. The PC PROBE™ bugbuster (\$1595) accounts for much of this success. Now that the PC/AT is the new standard for advanced commercial and scientific development, ATRON is proud to announce the AT PROBE™ bugbuster (\$2495). It has even more debugging capabilities than the PC Probe.



HOW BUGBUSTERS KEEP YOU FROM GETTING SLIMED

The AT PROBE is a circuit board that plugs into your PC/AT. It has an umbilical which plugs into your 80287 socket and monitors all processor activity.

Since AT PROBE can trace program execution in real time, and display the last 2048 memory cycles, you can easily answer the questions: "How did I get here?" and "What are the interrupts doing?"

It can solve spooky debugging problems. Like finding where your program overwrites memory or I/O-impossible with software debuggers.

You can even do source-level debugging in your favorite language, like C, Pascal or assembler. And after your application is debugged, the AT PROBE's performance-measurement software can isolate your application's bottlenecks.

Finally, the AT PROBE has its own 1-MByte of memory. Hidden and write-protected. How else could you develop that really large program, where the symbol table would otherwise demand most of your PC/AT memory.

BORLAND'S PHILIPPE KAHN: "THERE WOULDN'T BE A SIDEKICK™ WITHOUT ATRON'S DEBUGGERS."

So why waste more time reading through your program listing for the ten thousandth time, trying to find why your program starts howling with every full moon. Be like BORLAND, get your Atron bugbuster today and bust bugs tomorrow.



20665 Fourth Street • Saratoga, CA 95070 408/741-5900

*WSJ, June 24, 1985, reporting Softpak figures. © 1985 by ATRON. PC PROBE™ and AT PROBE™ ATRON. SIDEKICK™ Borland. IBM Corp. owns numerous trademarks. Ad by TRBA.

MEGAMAX C

Megamax C from Megamax Inc. is a one-pass C compiler with an optional "code improver" (optimizer), intelligent linker, librarian, and disassembler. Megamax lets you select from two text editors. The first is Apple's MDS EDIT. The second is an editor that works much like Apple's EDIT but is missing a few of its features and requires about one-third as much disk space. In addition, Megamax has licensed and included RMAKER.

The Megamax C compiler converts C source directly to object code that is ready for linking. There is no separate assembler available. However, in-line assembly is supported, allowing you to mix assembly and C code. In fact, the support of the C #define within in-line assembly modules effectively gives you assembly macro support. However, the lack of a separate assembler needlessly inhibits the developer from fully exploiting the limits of the Mac's potential. There are times when I want pure C code, other times when I want to mix C and assembly, and still other times when I want pure assembly-coded programs or modules.

Curiously, even though no assembler is provided, Megamax does include a disassembler. This would be even nicer if an assembly-level debugger were in the package. You are left

(continued)

WHO SAYS WORDSTAR 2000 IS SO GREAT?

“Move over MultiMate, MicroPro’s back on top.”
— *Business Software*

“The new package is packed with virtually dozens of features everybody wants... Even in a dedicated machine, word processing has never been more plushly self contained and comprehensive.”
— *Personal Computing*

“Three early users of WordStar 2000 gave the program high marks for its overall design, mnemonic command set and intelligent use of function keys.”
— *ComputerWorld*

“I’ve become addicted to some of the features such as undo, windows, and automatic reformatting.”
— *Popular Computing*

“Include WordStar 2000 on your shopping list— it’s competitive with anything now on the market.”
— *Computers and Electronics*

WORDSTAR[®]
2000
Now there are no limits.

MicroPro.

Table 4: Results of the compile-time test. The Frustration Factor is a subjective item that tries to indicate the amount of user interaction required for each compilation run; for example, can you start the compilation and go do something else or do you have to nursemaid the computer the entire time?

	Time Required (in minutes)	Frustration Factor
Softworks C	7:27	high
Mac C	7:47	high
Aztec C	4:07	
With RAM disk	0:40	low
Hippo-C	5:20	medium
Megamax C	4:16	medium
DeSmet C on IBM PC	1:20	low
With RAM disk	0:18	

to fend for yourself as you try to determine why your programs seem to be zapping the Mac as they execute. If Megamax can license Apple's editor and resource maker, why not also license and include MDS's fine

assortment of debuggers?

Megamax's intelligent linker is very good, adding to a program only those standard C library functions actually used. This compiler consistently generated the smallest program files of

the bunch. A good librarian further enhances the efforts of the linker and permits easy additions, extractions, and deletions from the library file.

Megamax C gives you two options for improving the execution times of a program. First, you can use up to four register variables. Second, you can use an optional optimizing pass just after compiling a program module. This is a traditional peephole optimizer that in the case of the benchmark tests seemed to offer speed improvements from 0 percent to 5 percent and code-size reduction of no more than one-half of 1 percent. Making this pass optional is a nice touch since it permits the programmer to skip the optimization in order to speed up the development cycle of a program as it is being debugged. All the Megamax C benchmark programs used this optimizing pass.

(continued)

BYTE Back issues for sale

	1981	1982	1983	1984	1985
Jan.	\$3.25		\$3.70	\$4.25	\$4.25
Feb.	\$3.25	\$3.70	\$3.70	\$4.25	\$4.25
March		\$3.70	\$3.70	\$4.25	\$4.25
April	\$3.25	\$3.70	\$3.70	\$4.25	\$4.25
May		\$3.70	\$3.70	\$4.25	\$4.25
June		\$3.70	\$3.70	\$4.25	\$4.25
July		\$3.70	\$4.25	\$4.25	
Aug.		\$3.70	\$4.25	\$4.25	\$4.25
Sept.		\$3.70	\$4.25	\$4.25	\$4.25
Oct.	\$3.25	\$3.70	\$4.25	\$4.25	\$4.25
Nov.	\$3.25	\$3.70	\$4.25	\$4.25	
Dec.	\$3.25	\$3.70	\$4.25	\$4.25	

Special BYTE Guide to IBM PC's — \$4.75

BYTE '83-'84 INDEX — \$1.75

Circle and send requests with payments to:

BYTE Back Issues
P.O. Box 328
Hancock, NH 03449

Prices include postage in the US. Please add \$.50 per copy for Canada and Mexico; and \$2.00 per copy to foreign countries (surface delivery).

Check enclosed

Payments from foreign countries must be made in US funds payable at a US bank.

VISA

MasterCard

Card # _____

Exp. _____

Signature _____

Please allow 4 weeks for domestic delivery and 12 weeks for foreign delivery.

NAME _____

ADDRESS _____

CITY _____

STATE _____ **ZIP** _____

"NOW IN OUR 8th YEAR"

THE WORLD OF PC UPGRADES

<p>***** 5 Mega Bytes Of software with the purchase of any PC HARD DISK ... FREE</p>	PC HARD DISK	PC HARD DISK	PC HARD DISK
	 10 Mbyte	 20 Mbyte	 30 Mbyte
	IS10 \$495	IS20 \$595	IS30 \$895

TANDY 1000 MULTI-FUNC BOARD	CACHE ASSIST	DIRECT ASSIST	COMMAND ASSIST
			
TMF-1 \$255	\$49.95	\$49.95	\$49.95

TAPE BACKUP	TAPE BACKUP	TAPE BACKUP	TAPE BACKUP
 10 Mbyte	 10 Mbyte	 60 Mbyte	 60 Mbyte
MT10 \$385	MT10P \$525	MT60 \$895	MT10E \$575 MT60E \$995

AT HARD DISK	AT HARD DISK	AT HARD DISK	AT HARD DISK
 20 Mbyte	 33 Mbyte	 80 Mbyte	 120 Mbyte
AT20 \$545	AT33 \$750	AT70 CALL	AT120 \$4,995

ORDER LINE **800-228-0891**
305-677-8333



Micro Design International Inc.

6566 University Boulevard, Winter Park, Florida 32792 (305) 677-8333 TELEX 332559 MDII ORL UD

1 YEAR WARRANTY, 30 DAY MONEY BACK GUARANTEE ON ALL OUR PRODUCTS

Megamax C uses glue routines to interface a C program to the Macintosh ROM Toolbox routines. These routines provide fully automatic interfacing to the ROM Toolbox, including setting function parameters in the proper order and converting between C- and Pascal-style strings as needed.

The manual for Megamax C is good and has a real index that covers all chapters and appendixes. After spending what seemed like forever scanning and rescanning the other compilers' manuals for information, it was a relief to find quick access to any topic I needed.

Megamax C offers numerous functions from the standard C library. Unfortunately, no source code is available for these. Furthermore, there are few additional support functions.

The outstanding features of Megamax C are its linker that produces very small run-time files (at least as

Listing 10: Register version of the FRAME benchmark.

```

/*      frame.c      */
#include "stdio.h"
#define COUNT 10000
main()
{
    register int i;
#include "startup"
    for (i = 0; i < COUNT; ++i) {
        ;
    }
#include "done"
}
    
```

compared with the other compilers in our group), its completely automated interface to the Macintosh ROM Toolbox, and its support of register variables and floating-point operations. Negative aspects of Megamax C are its lack of either an assembler

or assembly-level debugger, its scarcity of special Macintosh-oriented support functions, and its lack of source code for any of its standard C functions.

SOFTWAREWORKS MACINTOSH C

Softworks Macintosh C from Softworks Limited is a three-pass optimizing compiler designed to be integrated into Apple's Macintosh Development System. The result is a tightly knit unit that uses the MDS editor to create the C source code and launch the Softworks C compiler. The Softworks compiler produces assembly-language source code to be assembled and linked by MDS into an executable file that can be run. The integration of Softworks C with Apple's MDS is seamless.

At the core of Softworks C is a generic Whitesmiths Ltd. 68000-
(continued)

THE \$2995 I² DEVELOPMENT SYSTEM

Turns any personal computer into a complete, integrated microprocessor DEVELOPMENT SYSTEM. The control/display program runs under MS-DOS, CP/M, or ISIS, and controls the UDL via an RS-232 port.

ADAPTERS AVAILABLE FOR VAX, APPLE CP/M AND PDP-11



IN-CIRCUIT EMULATOR

32K bytes of EMULATION ROM (128K max) allows you to make program patches instantly. You can stop the program at break-point, single-step, and display or change registers, ports and memory. The target processor stays in its socket for perfect transparency.

BUS STATE ANALYZER

Features four-step sequential triggering, selective trace, and pass and delay counters. Symbolic trace disassemblers and debuggers are available for Z-80, NSC-800, 8048, 6301, R65, 6500, 6800, 6801, 6802, 6805, 6809, 8051, 8085, Z-8, 1802, 8088/80188, 8086/80186, and 68000/8.

EPROM/EEPROM PROGRAMMER

Doubles as a stimulus generator during system checkout. Handles 24 and 28 pin devices up to 27256.

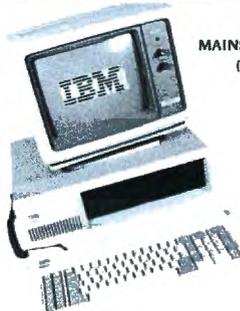
FOR FURTHER INFORMATION
TELEPHONE JOHN STANLEY

(415) 361-8883

OR WRITE:

ORION INSTRUMENTS, INC. 702 MARSHALL STREET • SUITE 614 • REDWOOD CITY, CA 94064

BUY ON THE GREEN MARKET!!!



IBM
MAINSTREET ENHANCED PC
 (equivalent to XT) 256K,
 1 Floppy Drive,
 10 MEG Hard Disk
\$2035

COMPAQ
DESKPRO
DESKPRO 20
 640K RAM, 2 Floppy
 Drive, 20 MEG
 Internal, Monitor
\$2999

WE'LL GIVE YOU...

10 GOOD REASONS TO BUY FROM MAINSTREET COMPUTER

- SERVICE** — Our Staff is courteous, knowledgeable, and ready to help.
- PRODUCTS** — The best products from the biggest names.
- PRICE** — We're competitors... Call us for the latest quotes.
- HONESTY and STABILITY** — If you would like reassurance, call our banker: Scott Gidley Vice President, High Tech Group, Interfirst Bank, Austin, TX (512) 397-2025.
- SUPPORT** — Our tech support people can talk you through it, guaranteed!
- SYSTEMS** — We excel in putting together a system to fit your needs. We assemble, test and burn in all systems.
- SHIPPING** — FREE... on most orders.
- WARRANTY** — On most products we double the manufacturer's warranty period. If it breaks, our technician will issue a return authorization. If an item is D.O.A. we pay freight both ways.
- PAYMENT** — If your check is good, we'll take it! We'll ship on receipt of business and personal checks — no wait. We accept VISA, MasterCard, American Express, and Diner's Club. Ask about C.O.D. terms.
- CORPORATE ACCOUNTS** — Ask for corporate accounts representative.

IBM

IBM™ AT+ — System unit keyboard, 1.12 MB & 1 360 KB disk drives, 20 MB Hard Disk and AST I/O, 512 K RAM	\$4099
SUPER PC+ — IBM™ PC, 640 K RAM, AST Sixpak Plus, 2 half high floppy drives, 20 Meg hard disk, tape backup, XT type power supply	\$3183
SUPER PC — IBM™ PC, 256K, one floppy drive, 10 MEG hard disk, tape drive, XT type power supply	\$2720
IBM™ PC 2/20 — 256K RAM, 2 half high floppies, 20 MEG hard disk	\$2204
IBM™ PC 2/10 — 256K RAM, 2 half high floppies, 10 MEG hard disk	\$2104
EXECUTIVE TURBO — IBM™ PC, 256K, floppy, 10 MEG, tape drive, XT type power supply, Orchid Turbo, 640K	\$3640
MAINSTREET ENHANCED PC — Equivalent to XT™ — IBM™ PC, 256K, 1 floppy drive, 10 MEG disk	\$2035

COMPAQ®

MAINSTREET ENHANCED DESKPRO™ — Equivalent to Model 4 - 2 half high floppies, 10 Meg hard drive, tape backup, 640K, Monitor	\$3495
COMPAQ PORTABLE — 256K, 360K drive, 10 Meg drive, Functional equivalent to Compaq Plus	\$2540
10 MEG UPGRADE FOR COMPAQ	\$549

HARDWARE

A-B Switch Box, 2 Printers on LPT1	\$69
AST Advantage w/128K	\$449
AST Sixpack Plus 64K w/Sidekick	\$244
AST Sixpack Plus 384K w/Sidekick	\$289
AST I/O+ - Serial, Clock, Software	\$129
CDC 360 KB Floppy Drive	\$129
Everex Edge - Color, Mono, Graphics	\$299
Everex Modem 1200 Baud	\$220
Everex Graphics Edge	\$299
Floppy Disk Controller	\$129
Hercules Graphics Card	\$329
Hercules Color Card	\$175
Mainstreet Hard Drive/Floppy Controller	\$345
Mainstreet Mono/Graphics Card	\$229
Mainstreet Memory Expansion 0-512K	\$135
Mitsubishi Half Height Floppy	\$99
Orchid Turbo 186 w/128K	\$699
Orchid Turbo w/640 (Includes Piggyback)	\$920
Paradise Modular Graphics Card	\$265
Paradise 5-Pack, SER, Clock, RAM	\$175
Perisyst Combo Card, Multifunction Plus Video	\$399
Tandon 360KB Full Height Floppy	\$129
TEAC 55B Half Height Floppy	\$109
Tecmar Captain, 0K, SER, PAR, Clock	\$189

POWER

DATASHIELD AT800	\$689
Back up power 800 Watts	
DATASHIELD XT300	\$369
DATASHIELD PC200	\$285
DATASHIELD S100	\$59
Surge Protector (6 Plug)	
DATASHIELD S85	\$49
DATASHIELD S75	\$36
Kensington Masterpiece	\$95
XT TYPE Power Supply	\$95

HARD DRIVES*

Includes all cables, controller, manual and software

10 Meg Internal	\$390
20 Meg Internal	\$490
30 Meg Internal	\$995



TAPE BACKUP*

10 Meg Complete from \$375	
Everex 60 MEG Excel	\$969
Interdyne 10 MEG	\$375
Irwin 10 MEG	\$590

*EXTERNAL SYSTEMS . . . ADD \$190

MODEMS

HAYES 1200 EXTERNAL	\$399
HAYES 1200B INTERNAL	\$369
HAYES 2400 EXTERNAL	\$649
IRMA 3279	\$888

BUSINESS SOFTWARE

ASHTON—TATE dBase II	\$275
dBase III	\$379
Framework	\$399
BORLAND Superkey	\$35
Turbo Pascal V3	\$35
Turbo Pascal 8087	\$60
Turbo Pascal BCD	\$60
Turbo Pascal 8087/BCD	\$89
Turbo Tutor	\$17
Turbo Toolbox	\$29
Graphics Toolbox	\$29
Sidekick Protected	\$30
Sidekick Unprotected	\$44
CENTRAL POINT Copy II PC	\$25
FUNK SOFTWARE Sideways	\$37
FOX AMPER GELLER Quick Code III	\$159
HARVARD SOFTWARE Total Project Mgr	\$275
HAYES Smartcom II	\$99
IMSI PC Paintbrush w/mouse	\$139
InFoCom Cornerstone	\$289
LIFEFREE Volkswriter Deluxe	\$159
LIVING VIDEOTEXT ThinkTank	\$109
LOTUS DEVELOPMENT 1-2-3	\$299
Symphony	\$439
MBDS KnowledgeMan	\$279
MICROPRO Wordstar 2000	\$269
Wordstar 2000+	\$319
Wordstar Propak	\$269
MICROIM R Base 5000	\$359
MICROSOFT Chart	\$159
Multiplan	\$119
Mouse	\$129
Project	\$159
Word	\$239
Flight Simulator	\$35
MICROSTUF Crosstalk XLJ	\$99
MULTIMATE Version 3.3	\$239
PETER NORTON Norton Utilities	\$49
POWER BASE Power Base 2.1	\$249
OUIDA SOFTWARE Copywrite	\$40
Disk Explorer	\$60
Zero Disk	\$60
ROSESOFT Pro Key	\$89
SOFTST	\$85
Write	\$85
SORCIM/IUS Supercak 3	\$179

TO PLACE AN ORDER CALL 1-800-426-MAIN

EPSON FX-80+	\$335	EPSON
EPSON LQ-1500	\$950	CITIZEN
EPSON FX-100+	\$475	NEC
EPSON LX-80	\$215	TOSHIBA
TOSHIBA 1340	\$589	OKIDATA
TOSHIBA 351	\$1299	
TOSHIBA 1351	\$1100	



NEC E*L*F	\$449
CITIZEN MSP-15	\$499
CITIZEN MSP-10	\$299
OKIDATA 182	\$239
OKIDATA 192	\$369
OKIDATA 193	\$497
OKIDATA 84	\$649

24 Hour Bulletin Board Service

• UPLOAD • SIGS • MAIL • DOWNLOAD • ORDERING
 512-321-7317
 ALL NON-ORDER CALLS - 512-321-4406

MONITORS

AMDEK 310A	\$179
PRINCETON MAX-12	\$179
PRINCETON HX-12	\$475
TAXAN Monochrome	\$165
TAXAN 425 COLOR	\$469
TAXAN 440 HI-RES	\$599
ZENITH AMBER	\$160

MAINSTREET COMPUTER CORPORATION

1025 Main Street • Bastrop, Texas 78602 • 1-512-321-4406
 To Place an Order, call 1-800-426-6246

IBM XT and AT are trademarks of International Business Machine Corporation. Compaq and Deskpro are trademarks of the Compaq Corporation. All brands are registered trademarks. Prices are subject to change without notice.

B1185

COMPUTER MAIL ORDER

THE CMO ADVANTAGE

- ✓ THE BEST PRICES!
- ✓ Next day shipping on all in stock items.
- ✓ Free easy access order inquiry.
- ✓ Orders from outside Pennsylvania and Nevada save state sales tax.
- ✓ Free technical support with our factory trained technical staff.
- ✓ There is no limit and no deposit on C.O.D. orders.
- ✓ There's no extra charge for using your credit card. Your card is not charged until we ship.
- ✓ No waiting period for cashiers checks.
- ✓ We accept purchase orders from qualified corporations. Subject to approval.
- ✓ Educational discounts available to qualified institutions.
- ✓ FREE CATALOG MEMBERSHIP

ORDER LINE

1-800-233-8950
In PA 1-800-242-4215

CUSTOMER SERVICE & TECH SUPPORT
1-717-327-1450

Dept. A111

MAILING ADDRESS

Computer Mail Order
Dept. A111
477 East Third Street
Williamsport, PA 17701



MEMBER DIRECT MARKETING ASSOCIATION

CREDIT CARDS



Inquiry 83



SHIPPING

Add 3%, minimum \$5.00 shipping and handling on all orders. Larger shipments may require additional charges.

All items subject to availability and price change.

Returned shipments may be subject to a restocking fee.

CANADIAN ORDERS

1-800-268-3974
Ontario/Quebec

1-800-268-4559
Other Provinces

1-416-828-0866
In Toronto

TELEX: 06-218960

2505 Dunwin Drive,
Mississauga, Ontario
Canada L5L1T1

All prices shown are for U.S.A. orders.
Call The Canadian Office for Canadian prices.

HOME COMPUTERS

ATARI

130XE (128K).....CALL
520ST (512K).....CALL



800XL 64K.....CALL
850 Interface.....\$129.00
1010 Recorder.....\$49.99
1050 Disk Drive.....\$144.00
1025 Dot Matrix Printer.....\$199.00
1027 Letter Quality Printer.....\$269.00
1030 Direct Connect Modem.....\$59.99

APPLE



APPLE IIe.....CALL
APPLE IIc.....CALL
MACINTOSH.....CALL
IIc LCD Display.....CALL

Commodore

C128 Computer.....\$299.00
C1571 (Disk Drive for C128).....\$NEW
C1902 (RGB 13" Monitor for C128).....\$NEW
C1670 (Modem for C128).....\$NEW

Commodore Plus 4.....\$199.00
CBM 64.....\$149.00
C1541 Disk Drive.....\$199.00
C1530 Datasette.....\$39.99
M-801 Dot Matrix Printer.....\$169.00
MCS 803 Dot Matrix.....\$179.00
C1702 Color Monitor.....\$189.00
C1660 Auto Modem.....\$59.99
DPS 1101 Daisy Printer.....\$339.00

PORTABLE COMPUTERS



41CV.....\$189.99
41CX.....\$249.99
HP 71B.....\$419.99
HP 11C.....\$62.99
HP 12C/15C/16C.....\$89.99
HP 75D.....\$949.00
HPIL Module.....\$98.99
HPIL Cassette or Printer.....\$359.99
Card Reader.....\$143.99
Extended Function Module.....\$63.99
Time Module.....\$63.99

We stock the full line of
HP calculator products

NEC

PC-8401.....CALL
PC-8201 Portable Computer.....\$289.00
PC-8231 Disk Drive.....\$599.00
PC-8221A Thermal Printers.....\$149.00
PC-8281A Data Recorder.....\$99.99
PC-8201-06 BK RAM Chips.....\$105.00

SHARP

PC-1350.....\$159.99
PC-1261.....\$159.99
PC-1260.....\$109.99
PC-1500A.....\$165.99
PC-1250A.....\$88.99
CE-125 Printer/Cassette.....\$128.99
CE-150 Color Printer Cassette.....\$171.99
CE-161 16K RAM.....\$134.99

8036 Atari Writer.....\$29.99
Star Raiders.....\$4.99
Missile Command.....\$4.99
Defender.....\$4.99
Galaxian.....\$4.99
Asteroids.....\$4.99
Centipede.....\$4.99
Robotron.....\$4.99
Eastern Front.....\$4.99

While Supply
Lasts!

BOARDS FOR ATARI

Axlon 32K.....\$39.99
Axlon 48K (400).....\$69.99
Axlon 128K.....\$199.00
Bit 3 Full View 80.....\$169.00

Macintosh Software

Lotus Jazz.....CALL
Microsoft Excel.....CALL
Microsoft Business Pak.....\$375.00
Living Videotext
ThinkTank 512.....\$159.00
Manhattan Ready, Set, Go.....\$79.99
Creighton Development
Mac Spell.....\$69.99
Monogram Dollars & Sense.....\$99.99
Peachtree Back to Basics - GL\$109.00
PFS File & Report (New Version)\$129.00
Silicon Beach Airborn.....\$25.99

Professional Software

Fleet System II w/Spell.....\$49.99
Trivia Fever.....\$29.99
Word Pro 4 Plus/5 Plus each.....\$239.00
Info Pro.....\$179.00
Administrator.....\$399.00

BRODERBUND

The Print Shop.....\$29.99



File (64).....\$59.99
Report (64).....\$49.99



PaperClip w/Spell Pack.....\$79.99
The Consultant DBMS.....\$69.99
Bus Card II.....\$139.00
80 Col Display.....\$129.00

DISKETTES

maxell

3 1/2" SS/DD.....\$39.99
3 1/2" DS/DD.....\$54.99
5 1/4" MD-1 w/Hardcase.....\$17.99
5 1/4" MD-2 w/Hardcase.....\$23.99
5 1/4" MD-2-HD for AT.....\$44.99



5 1/4" SS/DD.....\$19.99
5 1/4" DS/DD.....\$24.99
Disk Analyzer.....\$24.99



Elephant 5 1/4" SS/SD.....\$13.99
Elephant 5 1/4" SS/DD.....\$15.99
Elephant 5 1/4" DS/DD.....\$16.99
Elephant Premium DS/DD.....\$23.99



5 1/4" DS/DD Floppy Disks
(Box of 10).....\$25.99

DISK HOLDERS

INNOVATIVE CONCEPTS

Flip-in-File 10.....\$3.99
Flip-in-File 50.....\$17.99
Flip-in-File 50 w/lock.....\$24.99
Flip-in-File (400/800 ROM).....\$11.99
Flip-in-File 100.....\$24.99

AMARAY

50 Disk Tub 5 1/4".....\$9.99
30 Disk Tub 3 1/2".....\$8.99

MODEMS



Volkmodem.....\$59.99
Volkmodem 300/1200.....\$189.99
Mark XII (1200 Baud).....\$259.00
Signalman Express.....\$299.00
Lightning 2400 Baud.....\$399.00

DIGITAL DEVICES

AT300 - 300 Baud (Atari).....\$99.99



Smartmodem 300.....\$139.00
Smartmodem 1200.....\$389.00
Smartmodem 1200B.....\$359.00
Smartmodem 2400.....\$629.00
Micromodem IIe.....\$149.00
Smart Com II.....\$89.99
Chronograph.....\$199.00
Transet 1000.....\$309.00



Reach 1200 Baud Half Card.....\$399.00

microBITS

MPP-1064 AD/AA (C-64).....\$69.99



Smart Cat Plus.....\$319.00
J-Cat.....\$99.99
Novation 2400.....CALL
Apple Cat II.....\$229.00
212 Apple Cat II.....\$379.00
Apple Cat 212 Upgrade.....\$229.00
Macmodem.....\$319.00



Quadmodem II
300/1200.....\$339.00
300/1200/2400.....\$499.00

TELELEARNING

C64 300 Baud.....(Closeout).....\$39.99

GRAPHICS



IBM.....\$89.99
Apple/Franklin.....\$79.99



Palette.....\$1299.00

DRIVES

HARD



PC Stor.....CALL



10 meg Internal IBM.....\$429.00
20 meg Internal IBM.....\$569.00



10 meg Bernoulli Box.....\$1999.00
20 meg Bernoulli Box.....\$2599.00
5 meg "MacNoulli".....\$1499.00



12, 25, 35, 50, 80 meg (PC)
.....from \$1499.00

FLOPPY



Atari GT.....\$219.00
C-64 GT.....\$229.00



A1.5 Apple.....\$179.00
A2 Apple.....\$179.00



SD1 C-64 Single.....\$219.00
SD2 C-64 Dual.....\$469.00



320K 5 1/4" (PC).....\$109.00



320K 5 1/4".....\$109.00

CALL TOLL-FREE

MONITORS

PRINTERS

PC COMPATIBLES

Inquiry 83

AMDEK

300 Green.....	\$129.00
300 Amber.....	\$139.00
310 Amber IBM-Plug.....	\$169.00
Color 300 Composite.....	\$179.00
Color 500 Composite/RGB.....	\$389.00
Color 600 Hi-Res (640x240).....	\$399.00
Color 700 Hi-Res (720x240).....	\$499.00
Color 710 Long Phosphor.....	\$579.00
Color 722 IBM Enhanced.....	\$579.00



12" Amber/Green Composite.....	\$99.99
12" Amber/Green TTL.....(ea.)	\$119.00

NEC

JB 1260 Green.....	\$59.99
JB 1201/1205.....(ea.)	\$99.99
JB 1270 Green.....	\$139.00
JB 1275 Amber.....	\$149.00
JB 1280 G TTL/1285 A TTL.....	\$149.00
JC 1410 RGB.....	\$669.00

PRINCETON

MAX-12E Amber.....	\$179.00
HX-9 9" RGB.....	\$469.00
HX-9E Enhanced.....	\$519.00
HX-12 12" RGB.....	\$489.00
HX-12E Enhanced.....	\$559.00
SR-12 Hi-Res.....	\$599.00
SR-12 P Enhanced.....	\$649.00

TAXAN

115 12" Green Mono.....	\$119.00
116 12" Amber Mono.....	\$119.00
121 Green TTL.....	\$139.00
122 Amber TTL.....	\$149.00
420 Hi-Res RGB (IBM).....	\$429.00
440 Ultra Hi-Res RGB.....	\$559.00



8400 Quadchrome I.....	\$479.00
8410 Quadchrome II.....	\$429.00
8420 Amberchrome.....	\$179.00
8500 Quad Screen.....	\$1499.00



ZVM 1220/1230.....(ea.)	\$99.99
ZVM 1240 IBM Amber.....	\$149.00
ZVM 130 Color.....	\$269.00
ZVM 131 Color.....	\$249.00
ZVM 133 RGB/Color.....	\$429.00
ZVM 135 RGB/Color.....	\$459.00
ZVM 136 RGB/Color.....	\$599.00

INTERFACES



Multi I/O (Apple II).....	\$189.00
---------------------------	----------



Graphcard.....	\$79.99
Serial Card.....	\$99.99
Microbuffer II +.....	\$169.00
Microbuffer 32K.....	\$189.00



Microfazer.....	from \$139.00
Elazer (Epson).....	from \$79.99

Orange Micro

Grappler CD (C64).....	\$99.99
Grappler + (Apple).....	\$89.99
Grappler 16K + (Apple).....	\$159.00

DIGITAL DEVICES

Ape Face (Atari).....	\$49.99
U-Print A (Atari).....	\$54.99
U-A16/Buffer (Atari).....	\$74.99
U-Call Interface (Atari).....	\$39.99
U-Print C (C64).....	\$49.99
P-16 Print Buffer.....	\$74.99
U-Print II Apple IIc.....	\$89.99

TYMAC

C64 Epson.....	\$59.99
C64 Okidata.....	\$59.99
C64 Star.....	\$57.99

Canon

A40.....	CALL
LBP-8A1 Laser.....	CALL

CITIZEN

MSP-10 (80 col.).....	\$279.00
MSP-15 (132 col.).....	\$389.00
MSP-20 (80 col.).....	\$349.00
MSP-25 (132 col.).....	\$509.00

C. ITOH

Prowriter 7500.....	\$219.00
Prowriter 8510P.....	\$299.00
Prowriter 8510 NLO.....	\$329.00
Prowriter 1550P.....	\$449.00
Starwriter 10-30.....	\$459.00

corona

Lazer LP-300.....	\$2799.00
-------------------	-----------

DIABLO

D25 Daisywheel.....	\$549.00
630-109 Daisywheel.....	\$1749.00
D80IF Daisywheel.....	CALL

daisywriter

2000.....	\$749.00
-----------	----------

EPSON

LX-80, LX-90, FX-85, FX-185	
JX-80, DX-10, DX-20, SQ 2000	
HS-80, Homewriter 10.....	CALL

JUKI

6000 Letter Quality.....	CALL
6100 Letter Quality.....	CALL
6200 Letter Quality.....	CALL
6300 Letter Quality.....	CALL

NEC

8027 Transportable.....	\$299.00
2000 Series.....	\$699.00
3000 Series.....	\$1099.00
8000 Series.....	\$1449.00
ELF 360.....	\$449.00
Pinwriter 560.....	\$999.00

OKIDATA

84, 182, 192, 193, 2410.....	CALL
Okimate 10 (Specify C64/Atari).....	\$189.00
Okimate 20 (IBM).....	CALL

OLYMPIA

Needpoint Dot Matrix.....	\$289.00
Compact RO.....	\$299.00
Compact 2.....	\$369.00

Panasonic

KX1091.....	\$259.00
KX1092.....	\$389.00
KX1093.....	\$479.00



Quadjet.....	\$399.00
Quad Laser.....	CALL

SILVER-REED

500 Letter Quality.....	\$279.00
550 Letter Quality.....	\$419.00
770 Letter Quality.....	\$759.00



SG-10C (C64 Interface).....	\$NEW
SB/SD/SG/SR Series.....	CALL
Powertype Letter Quality.....	CALL

Texas Instruments

Ti850.....	\$529.00
Ti855.....	\$799.00
Ti865.....	\$1049.00

TOSHIBA

1340 (80 column).....	\$589.00
P351 (132 column).....	\$1149.00

IBM PC SYSTEMS

Configured to your specification.
Call for Best Price!

IBM-PC, IBM-PC II, IBM-XT, IBM-AT



All Models.....CALL



KP-2000 Portable.....CALL

SOFTWARE FOR IBM

ASHTON-TATE

Framework.....	\$369.00
dBase III.....	\$369.00

BORLAND

Turbo Pascal 3.0.....	\$49.99
Sidekick.....	\$39.99

CENTRAL POINT

Copy II PC-Backup.....	\$29.99
------------------------	---------

DECISION RESOURCES

Chartmaster.....	\$249.00
Signmaster.....	\$169.00
Diagram Master.....	\$229.00

ENERTRONICS

Energraphics/Plot.....	\$289.00
------------------------	----------

FOX & GELLER

Quickcode III.....	\$169.00
--------------------	----------

FUNK SOFTWARE

Sideways.....	\$39.99
---------------	---------

HARVARD SOFTWARE INC.

Harvard Project Manager.....	\$209.00
Total Project Manager.....	\$269.00

LIFETIME

Volkswriter Deluxe.....	\$159.00
-------------------------	----------

LIVING VIDEOTEXT

Think Tank.....	\$109.00
-----------------	----------

LOTUS

Symphony.....	\$439.00
1-2-3.....	\$309.00

MECA SOFTWARE

Managing Your Money.....	\$109.00
--------------------------	----------

MICROSTUF SOFTWARE

Crosstalk XVI.....	\$89.99
Crosstalk Mark 4.....	\$149.00
Microstuf Remote.....	\$89.99

MICRORIM SOFTWARE

R:Base 4000.....	\$259.00
R:Base 5000.....	\$399.00
Clout 2.0.....	\$129.00

MICROPRO

WordStar 2000.....	\$249.00
WordStar 2000 +.....	\$309.00
WordStar Professional.....	\$299.00

MICROSOFT

Word.....	\$239.00
Mouse.....	\$139.00
Flight Simulator.....	\$39.99
MultiPlan.....	\$129.00

MULTIMATE

Advantage.....	CALL
Multi Mate Word Proc.....	\$249.00

NOUMENON

Intuit.....	\$69.99
-------------	---------

NORTON

Norton Utilities 3.0.....	\$59.99
---------------------------	---------

PEACHTREE SOFTWARE

Peachtext 5000.....	\$169.00
PeachPack (GU/AP/AR).....	\$219.00

PFS:

IBM

Access.....	\$79.99
Write/Graph/File/Plan.....(ea.)	\$79.99
Report.....	\$74.99
Proof.....	\$59.99

PROFESSIONAL SOFTWARE

Wordplus-PC w/Boss.....	\$249.00
-------------------------	----------

ROSESOFT

Prokey.....	\$89.99
-------------	---------

THE SOFTWARE GROUP

Enable.....	\$339.00
-------------	----------

SATELLITE SYSTEMS

Word Perfect 4.0.....	\$219.00
-----------------------	----------

SORCIM/IUS

Accounting.....	
AP/AR/GL/INV/OE.....(ea.)	\$295.00
SuperCalc III.....	\$195.00
EasyWriter II System.....	\$195.00
Super Project.....	\$195.00

SPI SOFTWARE

Open Access.....	\$379.00
------------------	----------

THOUGHTWARE

Trigger.....	\$289.00
Sell, Sell, Sell.....	
Training.....	\$299.00
Application.....	\$179.00

TLB

Solomon III GL.....	\$519.00
---------------------	----------



Safari (7300).....	CALL
6300.....	CALL

corona

PPC400 Dual Portable.....	\$1289.00
PPCXT 10 meg Portable.....	\$1989.00
PC40022 Dual Desktop.....	\$1389.00
PC400-HD2 10 meg.....	\$1989.00

ITT

ITT X-TRA.....	
256K, 2 Drive System.....	CALL
256K, 10 meg Hard Drive System.....	CALL
XP5, 20 meg.....	CALL

SANYO

MBC 550-2 Single Drive.....	\$699.00
MBC 555-2 Dual Drive.....	\$969.00
MBC 511 10 meg.....	\$1799.00
MBC 675 Portable.....	CALL
MBC 880 Desktop.....	CALL



PC-158-21 Single Desktop.....	CALL
PC-158-52 Dual Desktop.....	CALL
PC-158-53 10 meg Desktop.....	CALL
PC-161-21 Single Portable.....	CALL
PC-161-52 Dual Portable.....	CALL
Z-200 (AT).....	CALL
171 (Portable).....	CALL
138 (Transportable).....	CALL
148 (DeskTop).....	CALL

MULTIFUNCTION CARDS



Six Pack Plus.....	\$239.00
Mega Plus II.....	\$269.00
I/O Plus II.....	\$139.00
Advantage-AT.....	\$399.00
Graph Pak /64K.....	\$599.00
MonoGraph Plus.....	\$399.00
Preview Mono.....	\$299.00
PC Net Cards.....	\$379.00
5251/11 On-line.....	\$669.00
5251/12 Remote.....	\$579.00
3780 Emulation Card.....	\$639.00



IRMA 3270.....	\$879.00
IRMA Print.....	\$999.00



Edge Card.....	\$299.00
Color Card (Graphics Edge).....	\$299.00
Magic Card II.....	\$179.00

HERCULES

Graphics.....	\$299.00
Color.....	\$159.00



IDEAmax - ZPR, 64K, C, S, P.....	\$229.00
IDEAminimax - MPR 128K.....	\$229.00
IDEA 5251.....	\$699.00

MYLEX

The Chairman.....	\$479.00
-------------------	----------

PARADISE

**UNPARALLELED SERVICE AT
THESE LOW PRICES!**

**BYTE
CONNECTION
BOTTOM LINE
Price Busters!
"Who you gonna call?"
(714) 778-6496**

AT & T PC 6300, w/ 256K, 360 floppy, 10MB HD,
AT & T graphics card & monitor **\$2525**

AT & T 7300 **Call**

ALPHA MICRO MULTI USER **Call**

COMPAQ PORTABLE, 256K, 360 floppy,
10MB HD **\$2662**

COMPAQ DESK PRO, 640K, 360 floppy,
10 MB HD, graphics card, monitor, serial, parallel,
c/c **\$2828**

COMPAQ DESK PRO, 640K, 360 floppy,
30MB HD, 10MB tape back-up, graphics card,
monitor **\$3838**

COMPAQ PORTABLE 286, w/ 512K, 1.2 floppy, 20MB
HD, serial, parallel, c/c **\$4444**

COMPAQ DESK PRO 286, 512K, 1.2 floppy,
30MB HD, graphics card, monitor, serial, parallel,
c/c **\$4848**

IBM PC, w/ 256K, two 360 floppies, color card,
monitor **\$1989**

IBM PC, 256K, 360 floppy, 10MB HD, graphics card,
monitor **\$2525**

IBM XT, 256K, 360 floppy, 10 MB HD, graphics card,
monitor **\$2727**

IBM AT, 512K, 1.2 floppy, 20 MB HD, graphics card,
monitor **\$4393**

PRINTERS

ANADIX 9620	\$1129
BROTHER NR25	\$ 639
BROTHER NR35	\$ 750
DIABLO P32	\$ 685
DIABLO 341Q	\$1250
DIABLO P38	\$1550
DIABLO D25	\$ 575
DIABLO 630 API	\$1595
DIABLO 630 ECS	\$1650
EPSON 85	\$ 399
EPSON 185	\$ 519
EPSON LQ1500	\$ 950
NEC 3550	\$1045
NEC 8850	\$1350
OKIDATA 192	\$ 389
OKIDATA 193	\$ 495
OKIDATA 84	\$ 659
OKIDATA 2410	\$1825
TOHIBA P351	\$1159

**We carry all name brand peripherals & soft-
ware, call for what is not listed, we guarantee
that your call will not be a waste.**

**No charge for testing and
configuring systems.**

**Prices and availability subject to change
without notice.**

(714) 778-6496

**163 West Cerritos Ave.
Anahelm, CA 92805**

REVIEW: C COMPILERS

Listing 11: Register version of the INTMATH benchmark.

```

/*      intmath.c      */
#include "stdio.h"
#define COUNT 10000
main ()
{
    int i;
    register int j, k;
#include "startup"
    for (i = 0; i < COUNT; ++i) {
        j = 240; k = 15;
        /* test byte-byte combinations */
        j = (k * (j / k));
        j = (k * (j / k));
        j = (k+k+k+k+ k+k+k+k+ k+k+k+k+ k+k+k+k);
        k = (j -k-k-k-k -k-k-k-k -k-k-k-k -k-k-k-k);
        /* test byte-word combinations */
        j = (j << 4); k = (k << 4);
        j = (k * (j / k));
        j = (k * (j / k));
        j = (k+k+k+k+ k+k+k+k+ k+k+k+k+ k+k+k+k);
        k = (j -k-k-k-k -k-k-k-k -k-k-k-k -k-k-k-k);
        /* test word-word combinations */
        j = (j << 4); k = (k << 4);
        j = (k * (j / k));
        j = (k * (j / k));
        j = (k+k+k+k+ k+k+k+k+ k+k+k+k+ k+k+k+k);
        k = (j -k-k-k-k -k-k-k-k -k-k-k-k -k-k-k-k);
    }
#include "done"
}

```

based C compiler. Draped around this inner core is a Macintosh user interface and some mechanisms that let you access the Macintosh ROM Toolbox. Whitesmiths compilers have been available for a variety of machines for some time. Using such an established and mature compiler as its nucleus should theoretically help to give the Softworks C user a well-designed, time-tested compiler without the "infant" bugs that often plague new software. However, theory and reality often do not converge. Such is the case with Softworks C.

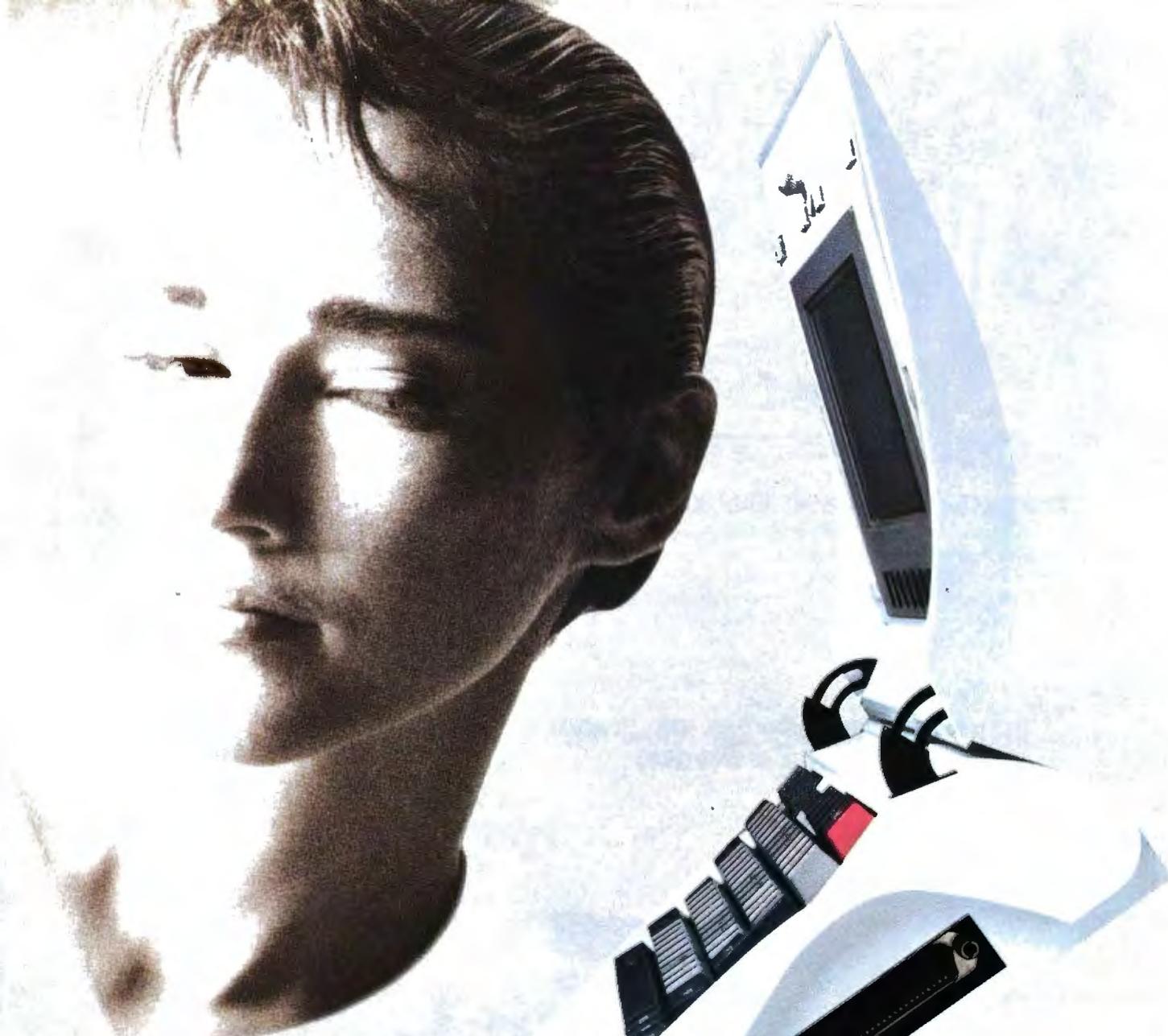
Actually, the "documentation" for Softworks C is the major source of difficulty. This supposed documentation consists of 5 stapled pages of notes entitled "Instructions for Softworks Macintosh C" and a 220-page generic Whitesmiths C programmer's manual. While the Whitesmiths manual is fairly comprehensive, the differences be-

tween the system it describes and the Softworks compiler are vast. More than half of the Whitesmiths manual does not relate at all to the facilities found in Softworks C.

"Instructions for Softworks Macintosh C" would be almost laughable if its shortcomings were not so serious. It is virtually useless, spending three of its five pages discussing implementation restrictions and known bugs without a good discussion of anything. For example, the important topic of interfacing C code with the Macintosh ROM Toolbox routines consists of seven sentences. Woefully inadequate.

If you turn to the Whitesmiths manual and scan the descriptions of C functions, you might well begin to get excited about the range and power of the compiler. However, when you turn back to "Instructions

(continued)



Chic.

Seldom are computers thought of as beautiful.

But out of every thousand, there is always one that catches the eye. Such a computer is the stunning new *WS-1*.

The audition starts when you open the flip-top of this intriguing portable. Switch on, and the *WS-1* becomes a word-processor, a spreadsheet, a database, or a graphics tool.

Stay in touch, with the *WS-1*'s built-in autodial modem, speaker phone, and cassette mechanism. Send files, take calls, or even run the *WS-1* as an answering machine!

Visit the Ampere exhibit at the Comdex Show in Las Vegas, November 20th to 24th, 1985

The *WS-1* offers some surprises inside too. Such as a powerful 16/32-bit 68000 microprocessor, ROM-based multitasking Operating System, and APL interpreter. Or features like the high-contrast 25 x 80 bit-mapped graphics LCD, RAM expansion up to 512K, and optional 3.5-inch microfloppy disk drives.

All this power comes in a sleek footprint of only 11 x 13 inches. We think you'll agree that the *WS-1* really is one out of a thousand.

ampère

Inquiry 22

FOR DISTRIBUTORSHIP INFORMATION AND PRODUCT DETAILS PLEASE CONTACT:

ampère
INCORPORATED

Asahi Bldg., 7-5-20 Nishi-Shinjuku, Shinjuku-ku, Tokyo, Japan. Phone: 03-365-0825.
Telefax: 03-365-0939. Telex: J33101 AMPERE. IP Sharp Mail Box Code AMP
(Group Code APLWS).

WORK SPACE
COMPUTER INC.

U.S. REPRESENTATIVE OFFICE: 3848 Carson St. Suite 301
Torrance, California 90503, U.S.A. Phone: 213-540-1553.
Telex: 322800 WORK SPACE



WHAT WILL WE HAVE TO IMPORT NEXT, COLLEGE GRADUATES?

Ever since World War I, most of the rest of the world has come to the United States for the latest in technology. Now there's a real danger that the pendulum is swinging the other way. We're importing know-how in many fields instead of exporting it.

Unfortunately this situation will get progressively worse. Unless we

protect American colleges from inflation. For our colleges and universities supply most of the important basic research upon which technological progress is built.

So please give generously. If we keep the intellectual balance of trade in our favor the industrial balance most certainly will follow.

HELP PRESERVE AMERICAN KNOW-HOW. GIVE TO THE COLLEGE OF YOUR CHOICE.

COUNCIL FOR FINANCIAL AID TO EDUCATION INC. 400 FIFTH AVENUE NEW YORK NY 10018  A PUBLIC SERVICE OF THIS MAGAZINE AND THE ADVERTISING COUNCIL

PC-AT COMPUTERS CAN GROW UP!

WINCHESTER STORAGE WITH OPTIONAL BUILT-IN TAPE OR LASER OPTICAL DISK BREAKS 32mb BARRIER!



FREE

Installation thru 12/31/85
*some restrictions apply

...ADD 8 INCHES OR MORE!

Mainframe: NMS mass storage, disk, tape back up, and laser optical memory systems provide economical, compact, and high performance disk storage with capacities of 84mb, 168mb, 335mb, 474mb, and 689 mb. Each controller supports any combination of two disk capacities, up to 1,300 megabytes!

Performance: Access times of 17 milliseconds and data rates of up to 2.4 mb/sec...Fast!

Leading Edge: Single board SMD/SCSI disc/tape/laser optical controller, occupies only one slot while supporting two SMD disks and your tape or laser optical memory too! NMS systems utilize Winchester technology exclusively made by Fujitsu...including Fujitsu model 2333 and new 2361.

Laser Optical: Your choice of 400 mb, or 1000 mb of removable, fast, laser optical, read-write, storage.(NMS 007 series).

Tape Back-up: NMS provides ANSI-IBM format 1/2 inch tape systems and 60 mb of file-by-file/streamer 1/4 inch cartridge tape systems. (NMS 9000 and PC.25 series).

Networks: Compatible with most major networks, NMS storage systems are the highest performing file servers available...reliable too with 60,000 MTBF!

Warranty: Controller...24 months (RTV), and 12 months (RTV) all other system parts.

Don't settle for 5 1/4 inches when you can get eight!

National Memory Systems Corporation
355 Earhart Way, Livermore, CA 94550

TWX 9103886506
TELEX 821892NMSUD

(415) 443-1669

National
Memory
Systems
CORPORATION



REVIEW: C COMPILERS

for Softworks Macintosh C," your hopes are dashed as you read: "The UNIX-style library mentioned in Whitesmiths manual is included in this release, but not all of Whitesmiths functions are included." You are instructed to use only those UNIX functions mentioned in pages 22 to 24 of chapter 2, ignoring those described in pages 26 to 143. The reader is cheerfully told that "explanations of the UNIX-style calls are available in most C tutorials." No complete list of what functions are implemented is to be found.

Well, things are grim but not all is lost. Most of the functions commonly found in standard C libraries are in fact included in the Softworks compiler. These functions work well and efficiently. However, the lack of adequate and organized documentation is a continual aggravation. You are never quite sure which C functions are available and which ones are not. There are 10 separate library modules on the Softworks C disk but no clue as to which library contains which functions.

It may be that Softworks is in the process of bringing its documentation up to par. On one enclosed disk entitled "Documentation Under Construction," I found a number of MacWrite document files that describe the interface to each of the Macintosh ROM Toolbox routines. They included a brief synopsis of what each routine does, what parameters it expects, and where in Apple's *Inside Macintosh* manual you can find more information.

The Softworks C compiler itself is not bad, with some things working in its favor and others against it. It supports float operations, register variables, and most standard C system-interface and library functions. However, the source code for these library functions is nowhere to be found, and there are no additional support functions beyond the standard C libraries, such as those found in Mac C and Aztec C to help in specific areas of Macintosh program development.

Being a three-pass optimizing com-

(continued)

An Interactive Digital Telecommunications System Sends Photos, Graphics, Text and Voice



Makes Communicating and Decision-making Easier, Faster

Now you can do it. Dial up your home office, client or service organization and have a two-way conversation with pictures, graphics and text to make your communications more effective and immediate. Point to areas of interest, draw in changes, transfer a file, exchange typed messages or switch to voice mode and hold a two-way conversation.

Easy to use PhotoMail is the system designed for organizations that must send complex information between offices or client facilities.

Applications abound in business, design and engineering, medicine, service and maintenance, insurance, security, access control, law enforcement, news and wire services.

PhotoMail is a complete hardware/software family of products that lets you send and receive pictures over ordinary phone lines to remote computers. Pictures of people, diagrams, text, houses, construction sites, property damage — anything you can capture with standard video equipment can be displayed and transmitted at resolutions up to 640 x 400 x 16 levels of gray. PhotoMail supports disk storage and hard copy printout and file conversion for "electronic mail" systems.

Simple to Use

1. Select a picture from disk file or capture it with a video camera. 2. Dial your party. 3. When the party answers, PhotoMail automatically links the two computer systems. 4. You can now discuss your business — using a

"mouse" to select the functions you desire: communicating, filing, capturing, edit screen and send image. Subfunctions "pop-up" for additional instructions.

Configure Your Own—You may already have some of the components . . .

	Component	PhotoMail Package	PhotoMail System	PhotoMail Workstation	Expansion Slots Used
REQUIRED	Computer (IBM PC, XT, AT)	User	User	•	—
	Monitor	User	•	•	—
	GA-1000 Graphics Adapter	•	•	•	1 Full
	PC-EYE Video Capture	•	•	•	1 Full
	PhotoMail Software	•	•	•	—
	Modem	User	•	•	•••
RECOMMENDED	Video Camera	User	•	•	—
	Pointing Device	•	•	•	1/2 Slot
	ScreenMaster	•	•	•	1/2 Slot
OPTIONAL	Camera Accessory Kit	User	•	•	—
	Expansion Chassis (8-Slot)	User	•	—	1 Full Slot in host for interface
	Printer	User	User	User	1 Slot for printer adapter

User - Supplied by user

• - Supplied with PhotoMail

••• - 1 full slot for plug-in board modem, 1/2 slot for external modems which connect to an asynchronous communications adapter board.

CHORUS

Write for Information including applications, operation, system configuration and specifications or call 1-800-0CHORUS.

Listing 12: Register version of the QSORT benchmark.

```

/* QSort.c */
/* sorting benchmark—calls random the number of times specified by MAXNUM to
   create an array of long integers, then does a quicksort on the array of longs.
   The program does this for the number of times specified by COUNT.
*/
#include "stdio.h"
#define MAXNUM 1000
#define COUNT 10
#define MODULUS ((long) 0x20000)
#define C 13849L
#define A 25173L
long seed = 7L;
long rrandom();
long buffer [MAXNUM] = {0};
main()
{
    int i,j;
    long temp;
#include "startup"
    printf("Filling array and sorting %d times \ n",COUNT)"
    for (i=0; i<COUNT; ++i)
    {
        for (j=0; j<MAXNUM; ++j)
        {
            temp = rrandom(MODULUS);
            if (temp < OL)
                temp = (-temp);
            buffer[j] = temp;
        }
        printf("Buffer full, iteration %d \ n",i);
        quick(0,MAXNUM,buffer);
    }
#include "done"
}
quick(lo,hi,base)
int lo, hi;
long base[];
{

```

piller, the Softworks compiler had me anticipating some pretty spectacular run times for the standard C benchmark tests. But there was really nothing that distinguished it from the middle of the pack.

I found some peculiarities about Softworks C somewhat disturbing. For example, every program *must* include at least one initialized global variable. If you neglect this, your program will compile and assemble just fine. But when you try to link the program, you will receive a number of unexplained "undefined external" error messages. The first few times this happens, you are sure to waste a significant amount of time trying to determine the cause of these errors.

I also discovered an incompatibility between the Softworks compiler and the MDS assembler when I tried to use the feature for structuring bit fields. The compiler had no problem emitting code to handle my bit fields, but the assembler choked when it tried to assemble the code produced by the compiler. After witnessing this, I would not be surprised to find other instances of incompatibility between the compiler and the assembler.

Softworks C is the only compiler of the bunch that does not have provisions for automatically opening and manipulating text windows for displaying standard printf operations. If you compile and run a standard C program using Softworks C, be prepared to see all text placed direct-

(continued)

Immediately Available – Large Quantities

The ATI-1000...presented by ATI

IBM AT* Compatible Motherboard

- Up to 640-kb main memory (1Mb on-board optional)
- 8 I/O Slots
- Same Dimensions as IBM AT* (12x13 inches)

Suggested OEM price \$1,095. (orders of 10 units or more); volume discounts available.

Also available: Power Supplies, Cases and Keyboards.

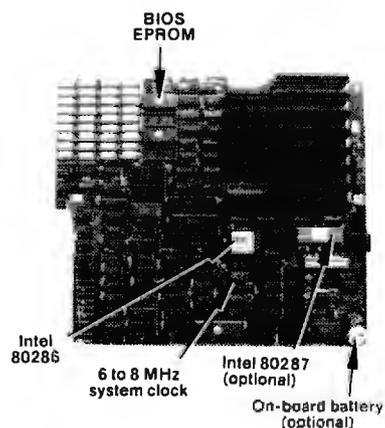
*IBM AT is a trademark of International Business Machines

New Product
ATI-2000

- 8MHz w/o Wait State • 67% Faster than IBM AT* • Call for price

ATronics International, Inc.

520 Valley Way • Milpitas, CA 95035 • (408) 943-6629 • (408) 263-6533



"A true data management product is inherently multi-user"

Edward M. Esber, Jr.
President Ashton-Tate Software, "InfoWorld" July 22, 1985

Thank you Mr. Esber. We at DataAccess Corp. couldn't agree more! That's why DataFlex was designed and implemented with *true* multi-user capabilities right from the start, way back in 1981.

And we mean RIGHT from the start.

Take for example DataFlex's multi-user data protection features. While other products deny users access to records... or even complete files... while they are in use, DataFlex allows all users access to all files and records at all times. With DataFlex's powerful data entry macro, locking occurs only during write operations, and then, only for the micro-seconds it takes to update the file. No user is ever affected by any other, and data integrity is absolute!

Another of DataFlex's multi-user facilities is its sophisticated, yet easy to use, on-line query program. Query allows even inexperienced users to produce complex multi-file reports simply by using a mouse or the cursor control keys to "point & shoot" at the data they wish to see presented. And because DataFlex maintains on-line data indices, query's output is sent to the screen, printer or file as quickly as it can be read from disk. You even have the option of generating error-free source code and using it as the basis of a more complex report.

Call your local dealer today and discover for yourself the joys of using "A True Data Management Product."

The TRUE Multi-User Applications Development Database

SUPPORTED OPERATING SYSTEMS AND NETWORKS

IBM PC DOS 1.x, 2.x, 3.x
MSDOS 1.x, 2.x, 3.x
IBM "AT" XENIX
IBM PC NETWORK
CP/M, CP/M-86
Concurrent CP/M-86
Concurrent DOS
MP/M-86
Novell NetWare
TurboDos
Corvus w/IBM PC
Molecular N/Star
TeleVideo Infoshare
3Com EtherShare
PC-Net
NorthStar Dimension
Action DPC/OS
DMS Hi-Net
Alloy Engineering RTNX



SEE US AT
COMDEX
BOOTH 3150

DATA FLEX™

DataAccess Corp., 8525 S.W. 129th Terrace, Miami, FL 33156
(305) 238-0012 TELEX 469021 DATA ACCESS CI

```

register int i,j;
long pivot, temp;
if (lo<hi)
{
    for (j=lo,j=hi,pivot = base[hi]; i<j;)
    {
        while (i<j && base[i]<pivot)
            ++i;
        while (j<i && base[j]>pivot)
            --j;
        if (i<j)
        {
            temp = base[i];
            base[i] = base[j];
            base[j] = temp;
            quick(lo, i-1, base);
            quick(i+1, hi, base);
        }
    }
}
long random(size)
long size;
{
    seed = seed * A + C;
    return(seed % size);
}

```

when you do, you still are not shown the covered error message. After a delay of many seconds, you are taken back to the MDS editor, where the C source file is opened in one window and, finally, a window opens to display the error message. However, all error messages are linked to the source files only by line numbers, so you have to count down lines from the top of the file. There is no excuse for a computer program forcing you to do such mundane tasks.

Aside from its documentation, the most significant shortcomings of Softworks C result from limitations of the Macintosh user interface and the MDS linker.

My feelings about Softworks C can be summarized in one word: disappointing. This compiler has a lot of potential. It is a complete implementation of C with decent power, but a number of areas must be cleaned up before it can be considered a professional development system.

ly onto the standard gray Mac background, making it very difficult to read.

Softworks C error messages have a couple of shortcomings. Whenever an error is found during compilation, an error message is displayed. However,

before you have a chance to read it, the message is covered up by a dialog box announcing that an error has been found. You are prompted to point the mouse and click on a dialog button to acknowledge that you are aware an error has occurred, but

PROBLEMS WITH MDS LINKER

As I have mentioned, Mac C and Softworks C use the MDS linker to combine or link one or more object files into a single executable application program. Unfortunately, some nega-

(continued)

When you support the Boys Club, you don't become just another member of just another club.

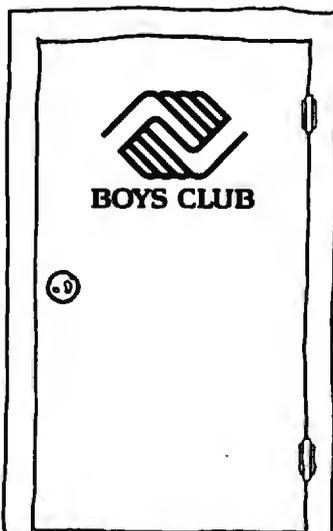
You become a member of a special group of people. A group of people who not only care about the problems and promise of kids, but care enough to do something. A group that knows kids need a place to grow besides the street.

You see, a Boys Club is a lot more than just a club. It's a place where kids learn everything from health care to nutrition to job skills. A place that not only gives kids personal guidance, but a chance to be leaders today, so they can grow to be constructive contributors to

society tomorrow. A place where over 1,200,000 kids connect with the promise of a future.

That's why a Boys Club really is so much more than just a club. But without your help, it wouldn't be much of a Club at all. After all, Boys Clubs operate almost entirely on private voluntary contributions. Clubs all across the country need business and community volunteers like you to support them, lead them—help them to thrive.

So you see, a Boys Club isn't like any club you can join. But with your help today, the kids in our Club may be joining yours tomorrow!



The Club that

beats the streets.

Power to the Printer.

Today's printers are good. Too good. Too bad most application software don't take advantage of their power. Well, now there's Printworks™. To help your printer do everything you want. And everything it was built to do.

Dot Matrix or Laser, Printworks gets the maximum performance from your printer. Changing fonts. Setting type size. Resetting your margins. Writing in foreign languages. Using scientific symbols. Printing spreadsheets sideways. And more.

All at the touch of a key.

Printworks for Lasers. Instant access since it's memory resident. Complete font selection. Prints, saves and merges graphic screens with text. Image reduction. Multiple copies. Manual or tray feed. Page format settings. Full page memo writer. And on-call software compatibility through complete Epson MX-80 printer emulation with text and graphics.

Your Hewlett-Packard LaserJet, LaserJet+ and Canon Laser Beam can't afford to be without Printworks for Lasers™. Just \$125.*

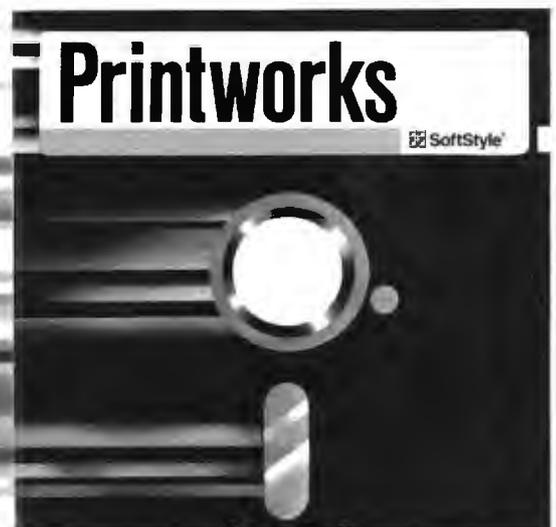
Printworks for Dot Matrix. Simple menu control. Pivot printing to print sideways quickly. Easily set print modes: condensed, emphasized, and more. Full IBM characters and even foreign languages. Create new characters and fonts. Many fonts included.

To get the maximum from your Epson, NEC, Okidata, Star, and over 30 popular printers, there's Printworks for Dot Matrix™. Only \$69.95*.

 **SoftStyle**® SoftStyle, Inc., 7192 Kalaniana'ole Highway, Suite 205, Honolulu, Hawaii 96825, (808) 396-6368.

Toll free (800) 367-5600.

Power to the Printer.™



*Suggested retail price. Printworks is for the IBM PC and compatibles. Printworks for Lasers requires DOS 2.0 or above and 256K. Epson and MX-80 are trademarks of Epson America, Inc. Canon and Laser Beam are trademarks of Canon U.S.A., Inc. Hewlett-Packard, LaserJet and LaserJet+ are trademarks of Hewlett-Packard Company. IBM is a registered trademark of International Business Machines Corporation. NEC is a registered trademark of NEC Corporation. Okidata is a trademark of Okidata. Star is a trademark of Star Mfg. Co., Ltd. SoftStyle is a registered trademark and Printworks, Printworks for Lasers, Printworks for Dot Matrix, Power to the Printer are trademarks of SoftStyle, Inc.

© 1985 SoftStyle, Inc.

Listing 13: Register version of the POINTER benchmark.

```

/*      pointer.c      */
#include "stdio.h"
#define COUNT      10000
#define ALLOTTED   128
main()
{
    char workarea[ALLOTTED];
    register char ptr;
    register int i;
#include "startup"
    for (i=0; i < COUNT; ++i) {
        ptr = workarea;
        while (ptr < (workarea + ALLOTTED)) {
            *ptr = ' ';
            ++ptr;
        }
    }
#include "done"
    printf("ALLOTTED = %d \n", ptr - workarea - 1);
}
    
```

tive aspects of the MDS linker dramatically affect the ease of use and the efficiency of both Mac C and Softworks C as professional software-development systems. The root of the problem is the fact that the MDS linker has no notion of a library.

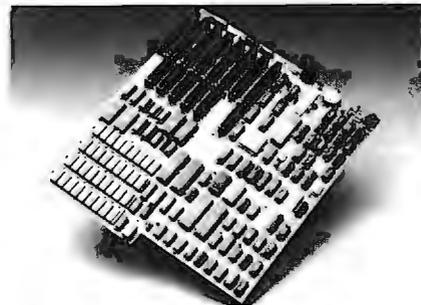
In the software-development world, a library is a special file that contains the object code for a number of operations commonly used by many programs. For example, a library might store the code for all the standard C functions. A linker that knows about such libraries can use them to selectively pull into the final executable file only those functions actually needed by the program being linked.

Linkers (such as the one used by MDS) that do not have the facilities to handle libraries must instead be supplied object-file modules contain-

(continued)

SMARTEK 1 MEGA BYTE SYSTEM BOARD

IBM AT COMPATIBLE CPU MOTHER BOARD



FEATURES:

- * Dual speed 8 MHz or 6 MHz CPU (80286) selectable by software (Optional 9, 10 MHz CPU) selection with standard 6 MHz operation
- * 1 Mega Byte standard main memory on board, 16 Mega Byte in system in the protected virtual address mode
- * Multiuser and multitasking operation
- * Virtual memory and disk capability
- * 2 sockets for 27256 eeprom (SMT Bios will be available with a nominal fee)
- * 8 I/O expansion slots: 6 with dual 62 pin and 36 pin connectors, 2 with single 62 pin connectors
- * Socket for 80287 Math processor
- * CMOS clock and calendar circuit
- * On board battery backup, no external cable required
- * External hardware reset capability
- * Power on LED indicator
- * NO selection jumper (no headache for system configuration)
- * 24 bit addressing, 16 bit data path
- * 16 level interrupt capability
- * 7 channel direct memory access (DMA)
- * 3 programmable timers available
- * Speaker/keyboard connector
- * Fully assembled and tested board \$995
- * EASY board with all sockets and components installed except ICs \$495
- * 90 days warranty, parts and labor

The Smartek 1 Mega Byte System Board has a lot of advantages over the Faraday's A-Tease, ATI-1000, and IBM PC AT boards.

	SMARTEK	FARADAY	ATI	IBM
Memory	1 Mega byte (standard)	640k (standard)	640k (standard)	512k (standard)
Number of ICs	129	154	130	130
Dual Clocks	6 MHz and 8 MHz select (9, 10 MHz opt)	6 MHz only	6 MHz only	6 MHz only
Jumpers option	none	plenty	plenty	1
Battery	on board (serviceable)	external	on board (unserviceable)	external
PCB layers	4	8	4	6
EASY BOARD (Option)	yes	no	no	no
Power on LED	yes	no	no	no
External Reset	yes	no	no	no
Lowest cost	yes	no	no	no

SMARTEK INC.

2000 Wyatt Dr. Suite #3, Santa Clara, CA 95054

Telex: 317994

Tel: (408) 988-4112
(408) 748-8501

OEM, VAR, Dealers and Corporate purchasing discount inquiry invited

(IBM AT are trademarks of International Business Machines Corporation)

**Which leading
monitor company
lets you best
display the
advantages of IBM's
new color
graphics cards?**



*Hint,
It's not IBM!*



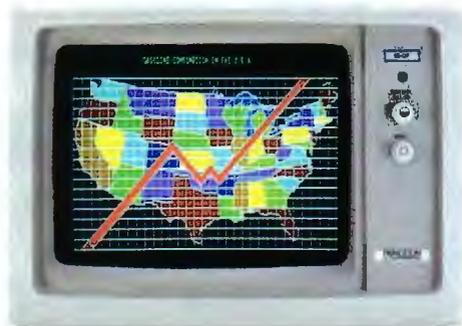
Princeton Gra In a class

When you put Princeton Graphic Systems Monitors to work with IBM's new graphics cards, you step up to a new class of performance. Exciting RGB color, sharp, crisp graphics and text and Princeton's quality and reliability...all at a great price!

Our full line of monitors clearly demonstrates why Princeton is an industry leader in high-resolution technology.

Princeton SR-12P Color Monitor

The first IBM compatible monitor available for the IBM Professional Graphics Controller.*



COMPARE:	Princeton SR-12P	IBM 5175
Dot pitch (The lower, the better.)	.26 mm	.31 mm
Sugg. Retail Price (The lower, the better too!)	\$999	\$1295
Warranty	1 Year	90 days

Designed for demanding professionals who won't settle for anything less than the finest color graphic capabilities. Displays more than 4,000 brilliant colors... features an anti-reflective coated black matrix tube for less fatigue and eye strain. You get the sharpest graphics and text... at a substantial savings!

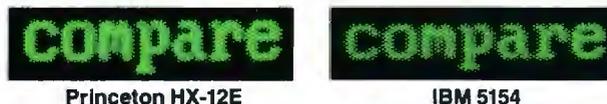
Princeton HX-12E Color Monitor

The superior choice for use with IBM's Enhanced Graphics Adapter.*



COMPARE:	Princeton HX-12E	IBM 5154
Dot pitch	.28 mm	.31 mm
Sugg. Retail Price	\$785	\$849
Tinted Black Matrix Tube	Yes	No
Warranty	1 Year	90 days

Ideal for most computing applications, the HX-12E offers 64 high-resolution colors and easy-to-read text. Compare Princeton's quality to IBM's...



The HX-12E gives you sharper colors, crisper characters... for less eye strain and easier viewing, hour after hour. Built-in versatility also allows you to display 16 colors with the IBM Color Graphics Adapter* automatically.

phic Systems above the rest

Princeton HX-9E

The first 9" RGB monitor to take advantage of IBM's Enhanced Graphics Adapter.*



For more performance in less space, the Princeton HX-9E is in a class by itself. Nobody else—not even IBM—offers a 9", high-resolution display. Features 64 brilliant colors and a .28mm dot pitch for sharp, crisp text. Can be conveniently used with IBM's Color Graphics Adapter.*

Our other monitors also give you full IBM compatibility:

Princeton HX-9 Color Monitor—features a built-in switch for green or amber text. Built-in tilt-and-swivel base.

Princeton SR-12 Color Monitor—boasts twice the vertical resolution of the IBM Color Display** ... and works with other cards such as the Sigma Designs Color 400.

Princeton MAX-12 Amber Monochrome Monitor—ergonomically designed to give you up to 15*** shades of high-resolution amber... plus high-resolution text and graphics when used with a monochrome card.

Princeton HX-12 Color Monitor—16 sharp, clear colors and superb character definition make the HX-12 the winning choice among monitor users...



Princeton HX-12



IBM 5155



See the clearly superior Princeton Monitors at your Authorized Princeton Graphic Systems Dealer. For the dealer nearest you, please call: **800-221-1490 (Extension 604)**, 609-683-1660 (NJ only), Telex: 821402 PGS PRIN. Princeton Graphic Systems, 601 Ewing Street, Bldg. A, Princeton, NJ 08540.



1984 and 1985 winner of the PC World "World Class PC Competition"!

* Or equivalents.

** When used with the Princeton Scan Doubler.

*** When used with IBM Color Graphics Adapter or equivalent.

IBM is a registered trademark of International Business Machines Corporation. Sigma Designs Color 400 is a registered trademark of Sigma Designs, Inc.

PRINCETON
GRAPHIC SYSTEMS
AN INTELLIGENT SYSTEMS COMPANY

Inquiry 307



dBASE

III

POWER TOOLS

QUICKREPORT™

dBASE Report Writer

- Prints *any kind* of report or form
- Up to **6 databases** per report!!
- Use bold, italics, etc.
- Incredibly easy to use
- No programming required

QUICKCODE III™

dBASE Program Generator

- Create PRG files *automatically*
- Data entry screens
- Data input error checking
- Computed fields & totals
- Link up to 8 databases!

**Why write programs yourself?
Let QUICKCODE III do it!**

dGRAPH III™

dBASE Graphics System

- Pie, line, bar charts
- Printer, plotter, or CRT
- Many automatic features

dUTIL III™

dBASE Program Utility

- Finds program errors
- Improves code
- Saves time

NEW QUICKINDEX™

- Index dBase files up to **10 times** faster than dBASE

-- Versions available for dBASE II --

FOR
INFORMATION

201-794-8883

FOX & GELLER

Fox & Geller, Inc. 604 Market St., Elmwood Park, N.J. 07407

dBASE, III, and dBASE III are trademarks of Ashton-Tate
QUICK, UTIL, and QUICKCODE III are trademarks of Fox & Geller, Inc.

REVIEW: C COMPILERS

Listing 14: Register version of the SIEVE benchmark.

```

/*      sieve.c      */
#include "stdio.h"
#define TRUE  1
#define FALSE 0
#define SIZE  8190
char flags[SIZE+1] = {0};
main()
{
    int iter, count, prime;
    register int i,k;
#include "startup"
    for (iter = 1; iter <= 10; iter++) {
        count = 0;
        for (i = 0; i <= SIZE; i++)
            flags[i] = TRUE;
        for (i = 0; i <= SIZE; i++) {
            if (flags[i]) {
                prime = i + i + 3;
                for (k = i + prime; k <= SIZE; k += prime)
                    flags[k] = FALSE;
                count++;
            }
        }
#include "done"
        printf("\n%d primes.", count);
        getchar();
    }
}

```

ing all the functions needed by the program. But such a linker cannot select which portions of a given module are needed and which are not. Rather, the entire object file must be included in the executable program, thus needlessly increasing the program size.

In addition to causing larger program sizes, the omission of library facilities in a linker usually complicates life for the programmer in another way. Linkers that know about libraries are usually smart enough to know about one or more standard libraries. For example, such a linker may know the name of a library containing all the standard C functions. Anytime a C program uses one of these functions, the linker automatically goes to that library to find the code that performs the requested function.

Since the MDS linker knows nothing about standard libraries of functions, it becomes the programmer's respon-

sibility to tell the linker which object file (or files) contains them. This creates a dilemma. If all the standard functions are grouped into a single object file, life is easier for the programmer, but the resulting program size quickly balloons. If the standard functions are broken into multiple object files, the final program size can be reduced, but the programmer must then be concerned with which of these object files to include or leave out. On top of this, when little or no documentation is included to tell the programmer which modules contain which functions, the result is a good deal of frustration.

USER INTERFACE

The makers of our Macintosh C compilers have taken two fundamentally different approaches in the area of the user interface, the way in which the programmer and the development system interact. On the one

(continued)

FREE SHIPPING!

No Credit Card Surcharge!

PC SOURCE

AST SixPakPlus



w/384K

\$249

AST Advantage! W128K... **\$399**

STANDARD BRAND PRODUCTS

All Standard Products Have A 2 Year Warranty!



Standard MFC
Multifunction Card
W/384K

- Parallel Port
- Game Port
- Software
- Memory Expansion
- Clock Calendar
- Serial Port

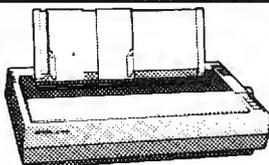
\$145

Memory

64K Chip Set

9 chips per set,
1 Yr. Warranty
Minimum Order 2 Sets... **\$5**

256K Chip Set
9 chips per set,
1 Yr. Warranty... **\$39**



LX80... **\$229**

FX85... **\$379**

Printer Cable \$25

EPSON



Number one.
And built like it.

FX185... **\$499**

LQ1500... **\$929**

W/Parallel Interface

Intel

Math Co-Processor

8087 **\$98**

80287 **\$219**

Complete Hard Disk Kits for the IBM PC™

✓ Reliable ✓ Full Instructions ✓ 1 Year Warranty

\$395
10 MB

\$495
20 MB

\$695
30 MB

COMPAQ

10MB Hard Disk Kit... **\$475**

20MB Hard Disk Kit... **\$629**



PC's & AT's



Call For Current Prices...

TEAC 55B



Half Height
Double Sided

\$99

MINUTEMAN™

Total Power Protection!

- Blackouts
- Interruptions
- Brownouts
- Surges
- Spikes
- EMI/RFI Noise

Minuteman 250

250 watts output power capability... **\$399**

Minuteman 500

500 watts output power capability... **\$549**

360K Floppy Drive

for the **IBM AT™**

360 K



\$119 Qty. 5 \$99

CORPORATE AND INSTITUTIONAL ACCOUNTS

Our national accounts division is dedicated to providing the prompt professional service required to keep your business running smoothly. We accept P.O.'s on a Net Terms basis, (minimum purchase of \$50) offer same day shipping, free fully insured UPS ground shipment. We offer full-time technical staff to answer any questions that might arise and to make fast repairs if needed. Call our national accounts staff today. We Make Your Job Easier...

OUR POLICY

We accept Mastercard & Visa (with no Surcharge!), money orders, certified checks, personal checks (allow 10 days for processing), COD (minimum purchase of \$50), Company/Institutional P.O.'s and wire transfers. We do not charge your card until we ship. We pay shipping (UPS ground, fully insured) on orders delivered in continental U.S.A. Add 6 1/8 sales tax if Texas resident. Prices are subject to change. All equipment carries a new factory warranty. Any return item must be accompanied by a return authorization number.

Call Toll Free (800) 626-4027 Within Texas (512) 331-6700



Inquiry 76



10904 Marble Road Austin, TX 78750

ATTENTION MEGABYTERS

Let your PC grow!

Vfeature
for IBM AT, XT and compatibles
supports **BIG** disks
secures disk data.

Vfeature operates with AT and XT compatible
hard disk controllers.

Golden Bow Systems

\$80.00

Add \$3 for shipping/
handling
California residents add
6% sales tax



3388 Second Ave., Suite F
San Diego, CA 92103
(619) 298-9349

Inquiry 169

8080
280
6809

AMX

8086
8088
Now
68000

Real-Time Multitasking Executive

- No royalties
- Source code included
- Fault free operation
- Ideal for process control
- Timing control provided
- Low interrupt overhead
- Inter-task messages

- Language Interfaces:
 - C
 - Pascal
 - PL/M
 - Fortran
- DOS File Access:
 - CP/M-80
 - IBM PC DOS

Options:

- Resource Manager
- Buffer Manager
- Integer Math Library

AMX is TM of KADAK Products Ltd.
CP/M-80 is TM of Digital Research Corp.
IBM PC DOS is TM of IBM Corp.

AMX for 8080	\$ 800 US
8086	950
6809	950
68000	1600
Manual (specify processor) 75	

KADAK Products Ltd. (804) 734-2798
206-1847 W Broadway, Vancouver, B.C., Canada V6J 1Y5
Telex: 04-55670

Inquiry 211

BASF

DISKETTES

BASF Diskettes at competitive price. Call TOLL FREE
(800) 235-4137 for prices and information. Visa and Master Card accepted.

PACIFIC EXCHANGES
100 Foothill Blvd
San Luis Obispo, CA
93401 (In Cal call
(805) 543-1037)

Inquiry 290

P.D.Q. CABLES

3021 PURDUE ROAD
DAYTON, OHIO 45420

No higher quality
computer cables on
the market today!!

**METALIZED HOODS
FULLY SHIELDED
POSITIVE STRAIN
RELIEF
100% GUARANTEED**

6' IBM PARALLEL CENTRONICS-----\$17.00
6' IBM SERIAL PRINTER CABLE-----\$17.00
6' IBM SERIAL FOR MODEM-----\$17.00
6' STRAIGHT PARALLEL CENTRONICS-\$18.00
6' RS232C-----\$17.00

**IF THERE IS A CABLE
NEEDED, P.D.Q. CAN
CONSTRUCT AND
GUARANTEE IT!**

CALL
(513) 254-8755

Inquiry 297

MODEL IQ-160 FROM DIGITAL MEDIA
**POWERFUL AND INTELLIGENT, FIRST TRULY
PORTABLE UNIVERSAL PROGRAMMER**

- Programs PAL/PE, IPL, PROM, EPROM, EEPROM including MOS, CMOS, NMOS, ECL, Bi-POLAR
- No personality modules
- Emulates 32K x 8 EPROM/PROM
- Software upgradeable for new devices
- RS-232 with automatic baud rate output between 300 and 19200 Baud
- Supports JEDEC and Intel Hex formats
- Built-in ultra fast logic interpreter DMI
- Built-in data manipulation commands
- Fast intelligent algorithms for EPROMs
- Can drive automatic handlers and GA-160 Gang Adapter
- Dynamic mode eliminates operator caused errors
- Automatic detection of reversed or wrong devices
- Automatic self calibration
- Stand-alone operation for field service
- Lightweight (2.5 lb) and portable (10 x 6 x 0.7 inches)
- 32 character LCD display
- Part numbers and operating modes selected from menu
- Tested by NMI, TI and National Semiconductor
- Introduction discount until November/Immediate delivery

Digital Media, Inc. - 3175 Gibraltar Avenue - Costa Mesa - CA 92626 - USA
(714) 751-1373

Inquiry 124

**Erases Most Eproms
in 3 Minutes**

ONLY \$34⁹⁵

**Solid State 2-8 Min.
Timer Version \$54.95**

For all 24 or 28 pin devices—2 at a time.
90 DAY WARRANTY SHIPPING & HANDLING
DEALERS WELCOME \$2.50
AZ RESIDENTS ADD 6% TAX

WALLING CO.
4401 S. JUNIPER • TEMPE, AZ 85282 • (602) 838-1277

Inquiry 381

REVIEW: C COMPILERS

hand, we find Mac C, Megamax C, and Softworks C offering the Macintosh's visually oriented user interface. On the other hand, Aztec C and Hippo-C create a more traditional programming environment oriented almost exclusively to receiving commands via the keyboard and responding with text on the display.

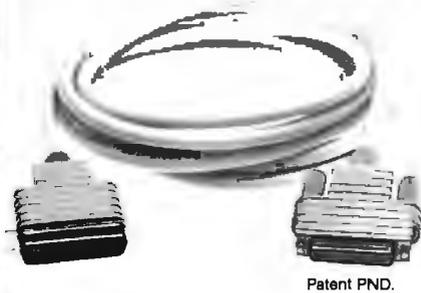
I am in general a strong supporter of the Mac's user interface. It can create a friendly and intuitive environment for users to interact with application programs. This greatly reduces the time required to learn new applications and reduces the difficulties of moving from one application to another.

For both practical and philosophical reasons, however, I contend that certain computer applications do not lend themselves well to the Mac user interface. Although time and space do not permit me to fully support this, it is my conviction that software development is just such an application. As long as the traditional command-line environment gives the developer full access to create applications that support the Macintosh environment, it is a potentially more powerful development environment as compared to the Macintosh environment. (Note: I say "potentially" because the quality of a given implementation of a command-line environment may be quite poor. This is demonstrated by Hippo-C's HOS environment.)

The UNIX-like environment of Aztec C gives it an edge over the three compilers based on the Mac environment. Those C compilers using the Macintosh environment are less flexible and more frustrating in the development cycle than Aztec C's more traditional UNIX-like command-line environment. A few examples of the features that greatly assist the programmer in Aztec C's command-line environment but which do not fit readily into the Mac icon-oriented environment include cat, which lets you quickly scan the contents of a text file without entering a text editor; use of global * and ? characters (to do such things as selectively get directory listings of

(continued)

THE ULTIMATE CABLE ASSEMBLY



Patent PND.

DATA SPEC®

FROM ALLIANCE RESEARCH CORPORATION

20120 Plummer Street
Chatsworth, CA 91311 • 1-818-993-1202

No More Fumbling with Screwdrivers! Just a twist of the thumb wheel screw heads and the cable is securely screwed into position! No cable looks or works quite like this. DATA SPEC® cable assemblies not only visually enhance your computer equipment, but provide superior quality inside and out.

FEATURES:

- Gold Plated Pins
- Positive Strain Relief
- Full Shielding (Exceeds F.C.C. EMI/RFI Emission Requirements)
- Large Convenient Thumbscrews (No More Screwdrivers Needed!)
- Exclusive P.D.T. Underhood for Maximum Integrity
- Lifetime Warranty

DATA SPEC® makes cable assemblies to fit any of your interface needs: RS232, Parallel (Centronics), Printers, Modems, Disk Drives, and monitors. For your IBM, Apple, AT&T and other popular PC's. Ask for DATA SPEC® cables at your nearest authorized DATA SPEC® dealer.

PRINTER JACK™

Apple IIc Serial to Parallel Printer Interface



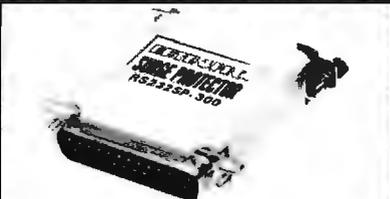
The Printer Jack™ is a device that will enable you to use the Apple IIc, which is not equipped with a parallel port, with any standard parallel printer. The Printer Jack can also be used with other computers with an optional cable. The Printer Jack set, Model A1250 includes: a CPU unit (the big box), a 9V power supply and a 5 pin to a 25 pin cable.

DATA SPEC®

FROM ALLIANCE RESEARCH CORPORATION

20120 Plummer Street
Chatsworth, CA 91311 • 1-818-993-1202

SURGE PROTECTOR



Power Spikes can occur anywhere! Even in RS232 lines! Stop power spikes with the NEW RS232 Surge Protector from DATA SPEC®. The RS232 Surge Protector will eliminate power spikes and surges generated by static discharges from damaging computers and peripherals. Comes with a Female DB25 on one end and a DB Male on the other end with gold plated pins. All 25 pins are wired through. Ask for the RS232 Surge Protector at your nearest authorized DATA SPEC® dealer.

DATA SPEC®

FROM ALLIANCE RESEARCH CORPORATION
20120 Plummer Street
Chatsworth, CA 91311 • 1-818-993-1202

RS232 MINI-TESTER



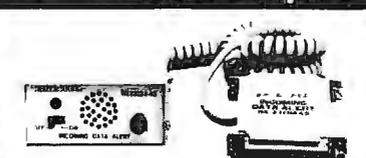
This miniature RS232 tester is designed to monitor RS232 lines. This tester is very useful in diagnosing RS232 communication problems.

There are 7 different colored LED indicator lights to monitor the following functions: Receive Data (RD), Clear To Send (CTS), Data Terminal Ready (DTR), Request To Transmit Data (TD), Request To Send Data (RTS), Data Set Ready (DSR), and Carrier Detect (CD). Ask for the RS232 Mini Tester at your nearest authorized DATA SPEC® dealer.

DATA SPEC®

FROM ALLIANCE RESEARCH CORPORATION
20120 Plummer Street
Chatsworth, CA 91311 • 1-818-993-1202

NO LOST DATA! Even Computer Owners Need Beepers



Have you ever lost data from a modem because you forgot to turn a switch? Now you can be "beeped" and visually alerted with the Incoming Data Alert from DATA SPEC®.

This device will sound an audible "beep" (for about 15 seconds) and light a red L.E.D. (which stays lit until reset) whenever data is being transmitted through an RS232 line. The Incoming Data Alert monitors pin 3 and can be used between modems and computers and terminals.

DATA SPEC®

FROM ALLIANCE RESEARCH CORPORATION
20120 Plummer Street
Chatsworth, CA 91311 • 1-818-993-1202

25 PIN DATA SWITCH \$59.95



All RS232 25 pin switch boxes are available in these configurations: AB-25, ABC-25 and ABX-25 (Cross Matrix, allows the use of 2 computers and 2 peripherals). Can be switched with IBM PC parallel port, compatibles too!

It's about time you benefit from high performance at affordable prices? Ask for the 25 Pin Data Switches at your nearest authorized DATA SPEC® dealer.

DATA SPEC®

FROM ALLIANCE RESEARCH CORPORATION
20120 Plummer Street
Chatsworth, CA 91311 • 1-818-993-1202

36 PIN PARALLEL DATA SWITCH (CENTRONICS TYPE)



These switch boxes also have gold plated pins and have all 36 pins switched. The 36 pin boxes are available in these configurations: AB-36 and ABC-36.

Quality features, outstanding durability and affordable prices! Ask for the 36 Pin Data Switches at your nearest authorized DATA SPEC® dealer.

DATA SPEC®

FROM ALLIANCE RESEARCH CORPORATION
20120 Plummer Street
Chatsworth, CA 91311 • 1-818-993-1202

L.E.D. 25 PIN DATA SWITCH BOX



Get all the outstanding features of DATA SPEC's RS232 25 Pin Data Switch Boxes and more with the ABL-25LE. This luxury edition data switch box features 7 L.E.D. indicators (TD, RD, RTS, CTS, DSR, DTR & CD) and gold plated pins.

Ask for the 25 Pin L.E.D. Data Switch Box at your nearest authorized DATA SPEC® dealer.

DATA SPEC®

FROM ALLIANCE RESEARCH CORPORATION
20120 Plummer Street
Chatsworth, CA 91311 • 1-818-993-1202

certain categories of files); redirection of standard input and output; use of files or devices as the source or destination of such redirection; and specification of compile-time, assembly-time, or link-time options when such an operation is invoked.

MACINTOSH PROGRAMMING ISSUES

Any development system designed to create Macintosh applications must address many Mac-specific issues. Unfortunately, space does not permit me to look at either the range or the detail of all these issues for each of our five compilers. However, I'll briefly cover a few of these issues as they relate to the compilers in our group.

Interface to ROM Toolbox: The real power in the Macintosh is due more to the hundreds of functions embedded within its ROM Toolbox than to any other single attribute. Thus, the

scope and method of access into this Toolbox provided for by a compiler is of utmost interest to Macintosh programmers.

The ROM Toolbox was designed to be accessed directly by Apple's Lisa-based Pascal compiler. This creates a couple of problems for a standard C compiler. However, due to differences between C and Pascal, any C compiler must provide some mechanism for assisting the C programmer in using the ROM Toolbox.

Our five compilers take two different strategies to provide a smooth interface to the ROM Toolbox. One method is to have the compiler produce standard C programs and then set up special glue routines to tie the C programs into the ROM Toolbox. One glue routine is set up for each Toolbox function. When the compiler spots a Toolbox function call in the C source, it sets up a call to the glue

routine associated with that Toolbox function. The glue routine is responsible for coping with any differences between the C calling program and the ROM Toolbox function. An alternative solution to this problem is to embed in the C compiler the knowledge of what the ROM Toolbox needs for each routine. Rather than use a special glue routine, the compiler can issue code that directly calls the ROM routines in the required manner. Direct interfacing maximizes the performance of C programs that use the ROM Toolbox, while glue routines can seriously impair the execution speed of such programs. However, glue routines are easier for a compiler creator to implement, and they keep the compiler "pure" by not making it do anything not C-like.

Parameter Passing: One difference between the way C and Pascal programs

(continued)

PathMinder™

THE VISUAL SHELL FOR DOS

File Manager Directory Manager Applications Manager Systems Log
File Encryption/Decryption Full Featured Text Editor

LOTUS-style menus. Context-sensitive help screens throughout.

Lightning fast—100% Assembly Language—Uses only 8K when running other programs! Kill function provides security from unauthorized file recovery. True moves from one subdirectory to another! Have several subdirectories open at once! Run any program from within the shell including interpreted BASIC. Systems integrators and MIS managers rave over the ability to create their own help screens and to "lock-in" the inexperienced user to the applications menu with only 2 keystrokes!

Evaluation copies available to dealers and corporate accounts.
Site Licensing available.

In use at NASA, Motorola, Tracor, E. I. DuPont, IBM, General Electric

\$9900 Introductory price
plus \$5.00 shipping

WESTLAKE DATA CORPORATION

P.O. Box 1711, Austin, TX 78767

7-Day, 24-Hour Order Line:

1-800-628-2828, ext. 555

VISA & MC Accepted

INTRODUCING THE



“FRIENDLY SUPERPOWER”

Advanced Business Software That's on Speaking Terms with You!

Power or ease of use . . . until now, you had to choose. The more you had of one, the less you had of the other.

No longer. KnowledgeMan/2 was created to bridge the gap between simple, single-function programs and powerful integrated multi-function programs. KnowledgeMan/2 is powerful. But you don't have to be a computer wiz to tap that power. Easy-to-use menus help you until you're ready for direct commands. If you run into trouble, on-line help screens come to your rescue. Now both the casual user and the power user get everything you'd expect in a high-powered business software, with the best of both worlds—power and ease of use.

See KnowledgeMan/2 in action! For the name of the dealer nearest you, call or write MDBS, P.O. Box 248, Lafayette, Indiana 47902, 317/463-2581.

KNOWLEDGE
man/2[®]
THE UNIVERSAL KNOWLEDGE MANAGEMENT SYSTEM

KnowledgeMan/2 and MDBS are registered trademarks of Micro Data Base Systems, Inc.



Inquiry 247

C *Low power* **Complete hard disk kit \$395**

Comes complete with virtually the identical controller that's in the IBM® XT, and Xerox® warranties the hard disk for one year

Guaranteed 100 percent IBM PC compatible

How can we offer this fantastic price? Simple. We buy in such volume that even the most avicious hard disk businessmen understand they have to give us the best price possible. We could pocket the difference, but we don't.

Instead, we put the extra profit into our testing facilities. That's why Xerox guarantees our \$395 10 megabyte hard disk for one year.

Xerox knows, as our customers know, that we have an extensive testing program. Here is what we contribute toward giving you the maximum hard disk performance.

Best Drives Available

First, we buy the best drives available. Sounds trite, doesn't it? I mean, a drive's a drive—right? Hardly. You should see some of the junk we get in our labs. Some have such high failure rates that we even questioned our own \$10,000 hard disk tester. But when we tested other manufacturers' drives we were assured that our equipment was fine, which just confirmed that the bad hard disks were not only bad—they were real bad.

But that's just the weeding out process. We then take each drive that we've put through our tester and test it again with the controller you've requested. We call this a "tested pair."

DOS Doesn't Do It

In case you're thinking that all

this is an unnecessary duplication of what DOS does for you, let me explain the disk facts of life.

If DOS did what you may think it is supposed to do when you format the disk, DOS would map around these bad areas. Unfortunately, DOS doesn't do this.

DOS 2.0 and 2.1 can't enter the bad tracks. DOS 3.0 can, but only on the IBM AT. Unfortunately, as the press has so well documented, the AT's hard disk develops bad tracks later on.

We do what DOS can't

We believe the problem is so bad, we use a software program that performs a powerful test of your disk drive on all of the IBM or IBM compatible computers—PCs, XTs, and ATs. Our format takes hours to analyze the disk. But when we finish, you know that the bad tracks are really mapped out so you won't write good data that will disappear into a black hole. We even send you a printed statement of our test results.

Our software allows you to type in the bad track locations from the list supplied by the manufacturers, so you'll never write good data to them—even if DOS didn't identify them as bad. The software even lets you save the location of these bad sections to a file, so that you can reformat your disk without spending hours retesting.

We even include a program that will give you continuous comments on the status of your hard disk. No more waiting for that catastrophic failure.

Average Access Time

As you might suspect, some hard disks are faster than others in their ability to move from one track of data to another. The time it takes the hard disk to move one-half way between the beginning of the disk to the end is called the "average access time."

The first generation of 10 megabyte hard disks had average access times of 80-85 milliseconds (msec). But computer users love speed, and guess what—the average access time for the new 20 megabyte hard disk in the IBM AT is only 40 msec. (We sell an AT equivalent with only 30 msec access time!)

There are some legitimate reasons for the shorter access time. It's particularly helpful when there are multiple users on the same hard disk. It's also important when running a compiler. But remember, before you get too wrapped up in the access speed, there's always that ST 506 interface which won't let data transfer from the hard disk to the computer any faster than 5 megabits/second. We've bypassed that choke hole, too. If you want the functional equivalent of a Ferrari with a turbocharger, order our 10 Mbit per second 100

megabyte hard disk with 18 msec of average access speed.

Compatibility

To be sure that your hard disk is 100 percent compatible with the IBM XT you don't need to buy the same hard disk that's in the XT. You can't even be sure what brand hard disk it is because IBM, like Express Systems, goes into the marketplace and buys hard disks from several vendors. However, they buy their XT hard disk controller from only one vendor—the same one we do.

You can buy the IBM XT controller from IBM for \$495 or you can buy from us, the functional equivalent, manufactured by the same company that makes it for IBM for only \$195. Is it the exactly identical IBM XT controller? No, it's better. First, it takes less power, and secondly, it can control from 5 to 32 megabytes—the IBM controller can work with only 10 megabytes. It is 100 percent IBM XT compatible, and 100 percent is 100 percent. If you want to save a slot, we carry a version that lets you operate two hard disks and two floppy disk drives.

More than 32 Megabytes

You can operate with more than 32 megabytes (the limit of DOS) through the use of "device drivers." Express Systems can supply you with device drivers for our hard disks for over 32 megabytes formatted. But, if you don't have individual files, or databases that are large, you might want to consider one of our controllers that can divide our 65 megabyte (formatted) hard disk into two equal volumes of 32 megabytes each.

Reliability

We offer you a choice between iron oxide and plated media—the stuff that covers the hard disk and gives it its magnetic properties. Iron oxide is, well, it's rust. If you inadvertently joust your disk, you may cause the low flying head to dig out some iron oxide. A little rust flake can ruin your whole day. Plated media is more resistant to damage, and if it happens, less data is lost.

We offer both types of hard disks. The iron oxide is older



technology, and quite frankly, manufacturers understand it better. Their better understanding, combined with some of the special head locking mechanisms, gives us peace of mind when we sell you one.

Power

Hard disks consume power. Our small, half-high hard disks consume so little power that you can use them with your existing IBM PC power supply. If you plan to use lots of slots, you'll want to increase your power supply to be safe. We offer the same amount of power for your PC that comes in the XT.

Our Customers

Some folks just never feel comfortable buying mail order. They forget that Sears began as a mail order house or that IBM is now into mail order. But, if it helps, here is a *partial* list of customers who have felt comfortable to buy from us.

IBM	Sears
American Express	Honeywell
U.S. Army	MIT
AT&T (Bell Labs)	RCA
Bausch & Lomb	Lockheed
Xerox	Sperry

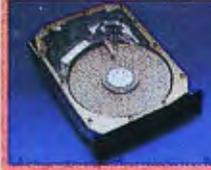
Easy to Install

If you're like most of us, raised on the boob tube rather than the Great Books, you'd rather see the movie than read the book. Well, now you can choose to read our installation manual or for only \$9.95 more, you can get a VHS or Beta video cassette showing the simple steps for installation.



Warranty

We offer you a one year warranty on our hard disks—the same as IBM on the AT and 90 days on the tape drives. (It's all the manufacturer gives us.) If



Complete Hard Disk Kits

Formatted MB	Height	Plated Media	Average Access	Transfer Rate	PC or PC/XT	AT
10	1/2	no	85 msec	5 Mbits/s	\$ 395	\$ N/A
10	1/2	yes	85 msec	5 Mbits/s	\$ 495	\$ N/A
21	1/2	yes	85 msec	5 Mbits/s	\$ 795	\$ 595
21	Full	no	30 msec	5 Mbits/s	\$ 1,535	\$ 1,340
32	1/2	yes	85 msec	5 Mbits/s	\$ 995	\$ 795
32	Full	no	30 msec	5 Mbits/s	\$ 1,775	\$ 1,575
65	Full	no	30 msec	5 Mbits/s	\$ 2,295	\$ 2,070
100	Full	yes	18 msec	10 Mbits/s	\$ 4,995	\$ 4,995

Removable Hard Disk

10	1/2	no	90 msec	5 Mbits/s	\$ 1,095	N/A
----	-----	----	---------	-----------	----------	-----

Tape Systems and Subsystems

Formatted Storage Capacity	Height	Data Transfer Rate (k/sec)	PC or PC/XT	AT
60 Mbytes	1/2	88	\$ 995	\$ 995
60 Mbytes Subsystem	1/2	88	\$ 1,295	\$ 1,295
21 Mbytes (unformatted) Start/stop Subsystem	24		\$ 595	\$ 595
26 Mbytes Floppy Tape® Subsystem	31		\$ 749	\$ 749

Controllers

All of our hard disk and tape controllers are available separately. Please call for prices.

Subsystem Chassis

Any of our disk or tape units are available in an external subsystem for an additional \$250.00. You can mix & match any of our 1/2 high hard disks or tape drives together or add any single full height hard disk.

Tape Cartridges

Express Certified 555 foot 310 Hci 1/4-inch Data Cartridge \$35.00

Power Supply

130 Watt Power supply \$75.00*
150 Watt Power supply \$125.00

*with the purchase of any drive

More questions?

Because we spend so much attention on the front end with ensuring that our disks will arrive in working order, we have a customer service department that, unlike many of our competitors, has little to do. When you need us, you won't get a constant busy signal.

Call our friendly, knowledgeable customer service staff to get answers to your questions—before or after the sale. Our people, who know the PC, can talk you through the sticky parts, and they'll respond to you quickly. Just call us.

How to order

Pick up the telephone and call 1-800-341-7549, to order. We accept Master Card, VISA, American Express and Diners Club. Or send a cashier's check or



money order (We'll take a check, but you'll have to wait for it to clear) and tell us if you want one of our recommended configurations or you want to mix and match yourself. Corporations with a DUNS number may send purchase orders for quantities over five.

Comes complete

All Express Systems products come complete with the appropriate software, tape and/or hard disk controllers, and cables where required. Hard disks are formatted and tested with the PC DOS of your choice. All drive sizes are formatted capacities.

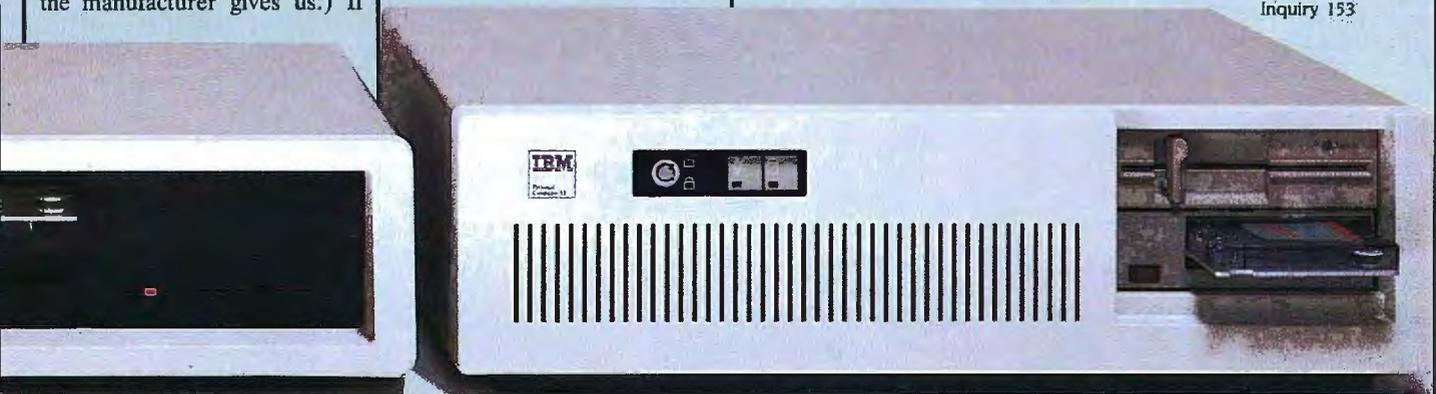
If your application requires a stacking kit, power splitter cables, daisy chain cable, or some other variation, we'll supply these items at a nominal charge. We even ship our hard disks with Command Assist™ an on-line DOS-like manual to give you help with your DOS commands.

EXPRESS SYSTEMS

Call Toll Free 1-800-341-7549 Ext. 1400
In Illinois call (312) 882-7733 Ext. 1400

Express Systems, Inc., 1254 Remington, Schaumburg, IL 60195

Inquiry 153



Color Diskettes

BY **TYCENTECH**

The Colorful Solution to Data Organization™

TIMELESS WARRANTY

SS-DD DS-DD
★70c Color Bulk QTY. 100 **90c★**
★89c Color Boxed QTY. 100 **\$109**
★99c ← Color Bulk 96 TPI QTY. 100 → **\$119★**
\$213★ DS-HD

IBM PC-AT Compatible Color Bulk
100% error-free beyond **75% clipping** level. Available in **13 useful assorted colors**.
 * Color Bulk w/Tyvek sleeves add 6c. Label Kits 2c
 * Pre-packaged in **Plastic Library Case/12**. A \$4.95 value case for 20c/disk extra.

***Best Deal in Memory**
Up to \$30 Cash Back from **3M**

LIFETIME WARRANTY

SS-DD DS-DD
\$115* 5 1/4" QTY. 5 BOXES **\$145***

\$184* ← 96 TPI → **\$228***
\$225* ← 3-5"/135 TPI → **\$329***

High Density for IBM PC-AT/DS-HD **\$313***
3M Headcleaning Kit **\$595***
3M Data Cartridges (DC-1000) ... **\$1060***
DC-300XLP **\$1737***
DC-600A **\$1860***

*Price after \$2.00 per box cashback direct from 3M.

Nashua "Boxed" Diskettes

LIFETIME WARRANTY

SS-DD DS-DD
79c ← 5 1/4" QTY. 10 BOXES → **89c**
\$240 ← 3-5" QTY. 5 BOXES → **\$275**

Factory fresh in boxes of 10 with Tyvek sleeves, user ID labels, write-protect tabs and reinforced hub ring.

Wabash's Pinnacle/Data Tech

LIFETIME WARRANTY

SS-DD DS-DD
65c 5 1/4" BOXED QTY. 10 BXS **75c**
\$208 ← 3-5" → **\$254**

High Density for IBM PC-AT DS-HD **\$224**

100% Error-Free **BULK** By Leading American Media Manufacturer one of the top 2

LIFETIME WARRANTY

SS-DD DS-DD
55c 5 1/4" QTY. 100 No sleeves/labels **65c**

PRINTER RIBBONS **DISK STORAGE**
 Epson MX 70/80 \$2.68 Amaray Media Mate
 Epson MX-100 \$4.06 50 \$8.75
 Okidata 80.82.83.92.93 \$1.36 Disk Minder II-75 \$9.75
 Okidata 84 \$2.95 Micro Disk Minder-36 \$7.75

PRICE PROMISE: We will better any lower delivered price on the same products and quantities advertised nationally.

TERMS: FREE USE OF VISA AND MASTERCARD. American Express also accepted. **Shipping:** Add \$3.00 per 100 diskettes or fraction thereof. **Other items** add \$3.00 for disk storage or headcleaning kit or dozen ribbons or C.D.O. orders. P.O. accepted from recognized institutions and schools on 2%–10 Net 30. Utah residents add 5 1/4% sales tax. Minimum order \$30.00

TOLL FREE ORDER LINE:

1-800-233-2477
INFORMATION AND INQUIRIES:
1-801-942-6717

Computer Affairs, inc.
 2028 E FT UNION BLVD #105
 SALT LAKE CITY UTAH 84121
 CALL 1-800-AFFAIRS
 HOURS 9AM-6PM M-F (Mon-Fri)

REVIEW: C COMPILERS

The ROM Toolbox routines using character strings expect the strings to be in Pascal format.

do things is in the order in which they pass parameters to procedures or functions. While both C and Pascal generally use the system stack to pass such parameters (except for Mac C, which passes parameters via registers), Pascal usually pushes the parameters onto the stack in order from left to right. C works through its list of parameters from right to left. For functions that have either no parameters or only a single parameter, this does not create a problem. However, for multiparameter routines, the list of parameters for C is in reverse order when compared to its Pascal equivalent.

Consequently, when a C program calls a ROM Toolbox function that expects multiple parameters in Pascal order, something must be done. The compilers that use glue routines, including Softworks C, Hippo-C, and Megamax C, rely on these glue routines to actually alter the order of the parameters on the stack as a program executes. Aztec C and Mac C, which offer direct interfaces to the Toolbox, change the output of the compiler so that the parameters for Toolbox function calls are initially placed on the stack in the appropriate order.

Strings: Another difference between C functions and the Pascal-oriented ROM Toolbox procedures and functions has to do with how Pascal and C define text strings. Pascal expects a string of characters to begin with a single byte that contains a count of the number of characters within the string, followed by the characters of the string itself. Consequently, a Pascal string is limited to 255 characters.

A C string is a string of characters followed by a zero (null) byte. This means that there cannot be a character represented by the value 0, but it does not limit the ultimate size of the string. Since the Mac ROM routines were written for use by Pascal, any of these routines that work with character strings expect the strings to be in normal Pascal format.

The situation requires that any C string be converted to its Pascal equivalent before being used as a parameter to a ROM Toolbox routine. Likewise, any string converted to Pascal form or created by one of the Toolbox routines must be changed back into a C string before being used by a standard C function.

Hippo-C and Megamax C glue routines provide for completely automatic string conversions. This eliminates the problem of a programmer neglecting to do the necessary string conversions. However, it does mean that such conversions will occur every time Toolbox routines that use strings are invoked.

On the other hand, Aztec C, Mac C, and Softworks C give the programmer the responsibility of doing conversions. This allows the programmer to determine when the conversions are absolutely necessary. For example, there may be many times when a string can initially be converted from C to Pascal form, left in Pascal form for use by Toolbox calls, and be converted back to a C string only when the resulting string is to be printed out with a standard C function. The compilers that take this route provide efficient string-conversion routines that the programmer can use when needed.

I prefer having the opportunity to make my programs as efficient as possible, so I will gladly take the added burden of deciding when string conversions are necessary rather than have my compiler do this for me. The thing I like most about C as compared with Pascal is the way C offers added flexibility at the cost of providing less "dummy protection" against my potential mistakes.

(continued)



NOW AVAILABLE VIA
 DOW JONES NEWS/RETRIEVAL:
Fidelity Investor's Express
 Place buy or sell orders online!

Feel right at home with the stock market.

Now you can use your personal computer and modem to help make investment decisions with confidence. Right in your own home.

Dow Jones News/Retrieval® is the surprisingly affordable, online financial news resource with exclusive electronic access to *The Wall Street Journal*. The combination of News/Retrieval and Dow Jones™ Software makes personal investment decisions easier by giving you a clear, organized picture of the facts.

Use News/Retrieval to check on your stocks or read up on companies and industries that interest you. Get tomorrow's business news today—90 seconds after it appears on the Dow Jones News Service® (the broadtape). See what impact government or world news is having on the marketplace.

Measure stock performance—past and present—with Dow Jones Quotes. And to round out the picture, review economic and earnings forecasts or SEC, Merrill Lynch and Standard & Poor's reports. It's all here in one place.

Then use Dow Jones Software to display trends, organize your portfolio and give you the entire picture in clear graphics.

After you've checked your investments, the whole family can use News/Retrieval to get hot sports news, shop at home, look up articles in the encyclopedia and much, much more.

For more information on how Dow Jones News/Retrieval can help *you* feel at home with the stock market, call **800-345-8500 Ext. 144***.

Dow Jones News/Retrieval & Software
Keeping you a step ahead.

Inquiry 137

*Alaska, Hawaii and foreign, call 1-215-789-7008 Ext. 144.

Segmentation: The maximum program block size that the Macintosh can work with is 32K bytes. However, through a group of ROM Toolbox routines collectively known as the Segment Loader, a programmer can divide large programs (those larger than 32K bytes) into multiple segments. The Segment Loader routines then can be used to bring appropriate program segments into whatever memory space is available as the segments are needed. This allows for very large and complex programs to run even when RAM space is limited.

Obviously, segmentation is important to Mac applications developers, so the support of segmentation by serious software-development systems is required. Of the five compilers in our group, Hippo-C is the only one that does not offer direct support of Macintosh segmentation. The use of the Mac's Segment Loader is quite

straightforward in the other four systems.

CONCLUSIONS

Which compiler is best? Of the five compilers in the group, I am most impressed with Aztec C. It won or tied for first in almost every test or comparison. Among other things, I like its flexible UNIX-like shell environment, its extensive documentation, and its numerous and powerful development tools. My only significant criticism of Aztec C is that it's copy-protected. The only people to whom I would recommend any of the other compilers over Aztec C are those allergic to the UNIX environment.

Mac C and Megamax C tie for second place. Each has many strengths and some weaknesses. The interesting thing is how much these two compilers complement each other. One's strength is the other's weakness and

vice versa. Megamax's support of floating-point operations and register variables, combined with its easy-to-use intelligent linker and its comparatively low price, just offsets Mac C's abundance of extra support functions and sample programs, source code, support of a full-fledged assembler, and inclusion of assembly-level debuggers.

Softworks C comes in fourth place. It offers a full C development system with a lot of potential, despite the documentation's determination to hide it. The weak link of the MDS linker hurts Softworks C. I do hold out some hope for this compiler. If its creators will come out with real and useful documentation and fix up the loose ends in the system, Softworks C will be up there fighting with Mac C and Megamax C.

Hippo-C pulls up the rear. The severely limited Hippo Operating System creates an unfriendly environment for professional software development. The compiler, assembler, and linker are inherently inflexible. The assembler is outclassed by the full-featured assemblers in Aztec C and the Apple MDS used by Mac C and Softworks C. All in all, Hippo-C just does not offer the sort of power required by professional software developers, nor does it provide for the needs of nonprofessional C programmers.

It is important to note that the compilers I've reviewed are surely not the last word in C development systems for the Macintosh. All the manufacturers of these compilers are working at improving their systems to better provide for the needs of their users. While I was working on this article, updates came through on every one of the five compilers. Many of the changes found in these updates were impressive, forcing me to step back and remove criticisms I had leveled against the earlier versions.

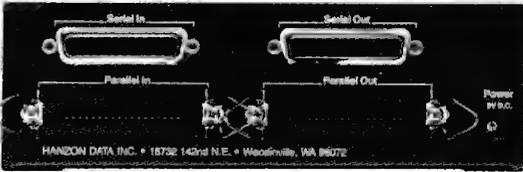
By the time this article is printed, entirely new compilers are bound to be offered. The exciting part is that the ultimate winners will be those of us who want to create C programs with and for the Macintosh. ■

Brainy Buffer.

Do you press print and wait? And wait? And wait?

Your waiting is over with the Universal Data Buffer — it frees your computer in seconds while it handles the printing of your file.

And the Universal Data Buffer from HanZon is smarter than the average buffer. For one thing it has two inputs—one serial and one parallel, and two outputs—one serial and one parallel. Since all the ports are active, it means the Universal Data Buffer can interface between serial and parallel devices — even at different speeds and protocols. All that is a bonus to its standard function — as a 64K buffer expandable to 256K. The buffer also has operator controls for selecting additional copies, and pausing.




Call HanZon today for your nearest dealer:
(206) 487-1717.

SEE US AT COMDEX BOOTH #M-2-11

Suggested Retail Price: \$385 - 64K Buffer
\$59 - 64K Expansion Module

HANZON
HANZON DATA INC. • 18732 142nd Ave NE • Woodinville, WA 98072



PRINTER BARGAIN

We guarantee that you'll never find a bargain as sensational as the letter-quality daisy wheel printer you see in this advertisement.

We covered up the name of the printer so as not to embarrass the manufacturer.

I realize that what you are about to read may seem incredible. I can understand. But occasionally there are indeed bargains and opportunities that only come once in a lifetime. I'm convinced that this is one of them.

By Joseph Sugarman, President

The letter-quality printer you see above has a suggested retail price of \$1795. It prints bidirectionally at 40 characters per second using a daisy wheel print element, comes with a parallel interface and prints a 13.6 inch line.

A similar printer might be found at some discount computer dealers for as low as \$1000. And at that price it is indeed a bargain.

AUTOMATIC FEATURES

If we'd offer it to you at \$499—a unit that we could be selling for \$1795 and that would be a bargain at \$1000—you'd probably think that there was a catch. But guess again. As unusual a bargain as this may appear, and despite all its quality features, this printer can be yours for the incredible low price of only \$499—below wholesale, below dealer cost and without question, the lowest priced high-speed letter-quality printer sold today.

JS&A bought out an entire warehouse full of these printers, promised that we would not display the name on the unit, in our photo, mention the name in our ad nor reveal the name over the phone to avoid embarrassing the manufacturer or his dealers.

I'm so convinced that this is one of the greatest values I've ever offered, I am making a bet and a commitment. First, the commitment. I'm giving you 30 days to test it out. If it's not the best printer value in the country, return it for a full refund including your \$25 postage.

Finally, I'll bet that you'll immediately recognize the name of the billion dollar company whose name is on the product or you don't deserve to own a computer. The company is a successful computer company whose products you may even now own. They'll back the product with service through its 90-day limited warranty and for years to come with hundreds of national factory service centers throughout the United States.

EXCEPTIONAL VALUE

The printer is not an outdated model with old technology but a brand new unit with the latest electronics and the most advanced technology. For example, there's an automatic print pressure control which automatically varies the printing pressure according to the shape of the

character. This single feature produces an incredibly clean impression while prolonging the life of the daisy wheel. But there's more.

An aluminum diecast integral-constructed frame gives the printer a solid home for its advanced electronics. And with a weight of 30 pounds, you know there's built-in commercial-quality construction. The controls include: 'line feed' which advances the carriage by one line, 'page advance' which advances the document to the next page when using continuous form paper and a 'set page' button that tells the printer where the start of the form is located. A lighted condition panel tells you the printer status with red and green LEDs. You can use single sheets or continuous form fan-fold paper and with the 'paper out sensor' the printer detects the last sheet of the fan fold paper and automatically sheets. And the printer has a 2K buffer memory.

There are also features that give you enormous printing flexibility. You can underscore words, double print each character which creates a bold look or you can use shadow print which moves the print head 1/120th of an inch between strikes. With the proper daisy wheel you can also set the printer for proportional printing which gives your documents a professional—almost printed look.

SELF-TEST MODE

There's a self-test mode which lets you print out all the characters on your daisy wheel continually until you stop. And the system uses standard Diablo daisy wheels and ribbons which you can get from JS&A or any computer store.

With the Pica pitch, you can print up to 136 columns and with the Elite pitch, up to 163. The 15.5" carriage will take a print area of 13.6 inches. It measures 6 x 16 x 24", comes with a 10-pitch daisy wheel, one ribbon and complete instructions. The unit has provisions for a tractor feed and a sheet feeder which can be purchased locally or at a discount from JS&A.

You can select either 10, 12 or 15 for the print pitch or even use the 10-pitch daisy wheel supplied with the unit at the 12-pitch setting for large and tight letter spacing. There are dip switches which let you customize each printer to any computer with a parallel printer interface. Setting recommendations are supplied for IBM, Apple and other popular computers.

What happened? How can JS&A obtain and then sell these printers—products that are brand new with the latest state-of-the-art technology and from a major manufacturer at a price that at first is hard to believe? Quite frankly, it wasn't easy.

With our low overhead we can efficiently sell

these units in tremendous quantities without the high markups that many stores must have to make a profit. And we can do this on a mass-market national scale. Since many manufacturers know this and know that we could quickly move tremendous amounts of merchandise without upsetting many of the retailers (because we keep the name of the manufacturer confidential) they are willing to let us buy their product direct, often at foreign, export prices.

We'll be happy to supply companies with several printers for their computer departments to upgrade their printing speed and quality. There is no limit to the number you can order although we only have a few thousand available so we reserve the right to return your order should we run out.

ACT QUICKLY

There are bargains available that are indeed too good to be true and often end up to be much less than you expected. But here's an example that is not only too good to be true but that we guarantee you'll find better than you expected. Order one at no obligation, today.

Simply send your check or money order using the order numbers shown in parentheses (IL residents add 7% sales tax) plus \$25 for postage and handling for each printer ordered. Credit card buyers call toll-free number below. Send your order to: JS&A Special Printer Bargain Offer at the address below.

Printer (6087)	\$499
Tractor Feed (6084)	189
Sheet Feeder (6088)	239
3-Pack Ribbons (6089)	15
Daisy Wheels: (List supplied with unit)	
Cables/Interfaces (includes everything you need to connect to your computer:	
IBM & Compatibles (25 pin) (6076)	39
Apple II + e (6099)	69
Apple IIc (7011)	69
Commodore VIC-20 C-64 & C-128 (7002)	69
Atari 400/600/600XL/800/800XL (7003)	69
Visual 1050 (7004)	39
All Other Computers with Standard Parallel Printer Port (36 Pin) (7009)	39

JS&A PRODUCTS
THAT THINK®

One JS&A Plaza, Dept. B Y
 Northbrook, IL 60062 (312) 564-7000

ORDERS ONLY: 800 228-5000

QUESTIONS ONLY: (316) 264-1109

IL residents add 7% sales tax. ©JS&A Group, Inc., 1985

240K Apple® Compatible Computer System

NEW

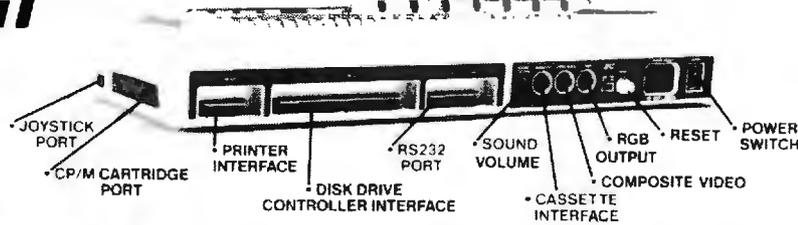
SALE

Aplus 3000 computer system includes 192K RAM, 48K ROM (32K Microsoft Basic plus 16K ROM Emulator), 144K Laser 5 1/4" Disk Drive (Runs Apple II Software), Magic Window Wordprocessor, MagiCalc spreadsheet, Magic Memory Database. All for only \$499.00

\$499⁰⁰

• **15 Day Free Trial**

"Aplus 3000" System



Double Immediate Replacement Warranty

If any of the Aplus 3000 computer system equipment fails due to faulty workmanship or material within 180 days of purchase we will REPLACE it immediately with no service charge!!

- Over 10,000 existing Apple® programs
- 240K (192K RAM, 48K ROM)
- ArtSci's Magic Window II, Magic Memory, and MagiCalc included
- 144K Laser 5 1/4" Disk Drive (Runs Apple II software)
- Centronics printer interface included
- RGB (80 columns in color) and composite included

SPECIFICATIONS

A plus 3000 is a complete, self-contained computer based on the popular 6502A microprocessor and can tap into the tremendous software library of Apple II. Features include 192K Bytes RAM, 32KB Enhanced Microsoft BASIC, 80 column text, 560H X 192V color graphic display, 81 key sculptured keyboard and high efficiency switching power supply. Also included as standard are Centronics bus printer interface, Cassette interface, 4 channel sound generator, and 5 1/4" Apple Compatible Disk Drive.

- **TEXT**
 - 40 columns X 24 rows or 80 columns X 24 rows software selectable.
 - 5 X 7 characters in 7 X 8 matrix.
 - Upper and lower case characters.
 - One of Eight colors for characters/graphics and background, Red, Green, Blue, Cyan, Magenta, Yellow, Black and White.
 - Character set with normal, inverse and flashing capabilities.
- **GRAPHICS**
 - 280H X 192V 6 colors — Black, White, Violet, Green, Blue, Orange.
 - 280H X 192V 8 colors bit image — Black, White, Red, Green, Blue, Cyan, Magenta, Yellow.
 - 560H X 192V 6 colors — Black, White, Violet, Green, Blue, Orange. (High resolution color monitor required)

Super Apple Compatible Disk Drive Sale

Quieter, Cooler, Better Disk Drives for your Apple II plus, IIe, IIc (specify when ordering). List \$299.95. Sale \$149.95.

15 Day Free Trial — If it doesn't meet your expectations within 15 days of receipt, just send it back to us UPS prepaid and we will refund your purchase price!!

More Features than Apple® for less than Commodore

Features	Aplus 3000	Apple IIe	Commodore
RAM	192K	64K	128
Runs Apple II Software	Yes	Yes	128K
Function Keys	24	None	No
4 Voice, 6 Octave Sound	Yes	No	16
Composite Video	Yes	Yes	Yes
Disk Drive	included	Extra Cost	Yes
Numeric Keypad	included	Extra Cost	Extra Cost
Video Cable	included	Extra Cost	Included
RGB Color Card	included	Extra Cost	Included
80 Column Card	included	Extra Cost	Included
Centronics Printer Interface	included	Extra Cost	Extra Cost
Drive Controller	included	Extra Cost	Included
\$150 Wordprocessor (Magic Window)	included	Extra Cost	Extra Cost
\$150 Spreadsheet (MagiCalc)	included	Extra Cost	Extra Cost
\$60 Database prg. (Magic Memory)	included	Extra Cost	Extra Cost

Your Cost **\$499.00** **\$1745.00** **\$1117.90**

ACCESSORIES

	LIST	SALE
2nd Disk Drive	\$299.95	\$149.95
2 professional analog joysticks	\$ 39.95	\$ 24.95
Z-80 cart. allows CP/M use	\$ 99.95	\$ 59.95
RS232 adapter	\$ 99.95	\$ 59.95
R/F Modulator (TV hookup)	\$ 29.95	\$ 19.95
RGB cable (RGB Monitor hookup)	\$ 24.95	\$ 19.95
Centronics cable (for Centronics printer)	\$ 34.95	\$ 24.95
Technical reference manual	\$ 29.95	\$ 19.95
Comstar 10x 120-140 CPS dot matrix printer	\$399.00	\$189.00
80 columns Hi-Res Amber Monitor	\$199.00	\$ 89.95
80 column Hi-Res RGB Monitor	\$399.00	\$279.00

Add \$25.00 for shipping and handling!!

Enclose Cashiers Check, Money Order or Personal Check. Allow 14 days for delivery. 2 to 7 days for phone orders. 1 day express mail! We accept Visa and MasterCard. We ship C.O.D. to continental U.S. addresses only. Add \$10 more if C.O.D.

COMPUTER DIRECT

We Love Our Customers
22292 N. Pepper Rd., Barrington, Ill. 60010

312/382-5050 to order

Famous Canon National Brand

10" Carriage

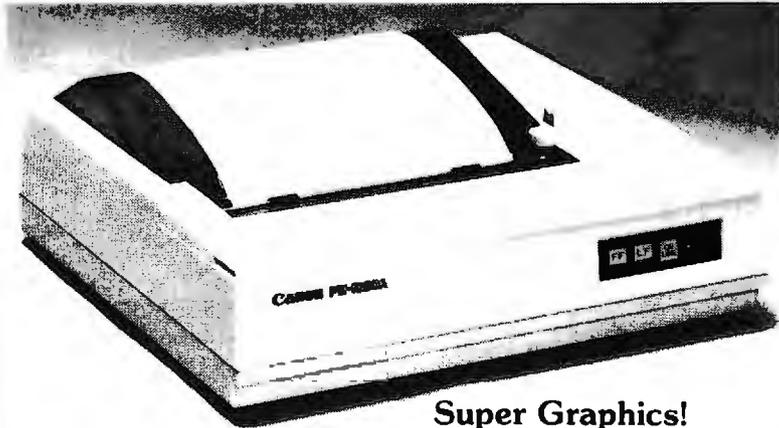
HI-SPEED

15" Carriage

PRINTER SALE

Below Wholesale Cost Prices!!!

- 160-180 CPS • High Speed Dot Matrix • Letter Quality Modes
- Tractor/Friction • 4 Character Styles • Business or Personal
- Programmable Characters • 2K Buffer • 15 Day Free Trial
- ONE YEAR IMMEDIATE REPLACEMENT WARRANTY



Super Graphics!

Print Sample

```

*** NLQ PICA PRINTING ***

CANON IMPACT MATRIX PRINTER  CANG
CANON IMPACT MATR
    
```

Check these features & prices

10" Printer

List \$499.00

\$199⁰⁰

Call for Volume Discounts

15" Printer

List \$699.00

\$249⁰⁰

Call for Volume Discounts

(IBM - Commodore)

Printing Method

Impact dot matrix

Printing Speed

160 CPS at standard character printing
27 CPS at NLQ character printing

Printing Direction

Text Mode — Bi-directional
Graphic Mode — Unidirectional

Print Head Life

100 million characters

Printing Characters

Standard 11 x 9 dot matrix
NLQ 23 x 18 dot matrix

Character size: 2 x 2.42 mm (standard)
Character set: Full ASCII character set (96),
32 special European characters

SPECIFICATIONS (Apple - Atari - Etc.)

Down Loading

11 x 9 dot matrix; NLQ 23 x 18 dot matrix
optional

Print Buffer

2K-byte utility buffer

Image Printing

Image Data: Vertical 8, 9 and/or 16 dot
Resolution: Horizontal 60 dots/inch
Horizontal 120 dots/inch (double density)
Horizontal 240 dots/inch (quadruple density)

Interface

8-bit parallel interface (Centronics type)

Paper

Plain paper, Roll paper, Single sheet,
Fanfold, Multipart paper: max. 3 sheets
(original plus 2)

Ink Ribbon Cartridge

Ribbon Life: 3 million characters/cartridge

Maximum Number of Characters

Standard:	10 cpi	80 cpl
Enlarged:	5 cpi	40 cpl
Condensed:	17.1 cpi	136 cpl
Condensed enlarged:	8.5 cpi	68 cpl
Elite:	12 cpi	96 cpl
Elite enlarged:	6 cpi	48 cpl
NLQ pica:	10 cpi	80 cpl
NLQ pica enlarged:	5 cpi	40 cpl

Physical Dimensions

Size: 15 3/4" x 12 5/8" x 4 3/8" (10")
Weight: 17.6 lbs. (10")

Cartridge Ribbon.

List \$29.95. Sale \$19.95.

Interfaces

IBM \$89.00

Apple \$59.00

Atari \$59.00

Commodore \$39.00

Add \$13.50 (\$15.00 for 15" Printers) for shipping, handling and insurance. Illinois residents please add 6% tax. Add \$20.00 for CANADA, PUERTO RICO, HAWAII, ALASKA, APO-FPO orders. Canadian orders must be in U.S. dollars. WE DO NOT EXPORT TO OTHER COUNTRIES, EXCEPT CANADA.

Enclose Cashiers Check, Money Order or Personal Check. Allow 14 days for delivery, 2 to 7 days for phone orders, 1 day express mail!

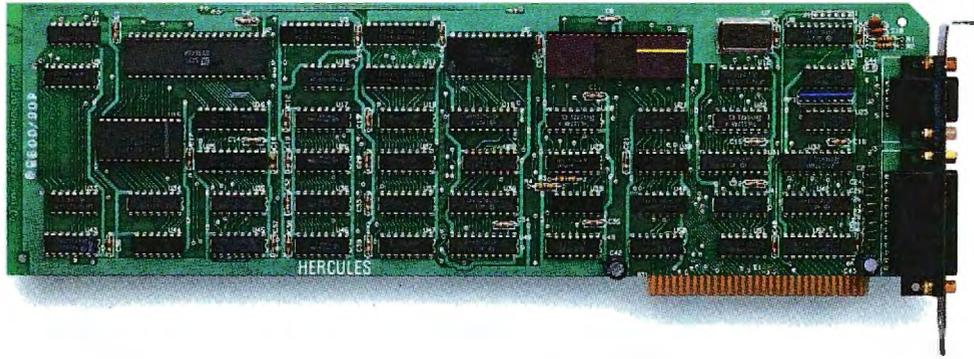
VISA — MASTER CARD — C.O.D. No C.O.D. to Canada, APO-FPO.

COMPUTER DIRECT

We Love Our Customers

22292 N. Pepper Rd., Barrington, Ill. 60010

312/382-5050 to order



The world's best selling monochrome graphics card for the IBM PC.

There are more Hercules™ Graphics Cards in more IBM® PCs, XT's and AT's than any other monochrome graphics card in the world.

Over a quarter of a million demanding users around the world use a Hercules Graphics Card to improve the performance of their software.

The Lotus® 1-2-3® Booster.

Consider Lotus 1-2-3. Hercules gives an off-the-shelf



copy of 1-2-3 the highest resolution possible on an IBM

PC, XT or AT. More 1-2-3 users choose the Hercules Graphics Card to get crisper text and sharper graphics than any other monochrome graphics card.

And we bring the same performance to other integrated programs like Symphony™, Framework™, and SuperCalc®3.

But we don't stop there. The Hercules Graphics Card

improves all kinds of software.

Like Microsoft® Word, a word processor that enables you to display text with subscripts, superscripts and italics.

Or pfs:® Graph, an easy-to-use business graphics program that converts your data into presentation quality graphs.

Or Microsoft® Flight Simulator, the high flying game for the overworked executive.

Or our own Graph X™, a library of graphics sub-routines that eases graphics programming.

Or AutoCAD™, a computer aided design program that offers features normally associated with expensive CAD systems.

And we supply free software with each card to do hi-res graphics using the PC's BASIC interpreter.



State-Of-The-Art Hardware.

The Hercules Graphics Card gives you graphics resolution of 720h x 348v and a

parallel printer port. Our unique static RAM buffer provides sharp 9 x 14 characters and flicker-free scrolling. Our exclusive safety features help



prevent damage to your monitor.

State-of-the-art custom IC technology delivers unsurpassed reliability. Ordinary graphics cards use up to 30 ICs to do what one Hercules IC does. By using fewer parts, we reduce the possibility of component failure.

Which is one reason we warranty the Hercules Graphics Card for two years.

Unbeatable reliability. Advanced technology. Proven by over a quarter of a million users. Why settle for anything less than Hercules?

Call 1-800-532-0600 Ext 408 for the name of a Hercules dealer nearest you and we'll rush you our free info kit.

Hercules.
We're strong on graphics.

Magic/L

This descendant of FORTH is a complete environment for program development

BY MICHAEL W. GILBERT
AND ALBERT S.
WOODHULL

Michael W. Gilbert is a composer and videographer, and a consultant in collaboration with Albert S. Woodhull. Albert S. Woodhull is an associate professor at Hampshire College. He is a biologist turned computer scientist who enjoys using FORTH and assembly language for real-world access. Both can be reached at Woodhull and Gilbert, 73 Spaulding St., Amherst, MA 01002.

Loki Engineering Inc. of Cambridge, Massachusetts, developed Magic/L (pronounced "magical"), a descendant of FORTH, for Data General and Digital Equipment Corporation minicomputers, but it has now adapted the language for 8-bit microcomputers running CP/M. All the versions share most of the same features; we are reviewing the CP/M product. This version does have several unique utilities and most CP/M system calls as primitives.

The new language takes advantage of the fact that hardware constraints are much less serious now than when its ancestors were developed. FORTH uses reverse Polish notation, requiring somewhat more effort on the part of programmers but permitting compact coding of program sequences. At the expense of more memory, Magic/L uses conventional infix notation. A Magic/L definition appears like a program written in Pascal or C, and programmers who know another conventional language might find Magic/L easier to learn than FORTH.

Both FORTH and Magic/L are more than languages; they are also complete environments for program development. They are extensible in that you add definitions (declarations, subroutines, functions, or procedures) to the resident core of the language system. Therefore, you can access variables and invoke executable program segments from definitions or directly from the console. As a result, although Magic/Ls FORTH ancestry provides for compilation and speedy execution of the compiled program, you still can have an interactive programming environment in which to assess immediately the effects of changes and additions to a program without first recompiling it. To enhance the programming and development environment, Magic/L includes both line and block editors, capability for immediate interpretation of console input, a compiler, an assembler, and an I/O (input/output) package. Users with very small systems should note that extensibility has its price; the smallest Magic/L version (execut-

able .COM file) that can be generated requires well over 30K bytes of disk space, the size of the unextended language.

THE USER'S VIEW

When you access Magic/L from CP/M, you will see a copyright notice, a version number, the amount of free memory, and the Magic/L prompt: `mgl>`. The Magic/L compilation process is incremental—compilation takes place as you enter the source statements from the console at the prompt or from a text file. For example,

```
mgl> INTEGER P Q R ( 10 )
```

compiles (allocates storage associated with a name) the simple integer variables P and Q, and R, a 10-element array of integers. The statement

```
mgl> P := 1
```

executes immediately, assigning a value to variable P. To verify, you can immediately execute the PRINT statement:

```
mgl> PRINT P
1
```

Of course, if you have not entered all the needed information, you cannot compile or execute statements immediately after you enter a line. FORTH users are familiar with the error message "Compilation only, use in definition." In this situation, Magic/L has a better approach—the software defers compilation until you complete the statement. At the prompt, a multiple `>` indicates that the statement requires further input and a `-` identifies an unfinished definition. Therefore, you can enter and test a conditional statement at the console:

```
mgl> IF ( P == 1 )
mgl> > PRINT "True"
mgl> > ELSE
mgl> > PRINT "False"
mgl> > ENDIF
*True*
```

(continued)

AT A GLANCE

Name

Magic/L

Type

Language with interactive development environment

Manufacturer

Loki Engineering
55 Wheeler St.
Cambridge, MA 02138
(617) 576-0666

Format/Computer

CP/M-80 version reviewed, available for other mini- and microcomputer operating systems

Documentation

200-page reference manual with examples, and separate 88-page CP/M supplement (other versions have own documentation)

Price

Magic/L CP/M-80	\$295
Magic/L MS-DOS	\$495
Magic/L RT-11	\$500
Magic/L UNIX	\$750

And you can also enter multiline definitions:

```
mgl> DEFINE MAXI
mgl - > PRINT MAX ( a b )
mgl - >> END
mgl>
```

THE INTERACTIVE ENVIRONMENT AND COMPILATION

Magic/L compilation involves only one pass over the input text. Thus, overall analysis and code optimization are not provided. The compiler does not produce native machine code, either. However, the process goes well beyond the replacement of strings by compact tokens. The Magic/L documentation is short on internal details, but we suspect that Magic/L "compilation" generates dictionary entries that consist of lists of addresses of more primitive entries, in a manner similar to FORTH. The run-time process is most properly described as interpretation of an intermediate language, although the efficiency of this process is high in terms of memory space and speed of execution.

Since Magic/L compiles and links new definitions into the language as you enter them, the environment acts as a debugger. You can try out new functions, subroutines, and commands directly from the keyboard, without the usual compile-and-link cycle that other languages require. For example, you could enter a function, test it with dummy data, and modify and retest it, all directly at the keyboard. You are encouraged to test your code frequently and to adopt a structured, modular approach. Magic/L doesn't entirely eliminate the traditional edit, compile, run, crash, and repeat cycles, but it can drastically shorten the time from discovery of a bug to testing a new version.

A block-editing facility lets you save the definitions you enter at the console on disk as text files. You can also use the Magic/L line editor or any other text editor to write routines and definitions as source files. The EXT (extend) command compiles definitions from a disk file into the Magic/L dictionary so you can save different

disk images of Magic/L under different names for specific applications. For example, you could create turnkey applications with a customized prompt and automatic execution of a predetermined definition.

Although compiling new definitions is very efficient in terms of memory usage, creation of turnkey versions will be most attractive for large applications, since the minimum size of the image stored on the disk is always large—the entire language is the runtime package. An alternative used extensively in the CP/M implementation of Magic/L is the use of relocatable precompiled modules. These require little disk space and load very quickly.

MAGIC/L SYNTAX

A Magic/L statement contains a series of strings that can include words (previously defined tokens maintained as an ordered list, the dictionary), literals, or undefined tokens as in a definition. The Magic/L dictionary initially contains about 500 words, which you can combine to form new words that you then add to the dictionary. You can make words to be variables and arrays, subroutines and functions, control structures, operators, definers (used to create new words), punctuation, assembler mnemonics, system calls, and immediate commands.

You delimit the tokens in a Magic/L statement with blanks or with the end of a line. You can have word names up to 15 characters long, although Magic/L retains only the first 5 characters and the length of the string. In the current version you can use virtually all the ASCII (American Standard Code for Information Interchange) characters to name a word, but the documentation suggests, in the interests of compatibility with future versions, that you limit names to alphanumeric and a few other special characters.

The dictionary can contain words that themselves contain old definitions of the same word. If you reuse the word NAME, the new definition will link to the old one and Magic/L will return the message: Redefined:

(continued)

COMPUTER WAREHOUSE

CALL TOLL FREE **1-800-528-1054**

FREE FEDERAL EXPRESS
Air Express Shipping
See Details Below

HARDWARE

PRINTERS

Anadex All Models	Call
Brother All Models	Call
C-Itch A-10-30	\$439
8510 AP+	\$314
Citizen MSP-10	\$255
MSP-15	\$349
MSP-20	\$319
MSP-25	\$489
Datasouth US180	\$1079
DS220	\$1299
DS-PP#1	\$419
DS-PP#2	\$615
Diablo D-25	\$549
630 API	\$1484
630 ECS/IBM	\$1659
Other Printer Models	Call
Epson All Printer Models	Call
Juki 5500	Call
6000	\$169
6100	\$349
6300	\$679
NEC 2010, 2015, 2050	\$619
3510, 3550	\$989
3515	\$1009
3530	\$935
8810, 8830, 8850	\$1379
P2, P3	Call
Elif 360	\$399
Elif 370	\$389
Okidata All Printer Models	Call
Panasonic 1090	\$175
1091	\$235
1092	\$349
1093	\$429
KXP3151	\$409

PRINTERS

Star Micronics All Printer Models	Call
Silver Reed	
EXP400 Parallel	\$205
EXP500 Parallel or Serial	\$279
EXP550 Parallel or Serial	\$389
EXP770 Parallel or Serial	\$699
Toshiba P1340 Parallel or Serial	\$509
P351 Parallel	\$975

DISKETTES

3M 5 1/4 DS/DD (Qty 100)	\$169
Maxell MD-1 (Qty 100)	\$115
MD-2 Plastic Box (Qty 100)	\$149
Sony MD/2 (Qty 100)	\$170

MONITORS

Amdex All Monitors	Call
NEC All Monitors	Call
Princeton Graphics	Call
Samsung All Models	Call
Taxan 121 Green	\$125
122 Amber	\$129
Zenith All Models	Call

VIDEO TERMINALS

Altos Smart III	\$599
IBM 3161 & 3163 Series	Call
Qume QVT Green 101	\$299
QVT Amber 101	\$314
Televideo 921	\$445
922	\$599
955	\$459
Wyse 30	\$279
3419	\$419
75	\$559
Wyse 85	\$579
Wyse 350	\$859
Zenith Z-22	\$489
Z-29	\$609
Z-49	Call

MODEMS

AT&T	
4000 External	\$319
Anchor Automation	
Anchor Express	\$235
Mark XII	\$229
Hayes Smartmodem 300 Baud	\$129
Smartmodem 1200 Baud	\$369
Smartmodem 1200B (IBM)	\$319
Smartmodem 2400 Baud	\$519
Micromodem IIE (Apple)	\$129
Novation Smart Cat Plus	\$279
Prometheus All Models	Call
US Robotics Courier 2400	\$389
Password 1200	\$195

BOARDS

AST Advantage	\$389
Six Pack Plus	\$219
Everex Boards	Call
Hercules Color Card	\$145
Graphic Card	\$289
Paradise Modular Graphic 06-1	\$259
Five Pak	\$119
Quadram	
Quadlink	\$325
Tec Mar Graphics Master	\$449
Captain No Memory	\$159

PLOTTERS

Enter Sweet-PS00	\$759
Epson HI-80	Call

KEYBOARDS

Keytronics 5151	\$159
5151 Jr	\$179

Canon «PC» PERSONAL COPIERS

Canon PC-10	\$509
Canon PC-14	\$649
Canon PC-20	\$719
Canon PC-25	\$939

COMPUTERS

Sanyo MBC-775 Portable	\$1789
Televideo PM 4T	\$5089
PM 16T	Call
Wyse Wyse pc Dual	\$1199
Wyse pc 10 Meg	\$1959
Zenith	
Z-156 All Models	Call
Z-160 All Models	Call
Z-138	Call
Z-148	Call
Z-171	Call
Z-200	Call

DISK DRIVES

Alpha Omega Turbo 10	\$529
Turbo 20	\$699
Turbo 30	\$949
Everex	
10 Megabyte	\$549
20 Megabyte	\$689
60 Megabyte Tape	\$879
Haba Harddisk for Macintosh	\$279
Imega Bernoulli Box for IBM	
10 Megabyte	Call
20 Megabyte	Call
20 Megabyte Plus	Call
5 Megabyte for Macintosh	Call



SOFTWARE

Gem Collection	\$115
Gem Desktop	\$29
Gem Draw	\$85

LANGUAGES

C Compiler (Microsoft)	\$235
Fortran Compiler (Microsoft)	\$209
Macro Assembler	\$89
Pascal Compiler (Microsoft)	\$178
Turbo Pascal 3.0	\$35
Lattice C Compiler	Call
Run C Interpreter	\$85
Quick Basic	\$59
Turbo Tool Box	\$28

PROJECT MANAGEMENT

Harvard Total Project Manager	\$239
Microsoft Project	\$149
Super Project	\$182
Timeline 2.0	\$253

COMMUNICATIONS

CompuServe Starter Kit	\$17
Crosstalk XVI	\$94
PFS Access	\$78
Remote	\$99

IBM PC and 100% Compatibles

INTEGRATIVE SOFTWARE

Enable 1.1	\$299
Framework	Call
Smart Software System	\$459
Symphony	Call

TRAINING

Flight Simulator	\$30
Typing Instructor	\$29
Typing Tutor III	\$29

GRAPHICS

Chartmaster	\$215
PC Paintbrush	\$62
Turbo Graphix Tool Box	\$28
Diagram Master	\$190
Dr. Halo	\$55
Energraphics	\$179
Energraphics w/ Plotter Option	\$228
Microsoft Chart	\$149
PC Draw	\$203
PC Draw Light Pen	\$104
PC Paint w/ Mouse	\$123
PC Mouse w/ Paintbrush	\$112
PFS Graph	\$78
Printmaster	\$30
Signmaster	\$135

WORD PROCESSORS

Leading Edge Word Processor	\$50
Leading Edge W/P with Spell & Mail	\$137
Microsoft Word 2.0	\$227
Multimate 3.3	\$206
PFS: Write	\$78
Wordstar w/Tutor	\$169
Wordstar Pro Pack	\$239

Word Perfect (Ver.4.0)	\$199
Wordstar 2000	\$239
Wordstar 2000 Plus	\$285

UTILITIES

1 DIR	\$48
Copy II PC	\$19
Norton Utilities 3.0	\$49
Sidekick	\$28
Sidekick (Unprotected)	\$43
Sideways	\$31
Superkey	\$35
Printworks	\$36
Spotlight	\$43

SPREADSHEETS

Lotus 1-2-3	Call
Multiplan	\$114
Spreadsheet Auditor 2.0	\$83

Supercalc 3 (Ver.2.) Call

MONEY MANAGEMENT

Dollars & Sense w/Forecast	\$95
Tobias Managing Your Money	\$94

DATA BASE MANAGEMENT

Cornestone	\$255
dBase II	Call
dBase III	Call
Nutshell	Call
PFS: File	\$78
PFS: Report	\$70
Quickcode	\$139
QuickReport	\$139
Extended Report Writer	\$80
Think Tank	\$93
Clipper	\$355
KnowledgeMan II	Call
KnowledgeMan Upgrade Kit	Call
Powerbase (New Ver. Reg. 320K)	\$205

R:Base 5000 \$335

Many other titles available.

Inquiry 88 for MS-DOS Products. Inquiry 89 for all others.

COMPUTER WAREHOUSE

Order Line: 1-800-528-1054
Order Processing: 602-224-9345
2222 E. Indian School Rd.
Phoenix, Arizona 85016
602-954-6109

Store Hours: Mon-Fri 10-5:30
Saturday 9-1
Order Line Hours: Mon-Fri 7-5:30
Saturday 9-1
Order Processing Hours: Mon-Fri 10-3

Prices reflect 3% to 5% cash discount. Product shipped in factory cartons with manufacturer's warranty. Please add \$9.00 per order for UPS ground shipping. Orders 10 lbs. and under you pay for ground service, receive air service at no extra charge. Available on orders 11-20 lbs. \$16 for air service. Orders 21-30 lbs. \$26 for air service. Prices & availability subject to change without notice. Send cashier's check or money order...all other checks will delay shipping two weeks.



CWF-985

We do not guarantee computer compatibility.

BUILD YOUR OWN IBM XT & IBM AT COMPATIBLE SYSTEMS

Introducing XT-16 Self-Assembly Kit

At Super Low Cost

- Including 256K XT-16 CPU Mother Board, Color Graphic Card, Floppy Controller, One DS/DD Slim Drive, Flip-Top Case, 135 W Power Supply, Keyboard, Assembly Instruction, and User's System Manual.

ONLY \$775.00



XT, AT CASE

- Same Dimension as IBM PC/AT
- For IBM PC/AT & Compatible Mother Boards **\$115.00**
- Flip-Top For Easy & Quick Access to Inside
- IBM Style Slide-In Case Also Available **\$79.00**



XT, AT POWER SUPPLY

- XT-135 W **\$ 89.00**
(Side Or Rear Switch)
- XT-150 W **\$115.00**
- AT-200 W **\$165.00**

XT, AT KEYBOARD

- XT—LED for Cap Lock & Num. Lock
- Big Return Key & Shift Key **\$79.00**



AT—Same Layout as IBM PC/AT **\$109.00**



XT, AT MOTHER BOARD

XT-16-II MOTHER BOARD

- IBM PC/XT Fully Compatible
- 8088 Microprocessor w/8087 Optional
- 8 I/O Slots, up to 640K on Board
- Assembled & Tested w/BIOS
- With 256K on Board **\$265.00**
- With 640K on Board **\$349.00**

AT-32 CPU Mother Board

- IBM PC/AT Fully Compatible
- 80286 Microprocessor w/80287 Optional
- 640K Standard, Upgradable to 1 MB on Board
- On Board Clock Calendar
- 8 I/O Slots **\$Call**

PC/AT ADD-ON CARD

- AT-1 1 MB Memory Card **\$Call**
- AT-1.5 MB Multifunction Card **\$Call**
- AT-1 Hard & Floppy Drive Controller **\$Call**

PC/XT ADD-ON CARD

- PCP-128 Eprom Programmer **\$139.00**
- Disk I/O Card (handle 2 Floppy Drive, Serial 2nd Optional), Parallel, Game, Clock w/cables & Software **\$149.00**
- Color Graphic Card **\$ 95.00**
- Floppy Disk controller (handle 4 drives) **\$ 59.00**
- Multi-Function (OK) **\$139.00**

- OEM Dealers Welcome
- Please Call For Our Special Dealer Price

C.J. COMPUTERS CORP.

(Manufacturer & Distributor)
2424 W. Ball Road, STE B
Anaheim, CA 92804

Mail Order Hot Line: (714) 821-8922, (714) 821-8923
(IBM is a trademark of International Business Machines Corporation)
340 B Y T E • NOVEMBER 1985

REVIEW: MAGIC/L

NAME. Newer words named NAME will link to the new definition. As in FORTH, you can use the FORGET command to cut definitions from the dictionary.

DATA TYPES, OPERATORS, AND CONTROL STRUCTURES

Table 1 shows the intrinsic data types, the full set of operators, and the control structures built into Magic/L. You can create records to contain variables of any data type, including other

records; record structures are similar to those available with C's struct feature. Magic/L has no intrinsic operators that act on record variables, although you can implement them. You can also define and create data types, although we did not attempt this.

All data types are defining words. You can use them to declare variables and enter them into the dictionary. For example:

```
mg1 > INTEGER A B C ;; LONG D E
```

(continued)

Table 1: Data types, operators, and control structures in Magic/L. All literals can be in decimal, octal, or hexadecimal, and the default radix can be set to any value. You can apply the assignment operator := and all the logical operators to strings. The DO and ITER LOOP constructs can access their index variables as an undefined variable I. In nested loops, you can refer to indices of outer loops as undeclared variables J and K. This is similar to FORTH. I', J', and K', which are also predefined, count down as I, J, and K count up. They are convenient when you require a loop that runs backward.

Data Types

CHAR	8-bit unsigned integer values
INTEGER	16-bit signed integer values
LONG	32-bit signed integer values
ADDRESS	16-bit signed integer values containing addresses
REAL	32-bit single-precision floating-point values
PARAMETER	named 16-bit integer constants

Operators

Arithmetic operators:	+ - * /
Bitwise operators:	NOT AND OR XOR
Logical operators:	== <> > >= < <= ==0 <>0 >0 >=0 <0 <=0
Assignment operators:	:= += -= INCREMENT DECREMENT CLEAR SET

Control Structures

```
IF ( <condition> ) ... ENDIF
IF ( <condition> ) ... ELSE ... ENDIF
BEGIN ... UNTIL ( <condition> )
BEGIN ... IF ( <condition> ) ... REPEAT
BEGIN ... FOREVER
WHILE ( <condition> ) ... REPEAT
CASE ( <function number> ) function0 , function1 , ... ENDIF
DO <low value> , <high value> ... LOOP [ ( <increment> ) ]
ITER <count> ... LOOP [ ( <increment> ) ]
```

Listing 1: An example of a DEFINE...END sequence.

```
DEFINE SQUAREIT INTEGER ;DEFINE <routine name> <type>
INTEGER NUMBER ;<input argument declarations>
SQUAREIT := NUMBER * NUMBER ;<executable code>
END ;END
```

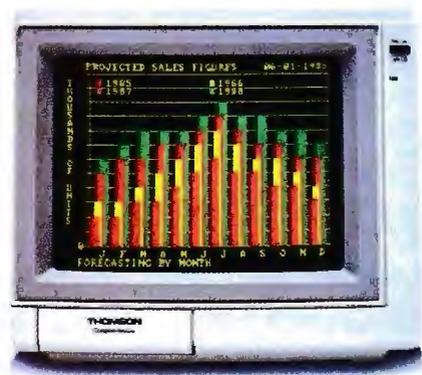
A
S I G H T
F O R
S O R E
E Y E S
T H O M S O N

To those of you who stare and stare—and stare at computers, blessed relief has arrived. Thomson™ monitors. We promise clearer, crisper resolution, remarkable colors and print-like text. Thomson builds a full line of monitors, from basic monochrome to high-resolution color models. All are designed to fulfill your needs today, and sophisticated enough to fulfill your needs in the future.

Thomson monitors are designed and built by Thomson, a \$6 billion international corporation. They're going to change the way America looks at computers.

Ask your local computer dealer for a Thomson monitor, or call 1-213-821-2995, ext. 34, for the Thomson dealer nearest you. Then take a stare at a Thomson monitor. It's a sight for sore eyes.™

Telex 3720233. Thomson is a trademark of Thomson S.A.



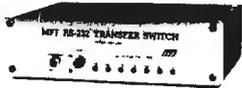
Model CM 3131SI. 12" diagonal, .31mm dot pitch RGBI color monitor with text switch and non-glare tinted screen.

THOMSON 

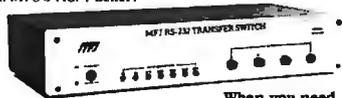
Switches to make your PCs powerful.

Reliable and affordable port expansion without memorizing complicated software commands. Switch your PC between peripherals with the push of a button. Is MFJ good? Joe Campbell in his book, *The RS-232 Solution* said, "Switch boxes are sold by many suppliers, but by far the two best values are from MFJ Enterprises." Below are just some of those values.

When you need to switch between two peripherals ... or you need to have two computers share the same peripheral ... MFJ-1240/879.95



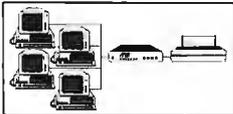
The 1240 has a built in transmit/receive switch that allows 2-way information flow. LEDs monitor data lines while built in surge protectors guard them. Can be used as a null modem. MFJ's No. 1 seller!



When you need 1-to-4 computers to share one peripheral or 1-to-4 peripherals to share a common computer... MFJ-1243/8119.95

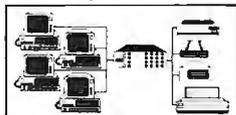
The perfect office switch. Save money. Don't buy extra printers or modems.

Connect 1-to-4 computers to a single printer or let a PC share up to four peripherals. LEDs monitor data lines; surge protectors guard them. Two way communication is allowed.



When you need to interconnect four computers and four peripherals at one time! The MFJ-1294 gives you a computer system...

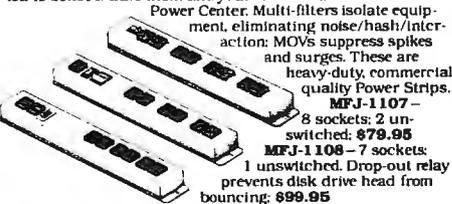
With the MFJ-1294 you can create a mini-network of computers and peripherals. All eight devices can be working simultaneously! Think of the production you'll get with the MFJ-1294's 16 possible combinations.



Seven additional models to choose from including MFJ's IBM and Centronics Parallel Switches. All RS-232 switches have RS-232 connectors, LEDs to monitor data lines, MOV surge protectors and transmit/receive buttons that allow 2-way communication.

And Power Strips to make them safe.

Your fine computer and peripheral equipment can be damaged by electrical surges much smaller than you've been led to believe. Save them and your valuable data with an MFJ Power Center. Multi-filters isolate equipment, eliminating noise/hash/interaction; MOVs suppress spikes and surges. These are heavy-duty, commercial quality Power Strips.



MFJ-1107 - 8 sockets; 2 unswitched; \$79.95
MFJ-1108 - 7 sockets; 1 unswitched. Drop-out relay prevents disk drive head from bouncing; \$99.95
MFJ-1109 - like 1107 but intelligent (switch on the device that's plugged into the control socket and everything else comes on); \$129.95

There are other Switches, Power Centers and Computer Peripheral Products available from MFJ. Call and talk with us about all your computing needs. When you do, ask for our latest catalog. Both the call and catalog are free.

1-800-647-1800

For technical/repair information, or in Mississippi, or outside the Continental United States, please telephone...

1-(601) 323-5869 or telex 53-4590 MFJSTKV

All MFJ products come with a double guarantee we think is unmatched. Order from MFJ and try any product for 30 days. If it doesn't satisfy your needs, just return it for a full refund less shipping. If you keep it you can be assured of continued service and our One Year Unconditional Guarantee.

Call toll-free 1-800-647-1800 and charge the products you need to your VISA or MasterCard, or send a check or money order, plus \$5.00 shipping, and our shipping department will promptly have your computer peripheral on its way to you.



MFJ Enterprises, Inc.
921 Louisville Road
Starkville, MS 39759

REVIEW: MAGIC/L

You do not explicitly declare string variables. You store string data in subscripted CHAR arrays:

```
mgj> CHAR CLIENT ( 10 )
```

Having declared the variables A and CLIENT, you can now assign values to them:

```
mgj> A := 327 ;; CLIENT := "Michael"
```

Loki has kept Magic/L trim by eliminating certain types of error checking. FORTH users will understand the philosophy; a lot of checking can slow down run-time performance. However, beginning users will have to be very careful. In the current version of Magic/L, you could assign a string longer than the length for which you defined the CHAR array. As a result, you might overwrite memory and cause an erroneous value or a crashed system. It is also possible to assign an integer value to a CHAR variable; in this case, you would obtain erroneous results but no apparent damage to the system.

We would prefer to have the check on string lengths. The errors are hard to avoid and, in a completed application, you are likely to include string input as part of the user interface;

checks protect the system from damage. We can't complain too much because, if you wish, you can personally implement checks—one of the benefits of an extensible language.

DEFINITION TYPES AND STRUCTURE

You can define functions, subroutines, commands, and parsed commands in a DEFINE ... END sequence. Functions can be of types INTEGER, LONG, and REAL. An annotated example of a function definition appears in listing 1. You could call the function with:

```
mgj> INTEGER A
mgj> A := SQUAREIT ( 8 )
mgj> PRINT A
64
```

You define subroutines in a manner similar to functions, but subroutines do not return values. A command is a special form of subroutine that avoids the use of parentheses in the calling syntax, counts the number of input arguments, and can then iterate through them. Parsed commands are commands that take string arguments only, without quotation marks. They are useful in creating routines that use

(continued)

Table 2: The CP/M command interface is entirely written in Magic/L. CP/M users will feel comfortable here, although the position of source and destination filenames is reversed relative to the CP/M standard.

Command	Description
BINCOM <file1> <file2>	a binary comparison of two files equivalent of PIP <dest> = <source>
COPY <sourcefile> <destfile>	directory, same as CP/M CCP
DIR <filespec>	displays space on current disk
DUMP <filespec>	dumps file to console in hexadecimal
ERA <filespec>	erase, same as CP/M CCP
GET <file>	equivalent of PIP currentdr:file = file
MOVE <file>	equivalent of PIP file = current dr:file
REN <oldname> <newname>	equivalent of REN <new> = <old>
TY <file>	type, same as CP/M CCP
DEV	displays current I/O byte assignments and possibilities
LST, PUN, RDR, CON	used with argument to set I/O bytes
RESET	equivalent of warm boot or Control-C
A:, B:, C:, D:	used to select disk/drive
\$SELECT	used to create new drive selection commands (e.g., MAKE "E:" \$SELECT 5 ; for a fifth drive)

OEM & OWN BRAND COMPOSITE & TTL COMPATIBLE COLOR & MONO MONITOR TERMINAL



SM-12SF 31A6; APPLE COMPATIBLE
SM-12SF 39A7; IBM COMPATIBLE

TERMINAL; SD-M1201

OEM BRAND; SM-12CL 31A1

SM-CL401 SNS; 8 COLORS
SM-C1402 SNS; 16 COLORS
IBM COMPATIBLE



SEOUL OFFICE
6~8TH FL, THE JOONG-ANG DAILY
NEWS BLDG., 7 SOONHWA-DONG,
CHUNG-KU, SEOUL, KOREA
TEL: 7516-955/7, 7516-959/961
TLX: STARNEC K22596
CABLE: "STARNEC" SEOUL
TEL

LONDON OFFICE
6TH FLOOR, VICTORIA HOUSE
SOUTHAMPTON ROW W.C.
1 LONDON, ENGLAND
TEL: (01) 831-6951/5
TLX: 264606 STARS LG
FAX: (01) 430-0096

SANTA CLARA OFFICE
3003 BUNKER HILL LANE,
SUITE 201 SANTA CLARA,
CAL. 95050, U.S.A.
TEL: (408) 986-8473
TLX: 171685 SAMSUNG SNTA

TOKYO OFFICE
KASUMIGASEKI BLDG., 2522
KASUMIGASEKI 3-2-5 CHIYOTA-KU
TOKYO, JAPAN
TEL: (03) 581-5804, (03) 581-9521-4
TLX: 228009 SANSEI

Subscription Problems?



We want to help!

*If you have a problem with your **BYTE** subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible. We'll respond A.S.A.P.*

BYTE
Subscriber Service
P.O. Box 328
Hancock, NH 03449

Magic/L comes with a basic dictionary that includes many functions, subroutines, system variables, and other words already defined.

Magic/L's CP/M command interface (see table 2). Within a definition, you can make local declarations to create local variables.

LIBRARY ROUTINES

Magic/L comes with a basic dictionary that includes many functions, subroutines, system variables, and other words already defined. All the language's features (including those mentioned in this review) are words delivered in the dictionary. Magic/L includes a full range of block moves; shifting, bit, maximum/minimum, and pack/unpack functions; type conversion routines; peeks and pokes; floating point; trigonometric functions; system variables accessible to the user; and buffers. We find the language to be complete and refer potential users to the manual.

A formatted print feature allows runtime specification of field width, radix, padding character, and tabbing, with all defined data types formatted appropriately. You can redirect text to an I/O channel, including out to a disk file or memory buffer. Input features include ASCII input of numeric or string data from the keyboard or from an I/O channel, which could be a disk file.

Magic/L uses a channel-based I/O system, with the mapping of a channel to a filename that you create with the OPEN function. The I/O system is rather basic and straightforward to keep it transportable. Magic/L supports random-access, block, sequential, and text I/O. You can create modular enhancements if needed.

The CP/M version includes a sophis-

ticated module facility and a library of precompiled relocatable modules that you can include during initial configuration or access during use. Designed to overcome CP/M 2.x's limited address space, this feature lets the user load precompiled relocatable binary files of code into free memory space. The delivered version includes ED (editor), ASM (assembler), BINCOM (binary comparison), CCP (console command processor), and others as modules that you call in as needed. You can create additional modules, but we have not tested this feature.

SYSTEM-DEPENDENT FEATURES

The CP/M implementation contains many features, especially the direct emulation of many CP/M features and commands, that will make regular CP/M users feel at home. The CP/M command interface emulates a standard CCP with integrated PIP and STAT functions. It is entirely written in Magic/L so you can use all CP/M interface words in your programs and definitions. You can also write your own CCP commands and custom command-line interpreters. You can redefine all standard CP/M system calls (0 through 40) as Magic/L words. Almost half of them are already implemented, and it is not hard to generate the remaining ones.

To allow for complete user customization, Loki's latest release (version 2.50) supplies source code for the CCP module. Moreover, the new version enhances several of the CCP commands. The DIR routine alphabetically sorts its listing but does not display SYS files. (A separate DIRS routine displays the SYS files.) You can display and change the current USER, the RO, and SYS attributes. The BINCOM and DUMP routines also let you specify a starting location.

You can create complex words to perform automatic backups, peripheral changes and routing, and so on. You could also create a one-word command to back up all data and index files on drive C to drive D, rename them, and then print the space remaining on the disk.

(continued)



Congratulations.
You're qualified to operate the Hewlett-Packard
1/4" Tape Backup System.

It's really that easy. In fact, the HP Tape Backup system, with its menu-driven software, can be mastered in a few minutes.

Then, if you ever lose a file accidentally or your system goes down, your data will always be safe.

The HP Tape Backup is compatible with



IBM right down the line, including the IBM PC, PC-XT, and PC-AT. And it's easy to install. There's only one thing simpler than the HP Tape Backup; finding out more about it.

For literature and the dealer nearest you call (800) FOR-HPPC. Ask for Dept. 276Y.



**HEWLETT
PACKARD**

Inquiry 183

PENMOUSE

We have the Mouse by the tail!



Penmouse by Abohm Corporation is a utility pen that performs all functions of a Mouse and more!

- Greater Accuracy
- Less Deskspace
- More Comfortable Grip
- Macintosh™ & Lisa™ compatible
- Also compatible with Amiga™

To order call 1-800-835-2246 ext. 98.

MasterCard/Visa Credit Card

\$99.95



Abohm Corporation
Ann Arbor, Michigan 48106-4369

Amiga is a licensed trademark of Commodore-Amiga Corporation. Apple and Lisa are licensed trademarks of Apple Corporation. Penmouse is a registered trademark of Abohm Corporation.

REVIEW: MAGIC/L

Magic/L has a good line-editing facility, reconfigurable for different terminals. You can use the block editor for editing control structures that are longer than one line and compound or block statements, including definitions. You can invoke the block editor at any time; as a convenience for debugging, it edits the contents of a buffer that contains the last-entered

multiline definition. If you wish, you can write the edited block to disk. The feature encourages the development of complex definitions in a "let's try it" interactive fashion. The text editor uses the same commands as CP/M's ED.COM with very few differences. ED is not everyone's favorite text editor, but we appreciate Loki's deci-

(continued)

Listing 2: *The Sieve of Eratosthenes in Magic/L.*

```

; Sieve of Eratosthenes, translated from Pascal version by
; Gilbreath

parameter flagsize := 8190
char flags ( flagsize + 1 )
integer prime kth count

define sieve
print "1 iteration"
caoff                               ; turn off console status check

count := 0
iter flagsize
flags ( i ) := -1
loop
iter flagsize
if ( flags ( i ) )
prime := i + i + 3
kth := i + prime
while ( kth <= flagsize )
flags ( kth ) := 0
kth := kth + prime
repeat
count := count + 1
print prime
:
endif
loop
print count , " primes"
end
    
```

Table 3: *Timing the Sieve of Eratosthenes. (See listing 2 for the Magic/L code. For the FORTH and BASIC code, see "A High-Level Language Benchmark" by Jim Gilbreath, September 1981 BYTE, page 180.) We performed the first tests using CP/M 2.2 with a Microsoft Softcard (a 2-MHz Z80) in an Apple. When we obtained our review copy of Magic/L, Loki Engineering informed us that it had not tested Magic/L in the CP/M Plus environment. Nonetheless, we repeated the benchmark with the CP/M Card's 6-MHz Z80 with the results in the second column. We had no qualitative problems using Magic/L with the Advanced Logic Systems CP/M Card and CP/M Plus in the Apple.*

	2-MHz Z80	6-MHz Z80
FIG-FORTH	16.4 seconds	6.6 seconds
Magic/L	22.7 seconds	9.2 seconds
MBASIC	6 minutes 5.2 seconds	3 minutes 31.9 seconds

THE ONLY AD YOU'LL SEE THAT OFFERS A 40 USER MICRO

The standard TDI Pinnacle is already the fastest micro in the world with its 68000 series 32-bit micro processor hurtling along at 12 million cycles per second.

But now there's Pinnacle XL. It has two 68000s in tandem to handle up to 40 Users superfast! They can drive up to 8 megabytes of RAM and 600 megabytes of Winchester disks. You can even use your existing micros as terminals.

So, with an entry price of under **\$10,000**, raise your glasses with us to unbeatable price/performance value.



TDI
PINNACLE
XL

CELEBRATE A NEW AGE IN MULTI-USER MICROCOMPUTERS

US DISTRIBUTORS **Pinnacle Systems Inc.** 10355 Brockwood Road, Dallas, Texas 75238. Tel (214) 340-4941 Telex 88-8442

ELECTRONIC MANUFACTURING SERVICE **Lamtech Electronics Corporation**, 620 Easy Street, Garland, Texas. Tel (214) 272-3504

INTERNATIONAL SYSTEMS GROUP **ISG Pinnacle** Dallas, Texas. Tel (214) 340-4941. (Distributor enquiries invited).

VERTICAL MARKET SYSTEMS **VMS Pinnacle** Dallas, Texas. Tel (214) 340-4941.

EUROPEAN DISTRIBUTORS **TDI Pinnacle Ltd** 29 Alma Vale Road, Bristol BS8 2HL England. Tel (0272) 742796 Telex 449273

Future Shock!

age **65**
 years worked **40**
 retirement benefits **0**

The U.S. Department of Labor has a free booklet that will help you answer these questions and a lot more. Send for this today.

Write: Pensions, Consumer Information Center, Pueblo, Colorado 81009

U.S. Department of Labor

PREMIUM QUALITY! LIFETIME WARRANTY!
DISK SALE!
 MONEY-BACK SATISFACTION GUARANTEE!

Made by top USA makers, not "low-end" or "seconds." We buy truckloads of major makers' overproduction. They won't let us to reveal their names, but when you receive them you'll probably recognize them as among the HIGHEST QUALITY PREMIUM DISKS made. Labeled or unlabeled! Certified, guaranteed 100% error free. MONEY BACK SATISFACTION GUARANTEE! FAST 18 HOUR SHIPPING! "BOXED" comes complete with sleeves and labels. "BULK" does not. Prices are per disk. Call for volume pricing.

from **46c**

HD40 BOXED 55/DD-351k (Apple)	10	100	200	1000	2000	100
HD40 BOXED 55/DD-Standard	72C	170C	87C	85C	82C	N/A
HD40 BOXED 55/DD-Standard	80C	77C	74C	71C	68C	N/A
HD40 BOXED 55/DD-Standard	87C	85C	81C	78C	75C	N/A
HD40 BULK 55/DD-351k (Apple)	N/A	60C	57C	54C	51C	48C
HD40 BULK 55/DD-Standard	N/A	64C	61C	58C	54C	49C
HD40 BULK 55/DD-Standard	N/A	74C	71C	67C	63C	58C

COMPUTER SUPPLIES AT WHOLESALE PRICES!
 UNIFILE-75, like "Zip-n-File" holds 75 disks \$10
 UNIFILE-100, w/lock and key, holds 100 disks \$15
 LETTER-QUALITY 8.5x11" white 20# micro-part 2400/ctn \$29
 DRAFT-QUALITY 8.5x11" white 16# std-part 3400/ctn \$29

HOW TO ORDER: Pay by MC/Visa/Amex/COD or send check with order. Include \$1 for shipping & handling \$2 if COD, for computer paper include \$4 for each ctn \$2 if COD. On All orders MC/V include daytime phone & street address. Minimum order \$15. Money-back 30 day satisfaction guarantee! Send for free flyer with 10% of discount supplies!

TOLL FREE **(800)343-0472**
 IN MASS (617) "UNI-TECH"
UNITECH 20Y HURLEY STREET
 CAMBRIDGE, MA 02141

Inquiry 423

BUY UNITED STATES SAVINGS BONDS



sion to implement its editor in a way that minimizes the relearning required to use the tool. However, the text editor does not let you return to interactive program testing while editing, as do the line editors in many FORTH versions. In sum, the Magic/L ED works quite well for small jobs, and we choose to use our usual editors for larger ones.

Programmers need a way to invoke assembly-language code for serious program development. You can link assembly-coded routines with high-level Magic/L code, including variable, value, and argument passing, and the CP/M implementation includes an assembler supporting 8080 syntax. Use of the Magic/L assembler is somewhat different from conventional assembly-language programming, and perhaps a little easier to learn, because assembly is interactive under Magic/L. This is a one-pass assembler and experienced assembly-language programmers will notice the restrictions on forward references. However, our experience in using assembly language in FORTH will apply to Magic/L as well: Assembly code segments are almost

always very short because only very limited time-dependent or hardware-specific routines require assembly language. A fairly simple assembler will almost always be adequate.

PERFORMANCE

We ran one iteration of the Sieve of Eratosthenes in Magic/L (see listing 2), FIG-FORTH, and standard CP/M Microsoft BASIC. The results are in table 3. Magic/L does pay a price in performance, relative to FORTH, for its much more convenient syntax, but the penalty is small. For many users the comparison with interpreted BASIC will be more important.

The command caoff in the SIEVE.MG program turns off Magic/L's normal checking for a console key press. Originally we wrote the program without this; the CP/M 2.2 version was slower by about 50 percent. The console checking had a much more serious effect under CP/M Plus, slowing the program by a factor of 6. This seems to be a problem of the console status-check routine in the Advanced Logic Systems CP/M Plus

(continued)

MAGIC/L UPDATE

We have spent many months with Magic/L version 2.40 for CP/M. After we finished the initial review, Loki supplied us with the updated version 2.50, which features several improvements.

First, a command retrieval function stores the most recently entered Magic/L command lines in a 512-character circular buffer. You can recall, edit, and reexecute them.

A cross-reference capability lets you generate a complete listing of all symbols used by a program.

A dictionary editing utility lets you compress, edit, or eliminate the symbol table from a saved Magic/L program. This saves memory and, when used on a turnkey program, can elimi-

nate the requirement for Magic/L runtime sublicensing.

Control-C no longer aborts to the CP/M prompt. You have the choice of returning to CP/M or to the mgl> prompt.

Improved floating-point support further speeds optimization and now conforms internally to the IEEE standard, making it compatible with the 8087 (this is of interest to MS-DOS-version users).

This release also includes several new source files. Loki has indicated that future releases might include the information necessary to recompile a smaller kernel of the language for target applications, as is possible with many versions of FORTH.

Plotter graphics prevent boardroom boredom



Crisp, clean, hardcopy graphics make dramatic impressions. Now, with Houston Instrument's PC Plotter, you have an affordable way to link the power of graphics to your personal computer. The PC Plotter produces quality graphics at a price you won't mind paying. It allows you to produce vibrant line, bar, and pie charts using eight different colors on either paper or overhead transparencies. And you can create either 8½" x 11" or 11" x 17" graphics.

Whether you're a computer wizard or novice, the PC Plotter is simple to operate and can be used with virtually any computer on the market today. Plus, your graphics software choices are unlimited. Houston Instrument products are supported by a versatile collection of more than 250 graphics software packages.

For example, just take a look at the above photo and you'll see plots created by PFS:® Graph, Lotus® 1-2-3,™ Peachtree Business Graphics System,™ Design Intelligence,™ Energraphics,™ and Smart Spreadsheet with Graphics.

Make the most out of owning an IBM,® Apple® or other personal computer. Give it a PC Plotter. . . and give your presentations the visual advantage you need to win in business.

Visit your authorized Houston Instrument dealer or local computer store today and ask for a demonstration of the PC Plotter. For more information, call us at 800-531-5205. Texas residents may phone (512) 835-0900. Houston Instrument products are designed, marketed, and manufactured in Austin, Texas.

**houston
instrument**

Inquiry 187

4P019

WALTZ LISP

The universal, superefficient LISP for MS-DOS and CP/M.

Waltz Lisp is a very powerful and complete implementation of Lisp. It is substantially compatible with established mainframe Lisps such as *Franz* (the Lisp running under *Unix*), *Common Lisp*, and *MacLisp*.

Ultra fast. In independent tests, **Waltz Lisp** was up to twenty(!) times faster than competing microcomputer Lisps.

Easy to use. Built-in WS-compatible full-screen file editor. Full debugging and error handling facilities are available at all times. No debuggers to link or load.

Practical. Random file access, binary file support, and extensive string operations make **Waltz Lisp** suitable for general programming. Several utilities are included in the package.

Full Lisp. Functions of type *lambda (expr), niambda (fexpr), lexpr, macro*. Splicing and non-splicing character macros. Full suite of mappers, iterators, etc. Long integers (up to 611 digits). Fast list sorting using user defined comparison predicates. Built-in prettyprinting and formatting facilities. Nearly 300 functions in all.

Flexible. Transparent (yet programmable) handling of undefined function references allows large programs to reside partially on disk at run time. Automatic loading of initialization file. Assembly language interface.

Superbly documented. Each aspect of the interpreter is described in detail. The 300+ page manual includes an exhaustive index. Hundreds of illustrative examples.

Order **Waltz Lisp** now and receive *free* our **PROLOG Interpreter**. **Clog PROLOG** is a tiny (but very complete) PROLOG implementation written entirely in **Waltz Lisp**. In addition to the full source code, the package includes a 50 page **Clog** manual.

16-bit versions require DOS 2.x or CP/M-86 and 128K RAM (more recommended). Z-80 version requires CP/M 2.x or 3.x and 48K RAM minimum. **Waltz Lisp** runs on hundreds of different computer models and is available in all disk formats.



\$169

*Manual only: \$30 (refundable with order). Foreign orders: add \$5 for surface mail, \$20 for airmail. COD add \$3. Apple CP/M, hard sector, and 3" formats add \$15. MC/Visa accepted.

For further information or to order call **1-800-LIP-4000 Dept. 31**
In Oregon and outside USA call 1-503-684-3000.

PRO CODE INTERNATIONAL
15930 SW Colony Pl.
Portland, OR 97224

REVIEW: MAGIC/L

Magic/L is designed more for the serious software developer than for the novice.

BIOS (basic input/output system) rather than a problem with Magic/L.

DOCUMENTATION, BUGS, AND SUPPORT

The documentation is fairly good and contains quite a bit of information. It has discussions of advanced applications and features, good hints on debugging code, and an interesting discussion on speed efficiency versus space efficiency. We would have liked a glossary that was more detailed than an index but more concise than a reference manual. It would also be nice to have a single comprehensive index to the terms defined in the user's manual and the Magic/L CP/M supplement.

Some words expect argument values in octal, and the documentation occasionally refers to octal. The use of octal is a carryover from implementations on minicomputers. Most micro users would prefer to specify character codes and other arguments in hexadecimal. We also wished for some familiar FORTH tools, like the VLIST command that displays all defined words with the most recently defined first. The Magic/L equivalent lists the most recent words last, an annoyance when you just want to see how you named a variable.

REAL operations did not function properly in the version 2.40 (see the text box "Magic/L Update," page 348, for the features of the latest version) that we originally received. A call to Loki resulted in a quick fix:

```
C>type realfix.mg
; REAL FIX FOR MG/L
;
; DEFINE FIXREAL
if ( dup ( rliteral ( $tbuf ) ) )
exec ( rlval 2315x )
```

```
endif
END
poke ( base fixreal , 33fex )
```

The fix, which Loki dictated over the phone, shows the ease with which you can make changes in Magic/L.

The error-message facility requires that you have the error-message text file on the system. Magic/L lets you specify the drive on which the message file exists. We would have preferred to have the messages as a module. Most, but not all, error situations are documented. The error checking in general is simpler and sparser than in most high-level languages, and it is sometimes easy to crash the system with an error (a stack underflow, for example). We did this a few times when we were starting, but we no longer have this problem.

CONCLUSION

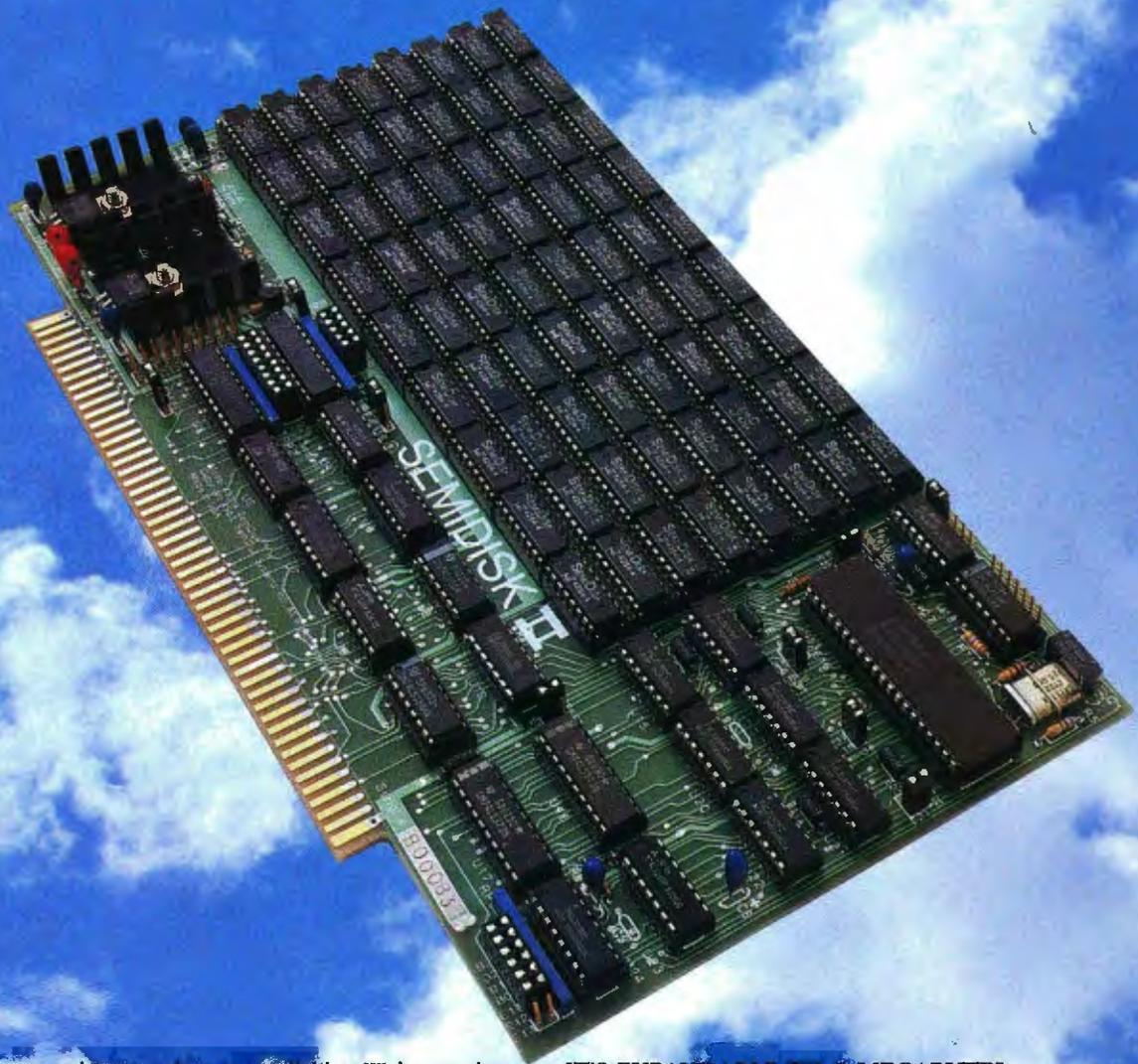
Overall, we have found Magic/L to be a well-conceived, well-implemented, and useful language combining the finer features of various other languages. The ability to create and use modules to be imported to and exported from the Magic/L system is especially powerful, since you can customize any or all the parts of Magic/L for individualized applications. And those already used to a structured programming language like Pascal or C should be able to write useful programs quickly because of the ease of translation.

In addition to the features we have discussed, Magic/L has other interesting aspects. For example, the language permits vocabulary branching, has the ability to divide the symbol table into subvocabularies, and lets you directly access Magic/L internal compiler routines.

Obviously, Magic/L is not a panacea for all programming problems. Magic/L, like FORTH, is designed more for the serious software developer than for the novice. Once mastered, however, it offers an environment in which development seems to flow very naturally. Magic/L is easily maintained and modified and can be as powerful as a user's ability to extend it. ■

TIME & MONEY

SemiDisk is the disk emulator that saves you more of both.



We've just done something we know you'll like. We've made the SemiDisk far more affordable than ever before. With price cuts over 25% for most of our product line. Even our new 2 megabyte units are included.

COMPARE WITH THE OTHERS.

SemiDisk Systems builds fast disk emulators for more microcomputers than anyone else. S-100, IBM PC, Epson QX-10, TRS-80 Models II, 12, and 16. Up to 2 megabytes per board, standard. Up to 8 megabytes per computer, using only four bus slots, max! Software drivers are available for CP/M 80, MS-DOS, ZDOS, TurboDOS, VALDOCS 2, and Cromix. SemiDisk turns good computers into great computers.

GREAT NEWS FOR IBM PC AT USERS.

New MS-DOS 3.0 software drives take full advantage of the 80286's expanded instruction set, moving data four times faster than can be done on PC or XT.

BATTERY BACKUP, TOO.

At 0.7 amps per 2 megabytes, SemiDisk consumes far less power than the competition. And you don't have to worry if the lights go out. The battery backup option gives you 5-10 hours of data protection during a blackout. Nobody else has this important feature. Why risk valuable data?

IT'S EXPANDABLE TO 8 MEGABYTES.

You can start with as little as 512K bytes, and later upgrade to 2 megabytes per board. At your own pace, as your needs expand.

In an IBM PC, XT, and AT you can have multiple drives on a single system. And the SemiDisk gives you mainframe performance on the top of your desk.

AND THE BEST NEWS IS SAVED FOR LAST:

	<u>512K</u>	<u>1Mbyte</u>	<u>2Mbyte</u>
SemiDisk I, S-100	\$695	\$1395	
SemiDisk II, S-100	\$995		\$1995
IBM PC, XT, AT	\$695		\$1795
QX-10	\$595		\$1795
TRS-80 II, 12, 16	\$695		\$1795
Battery Backup Unit	\$150	\$150	\$150

SEMIDISK

SemiDisk Systems, Inc.

P.O. Box GG, Beaverton, Oregon 97075

503-642-3100

Inquiry 337



Amazing what's Macintosh these



going into days.



Macintosh is getting into more businesses these days because it is now compatible with IBM PC software. That's right, IBM software. Thanks to what's been hailed as the best new computer product of 1985: MacCharlie.

By attaching MacCharlie to Macintosh you suddenly possess the premier qualities of the world's two most popular personal computers.

We call it the best of both worlds. Others call it revolutionary, miraculous, amazing, and other similarly embarrassing adjectives. And with good reason.

First of all, your heavy investment in IBM PC software can now receive even heavier use.

And each program is enhanced by Macintosh's many beloved features: window sizing, the menu bar, clipboard, calculator and notepad. All controlled, of course, by the infinitely convenient mouse.

But MacCharlie also provides several other unexpected pleasures. Like the ability to link Macintosh to IBM serial networks and mainframes. And the flexibility of file transfer between the two popular PC's, which means offices using both computers can kiss double entries goodbye.

MacCharlie also makes Macintosh compatible with almost any IBM peripheral, including printers, modems and even hard disk drives.

In brief, MacCharlie makes it a cinch to justify adding the powerful, easy-to-use Macintosh to your software-laden family of IBM PC's.

And once that happens, you'll be amazed at the good things going into your Macintosh. And out of your office.



MacCharlie™
by Dayna Communications
50 South Main, Salt Lake City, Utah 84144

For more information, contact your authorized Dayna Dealer, or call Operator 14A toll-free, 1-800-531-0600. (In Utah, call 531-0600.)

Apple is a registered trademark of Apple Computer, Inc. Macintosh is a trademark licensed to Apple Computer, Inc. IBM is a registered trademark of International Business Machines Corporation.

At NEC, monitors and printers are not peripheral issues.

All too often, brand-name CPUs are "bundled" with mediocre peripherals — a practice that makes for profitable sales, but does nothing for the system's performance.

In Japan, where most computer peripherals are actually built, NEC is the largest personal computer company — by far. And NEC didn't make it to first place by offering second rate peripherals.

The monitors with the broadcast video heritage.

While dozens of companies market display monitors, only a handful possess the tube technology and manufacturing capability to actually *build* them. NEC is one of the few. In fact, NEC's complete line of color and monochrome monitors reflects the professional and broadcast video

expertise that twice earned NEC Emmy Awards from the National Academy of Television Arts & Sciences.

Winning the printer race takes both speed and endurance.

Ask people who really know about printers, and they'll tell you that NEC builds the best. They may also point out that NEC builds printers for other computer companies. And if you ask them to choose one word to sum up what makes NEC printers stand out, it will probably be "reliable." This is why NEC has become the printer of choice for the most demanding installations.

So before you buy a peripheral from any name company, make sure the company puts more into the peripheral than just its name.

PC-PR105A IBM PC PLUG COMPATIBLE TRI-MODE DOT MATRIX PRINTER



JB-1280DA IBM PC PLUG COMPATIBLE GREEN PHOSPHOR BLACK SCREEN MONITOR

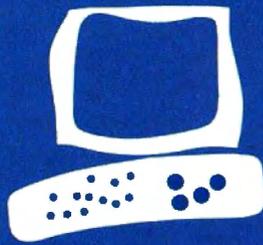


NEC

NEC Home Electronics (U.S.A.) Inc.

Personal Computer Division
1401 Estes Avenue
Elk Grove Village, IL 60007
312-228-5900

Inquiry 279



IBM's Professional Graphics System

For what
you get,
it's less
expensive
than it
seems

BY RIK JADRNICKEK

With CAD (computer-aided design) software rapidly becoming an economical and professional reality on desktop microcomputers, the search is on for the hardware to keep pace with it. The 320- by 200-pixel four-color graphics cards available for the IBM Personal Computer are just not equal to the detailed drafting, painting, and surface-shading tasks required in a professional environment.

The IBM Professional Graphics System (PGS) consists of a high-resolution color monitor matched to a graphics-controller board; it provides flickerless 640- by 480-pixel graphics images in 256—out of a possible 4096—simultaneously displayed colors. To better understand the difference between PGS and the average microcomputer CAD offering, let's take a brief look at the graphics capability currently available for IBM PCs.

Many personal computers come from the factory equipped with high-resolution graphics capability, including the NEC APC and the Victor 9000. IBM PCs offer "expansion slots"; third-party vendors fill these slots with a wide variety of graphics-enhancement controller boards that provide tremendous flexibility when configuring a system for graphics work.

Many of these graphics-enhancement boards for the IBM PC serve a dual purpose. They emulate the standard 320- by 200-pixel IBM color-graphics card, making the PC compatible with much of the business-graphics software currently available. In addition, they provide a variety of high-resolution graphics options ranging from monochrome to 1024- by 1024-pixel color resolution. A quality graphics software package attempting to do professional CAD work will use the higher-resolution products.

The Tecmar Graphics Master board (\$695) is a popular choice because it emulates standard IBM color graphics and provides a 640- by 480-pixel high-resolution color option that lets you display 16 different

colors simultaneously on a graphics monitor. It uses a standard TTL (transistor-transistor logic) nine-pin connector and provides character generation for displaying text. Since the board puts out an interlaced signal, a standard graphics monitor flickers when it displays the higher-resolution image. Many users have found out the hard way that you need a special long-persistence phosphor monitor (costing between \$695 and \$1500) for an acceptable display. This configuration is limited to applications requiring only 16 colors.

Some graphics boards, like Conographic's Cono-Color 40, require a special monitor (starting at \$1600) with a higher non-standard horizontal-scan rate and analog inputs. The Artist 1 from Control Systems (\$2250) provides 1024- by 1024-pixel resolution with 256 simultaneous colors displayable out of a palette of 16 million. However, it doesn't have 6845 emulation for text generation, so you need a dual-monitor system to do nongraphics work. Also, you need a 19-inch monitor with a nonstandard horizontal-scan rate and long-persistence phosphors (starting at \$2400). To complicate matters, different software packages may have drivers for different graphics cards. You can end up with a lot of gear that may soon be obsolete.

What do you do if you want to create fine line drawings requiring no more than 16 simultaneous colors with your IBM PC? At the same time you want to paint and create surface shading requiring at least 256 simultaneous colors with that same system. In addition, you want to display text and run business-graphics software for financial analysis. Well, you are well on your way to \$5000 worth of gear and a two-monitor system.

THE PROFESSIONAL GRAPHICS SYSTEM

The IBM PGS consists of a matched high-resolution color monitor and graphics-

(continued)

Rik Jadrnickek, a BYTE contributing editor, is president of Microflow (POB 1147, Mill Valley, CA 94942) and a CAD consultant combining knowledge of systems integration, software design, and programming. Rik also enjoys sailing, music, and video.

AT A GLANCE

Name

IBM Professional Graphics System

Manufacturer

International Business Machines
1000 NW 51st St.
Boca Raton, FL 33432

Components

Professional Graphics 12-inch display (CRT), Professional Graphics controller card

Software

Demo disks, diagnostics disk, Graphical Kernel System (six disks), Professional Graphics Series device drivers, Graphics Development Toolkit (includes language libraries and supplemental programs)

Features

640- by 480-pixel resolution,
256 simultaneous colors

Documentation

Installation guide, booklet covering display-device driver, GKS programmer's guide, two volumes covering GKS language bindings, and reference booklets for FORTRAN, BASIC, Pascal, and Macro Assembler

Price

Professional Graphics display	\$1295
Professional Graphics controller card	\$2995

controller card. The system emulates the 6845 for text generation and the standard IBM color-graphics card to run business-graphics software, it provides graphics with 640- by 480-pixel resolution displayed in 256 simultaneous colors, and it is an integrated system. When you consider the costs of a good graphics board and compatible monitor, PGS's \$4290 price tag doesn't seem so expensive.

The PGS board occupies two slots in the IBM PC. A TTL nine-pin connector carries the noninterlaced signals to a special high-resolution color monitor that looks much like the standard IBM color monitor. PGS will not drive a standard color monitor.

I used the AutoCAD program from Autodesk Inc. (Sausalito, California) and the AE/CADD Master Template architectural software from Archsoft Corporation (San Francisco) to evaluate the graphics system. These products make extensive use of color and drawing primitives to create professional drawings on the display. I was unable to find any painting or three-dimensional software that currently supports PGS.

Comparisons of color palettes and fine line representations are shown for the standard IBM color-graphics card (see photos 1 and 4), the Tecmar Graphics Master card (see photos 2 and 5), and the IBM PGS (see photos 3 and 6). PGS provides the ability to represent subtle shades of color because it is capable of displaying 256 simultaneous colors.

With the Graphics Master, the image tends to flicker despite the use of a long-persistence phosphor monitor due to the interlaced signal generated by the board. It can be quite distracting during prolonged use in a production environment. PGS did not flicker at all while displaying the same images. This is reason enough to consider the product for professional work.

When I was using PGS as a single-monitor system, the 6845 emulation for text generation seemed to be quite slow compared to both the IBM color-graphics card and the Tecmar board. During text editing and direc-

tory scrolling, PGS was sluggish to an extent that could interfere with production work. Keep in mind that you can use PGS in a dual-monitor configuration with the text displayed on a monochrome monitor.

In my work I use the IBM AT for writing, drafting, data extraction from drawings for report generation and spreadsheet analysis, three-dimensional manipulation of two-dimensional images, and renderings using images created in the drafting and three-dimensional stage. I am constantly putting different graphics boards into my system and using two monitors. In general, professional drafting software tends to support the 16-color boards, while professional three-dimensional and painting software requires and supports the 256-simultaneous-color boards. If these packages begin to support graphics systems like PGS, the days of swapping graphics boards and monitors may soon be over.

The PGS package includes ample documentation if you want to develop drivers for existing software or entirely new applications. It comes with a three-disk Graphics Development Toolkit that contains a set of linkable libraries for graphics and text functions. The Virtual Device Interface Controller and a set of device drivers for display units, printers, and plotters are also included.

Reference booklets contain the specific language syntax for each function. I saw booklets for FORTRAN, BASIC, Pascal, and Macro Assembler. The Toolkit provides the means for writing device-independent graphics software so you can direct program output to any supported workstation or input/output device without having to modify your application.

The three-volume Graphical Kernel System (GKS) includes six disks, a programmer's guide, and two volumes of language bindings. GKS is designed for use by BASIC, C, or FORTRAN programmers. You do not need expertise in graphics programming, but GKS does assume you have a certain

(continued)

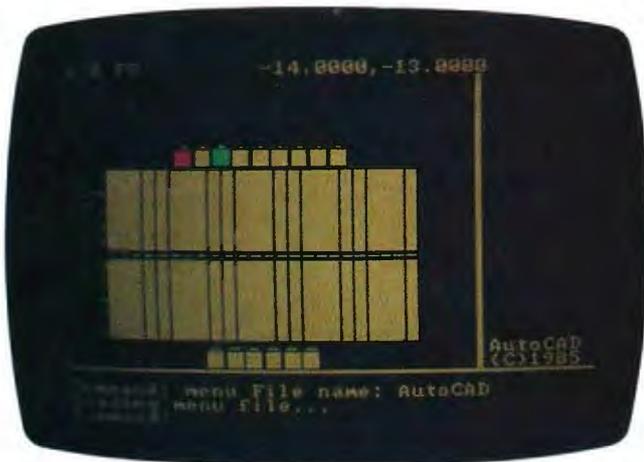


Photo 1: A palette of 256 colors created with Autodesk's AutoCAD program and displayed using the standard IBM color-graphics card.



Photo 4: An architectural drawing using Archsoft's AE/CADD Master Template displayed using the standard IBM graphics card with 4 simultaneous colors at 320- by 200-pixel resolution.



Photo 2: The same palette of 256 colors displayed using the Tecmar Graphics Master.



Photo 5: The same architectural drawing displayed using the Tecmar Graphics Master board with 16 simultaneous colors at 640- by 480-pixel resolution.

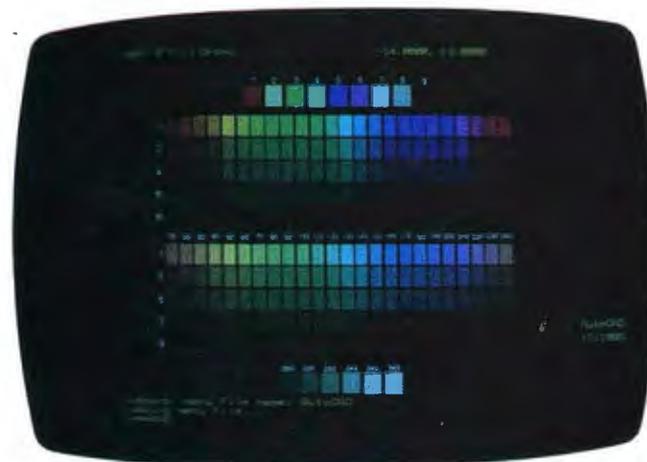


Photo 3: The same palette of 256 colors displayed using the IBM Professional Graphics System.



Photo 6: The same architectural drawing displayed using the IBM Professional Graphics System with 256 simultaneous colors at 640- by 480-pixel resolution.

A SYSTEMS PROGRAMMER'S EXPERIENCE WITH IBM'S PROFESSIONAL GRAPHICS CONTROLLER

BY RODRIGO SILVEIRA

I recently set out to write a display driver to be used by Autodesk's AutoCAD program to drive the IBM Professional Graphics Controller (PGC). Two design assumptions tailored my effort. First, the AutoCAD program won't allow any software between itself and any graphics boards. This means that all communications between AutoCAD and the graphics board must be handled by the AutoCAD software itself. The Graphical Kernel System (GKS) and Graphics Development Toolkit accompanying the PGC were therefore of no use in this particular application. Second, AutoCAD's core code expects a series of well-defined subroutines to exist at the driver level. Anytime a display operation is needed, AutoCAD calls one of these subroutines.

In the driver design there are three layers of subroutines: well-defined AutoCAD subroutines, PGC primitive subroutines, and AutoCAD/PGC communication subroutines.

Since the documentation accompanying PGC pertains to GKS and to the Toolkit, I had to get the Professional Graphics Controller technical reference manual from IBM.

There was no documentation on how to use the cold-restart flag, the warm-restart flag, and the error-enable flag, addressed C600:0306, C600:0307, and C600:0308, respectively (all hexadecimal). I called IBM for help and was told to set each of them to a nonzero

value to correct the problem. This was the first in a series of satisfactory results obtained by calling IBM technical personnel.

During the first development phase, I ran into a problem testing the AREA subroutine. I wrote a series of small programs designed to execute the primitives in listing A. After execution I expected the ellipse to be filled with the color 24 (red), the current default color. Instead, the ellipse was not filled, but part of the viewport was. If I changed the current color to a color other than 24 before executing the AREA command, then the ellipse was filled properly. I never did resolve this situation because I didn't need this feature.

I ran into several instances where the PGC "lost control" in the communication area. This happened when AutoCAD drove the controller very fast. For

example, when a VIEWPORT was followed by a series of drawing commands, the board would draw using the previous VIEWPORT instead of the current one. In order to circumvent the problem, I inserted timing delays between the VIEWPORT command and AutoCAD. However, since the driver was initially developed on a PC XT, the problem recurred when I tried to run it on a PC AT.

Further investigation led me to change the algorithm used to write commands to the communication area. Initially, I wrote bytes to the communication queue as long as there was at least 1 byte free. The algorithm read the WRITE and READ pointers, determined the number of bytes available, and wrote either the whole command or as many bytes as were available. Once the entire command was written, control returned to the driver. I

Listing A: The primitive commands that should have filled the ellipse with red.

HX	—Communications are in hex
RESETF	—Reset program parameters
WINDOW 0,639,0,479	—Define the viewport coordinates
LUTINT 0	—Initialize the lookup table
COLOR 24	—Set the current color
MOVE 320,240	—Set the current point
ELLIPSE 200,100	—Draw an ellipse
AREA	—Random area fill

familiarity with graphics concepts. Unless you are simply using PGS with existing applications software, GKS is an integral part of it. The manual covers installation and start-up procedures, GKS concepts, programming with GKS, and GKS routines. The volumes of language bindings discuss how to adapt GKS to specific pro-

gramming languages. Binding conventions, argument conventions, and GKS error handling are discussed along with installing and linking your programs to the GKS libraries.

SUMMARY

The IBM Professional Graphics System has something to offer for both

the end user and the program developer. Since the card is likely to be widely supported, you may find all the software you need supported by one hardware system. PGS is a good candidate for the CAD/CAM (computer-aided manufacturing) field since you can display drafting drawings that require only a few colors along with

REVIEW: PROFESSIONAL GRAPHICS SYSTEM

changed the algorithm to write to the communication queue only after determining that there were 256 bytes available. This circumvented the problem for both the XT and the AT.

A refinement of this algorithm was later developed at the suggestion of my colleague Greg Lutz. He proposed that I write to the output queue only after determining that the number of bytes available equaled or exceeded the number of bytes used by the command to be executed by the PGC. This new algorithm did not work, and it exhibited the same symptoms as the ones I'd experimented with before.

A simple change did the trick. By writing to the output queue only after determining that the number of bytes available exceeded the number used by the command, I got the PGC to work satisfactorily.

While creating the display driver, I loaded my own RGB (red-green-blue) values into the lookup table (LUT). Later, when I used the RESETF command, the default palette 0 was not loaded. I tried the LUTINT 0 command but it didn't work either. In order to reset the default palette to 0, I had to turn the power off and then on again. Since this doesn't create a significant problem in the functioning of the driver, I decided to live with it.

In general, interfacing software to the IBM PGC is straightforward compared to other cards I've used. You send com-

mands to the PGC board via high-level commands. The board comes with primitives that are easy to use. For example, if you want to construct a circle, you simply execute a single primitive instead of manipulating a variety of mathematical constructs. This eliminates the need for assembly-language programming and makes driver creation faster, easier, and simpler to debug. And the driver will be simpler to maintain in the future because the code is easy to understand.

As a graphics controller, the IBM Professional Graphics System has good color capability at 640- by 480-pixel flickerless resolution of up to 256 simultaneous colors. However, some improvements are definitely possible. The resolution should be 1024 by 1024 pixels for the price. Also, when you are using the system with a single monitor for graphics and text, the 6845 emulation for character generation is quite slow. Other than that, the IBM Professional Graphics System seems equal to most of the graphics tasks you might face.

Rodrigo Silveira (521 MacArthur Ave., Redwood City, CA 94063) is a systems programmer and technical manager for Autodesk Inc. He spent five years as a Sperry Univac 1100 systems programmer and has been in the CAD/CAM/CAE industry for the past three. Rodrigo's other interests include chess and volleyball.

painted and three-dimensional surface-shaded images that require a wide variety of simultaneous colors.

Don't let the price tag discourage you. The cost of putting together a graphics system that compares with PGS using the graphics cards and monitors currently available exceeds the PGS price of \$4290. As a bonus,

the PGS 6845 emulation for text generation lets you do it all on a single-monitor system, saving the cost of a monochrome card and monitor. Looking at PGS, I get the feeling that things are going in the right direction. I only wish the display had a resolution of 1024 by 1024 pixels. Maybe next year. ■



At last, the breakthrough you've been seeking in a database management system.

FoxBASE™ is more than just a relational database management system. Because it's written in C, FoxBASE is a highly portable, sophisticated interpreter/compiler that's ultraquick. Very economical. And dBASE II® source compatible (including full macro usage).

FoxBASE emits compact object code and makes automatic use of an 8087 or 80287 chip to let you develop and run applications with unsurpassed speed.

And for as little as \$10 per license, you can distribute FoxBASE with your applications. FoxBASE even comes with a 30 day moneyback guarantee.

MS DOS \$395. AOS/VS \$995.
UNIX™ (priced according to host).

Don't be outfoxed by the others. Call or write Fox Software today.

dBASE II is a registered trademark of Ashton-Tate

FOXBASE 

FOX SOFTWARE, INC.

27475 Holiday Lane, Perrysburg, OH; 43551
419-874-0162

For IBM-PC Add-On Users

In A Pinch? Give QIC The Inch

We Have the Right Products ... at the Right Prices

... Right Now!

Mass Storage at
Massive Savings

**QIC-01 10, 20, 32 MB Internal
Hard Disk Subsystem**



10MB
\$489
20MB
\$589

This low power Microscience sub-system comes complete with controller, cables, drive, easy instructions. Fits inside your floppy slot. Compatible with DOS 2.0, 2.1, and 3.0 without any patches. 32 MB half-height w/controller, \$1,095 ... 20 MB Drive for the PC AT, \$795. Mounting hardware for Compaq is available. External 10 MB \$549, external 20 MB \$649.

**QIC-03 300/1200 Baud
Modems**



\$199

\$299

Our modems are fully Hayes compatible with features such as low heat dissipation, low power consumption, software volume control for the speaker, and large-scale-integration "Modem on a chip" for high reliability. It also comes with communications software which lets you emulate VT100 or IBM 3101. Half-size Internal \$299.

More Functions ...
Less Cost

QIC-05 Multi-Function Card



\$139

It gives you more than just added memory. It gives you reliable memory expansion (up to 384K), a serial port, a parallel port, a game port, and a battery back-up clock calendar. Includes RAM disk, print spooler, and clock utilities (The 64K RAM set is only \$15.) With 2 serial ports \$175.

**QIC-20 External Hard Disk
with Tape Backup.**

\$1755



20 MB hard disk with 60 MB tape backup unit in a chassis with two extra I/O slots. Comes with cable and a half size host adapter card. 20 MB hard disk with 60 MB tape is only \$2450.

**QIC-02 10, 20, 60 MB
Half-Height Tape
Back-up Systems**

Out of slots? Low on budget? Our 10 MB reel tape back-up unit plugs into the back of your floppy controller. It works like a floppy disk so you can use all the DOS file commands such as COPY or DIR. Back-up 10 MB in 15 minutes. Our



10MB
\$499

20 MB cassette and 60 MB cartridge back-up systems come with controller, cables and drive. Back-up 20 MB in 6 minutes. You can even do fast Image back-up and then file-by-file retrieval. Works on IBM PC, XT or AT. Internal 10 MB \$499, 20 MB \$699, 60 MB \$899. External 10 MB \$675, 20 MB \$875, 60 MB \$995.

Graphics Boards

Hercules, Color \$185
Hercules Compatible, Mono \$199
Color Graphics Card \$125
Everex Graphics Edge \$295

Half Size Cards

Memory card with
8K \$ 79
384K \$175
576K \$225
IO card with 2 serial ports,
1 parallel port,
clock/calendar \$125
Internal Power Supply
135 Watt \$ 99
150 Watt \$115
Expansion Chassis with
I/O Slots \$645
IBM PC, 256K, 1 Drive \$1499

We Guarantee Satisfaction!

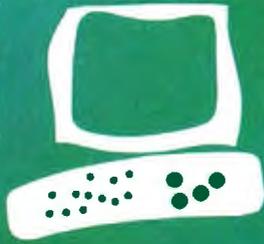
No Risk. All our products carry the manufacturer's warranty. And remember, if for any reason, you are not completely satisfied within 30 days, you can return it for a full refund.

Call Us Today!
(408) 942-8086

Telex: 5101002379 QICRCH

QIC RESEARCH
INCORPORATED
489 Valley Way
Milpitas, Ca 95035

QIC-405



Juki's 6300 Daisy-Wheel Printer

**Letter-quality
output and
Diablo
compatibility**

BY WAYNE RASH JR.

Juki's 6300 printer, a Diablo 630 clone, is the company's top-of-the-line offering to people looking for low- and medium-priced printers. Juki brought dot-matrix-printer prices to the letter-quality-printer field when it introduced its 6100 nearly two years ago. That printer was characterized by solid construction and the best manual in the printer industry. The 6300 follows in that tradition.

Fortunately, the 6300 has departed from its older sibling's footsteps in several important ways. You do not, for example, have to disassemble the printer to set the configuration switches. The linear induction motor that drives the carriage for the 6100's print head is gone as well, replaced by a cogged belt that may be low tech but is more accurate in positioning the print head.

The Juki 6300 is a better clone of the Diablo than its predecessor is. Where the 6100 is merely plug-compatible with a Diablo printer, the 6300 also accepts Diablo ribbons and print wheels. This makes buying supplies a lot more convenient since Juki daisy wheels are rarely stocked by any but Juki retailers. The 6300 uses regular Diablo HyType II ribbon cartridges but will not accept the ¼-inch taller HyType II High Capacity cartridges. I must admit that Diablo ribbon cartridges are not as easily obtainable nor as inexpensive as the IBM Selectric typewriter ribbons used by the 6100.

The printer software supports every print mode of the Diablo 630 with the exception of the alternate ribbon color. In addition, you can select shadow printing that is similar in appearance to bold printing. When you install the printer driver for your word processor, all you have to do is select the menu choice for the Diablo 630. Juki does give you instructions for installing the shadow-printing feature into WordStar.

The 6300 also supports graphics just as a Diablo does. Regrettably, very few commercial software packages support the excellent graphics produced by this printer. For this reason, I was unable to test this fea-

ture myself; however, I have seen graphics produced by it, and I have used the Juki 6100 for graphics.

The ease of setting the configuration switches for the serial interface and for the various print options is improved significantly over the earlier Juki printer. With the 6100, you had to strip the printer down to its frame to set the serial interface. Now, all the DIP (dual in-line package) switches are located on the rear of the printer or underneath the front cover.

USING THE 6300

Even an inexperienced user should have an easy time with the Juki 6300. The setup instructions in the manual are excellent, and the DIP switches are preset with the settings you are most likely to need.

The optional tractor feed takes only a moment to install. The mechanism snaps on top of the printer, and the paper alarm plugs into the rear. This is a well-constructed bidirectional tractor feed that works well once the paper is in place. Getting the paper started is inconvenient: You must lift the rear of the feed mechanism and flip the platen pressure control to make the paper feed properly. Once the paper is started, you flip this control to its original position and lower the rear of the feed mechanism.

The Juki 6300 seems to be quieter and less obtrusive than the Diablo 630 it emulates. It is much smaller and lighter and seems to impart less vibration to the printer stand. The noise shield included with the printer works with the tractor feed in place.

In general, the Juki 6300 is equally capable of working with WordStar or printing program listings. Only WordStar 2000 upset the calm by somehow defeating bidirectional printing, but it does this with all the printers I've tried.

THE BENCHMARKS

Juki claims that the 6300 generates text at the rate of 40 characters per second (cps)

(continued)

Wayne Rash Jr. is a member of the professional staff of American Management Systems Inc. (1777 North Kent St., Arlington, VA 22209), where he consults with the federal government on microcomputers.

AT A GLANCE

Name

Juki 6300

Type

Daisy-wheel printer

Manufacturer

Juki Office Machine Corp.
299 Market St.
Saddle Brook, NJ 07662
(201) 368-3666

23844 Hawthorne Blvd.
Suite 101
Torrance, CA 90503
(213) 320-4860

Size

23.6 by 15.7 by 4.9 inches;
32 pounds

Features

32-cps Shannon test at 12 pitch; 3K memory expandable to 15K; friction feed; accepts Diablo print wheels and ribbons; software-compatible with Diablo 630; supports Diablo graphics; supports 10-, 12-, and 15-pitch settings and proportional spacing

Options

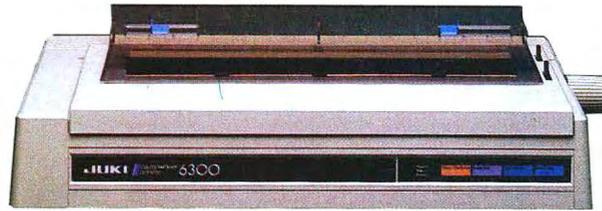
Tractor feed; memory expansion to 15K

Documentation

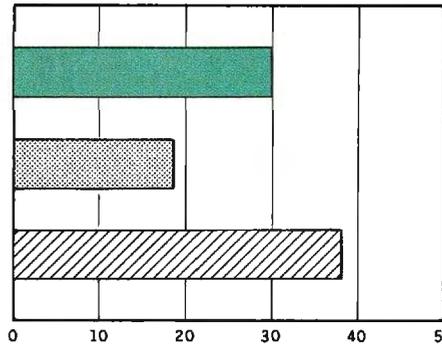
User's manual, spiral-bound, 215 pages

Price

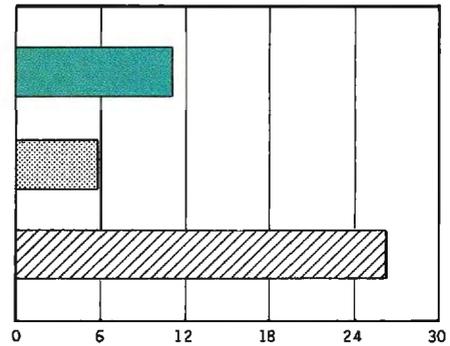
\$995



PRINT SPEED (CHARACTERS / SECOND)



LIST PRICE (\$100)



JUKI 6300
 JUKI 6100
 DIABLO 630

This is the Juki 6300 daisy wheel printer

This is the Juki 6100 This is the Juki 6100

This is the Diablo 630 printer.

The Juki 6300 printer (using a Courier 72 daisy wheel) is compared with the Juki 6100 (using a Courier 10 daisy wheel) and the Diablo 630 (using a Courier Legal 10 daisy wheel). The pitch for all printers is 10 characters per inch.

Print speeds were determined by timing how long it took the printers to print the Shannon test (573 characters; see the February 1984 BYTE, page 193). The prices are list prices, including tractor-feed mechanism.

and prints the Shannon test at 32 cps. While the printer performs as promised, you should not expect to turn out characters at this rate. To see why requires a few words about performance tests for daisy-wheel printers.

The primary factors in determining the speed of a daisy-wheel printer are the time required for the print mechanism to move from one letter position to the next and the time re-

quired for the daisy wheel to spin into position to print the required character. As a result, the speed of the printer is affected by both the pitch and the nature of the text being printed.

The effect of the pitch is fairly obvious. If you are printing 12 characters per inch, it takes less time to move between characters than it does if you are printing 10 characters per inch. Printing at 12 pitch is faster, and this

is the pitch used by Juki for determining its speed specifications.

The effect of the nature of the text on printing speed is a much more complex issue. Sergio Mello-Grand treated this issue very thoroughly in his article "The Art of Benchmarking Printers" (February 1984 BYTE, page 193). He also presented a number of benchmarks for dot-matrix and daisy-wheel printers, some of which I used

(continued)

Buy Mouse, Paint Free.

Now when you buy the Microsoft® Mouse, you get a dazzling new color paint program, PC Paintbrush™, free.

PC Paintbrush supports a host of graphics cards (including the new IBM® EGA and Hercules™ Graphics Card) and over 30 printers and plotters.

Microsoft Mouse is the high performance mouse for the IBM Personal Computers.

It puts the power to

run Microsoft Multiplan®,

Lotus® 1-2-3®, Microsoft Word and other popular programs

in the palm of your hand. It's available

in serial and bus versions.

So why monkey around with any other mouse. For the name of your nearest Microsoft dealer, call (800)

426-9400. In Washington State

and Alaska, call (206) 828-8088.

In Canada, (416) 673-7638.



MICROSOFT
The High Performance Software™

A hand holding a large, stylized 'MICROSOFT' logo. The logo is made of thick, black letters and is being held up by a hand from the bottom right corner. The background is a light blue gradient.

Microsoft and Multiplan are registered trademarks and The High Performance Software is a trademark of Microsoft Corporation. Lotus and 1-2-3 are registered trademarks of Lotus Development Corporation. IBM is a registered trademark of International Business Machines Corporation. Hercules is a trademark of Hercules Computer Technology. PC Paintbrush is a trademark of ZSoft Corporation.



A word for this Punch/Reader Combo is

Speed! Model 510 punches paper tape at 110cps, reads at 150cps. This rugged machine is computer compatible offering RS232C, current loop, parallel inputs. The ASCII-to-Baudot code conversion permits direct keyboard entry for Telex/TWX transmission. Plus: 256 character storage, 75-9600 baud rate, 5-8 level tape, stock. ADDMASTER CORP, 416 Junipero Serra Dr., San Gabriel, CA 91776 ★ 818/285-1121.

Inquiry 7

Software for Engineers

Electronic Circuit Analysis

- Nonlinear transient, DC, AC analysis
- Worst Case, Monte-Carlo
- Frequency, time dependent parts

\$450.

Logic Simulation System

- Full delay analysis (min, max, typical, load dependent)
- Ability to save simulation results

\$395.

Both have:

- Built in editor, fully interactive
- Macros (unlimited)
- Large circuits

For MS-DOS, 192k minimum

Tatum Labs
 33 Main Street
 Newtown, CT 06470
 (203) 426-2184

Inquiry 358

Universal Machine Independent Assembler

MOPI:
 The only assembler capable of generating machine code for any 8- or 16-bit micro using a universal set of instructions, including procedural, the manufacturer's or user defined instructions.

The first assembler to implement a proposed AL Standard, applicable to any computer; simplifies learning AL, reduces development time, offers limited portability.

Simple enough for a beginning programmer, sophisticated enough for experienced computer professionals.

For CP/M or PC-DOS - \$195
 Proposed AL Standard - \$10
 Special Club, Site, Dealer Rates

VOCS
 P.O. Box 3705
 Mpls., MN 55403



Inquiry 380

Juki excels in documentation; the manual is well written and easy to read.

to determine the printing speed of the Juki 6300.

Two of the benchmarks used at BYTE for dot-matrix printers were listed by Mello-Grand as Bench 6 and Bench 7. Bench 6 consists of printing 50 lines, each containing 80 As. Bench 7 consists of 10 spaces followed by 60 As. The latter tends to favor printers that look ahead far enough to skip past spaces. Neither of these tests gives you an approximation of a daisy-wheel printer's actual printing speed, although they will show you how fast the print mechanism moves. In this case, the test results of 39.18 cps came very close to the Juki's maximum rated speed of 40 cps using Bench 6. Bench 7 showed a slightly slower 37.93 cps. The difference was most likely due to the higher proportion of carriage returns per character. Both benchmarks were printed at 12 pitch. At 10 pitch, the speeds slowed to 30.53 cps and 30.30 cps, respectively.

A more accurate approximation of a daisy-wheel printer's capabilities can be shown using benchmarks designed specifically for this type of printer. The most common of these benchmarks is the Shannon test (Mello-Grand presented two versions in his article). An even more accurate benchmark is Mello-Grand's first-order approximation using on-line UNIX manuals.

The two Shannon tests are distinguished by having different line lengths. The shorter line requires more carriage returns, and this can affect the overall speed. I ran both tests at 10 pitch and at 12 pitch. The 12-pitch tests support Juki's claim of 32 cps, since the 80-column Shannon test resulted in a speed of 33.12 cps and the 60-column test resulted in 32.56 cps. At 10 pitch, the speeds fell

to 30.16 cps for either test.

The first-order approximation puts daisy-wheel printers through a tougher test, and the resulting speeds demonstrate that fact. At 12 pitch, the Juki 6300 was able to print at 27.62 cps, while at 10 pitch the speed fell to 26.32 cps. According to Mello-Grand, this last benchmark most closely approximates the speed at which the printer will actually operate when printing normal English text. You should remember when you read these benchmarks that most printers are set at 10 pitch for normal printing. In any case, the Juki 6300 was somewhat slower than the Diablo 630 in these tests.

DOCUMENTATION

If there is an area where Juki excels, it is documentation. As far as I remember, this is the best printer manual I've ever seen. The 6300's 215-page manual is surprisingly complete, well written, and easy to read. There is a complete, detailed table of contents and a complete index as well.

The manual has specific instructions for connecting the printer to the most popular computers, including the IBM PC, the Apple II, and Kaypro computers. There are also generic instructions in case your computer doesn't resemble any of these. I connected the printer to a Zenith Z-100 using the instructions for the IBM PC parallel printer.

CONCLUSION

Juki's 6300 is an excellent medium-speed printer. It appears to be entirely adequate for office use, yet it is priced low enough for many home users. The printer works with nearly any word-processing program due to its nearly complete emulation of the Diablo 630.

While there are a few compromises that reflect the 6300's lower price, they are very few. The speed is a little slower, and you don't get to change ribbon colors. But on the other hand, the Juki is smaller and quieter than the Diablo 630. And on top of everything else, there's that excellent manual. ■

THE CASE OF THE DISAPPEARING CABLES



Front view.



Back view.

Here's a puzzle for you, Watson! Look at this new MicroManager!

Can't say I see anything out of the ordinary, Holmes.

Think, Watson, not about what you see, but rather what you *don't* see.

But, Holmes, everything seems perfectly in order.

Precisely! When did you ever see a printer station that was perfectly in order, Watson?

Zounds, Holmes! Some rascal has stolen the cables!

So it seems, Watson, but observe carefully—there's more to this than meets the eye. The cables have been cleverly concealed right under our very noses! Notice how each cable disappears through a knock-out hole and enters a channel in the rear of the device. Remove these vertical panels and—voilà!—we discover the cables passing from level to level through secret compartments.

THE MICROMANAGER SYSTEM

Holmes, you've solved the Case of the Disappearing Cables!

Elementary, my dear Watson. But the MicroManager has solved an even deeper mystery—*where to put the printer!* See how this Basic Floor Unit is actually composed of individual sections—"modules," Americans call them. Consider the possibilities, Watson—single modules used as desktop printer or monitor stands, for keyboard storage, or what-have-you. Combined, they can form any sort of work station we need! The base has locking casters for instant mobility. There's even an optional paper refolding attachment! Cunning, isn't it?

By Jove, Holmes, this new MicroManager is the most diabolically clever device we've ever encountered!

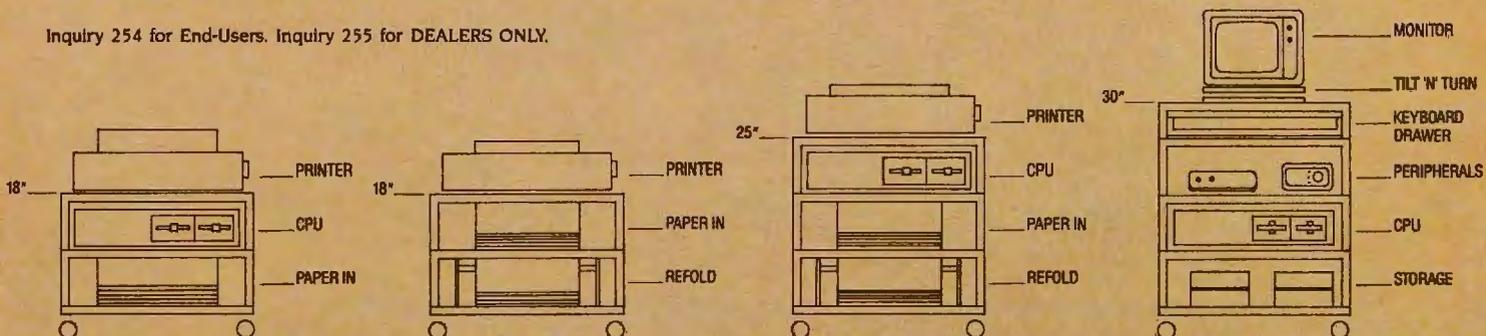
Indeed, Watson. Thank Heaven its creators are on our side!

MicroComputer Accessories, Inc.



USA: P.O. Box 3725, Culver City, CA 90231. Telephone 213/641-1800. EUROPE: Rue de Florence 37, 1050 Bruxelles, Belgique. Telephone 02/538.61.73.

Inquiry 254 for End-Users. Inquiry 255 for DEALERS ONLY.



**There's a good chance
that a computer in
your future will
come with
Microware software.**

**People who can't wait for the
future have Microware
software now.**

Right now, many of the biggest names in the business have their next-generation personal computers on the drawing boards. These advanced systems will have capabilities that will go far beyond what's available today. Many of these exciting new products will feature high-performance system software by Microware.

Operating systems and programming languages are the foundations upon which all other applications are built. Microware's OS-9 operating system is the ideal base for innovative fourth-generation application packages. It provides many advanced capabilities including true multitasking, a universal file and I/O system, modular construction, powerful graphics, unlimited communications gateways, and real-time response. And it's so versatile it can be used on almost any size system — from inexpensive personal computers all the way up to large multiuser systems.

Microware also has outstanding versions of the most popular programming languages. For example, Microware's extended, structured Basic is friendlier than an interpreter, yet it runs as fast as a compiler. And it's so smart that it actually reports bugs as programs are typed in. Or consider Microware's full-feature C Compiler. It can recompile almost any Unix application program to be much smaller and faster than the Unix equivalent. You can also choose Fortran and Pascal compilers of equal calibre.

Software like this doesn't happen by accident. Microware software is specifically designed to unleash the full potential of the extraordinary

68000 and 6809 microprocessor families. Microware works in close cooperation with the people who actually design the systems and silicon in order to achieve maximum integration and performance. That's why Microware software has already made a big impact within the scientific, engineering, and industrial communities.

Affordable, powerful personal computers with Microware software are available now at most Tandy/Radio Shack retail locations, and through Fujitsu and Hitachi in Japan. Plus over a hundred innovative manufacturers worldwide offer a veritable banquet of professional systems and software for VME, Multibus, STD, and most other popular standard bus architectures. If you're technically oriented, you can even get a reasonably priced Microware PortPak™ and install OS-9 on your own custom 68000 system.

Some things change, others can't. Will Unix ever become affordable and understandable enough for you? How long can MS-DOS keep up with new technology? You can wait and find out, or you can step into the future today. Contact us today and we'll send you complete information.



MICROWARE®

MICROWARE SYSTEMS CORPORATION
1866 N.W. 114th Street • Des Moines, Iowa 50322
Phone 515-224-1929 • Telex 910-520-2535

MICROWARE JAPAN, LTD.
41-19 Honcho 4-Chome, Funabashi City • Chiba 273,
Japan • Phone 0474-22-1747 • Telex 298-3472

OS-9 is a trademark of Microware and Motorola. Unix is a trademark of Bell Laboratories. VAX is a trademark of Digital Equipment Corporation. Multibus is a trademark of Intel Corporation.

Inquiry 263

THE TANDY 1000

The \$999 Tandy 1000 is not at all IBM PC-compatible and is undoubtedly the worst-supported computer in its price class (see "The Tandy 1000" by Rich Malloy, August, page 266).

The 128K-byte version of the 1000 does a pretty good job of emulating the Sanyo MBC-550, which no one should find very exciting. Only by adding the overpriced 256K-byte memory-expansion board, which comes with 128K bytes in spite of its name, can you make the 1000 run most, but not all, IBM software. That board includes the DMA controller that is part of the IBM motherboard. So much for compatibility.

The Tandy 1000 is not even compatible with its own documentation. It is advertised as providing four times as many colors as the IBM, and its reference guide specifies that screen mode six provides 16 colors. It actually provides 4 colors, including black and white. That discrepancy is explained away as being a misprint in the manual.

I purchased the 1000 in November 1984 on the dealer's verbal representation that the technical reference manual and fixes for the BASIC language bugs would be available early in 1985. There has been no sign of either of these necessities as of July 1985, and Radio Shack in Fort Worth will not answer my correspondence.

KEN BARBIER
Covina, CA

I tested several IBM PC programs on the Model 1000, both with and without the extra memory/DMA board. All of them ran without problems.

Like the IBM PCjr, the Tandy 1000 provides 16 colors in medium resolution (320 by 200 pixels). This is four times the number that the IBM PC Color Graphics Adapter provides at the same resolution. This is evidenced by a color photo in my review that shows over 12 colors on the screen at one time. Tandy's BASIC manual does not make it very clear, however, that to access these extra colors from BASIC you have to first use a CLEAR ,,32768 command.

Unfortunately, early versions of computers are often subject to more prob-

lems than later versions. Check with your dealer for updates.

—RICH MALLOY
Senior Technical Editor

THE JUKI 6100

I was interested in David Lewiston's letter about the Juki 6100 printer (August, page 286). I have not had the ribbon problem to which Mr. Lewiston refers. When the printer refuses to print because it is out of ribbon, the reel is out of ribbon. I have not had a problem with ribbon starts.

I have had problems with an irregular form feed caused by the fact that the gears needed grease. Once I greased the gears, I had no problems with the form-feed mechanism. Another minor mechanical problem is that the small metal flanges used to keep the ribbon in place have come loose, but all that keeps me from repairing that is a couple of small screws and my own laziness.

Having used the Juki 6100 for a year and a half under fairly rigorous conditions, I am pretty pleased with it. I can only conclude that Mr. Lewiston received a defective machine and that he should have had it replaced with a good one.

GEORGE G. JUMPER
Canoga Park, CA

LETTER BUG

My letter on Microsoft BASIC (July, page 299) should have read "I wish that Microsoft provided an Install program . . ."

ALAN T. CHATTAWAY
Vancouver, British Columbia, Canada

PRINTER CRITERIA

I want to suggest a couple of additions to your checklist of features to look for when you review printers. I own four different brands of printers and it astonishes me how poorly they meet my needs. New machines don't seem to be any better.

First, I'd like to see you check for whether the printer makes labels. This seems silly considering how much software has been written for this application, but of all my printers only the IDS Prism printers will do the job. If you have a printer with a cylindrical platen, the labels peel off the carrier, particularly if it's hot and humid and your office is not air-

conditioned. If the climate is controlled in your office, a simple test is to put the labels in the printer at quitting time and try to run the printer the next morning. You'd have to send my Diablo out for service because the labels come off in completely inaccessible places.

Second, you should see whether you can print an address on an envelope. This too seems elementary, but the Diablo is the only machine I have that will pass the test. The Prism can't grip an envelope at all. My Mannesmann Tally printers smudge the envelope and require special control codes to disable the "paper out" feature.

This reminds me of a third glitch. The Mannesmann Tally 180L "paper out" sensor is not in the paper path if you use bottom feed. In that case, you always have to disable it via control codes from the computer—a real inconvenience.

FARRELL CHOWN
Arnprior, Ontario, Canada

We certainly appreciate your concerns. However, we presently feel that application-specific tests would be of less general utility for our readers. We will keep your suggestions in mind if we ever decide to change our criteria.

—GLENN HARTWIG
Technical Editor, Reviews

PCJR COMMUNICATIONS

I'd like to reply to P. M. Moretti's problem with PCjr communications programs (July, page 299). Two versions of PC-Talk III in the public domain have been modified for the PCjr: one for the internal modem and one for an external modem.

These might not be available on your local bulletin board or, if they are, you might not be able to download them. They are both available from Public Brand Software, POB 51477, Indianapolis, IN 46251. The company also has a complete catalog of IBM PC-/MS-DOS software.

BOB OSTRANDER
Indianapolis, IN ■

REVIEW FEEDBACK is a column of readers' letters. We welcome responses that support or challenge BYTE reviews. Send letters to Review Feedback, BYTE Publications, POB 372, Hancock, NH 03449. Name and address must be on all letters.

Filling your needs m

Today's PC buyer is no pushover. Not only are low prices and prompt delivery demanded, but professional support, sound advice and innovative servicing of accounts is expected. It's no coincidence then that PC buyers all across the nation call PROGRESSIVE MICRO DISTRIBUTORS first. Here's why.

LOW COST, HIGH TECH SOLUTIONS.

PROGRESSIVE MICRO DISTRIBUTORS has the best prices on popular IBM PC hardware and software in the country (call and compare). Most orders are shipped the same or next day from our 25,000 sq. ft. warehouse. Although we ship literally hundreds of orders daily, all PC's are burned in overnight to insure that your system arrives in excellent condition.

We believe it takes a professional to provide professional service. That's why all sales and service staff members, from our factory authorized technical experts to our highly experienced account representatives, are rigorously trained on all current and new hardware and software. And if the need ever arises, direct access to our on-line customer service and technical support centers is available and convenient to use.

HOW TO KEEP UP WITH PROGRESSIVE.

As a PROGRESSIVE MICRO DISTRIBUTORS' customer, you'll also be privy to new product information and special money saving incentives through the Microgram,[™] our monthly customer newsservice. You'll also receive monthly price lists showing current pricing on our complete line of hardware, software and services. Lists are shipped automatically with all system orders and are available on disk when requested. Plus, **FREE** UPS shipping is guaranteed on all prepaid orders with confirmation of current pricing.

Call PROGRESSIVE MICRO DISTRIBUTORS today, **TOLL FREE** at **1-800-446-7995**, and we'll mail a current price list to you immediately. And remember, only PROGRESSIVE MICRO DISTRIBUTORS gives you all of these benefits: low prices, sound advice, prompt delivery, professional support and direct customer service.



POLICIES

1. We accept VISA, MC, AMEX; No surcharge for VISA or MC.
2. COD requires cash or certified check; Company check when approved.
3. Allow 1 week for personal and company checks to clear.
4. Wiring information available upon request.
5. Corporate, Government and Institutional volume purchase agreements available.
6. Call for exact shipping charges; air shipments take priority.
7. If we must split shipment, you incur no additional shipping charges.
8. All orders shipped insured — No additional charge.
9. All products fully warranted; Some up to 5 years.
10. All items subject to availability; Prices subject to change without notice.

FOR ORDERS

1-800-446-7995

CUSTOMER SERVICE

1-404-446-7996

ORDERING INFORMATION

1-404-446-7995

TECH ASSISTANCE

1-404-446-7997

HRS: 8AM-8PM EST. SAT. 12N-5PM EST.

©1985 AT&T Information Systems.
IBM is a registered trademark of the International Business Machines Corp.

akes us Progressive.

PC SYSTEMS

AT&T PC 6300
640K, 2 drives, monochrome monitor/adaptor, DOS/BASIC \$1999
640K, 2 drives, color monitor/adaptor, DOS/BASIC \$2499
640K, 1 drive, 10MB hard disk, DOS/BASIC \$2899

AT&T PC 7300 & 8300
Call for your best price on your specific configuration

IBM PC
286K, 2 drives, monochrome/printer adaptor & monitor \$2199
286K, 2 drives, color/graphics adaptor & monitor \$2499
286K, 2 drives, 10MB internal hard disk \$2899

IBM PC XT
286K, 2 drives, monochrome/printer adaptor & monitor \$2299
286K, 2 drives, color/graphics adaptor & monitor \$2599
286K, 2 drives, 10MB internal hard disk \$2899
286K, 2 drives, 20MB internal hard disk \$2899

IBM PC COMPATIBLE
286K, 2 drives, 8 slots, 135w power supply \$999
286K, 1 drive, 10MB, 8 slots, 135w power supply \$1899

SANYO MBC 555-2
MS/DOS w/128K, 2 drives, color monitor \$999
These systems are brand new, shipped fully tested and burned in, fully warranted for ninety days AND ARE ALWAYS IN STOCK!

PRINTERS

EPSON
FX-85 (160 cps narrow carriage NLQ dot matrix) \$428
FX-185 (160 cps wide carriage NLQ dot matrix) \$628
LX-80 (100 cps narrow carriage NLQ dot matrix) \$249
JX-80 (160 cps narrow carriage color dot matrix) \$528
LQ-1500 (LQ dot matrix w/parallel interface) \$999

OKIDATA
ML 192 (160 cps narrow carriage dot matrix) \$599
ML 193 (160 cps wide carriage dot matrix) \$699
PACEMARK 2410 (350 cps wide carriage dot matrix) \$1999

CANON
LBP-6A1 (8 ppm, better than HP) \$2699
PW-1080A (160 cps dot matrix) \$529
PJ-1080A (32 cps color printer) \$649

TOSHIBA
P-351 (192 cps wide carriage LQ dot matrix) \$1299
P-1340 (120 cps narrow carriage LQ dot matrix) .. \$699

TEXAS INSTRUMENTS
TI-856 (160 cps narrow carriage LQ dot matrix) .. \$649

BROTHER
HR-16 + (17 cps narrow carriage letter quality) .. \$599
HR-25 (23 cps wide carriage letter quality) \$680
HR-35 (32 cps wide carriage letter quality) \$799

G. ITOH
Starwriter (40 cps letter quality) \$699
Printmaster (55 cps letter quality) \$1199

NEC
Pinwriter P-2 & P-3 CALL
Spinwriter 2080, 3550, 8550 CALL
Ask about our full line of tractors and cut sheet feeders!

PLOTTERS

We carry all HOUSTON INSTRUMENTS and HEWLETT-PACKARD plotters

FLOPPY DISK DRIVES

TANDON TM 100-2 (DS/DD 360K) \$149
CONTROL DATA (DS/DD 360 K) \$149
HALF-HEIGHT 360K (PC/XT/AT compatible) \$119
HALF-HEIGHT 1.2MB (PC/XT/AT compatible) \$199

MISC. HARDWARE

POLAROID Palette (Makes color slides from your PC's screen) \$1599
ORCHID PG Turbo (adds 5MHz processor, multitasking to PC) from \$649
KEYTRONIC KB 5151 & 5153 keyboards CALL
MOUSE SYSTEMS Optical PC MOUSE w/PAINT \$185
MICROSOFT Serial or Bus mouse w/Mouse Menu \$185
GIS Power Back-ups (BPS' and UPS') CALL
QUADRAM Microfazer Printer Buffer from \$195
CURTIS System accessories CALL

HARD DISK DRIVES

Internal
PC/XT 10MB... from \$429 AT 105MB \$899
AT 20MB \$699 AT 140MB \$899
PC/XT 20MB \$648 AT 190MB \$449
AT 30MB \$595 AT 280MB \$899

External
PC/XT 30MB \$999 PC/XT 10MB \$699
AT 85MB \$899 PC/XT 20MB \$948

We proudly offer what we think are the best price/performance hard disk and streaming tape sub-systems available. We will gladly test and format any hard disk we sell at a nominal charge. Our line includes: BERNOULLI TECHNOLOGY, CIPHER DATA, EMERALD SYSTEMS, DMA, IRWIN, PEACHTREE TECHNOLOGIES, QUADRAM, SYSGEN, TALLGRASS, and WANGTEK

MULTIFUNCTION BOARDS

AST RESEARCH
Six Pak (384K, serial, parallel, C/C, opt. game).... \$269
Advantage (AT RAM expansion with options) from \$599

QUADRAM
Quadboard (384K, serial, parallel, game, C/C, bracket) \$259
QuadMem (AT memory expansion up to 4MB) from \$589
QuadPort (AT serial and parallel, opt. 4 more serial) \$109

MICROLOG
Baby Blue II w/64K (64-384K, Z80, 2 ser. par. C/C) \$489
Little RedRam (256K memory expansion) \$199

CHIPS

64K (nine chips) \$10 128K (AT RAM).... CALL
8087 (coprocessor) .. \$119 256K (jr & AT boards)
80287 (coprocessor) \$199 CALL

CALL FOR QUANTITY DISCOUNTS

GRAPHICS CARDS

We carry a variety of display adapters. So, call us if you don't see the one you want or need help choosing.

HERCULES
Graphics Card (Lotus compatible monochrome graphics) \$589
Color Graphics Card (Short-slot color card w/par) \$179

PARADISE
Modular Graphics Card & Multi-Display Card from \$299

TECMAR
Graphics Master (640x400 16 colors and monographics) \$469

PERSYST
BoB Board (clear text on a color monitor) \$489

TSENG LABS
UltraPAK (132 col. mono graphics, ser. par. C/C) .. \$459

MONITORS

AMDEK
300G & 300A (Green or Amber, composite video monitors) \$189/\$159
310A (Amber TTL input, non-glare tube) \$169
COLOR 800 (13" 640x240 RGB w/text button, audio) \$428
COLOR 700 (13" 720x480 RGB w/.31mm dot) \$475
COLOR 710 (13" 720x480 RGB, non-glare/flicker) \$378

PRINCETON GRAPHICS
PGS MAX-12 (Amber TTL input, non-glare tube) .. \$189
PGS EK-12 (690x480 RGB w/.31mm dot) \$449
PGS SR-12 (690x480 non-interlaced RGB w/.31 dot) \$599

TAXAN
RGBvision 420, 420L, 425 & 440 CALL
We carry WYSE and KIMTROM terminals, call for prices.

PROTOCOL CONVERSION

We carry all AST and DCA products, call for prices.

MODEMS

HAYES
Hayes 1200 (external 300/1200, auto answer/dial) .. \$419
Hayes 1200B (internal 300/1200, w/Smartcom II) .. \$579
Hayes 2400 (New external 2400 baud modem) \$678

DCA
New Fastlink 10KB modem CALL

ANCHOR AUTOMATION
Signalman Mark XII (1200 baud at 300 baud price) \$259
We also carry modems by AST RESEARCH, BIZCOMP, PENRIL, QUADRAM, RIXON, VENTEL — please call for current pricing.

NETWORKING

We carry all the best names including 3COM, AST RESEARCH, FOX, IBM, NOVELL, and ORCHID TECHNOLOGIES. Call our Networking Applications experts to design a cost-effective device-sharing networked layout for your office!

DISKETTES

VERBATIM
Single sided/Single density: 10/884 100/8199
Double sided/Double density: 10/889 100/8849

DYSAN
Double sided/Double density: 10/889 100/8849
High density AT diskettes: 10/889 100/8849

MAXELL
High density AT diskettes: 10/889 100/8849

PMD
Double sided/Double density 10/818 100/8189

SOFTWARE

LOTUS Symphony \$449
ASHTON-TATE Framework \$599
ENABLE by Software Group CALL
SOFTWARE PUBLISHING Pfs Write, File, Graph, Report from \$79

SSI WordPerfect \$239
MULTIMATE w/spelling checker and tutorial \$279
MICROSOFT Word 4.0 \$239
LIFETREE Volkswriter Deluxe w/Textmerge \$169

LOTUS 1-2-3 \$509
ASHTON-TATE dBase III \$599
MICRORIM 5000 \$599
MICROSTUF Crosstalk XVI \$109

PERISOFT SmartTerm 100, 125, 400 CALL
RELA CALL
DOW JONES All products CALL

SORCIM/TUS Complete accounting modules from \$259
BPI ACCOUNTING Complete accounting modules CALL
OPEN SYSTEMS Accounting CALL
SYSTEMS PLUS Books! accounting system CALL

MECA/TOBIAS Managing Your Money \$189
MONOGRAM Dollars and Sense \$119
DECISION RESOURCES Signmaster/Chartmaster \$179/\$249

AUTODESK AutoCAD with or without extensions 1, 2, & 3 CALL
ZSOFT PC Paint Brush \$95
HARVARD Harvard Project Manager CALL
MICROSOFT Project CALL

WORDTECH dBase compilers \$249
BORLAND Turbo Pascal & Toolbox ea. \$39
MICROSOFT All products CALL
DIGITAL RESEARCH All products CALL

BORLAND All products from \$59
SOFTSTYLE Printworks printer utilities \$85
NORTON Utilities, Disk Explorer & Zero Disk \$69
QUAD Copywrite, Disk Explorer & Zero Disk CALL

CENTRAL POINT Copy II PC copies protected software \$85
ATT Training \$85

PROGRESSIVE MICRO DISTRIBUTORS

3039 Amwiler Road, Atlanta, Georgia 30360



Kernel

COMPUTING AT CHAOS MANOR: OLD FAVORITES AND NEW ONES <i>by Jerry Pournelle</i>	373
CHAOS MANOR MAIL <i>conducted by Jerry Pournelle</i>	399
ACCORDING TO WEBSTER: MEMORIES <i>by Bruce Webster</i>	401
BYTE U.K.: LIVING C-PERSONAL <i>by Dick Pountain</i>	419
MATHEMATICAL RECREATIONS: REPEATING DECIMALS <i>by Robert T. Kurosaka</i>	433
BYTE JAPAN: COMPARING FUJITSUS <i>by William M. Raibe</i>	445
CIRCUIT CELLAR FEEDBACK <i>conducted by Steve Ciarcia</i>	416

This month's Computing at Chaos Manor finds Jerry falling behind on his computer research. He does provide some legitimate reasons for this happening but admits that the real reason is that he got hooked on BYTE's new computer-conferencing system called BIX. This leads Jerry to a discussion of both ARPANET and BIX. There are also sections on the computers he uses most often and on this year's NCC in Chicago.

Bruce Webster wrote his column on a Macintosh for the first time. The reason he did this is because his product of the month is the Monster Mac upgrade from Levco. It is Bruce's opinion that this 2-megabyte upgrade goes a long way toward turning the Mac into a high-powered, high-speed machine. He also looks at Apple's plans for the Mac, discusses proper balance in computer systems, and gives his view of NCC.

In BYTE U.K., Dick reviews an early beta-release version of Living C-Personal this month. It's a new software product that features an editor, interpreter, animator, and tracer/debugger, all rolled into one menu-driven windowing environment. Dick found the maintenance of existing programs the most interesting application and claims that, at \$99, Living C-Personal is one of the software bargains of our time.

In this month's Mathematical Recreations, Bob Kurosaka explores the properties of repeating decimals, those nonterminating decimals with a cycle that repeats endlessly. He also includes a program to calculate the cycle and discusses how to handle repeating decimals.

In BYTE Japan, Bill describes his latest computer purchase: the Fujitsu FM-16 β . He bought the HD model, which has a 5¼-inch 10-megabyte hard-disk drive that replaces the topmost floppy-disk drive. The hard-disk interface occupies one of the four expansion slots but also leaves open the possibility of connecting an additional hard-disk drive.

THE PROGRAMMER'S SHOP™

helps save time, money and cut frustrations. Compare, evaluate, and find products.

SERVICES

- Programmer's Referral List
- Dealer's Inquire
- Compare Products
- Newsletter
- Help find a Publisher
- Rush Order
- Evaluation Literature free
- Over 700 products
- BULLETIN BOARD - 7 PM to 7 AM 617-826-4066

Free Literature - Compare Products

Evaluate products Compare competitors Learn about new alternatives. One free call brings information on just about any programming need. Ask for any "Packet" or Addon Packet ADA Modula AI BASIC C COBOL Editors FORTH FORTRAN PASCAL UNIX PC or Debuggers Linkers etc

RECENT DISCOVERIES

Fortran >> C - FORTRIX creates maintainable translations. MSDOS \$995

ARTIFICIAL INTELLIGENCE

ARITY/PROLOG-full, debug, to ASM&C, 16 Meg use, windows, strings. With compiler \$1950. MSDOS \$495

EXSYS - Expert System building tool. Full RAM, Probability. Why, serious, files PCDOS \$365

GC LISP - "COMMON LISP", Help. tutorial, co-routines, compiled functions, thorough. PCDOS Call

Insight 2 by Level 5 - backward, forward, partitions, dB2 PCDOS \$449

LISP-86- "COMMON" subset tutorial, editor, PP, trace. Best to learn. All MSDOS Only \$75

M Prolog - full, rich, separate work spaces. MSDOS \$725

PROLOG-86 - Learn fast. Standard, tutorials, samples of Natural Language. Exp. Sys. MSDOS Call

TLC LISP - "LISP-machine"-like. all RAM, classes, turtle graph., 8087, Compiler. CPM-86. MSDOS \$225

WALTZ LISP - "FRANZ LISP" - like, 611 digits, debugger, large programs. CPM80 MSDOS \$149

MicroProlog - improved MSDOS \$229

BASIC

CADSAM FILE SYSTEM - full ISAM in MBASIC source. MSDOS \$150

Quick BASIC by Microsoft - Compiles full syntax of IBM, 640K, BASICA. PCDOS \$ 85

CB-86 - DRI CPM86. MSDOS 419

Data Manager - full source MSDOS 325

InfoREPORTER - multiple PCDOS 115

Prof. Basic - Interactive, debug PCDOS 85

TRUE BASIC - ANSI PCDOS 119

Ask about ISAM, other addons for BASIC

EDITORS FOR PROGRAMMING

BRIEF Programmer's Editor - undo, windows, reconfig. PCDOS Call

EMACS by UniPress - powerful, multi-file, windows, DOS, MLISP language built in. Source: \$949 MSDOS \$299

Firs Time by Spruce - Improve productivity. Syntax directed for Turbo (\$70), Pascal (\$235), or C (\$285).

C Screen with source 86 80 75

Epsilon - like EMACS PCDOS 179

PMATE - powerful 8086 159

VEDIT - well liked PCDOS 119

XTC - multitasking PCDOS 95

DEBUGGERS

Advanced Trace 86 Symbolic PCDOS 149

Atron Debugger for Lattice. MSFTN PCDOS 399

Penscope Debugger - PCDOS 269

Pfix Plus Debugger MSDOS 299

TRACE86 debugger ASM MSDOS 115

C LANGUAGE

C-terp Interpreter by Gimpel, full K&R, .OBJ and ASM interface. 8087 MSDOS \$249

INSTANT C - Interactive development - Edit. Source Debug, run. Edit to Run - 3 Secs. MSDOS \$399

"INTRODUCING C" - Interactive C to learn fast. 500 page tutorial. examples, graphics PCDOS Call

Q/C 88 by CodeWorks with full compiler source, produces decent code, has cross & native MSDOS \$295

Wizard C - Lattice C compatible, full sys. III syntax, lint included, fast. lib. source. MSDOS \$399

MSDOS: C86-8087, reliable call

Lattice C - the standard call

Microsoft C 3.0 - new 259

RUN/C - Interpreter 119

Williams - debugger, fast call

CPM80: BDS C - solid value 125

MACINTOSH: Hippo Level 1 109

Consular's MAC C with toolkit 299

MegaMax 239

Compare, evaluate consider other Cs

CADDONS

COMMUNICATIONS by Greenleaf (\$149) or Software horizons (\$139) includes Modem7, interrupts, etc. Source. Ask for Greenleaf demo.

C SHARP Realtime Toolkit-well supported, thorough, portable, objects, state sys. Source MANY \$600

CIndex + -full B+Tree, vari. length field. Source, no royal. MSDOS \$359

dbVista FILE SYSTEM - full indexing, plus optional record types, pointers. Source, no royalties. MSDOS \$450

Faster C Lattice & C86 users eliminate Link step. Normal 27 seconds. Faster C in 13 sec. MSDOS \$ 95

PC Lint - full C program checking and big, small model. All C's. MSDOS \$85

CHelper: DIFF, xref, more 86 80 135

CTree - source, no royalties ALL 345

CURSES by Lattice PCDOS 110

C Utilities by Essential MSDOS 149

dBc ISAM by Lattice 8086 219

Greenleaf-200+, fast. MSDOS 149

PHACT-up under UNIX, addons MSDOS 225

ProScreen - windows PCDOS 275

Windows for C - fast, reliable MSDOS 175

FORTRAN LANGUAGE

MacFORTRAN - full '77, '66 option. toolbox, debugger, 128K or 512K. ASM-out option MAC \$369

RM/Fortran - Full '77. BIG ARRAYS. 8087, optimize, back trace, debug. MSDOS \$429

Ask about Microsoft, Supersoft, others.

MS FORTRAN-86 - Improved. MSDOS 239

DR Fortran-86 - full '77 8086 249

PolyFORTRAN-XREF, Xtract PCDOS 149

LANGUAGE LIBRARIES

MultiHALO Graphics-Multiple video boards, printers, rich. Animation, engineering business.

ANY MS language, Lattice, C86 \$195, for Turbo \$95.

Screen Sculptor - slick, thorough, fast, BASIC, PASCAL. PCDOS \$109

GRAPHMATIC - 3D, FTN, PAS PCDOS 125

File MGMT: BTneve - all lang. MSDOS 199

Micro: SubMATH - FORTRAN full 86.80 250

MetaWINDOW - icons, cup PCDOS 119

PANEL - many lang., terminals MSDOS 239

OTHER LANGUAGES

Professional Pascal - for performance; extensions like "packages"; "Iterators"; 5 memory models; 64 bit 8087; strings. Space vs. speed optimization options. MSDOS \$895

SNOBOL4+ - great for strings, patterns. MSDOS \$ 85

MacASM - full, fast, tools MAC 99

Assembler & Tools - DRI 8086 149

PC FORTH - well liked MSDOS 89

SUPPORT PRODUCTS

PLINK 86 - a program-independent overlay linker to 32 levels for all MS languages, C86 and Lattice. \$299

Multitask - Multitasking PCDOS 265

Pfinish - Profile by routine MSDOS 299

Polylibrarian - thorough MSDOS 85

PolyMAKE PCDOS 85

ZAP Communications - VT100, TEK 4010 emulation, full xfer. PCDOS 85

COBOL

Microsoft Version II - upgraded. Full Lev. II, native, screens. MSDOS \$500

Flexgen CPM, MSDOS 475

Macintosh COBOL - Full. MAC 459

MicroFocus Prof.-full PCDOS call

Ryan McFarland-portable MSDOS 695

Call for a catalog, literature, and solid value

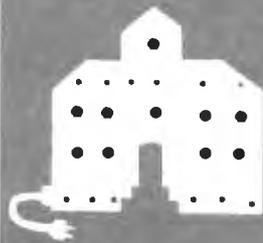
800-421-8006

THE PROGRAMMER'S SHOP™

128-B Rockland Street, Hanover, MA 02339

Mass: 800-442-8070 or 617-826-7531 1085

Note: All prices subject to change without notice. Mention this ad. Some prices are specials. Ask about COD and PCs. All format's available. UNIX is a trademark of Bell Labs.



C·O·M·P·U·T·I·N·G A·T· C·H·A·O·S M·A·N·O·R

Old Favorites and New Ones

ARPANET

BIX

Zeke

SideKick

SuperKey

Kaypro 286i

NCC

Fastback

Janus Ada

Seastalker

BY JERRY POURNELLE

I really meant to be organized this month. Alas, it didn't work. First there was a book-signing tour with Larry Niven to promote our novel *Footfall*. Seven cities in five days. These tours are a lot of fun, but they can be grueling: in the trade we call them the author's death march. It was great, though, especially in Silicon Valley, where not only were there long lines of people waiting to have books signed, but they had *my* books rather than Larry's. . .

I hadn't long returned from that when I headed to Chicago for the National Computer Conference (NCC). I just got back from that, and I leave for Europe in five days. I've got the best travel agent in the business, and Mrs. Pournelle is both temperamentally well-organized and highly skilled at taking care of details; even so, I have to do some things myself.

I know the cheapest commodity in the world is a good excuse, but I have *very* good reasons for falling behind. However, we must be truthful. The *real* reason I got so little research done this month is that I got hooked on BIX.

THE OLD ARPANET

To explain the fascination of BIX, I'll have to give a bit of history.

Computer-assisted communications have some similarities to telephone networks and more similarities to magazine and pamphlet publishing; but in truth they're a radical break with the past, something new and different and exciting. Except for science-fiction writers, few even suspect their implications. (Vernor Vinge's *True Names* and William Gibson's *Neuromancer* are two SF works that try to look at the electronic future. They describe a future more bizarre than I foresee, but they're well worth reading.)

I was fortunate enough to get on a large computer network almost as soon as I had a microcomputer. The U.S. Department of Defense Advanced Research Projects Agency (originally called ARPA, now called

DARPA for reasons I never heard) maintains a fairly extensive communications system to assist DOD-sponsored research. DARPA supports computer facilities at several hundred universities and companies. There are ways to call local numbers and be connected, through the network, to all parts of it, including some very distant places.

The ARPANET was constructed to aid official research projects. Because it's paid for by the taxpayers, it is supposed to be restricted to "official business." Finding the limits of "official business" isn't simple. Example: a visiting scholar is coming to work on a DARPA project. A network message requesting housing is certainly "official." Suppose, though, that the scholar is coming to work on a nonofficial project, but the local people responsible for her *do* work on DARPA projects and would have to neglect DARPA business in order to find quarters. Or—but I expect the point is made. No matter what the message, so long as the people involved have some relation to DARPA-sponsored research, you can make a good case that it's in the government's interest to make their lives simpler.

What, though, of people who have no relation to DARPA projects at all?

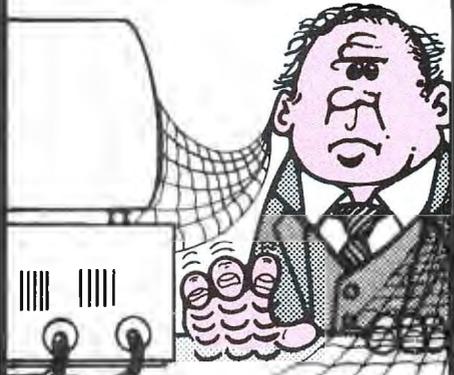
The ARPANET was designed to handle a certain peak load of traffic, and that capacity must be paid for, even when it is not all used. In fact, it costs the government precisely nothing to allow semiofficial business to take up the slack, so long as the outsiders don't get in the way. A few institutions, particularly universities, quietly arranged for demonstration, or tourist, accounts for people who might have something to contribute.

Some outfits tightly controlled these tourist accounts. Other places were quite generous with them. After a while, the ARPANET attracted an amazingly diverse group. Many, but not all, were hackers. Most were young, but again not all. What they had in common was an interest in explor-

(continued)

Jerry Pournelle holds a doctorate in psychology and is a science-fiction writer who also earns a comfortable living writing about computers present and future.

**WHY WAIT FOR
ANSWERS FROM YOUR
IBM PC/AT/XT
NOW THERE'S
MEGA-MATH™**



Engineers, scientists and statisticians are discovering the time saving capability of New "Mega Math" II. A library of over 45 assembly language subroutines for fast numeric calculations, up to 11 times faster than your present compiler.

The pretested routines use the 8087 or 80287 coprocessor for optimum performance. The routines reduce development time, code size and testing time.

"Mega Math" II Includes:

- MATRIX OPERATIONS**
- VECTOR OPERATIONS**
- VECTOR SCALAR OPERATIONS**
- STATISTICAL OPERATIONS**
- FAST FOURIER TRANSFORM**
- CONVOLUTION**
- SOLUTION OF LINEAR EQUATIONS**

The library is callable from Microsoft Fortran, Basic, "C" and Pascal compilers. Also IBM Professional Fortran and Macro Assembler.

Get "Mega Math" II Performance for only

\$299.00 (U.S.)

Also available is the "Mega Math" A.T. "Booster". A single PC board, designed to reduce execution time in numeric processing applications.

If your IBM AT is equipped with the 80287 coprocessor, the "Booster" will enhance its performance by up to 50%.

PRICE **\$249.00 (U.S.)**

For increased performance of Mega Math Routines, inquire about Micray's high performance floating point processor for the IBM AT or compatibles.

**MICRAY
ELECTRONICS LTD.**

(403) 250-1437

Bay 1, 4001A - 19 Street N.E.

Calgary, Alberta, Canada T2E 6X8



DEALER INQUIRIES WELCOME

TRADEMARKS:

(IBM, PC/XT/AT)

INTERNATIONAL BUSINESS MACHINES
(MICROSOFT) MICROSOFT CORPORATION
(MEGA MATH) MICRAY

CHAOS MANOR

*Alas, the ARPANET
that I knew has
vanished. I suppose
it was inevitable.*

ing what could be done with a resource like this.

It was the first major experiment in computer-mediated human communication, and it was fascinating. In no time at all, the ARPANET developed into a free-swinging intellectual community in which nearly anything could be said and often was. Arguments developed. Discussions ranged from the profound to the utterly trivial. Then, slowly, a consensus of what was and was not appropriate behavior evolved. Even though there was a high turnover in network participants—most were students—the network as a group learned much about how to use this resource. Standards developed. The standards were group-enforced, not imposed from above.

At periodic intervals some bureaucrat would ask, "What good does this do the taxpayers?" It was easy to show that the subject matter of the ARPANET discussions was far less important than the interest. The government greatly benefited from even the maddest discussions because most ARPANET addicts, official or tourist, were computer enthusiasts maniacally bent on improving the system. They thus wrote, at no cost to the government, a great deal of the software that is now in standard use. With minor exceptions, the network was left in peace.

Participation in the old ARPANET was one of the most exciting experiences of my life. Quite reasonably, unofficial users couldn't log on until late at night. Once on, there was an endless variety of stuff. Speculations on the future of computing. News. Arguments and conversations. And always, new information on things you could do with computers: big computers,

small computers, minis, micros, all of them. It was all very wonderful.

Some of the excitement abated when capabilities that began on big minis were transferred to microcomputers. Soon we all had spelling checkers, intelligent text editors, and the like. The network remained interesting. Some achievements still need big machines, at least for their development. One that really fascinated me was MACSYMA, the symbolic-algebra program. If I'd had that available when I was an undergraduate, I'd probably have become a theoretical physicist. I can't wait to get a micro version.

I'd never have known about MACSYMA if it hadn't been for the ARPANET. There were other such gems, and the conversations were enormously stimulating. In those days, it was hard waiting until it got late enough to log on. Alas, the network that I knew has vanished. I suppose it was inevitable.

RASCALS IN PARADISE

The ARPANET was largely designed to be easy to use. Easy to use also means easy for unauthorized users to get onto. About 50,000 people had some connection with the system, and few saw much reason for tight security. It was no wonder that unauthorized people "broke into" the ARPANET, and not even surprising that many of them were kids. Alas, some journalists would rather write a sensational story than check the facts. Periodically, you'd see some silly story about how a bunch of teenage hackers had "broken into the defense network." Worse, since the ARPANET has nodes at Los Alamos and Lawrence Livermore Labs, both of which have top-secret research projects, and the network address of those facilities is easy to come by, some journalists would color their stories by saying that the kids had gotten into atomic-research facilities.

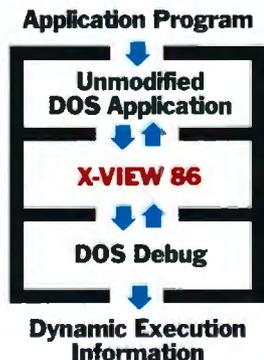
All true, but irrelevant: all the kids ever got to see was unclassified research files, and not all that many of them. Nuclear research was done

(continued)

X-RAY VISION

Get it with X-VIEW 86™

X-VIEW 86™ analyzes, profiles, and debugs DOS application software — for improved performance on the IBM PC and its compatibles.



X-VIEW 86 lets you observe the internal operations of DOS application software.

Helps you analyze, debug, test, port, or convert DOS application software — and get faster, more reliable results.

Real solutions to technical challenges.

- Looking for code hot spots? X-VIEW 86 helps you find them fast.
- Irritated by bugs that DEBUG can't reach? X-VIEW 86 captures them.
- Sweating over hardware compatibility issues? X-VIEW 86 pinpoints the trouble spots.
- Struggling with a conversion that just won't work? X-VIEW 86 breaks the deadlock.

What X-VIEW 86 does.

X-VIEW 86 saves you hours of time-consuming, tedious work. It automatically collects data on application programs:

- memory map references
- I/O space references
- INT call usage
- instruction set usage
- segment usage data

X-VIEW 86 can interrupt the application program

- on any processor I/O access
- on any processor INT instruction
- on a specified execution path address
- on a specified memory location reference

X-VIEW 86 can also start the application program execution at a specified address. And it displays the results of the analysis on screen.

Hardware and software requirements.

X-VIEW 86 runs on any member of the IBM PC family — or any operationally-compatible machine that has at least 64 Kbytes of memory. And it's not copy-protected. You use it with PC DOS DEBUG 2.0 or 2.1.

Exciting — not expensive.

X-VIEW 86 is priced at an affordable \$59.95.

To order, call 1-800-221-VIEW.

In Texas, call 1-800-233-VIEW. Then get ready for a whole new outlook on your work.

Inquiry 162



To order X-VIEW 86™ by credit card, call toll free 1-800-221-VIEW. In Texas call 1-800-233-VIEW or send the coupon today.

Customer Service
McGraw-Hill Inc.
8111 LBJ Freeway
Dallas, Texas 75251

X-VIEW 86™ is \$59.95. All orders are subject to acceptance by McGraw-Hill, Inc. Prices are subject to change without notice.

- Check enclosed (Make check payable to McGraw-Hill Inc. Orders paid by check are subject to delay.)
- A.E. M.C. VISA D.C.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone (____) _____

Qty _____	\$59.95	Amt _____
Shipping (\$2.00 per copy) Texas sales tax (\$3.67 per copy)		_____
Total		_____

Signature _____

Name on card _____

Credit card no. _____ Expiration date _____

"BRIEF, The Programmer's Editor, is simply the best text editor you can buy."

— John Dvorak, InfoWorld, 7/8/85

Be more productive and avoid frustration with BRIEF.

- A high-level, readable **Macro Programming Language** - allows customization for programming languages . . . Complete, unlimited variables, etc.
- Edit **multiple files of unlimited size** (2 Meg is OK)
- Multiple **Windows** on screen with different or same file, fragments, etc.
- A bona-fide **UNDO** stack (up to 300) of **all operations**: deletions, reading files, search, translate, more
- Full "**regular expression search**" - wild cards, complex patterns
- Reconfigurable keyboard
- Adjustable line length - up to 512.
- **Keystroke macros** - for common typing sequences
- Suspend BRIEF to execute, **exit to DOS** - run another program (like a compiler, dir, XREF, DIFF, or DEBUG) then resume BRIEF session
- **Compiler-specific** support like auto indent, syntax check, compile within BRIEF

FREE WITH ORDER: Best of BRIEF Macros™ — includes Fortran, C, Calculator. Call before 11/30/85.

Only \$195

Full Refund if not satisfied in 30 days.
CALL 800-821-2492.

335-B Washington St., Norwell, MA 02061
617-659-1571

**Solution
Systems**

PROLOG-86™

Become Familiar in One Evening

Thorough tutorials are designed to help learn the PROLOG language quickly. The interactive PROLOG-86 Interpreter gives immediate feedback. In a few hours you will begin to feel comfortable with it. In a few days you are likely to know enough to modify some of the more sophisticated sample programs.

Sample Programs are Included like:

- an **EXPERT SYSTEM**
- a **NATURAL LANGUAGE INTERFACE**
(it generates a dBASEII "DISPLAY" command)
- a **GAME** (it takes less than 1 page of PROLOG-86)

PROTOTYPE Ideas and Applications QUICKLY

Series development of experimental systems and prototypes is practical with the full syntax of PROLOG-86. 1 or 2 pages of PROLOG is often like 10 pages in "C".

Programming Experience is not required but a logical mind is. PROLOG-86 supports the de facto STANDARD.

RECENT IMPROVEMENTS: Access to MSDOS, on-line help, load Editor.

AVAILABILITY: All MSDOS, PCDOS systems.

FREE with order: "Best of Prolog-86 Programs"—contest entries include: a primate expert system, an automobile expert system, a blocks world natural language system, etc. Call before November 30.

Only

\$125.

Full refund if not satisfied during first 30 days.

**Solution
Systems**

335-B Washington St.,
Norwell, Mass. 02061
617-659-1571
800-821-2492

CHAOS MANOR

on entirely different machines that weren't even connected to the network; it would have been impossible to get at the information on those without physically breaking into the lab. That didn't make for much of a story, though, and journalists kept hammering at the matter. Eventually, DARPA was pressured into doing something about it; and as all bureaucracies do, they overreacted. The old ARPANET was chopped into chunks, passwords were required for nearly all uses of the system, and semiofficial accounts were pruned out.

Some of the pruning was done by quite young graduate students acting, as far as I can tell, on whim. In any event, it became much harder to get an ARPANET account. The old community magic was broken. Network traffic got more official and less interesting. By the time my account was (rather rudely and abruptly) closed, I'd almost stopped using it.

BIX

Coincidentally, they began testing the BYTE Information Exchange (BIX) about the time my ARPANET account vanished. I've long paid for The Source and CompuServe accounts, but in practice I seldom logged onto them, mostly because the ARPANET account was more useful. About a year ago, BYTE tried out a conferencing system—not BIX—and the software was, to be kind, not well-designed; in fact, it was downright user-punishing. When BYTE asked me to try BIX, I was dubious.

"All new," said Phil Lemmons, our editor in chief. "Greatly improved. Try BIX, you may like it."

When my ARPANET account vanished, it seemed reasonable to try BIX, so I did—and found the excitement is back again, but even more so. Next thing I knew, I was a BIX junkie—and I wasn't alone: BYTE and *Popular Computing* editors and staff; computer programmers from a variety of companies; writers, teachers, historians, journalists. Men and women from a wide cross section of occupations,

(continued)

THE X-10 POWERHOUSE DOES EVERYTHING BUT PUT OUT THE CAT.



Model CP290

THE X-10 POWERHOUSE INTERFACES WITH YOUR COMPUTER TO CONTROL YOUR HOME...FOR SECURITY, COMFORT AND ENERGY SAVINGS.

This remarkable Interface lets you run your home through your Apple IIe or IIc, Commodore 64 or 128 and a mouse, keyboard or joystick.

When you're away, it makes your home look and sound lived in. When you're home, it can turn off the TV at night and wake you up to stereo and fresh brewed coffee in the morning. It can even turn on your air conditioner and control your heating.

SPECIAL COLOR GRAPHICS MAKE PROGRAMMING A SNAP.

You simply pick a room from the display screen. Use your mouse, joystick, or keyboard to position graphics of lights or appliances. Then follow on-screen instructions to program any light or appliance to go on or off whenever you choose. You can even control thermostats, light intensity and more.



THE WAY IT WORKS. The X-10 Powerhouse Interface is cable-connected to an Apple RS-232 port or a Commodore "User" port and plugged into a standard 110V outlet. After it is programmed, the Interface sends digitally encoded signals through your home wiring to special X-10 Modules. To control a lamp or appliance, you simply plug the electrical device into a Module



and then plug the Module into an outlet. The Interface can control up to 256 Modules throughout your home and won't interfere with normal use of lights and appliances.

There are plug-in Appliance Modules, Lamp Modules, Wall Switch Replacement Modules and Special 220V Modules for heavy duty appliances such as water heaters and room air conditioners. Plus Thermostat Controllers for central heating and air conditioning, Telephone Responders to control your home from any phone, and much more.

IT WON'T TIE UP YOUR COMPUTER. Use your computer only for programming. When you're finished, disconnect the Interface from your computer and keep it plugged into any convenient power outlet in your home. It will operate as a stand-alone controller with battery back-up and will run your home automatically.

SURPRISINGLY INEXPENSIVE. A Powerhouse System including the Interface, software and connecting cables costs less than \$150. X-10 Modules are less than \$20 each.

FOR THE X-10 POWERHOUSE DEALER NEAREST YOU, CALL TOLL-FREE: 1-800 526-0027

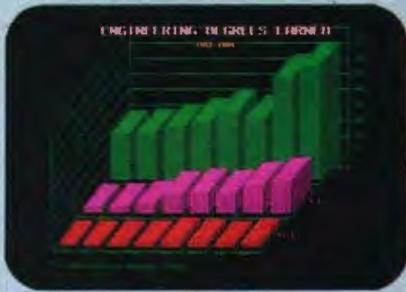
NEW JERSEY RESIDENTS CALL (201) 784-9700

X-10® POWERHOUSE
NUMBER ONE IN HOME CONTROL

Apple, Apple IIe and IIc are registered trademarks of Apple Computer, Inc. Commodore 64 and Commodore 128 are registered trademarks of Commodore Int'l., Ltd.

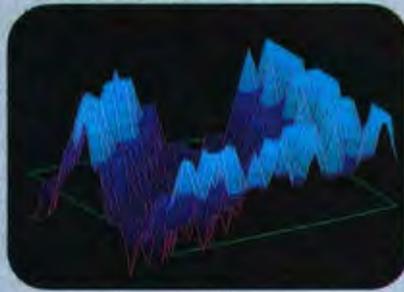
CHECK-OUT ENERGRAPHICS™

YOUR TOTAL GRAPHICS SOFTWARE

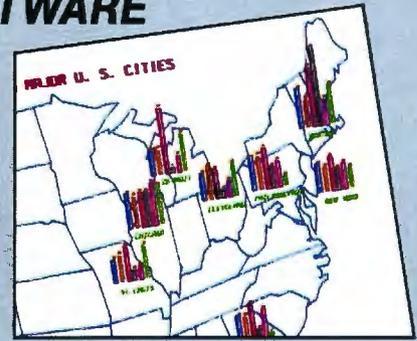


Presentation Business Graphics

EnerGraphics delivers pie charts, flowcharts, bar charts, line graphs and more with easy interface to Lotus 1-2-3, MultiPlan and other spreadsheet. You'll learn it quickly because we're menu-driven.

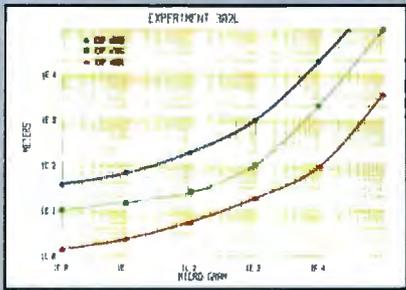


Drawing Capability With EnerGraphics, simple keystroke commands enable you to create text, flow, gantt, pert and organization charts with the capability to enlarge, reduce, rotate, draw, modify, duplicate and overlay.

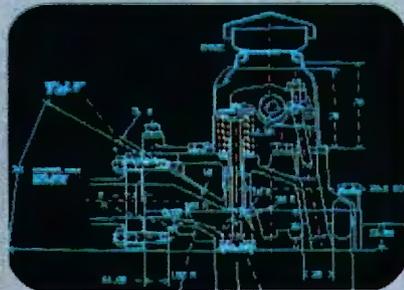


3-D Object & Surface Drawings

EnerGraphics gives you entry-level 3-D CAD features such as zoom, rotate and hidden line removal.



Statistics EnerGraphics enables you to analyze data using linear and log scales to do linear and polynomial regression. Statistical information can be represented in scatter graphs.



Mainframe Link Our new EnerConnect program allows you to combine PC-based graphics with mainframe graphics such as GDDM, ISSCO'S Tel-A-Graf®, Disspla® and IGES data files.



PC Compatibility EnerGraphics can give you an unlimited number of graphics applications on Wang, Ti, IBM PC/XT/AT, 3270/PC and compatibles.



Slide Show Any of our attractive graphics can be converted into color or b/w slides, or overhead or on-screen presentations using the Polaroid Palette.

FORTUNE 500

Corporate Use You'll find EnerGraphics is the graphics software choice of over 100 leading corporations with more being added all of the time.



Price At a retail price of just \$350 (\$450 with plotter) EnerGraphics actually costs less than many packages that offer only a few of these features.

EnerGraphics. Brought to you by the specialists in graphics application software.

Find out why users rate us at the top among stand alone business graphic packages. Just check with your local EnerGraphics dealer today.

ENERTRONICS

Enertronics Research, Inc. • 150 N. Meramec

SEEING IS BELIEVING

St. Louis, MO 63105 • (314) 725-5566 • Toll Free 800-325-0174

CHAOS MANOR

many but certainly not all of them computer-related, have become compulsive BIXies and can be found logged on at any hour of the day or night.

It's hard to say precisely why BIX is so fascinating. Certainly there are conferences on interesting topics, one of which is the theory of computer conferencing; but that can't be all of it. One of the most popular conferences is about cats; it's so popular that when the BIX managers tried to close it down in the interest of economy, Cats went underground, after which it was revived by popular demand. If you'd told me a month ago that I'd spend time reading people's tales about their cats, I'd have said you were crazy.

Partly it's the people. I've always found BYTE readers an interesting lot, and nearly all the BIXies are avid BYTE fans. Even so, while I enjoy meeting readers at conventions, it's not the same.

The medium changes everything. Electronically mediated conferences allow a lot of people to take part in a conference. Indeed, "a conference" is a misnomer because most conferences end up with half a dozen related but separable trains of thought all going at once. The result can be a heady mixture indeed—and unlike most face-to-face conversations, the results are automatically recorded and transcribed, available for later reference or publication.

The software helps. BIX has the best conferencing software I've ever seen. That isn't just my opinion. Friends, old and new, who have been addicts of other conferencing systems for a long time now greatly prefer BIX. The software isn't finished, either. It was designed by Alastair Mayer, who grew up in science-fiction "fandom"—his father was a member of the old Science Fiction League and also published some of Arthur C. Clarke's first stories—and Al logs onto the system. (In fact, he's there so often I suspect he has clones.) For the past couple of months, the BIX users have been interactively improving the software.

The instructions help, too. Donna

Osgood, of BYTE's West Coast office, has done a marvelous job of designing a learning conference and putting the manuals on line, where they're being critiqued and refined and revised by a whole bunch of BIX junkies, including me.

So. The real reason I'm behind in my computer research is BIX addiction. I'd have thought the spell would wear off, but so far it hasn't. I'm about to take off for Europe, and one of my main concerns is being sure I can get a periodic BIX fix while I'm there.

Of course, things will get complicated when tens of thousands of BYTE readers climb aboard. Computer-conferencing literature calls the phenomenon "information overload." We're working on ways to handle it. BIX will almost certainly absorb much of the time I now put into reading mail. Apologies, but I see no way out. However, at present we can publish only a tiny fraction of the truly interesting letters I get; BIX will let lots of readers interact not only with me, but with each other. I don't know where that leads, but I like the idea a lot.

Electronic conferencing is important: in a real sense, it's an electronic implementation of the first amendment. Also, I'm having a ball.

TAKING STOCK

It happens a lot at shows. A reader comes to the BYTE booth, and we get into a discussion.

"You've used a lot of machines.

What's the best?"

"That depends."

"On what?"

"Mostly on what you want it for, but there's also a lot of just plain preference and taste involved."

"Yeah, sure, but look, I'm trying to write a book, and I know I need a computer, so I'm trying to figure out what I should get."

Last time it happened, though, I got a new question: "If you had to get rid of all your computers but one, which one would you keep?" I thought about that one. "Okay," I said. "I'll answer that, but fair warning, the

(continued)

Available, Reliable, Affordable Solutions for Computerization

Little Board™/186 . . . \$499 with (128K)

Single Board 16-Bit Computer with SCSI/PLUS™ Bus

- Data and file compatible with IBM PC
- Three times the COMPUTING POWER of a PC
- Boots PC-DOS 2.10, 3.00
- Runs most MS-DOS generic software
- Mounts directly to a 5-1/4 inch disk drive
- Includes: 8 MHz 80186 CPU, 128K or 512K RAM, 16K-128K EPROM, 2 RS232C Serial Ports, Centronics Printer Port, Floppy Disk Controller, SCSI/PLUS™ Multi-Master bus for: hard disk / networking / I/O expansion
- Available with 512K RAM

NEW
for
PC-DOS



NEW
for
CP/M



Little Board™/PLUS . . . \$349

Single Board 64K CP/M Computer with SCSI/PLUS™ Bus

- Same as Little Board/186 except:
- 4 MHz Z80A (8-bit) CPU
 - 64K RAM, 4K to 16K EPROM
 - CP/M 2.2 included

Little Board™ (original) now **\$289**

same as Little Board/PLUS except no SCSI, 4K EPROM

Bookshelf™ Series

Cost Effective, Compact, Versatile computer systems

Choice of Little Board CPUs, 1 or 2 floppy drives (48 or 96 tpi); 10MB internal hard disk option. 6 1/2" high, 7 1/4" wide, 10 1/2" deep, 12 1/2 lbs.



DISTRIBUTORS

Argentina-Factorial, S.A.	1-41-0018
Australia-ASP Microcomputers	613-500-0628
Belgium-Centre Electronique Lempereur	041-23-45-41
Canada-Dynacomp	(604) 872-7737
Denmark-Danbit	03-66-20-20
England-Quant Systems	01-253-8423
Finland-Symmetric OY	358-0-585-322
France-EGAL+	1-502-1800
Israel-Alpha Terminals	03-491695
Spain-Xenios Informatica	3-593-0822
Sweden-AB AKTA	08-54-20-20
USA:	CALL AMPRO

IBM is a registered trademark of Intl. Bus. Mach.
MS-DOS is a registered trademark of Microsoft.
Z80A is a registered trademark of Zilog, Inc.
CP/M is a registered trademark of Digital Research.

AMPRO

COMPUTERS INCORPORATED

67 East Evelyn Ave. • Mountain View, CA 94041
(415) 962-0930 • TELEX 4940302

answer isn't going to be as useful as you think."

Since then I've gotten half a dozen letters asking almost the same question. I don't know if it's coincidence or a conspiracy. Anyway, here goes, but the warning still applies.

I have, at last count, 29 working computers, including the most state-

of-the-art stuff available; yet I'm writing this on Zeke, a CompuPro S-100-bus Z80 CP/M 2.2 machine with 8-inch disk drives. That's archaic, and the rest of the system is more archaic: the video display comes from an old Processor Tech VDM memory-mapped video board, and the keyboard is an ancient Archive one. The

display goes onto an 8-year-old Hitachi 15-inch white-on-black monitor.

Zeke is not only old, he's enormous, much larger than most of the more modern—and far more powerful—machines that I have. My new offices are wonderful, but even here space around my desk is in short supply. I'd miss Zeke a lot, but I'm tempted to switch just to make a bit more room.

I don't, though, because I haven't found anything remotely as good as Zeke for creative writing. Other machines are better at nearly every other task; but if I had to get rid of all but one computer, I think I'd keep Zeke in preference to all the others. After all, CP/M 2.2 and a Z80 can handle just about everything I do on computers, and, indeed, for a couple of years Zeke was the only computer I had running. Zeke is more than good enough.

There are two reasons Zeke is the right machine for creative writers. The first is WRITE, the text editor designed by Tony Pietsch with assistance from Larry Niven and me. I've probably spent too much time on WRITE already, so I'll summarize by saying that it's the most transparent text editor I know of. Once you know WRITE well, it's a bit like telepathy: thoughts go on screen painlessly and automatically.

WRITE was crafted in 8080 assembly language and makes use of a number of CP/M's features. In other words, if you want WRITE, you have to stick with CP/M. The editor isn't available for MS-DOS. However, it runs fine on 8/16 dual-processor machines, such as the Zenith Z-100, the CompuPro 286 with Z80 slave (SPUZ) board, or an S-100 system with the Macrotech 286/Z80 board. Moreover, 8/16 systems give you a larger workspace and have much faster disk operations. I have a CompuPro 286/SPUZ, a Macrotech 286/Z80, and a Zenith Z-100, so the question inevitably arises: Why keep Zeke?

Well, it's this way. Larry Niven has a machine identical to mine. If I change primary machines, he pretty

(continued)

GIVE YOUR PC THE GIFT OF SIGHT.



Once installed, our electronic digitizing scanner allows you to capture images in high resolution. These can then be manipulated, stored, retrieved, and even printed.

But what's truly amazing is the range of applications for the Datacopy 700. Such as generating complex documents including text, drawings and pictures.

Until now, your PC was telling only half the story. Because no matter how you look at it, words and numbers are simply that: words and numbers.

But the Datacopy 700 changes all that.

TURN YOUR WORD PROCESSOR INTO AN IMAGE PROCESSOR.

This remarkable peripheral enables you to combine photos, diagrams, even 3-D objects with word processing, data base, CAD and communications applications using standard software.

All you need to get the picture is an IBM XT, AT, or compatible. Our friendly, yet powerful, Word Image Processing System™ software is included in your purchase.



Technical manuals. Catalogs. Personnel or document files. Or what ever you decide.

The result is a visionary achievement: the power to give words and numbers far more meaning. To publish information, not just data. And to extend the possibilities of your PC. All for a surprisingly low cost.

For more details, call toll-free 1-800-821-2898 or in California 415-965-7900.

Or write to Datacopy Corporation, 1215

Terra Bella Avenue,
Mountain View,
CA 94043. Telex:
701994 DATA-
COPY UD.

DATACOPY
The Eye of the Computer

For fastest response, call 1-800-556-1234 or in California 1-800-441-2345. Ask for extension 96.

TOLL FREE 1-800-848-FAST



TOLL FREE 1-800-848-FAST

NOW GET THE TOP NAME DISKETTES AT THE LOWEST PRICES EVER.

	5.25" SSDD 48 TPI	5.25" DSDD 48 TPI	5.25" DSDD-HD PC/AT	3.5" SSDD	3.5" DSDD
<i>Dysan.</i>	\$1.65	\$2.20	\$4.50	\$2.85	\$4.05
<i>Verbatim. DataLife</i>	\$1.49	\$1.85	\$4.15	\$2.80	\$4.00
3M	\$1.42	\$1.74	\$3.75	\$2.55	\$3.86
maxell	\$1.35	\$1.80	\$3.70	\$2.50	\$3.80
XIDEX	\$.80	\$.90		\$2.45	

These diskette brands represent the vast majority of all diskette sales. And for good reason. They're simply the highest quality and most reliable diskettes on the market. Now with one simple toll-free call you can buy them at the lowest prices around. So why settle for a brand you never heard of when you can have the best for less?

TOLL FREE 1-800-848-FAST

TO ORDER

PAYMENT: We accept MasterCard and Visa with no service charge • Bank checks, certified checks and money orders will insure fast delivery • COD — Add \$3.00 - certified, bank check or money order only • Personal checks - we must wait 10 days to clear before shipping • Corporate accounts and purchase orders welcome, subject to credit approval • Prices subject to change without notice. **Shipping and Handling** — Standard case lot is 50 diskettes of the same type per case • Add 5% for less than case lot quantities • Minimum order size is \$30.00 • Add 3% (minimum \$3.00), per each 100 or fewer diskettes • Ohio residents add 5.5% for State Sales tax.

EXPRESS MICRO SUPPLIES INC. • DEPT. L-557 • COLUMBUS, OH 43260

ORDER NOW AND ASK ABOUT OUR FREE HOLIDAY ITEMS.

Thinking of the C Language?

THINK COMPUTER INNOVATIONS

NEW!!

C86 VERSION 2.3 with Source Level Debugging Support

The C language has rapidly become the development language of choice for applications ranging from Operating Systems to Accounting Packages. WHY? Its structured approach and extreme portability make it perfectly suited to today's fast-paced environment.

Of all of the C Compilers available for PC/MSDOS, more programmers choose COMPUTER INNOVATIONS' C86. WHY? Because it's part of a COMPREHENSIVE family of C products with an unparalleled reputation for performance, reliability, and stability.

C86 2.3 C COMPILER

C for PC/MSDOS began with C86 and today it remains perhaps the most solid, stable C Compiler available. Even competitor's ads show C86 as a consistent top level performer in benchmark testing.

Version 2.3 offers a host of new features including source level debugging support and a 40% boost in compilation speed. Call for complete specifications.

COST: \$395 UPDATE TO 2.3: \$35 w/old diskettes NOT COPY PROTECTED CALL ABOUT VOLUME DISCOUNTS

LEARN C INTERACTIVELY WITH INTRODUCING C

Intimidated by rumors about the difficulty of learning C? Need to train your staff quickly? INTRODUCING C can help. INTRODUCING C combines a thorough, self-paced manual with a unique C interpreter to provide a fast, efficient method of learning C. Designed for both professional and casual programmers, it provides a comprehensive understanding of important C concepts such as standard K&R syntax and operators, full structures and unions, arrays, pointers, and data types. Requires IBM PC, XT, or AT with one disk drive and 192K bytes of memory.

COST: \$125 - NOT COPY PROTECTED

CI PROBE SOURCE DEBUGGER

Take advantage of C86 2.3 source level debugging support with CI PROBE. Cut down program development time and save money! CI PROBE is highly economical yet has the features of debuggers costing far more.

COST: \$225 - NOT COPY PROTECTED

C-TERP C86 COMPATIBLE INTERPRETER

The C-TERP INTERPRETER is a full K&R implementation that allows you to write code and execute it immediately without the compile and link steps. Once you have your program running with C-TERP you can compile the code (without alterations) with C86 for fast, efficient executable files. C-TERP requires 256K, 512K is recommended.

COST: C86 version - List Price: \$300, Special Computer Innovations Price \$250. Combined C86 & Lattice version - List Price: \$400, Special Computer Innovations Price \$350.

Start With Us, Stay With Us

Computer Innovations offers a complete range of products that let you enter the C environment and create applications with the most advanced set of development tools available. Unparalleled tech support assures that you're always at the height of productivity.

To order call: **800-922-0169**

 **COMPUTER INNOVATIONS, INC.**

980 Shrewsbury Ave., Tinton Falls, NJ 07724 • (201) 542-5920

C-TERP is a trademark of Gimple Software. Prices and specifications subject to change without notice

well has to, and Larry doesn't use a computer for anything except writing. Actually, that's not strictly true: Larry does use his computer to play Infocom games. (He always buys the hints and uses them liberally.) Anyway, whatever I change to had better be at least as good for creative writing as Zeke, or I'll hear from my partner. Nothing is, which once again raises the question, why?

Because of the Processor Tech VDM board, Hitachi monitor, and Archive keyboard, that's why. None of those other machines have software that would let me use that combination; and I won't willingly give them up.

Alas, the Archive keyboard is no longer available. At the 1985 NCC in Chicago I ran into Lee Felsenstein, who designed the VDM board. We speculated that Larry and I may be the last VDM users in the world. The board isn't made anymore, and Lee has the last unused one. It's not even easy to get this model of Hitachi monitor.

I told you that finding out which machine I'd keep wasn't going to be as useful as you thought. Zeke is optimized for one single purpose, creative writing, and besides, most of the components aren't available anyway.

SIDEKICK AND SUPERKEY

I keep a log of which machines I use. A moment ago I got it out and discovered something surprising. For the last month there have been only three: the CompuPro 286/SPUZ, which I used for two hours to pay the bills and do the monthly accounting; Zeke; and Big Kat, the Kaypro machine officially known as the 286i.

That's surprising. Last month I did all my BIXing on Bellerophon, the AT&T UNIX PC, which remains a fine little UNIX box that hasn't had a glitch since it recovered—by itself—from the power failure a month or so ago. I find it easier to stare for hours at Bellerophon's screen than at the Kaypro's, and I *hugely* prefer the AT&T's keyboard to the Kaypro's; yet for all that, lately I've done all my BIXing on

(continued)

FASTER THAN TURBO

ZBASIC

New lightning-fast ZBASIC zaps the competition.

It's hot. It's brand-new. And light years ahead of anything else.

It's ZBASIC. Written for programmers by programmers. (If you know BASIC—you know ZBASIC!) Now you can write a program exactly the same way on an Apple, an IBM, a Tandy, or any other major micro and port the source code. You only write the program *once* ...and it runs on all the major micros. The commands stay the same—regardless of the computer* (even graphic commands and disk I/O!).

ZBASIC. Starting now, it's the only language you'll ever have to know.

*subject to hardware limitations.

The finest implementation of the BASIC language for microcomputers!

**YES N/A=Not available	ZBasic Interpreter 3.0	TURBO PASCAL 3.0	MBASIC compiler	True BASIC	BASICA Interpreter (IBM PC)
IBM and compatibles	*	*	*	*	*
Apple IIe, IIc (6502)	*	N/A	N/A	N/A	N/A
Macintosh	4th Qtr.	N/A	N/A	N/A	N/A
CP/M-80 2.2, 3.0	*	*	*	N/A	N/A
TRS-80 Mod I, III, 4, 4p	*	N/A	*	N/A	N/A
Direct commands	*	N/A	N/A	*	*
Maximum scientific digits of accuracy (COS, SIN, ATN, LOG, EXP etc.)	6 to 54 selectable by the user	11 Binary BCD N/A	16	16	8
Device Independent Graphics (same CMDS all graphic modes and computers)	*	N/A	N/A	N/A	N/A
SAME File commands all computers?	*	N/A	N/A	N/A	N/A
STRUCTURED. Labels, Functions, LONG IF etc.	*	*	N/A	*	N/A
Same editor commands all versions/computers	*	*	N/A	N/A	N/A
Sieve benchmark (Byte January 1983, 10 iter's)	13.7 sec.	14.1 sec.	14.8 sec.	261 sec.	2190 sec.
Shell-Metzner SORT (Sybex-BASIC for Scientist's and Eng. 2,000 5 char. strings)	19 sec.	28 sec.	71 sec.	194 sec.	2700 sec.
Executable Machine Lang. & approx. File size	12k	12k	32k	N/A	N/A
PRICE with BCD (BCD=No rounding errors)	89.95	109.95	450.00	N/A	N/A
PRICE without BCD	89.95 BCD FREE	69.95	395.95	149.95	Comes with computer.

AVAILABLE NOW!

- Works the same on all micros
- Uses same commands—regardless of computer make
- Structured Basic—(spaghetti optional)
- Device-independent graphics (same graphic commands on all computers)
- 6-54 digits of precision (selectable by user)
- Built-in interactive editor and compiler—to compile and execute, just type "run."
- Choice of alphanumeric labels or line numbers

Not copy protected

One low price gives you everything—there are no hidden costs. Only \$89.95 complete.

ZBASIC™

The lightning-fast BASIC from Zedcor

To order use this coupon or call

1-800-453-4100

Utah Residents 1-800-662-8666; Alaska Residents 1-800-982-1500

Mail to: ZEDCOR

3438 N. Country Club Road / Tucson, AZ 85716

(Name) _____

(Address) _____

(Apt.) _____

(City) _____

(State) _____

(Zip) _____

(Day Phone) _____

CREDIT CARD—MASTERCARD/VISA/AMEX C.O.D.

EXPIRATION DATE: _____

ZBASIC is a trademark of ZEDCOR, Inc. © 1985. All rights reserved. IBM and compatibles are trademarks of International Business Machines Corp. Apple IIe, IIc, and Macintosh are trademarks of Apple Computer, Inc. CP/M-80 is a registered trademark of Digital Research, Inc. TRS-80 is a registered trademark of the Tandy Corp. TURBO-PASCAL is a registered trademark of Borland International, Inc. ZBASIC is a registered trademark of Zedcor, Inc. ZEDCOR is a registered trademark of Zedcor, Inc. All other trademarks are the property of their respective owners.

ZBASIC IBM PC/Compatible (128K, MS DOS 2.0 or better recommended) \$89.95

ZBASIC Apple IIe, IIc (128K, Dos 3.3) \$89.95

ZBASIC CP/M-80 (2-80-2.2 or 3.0) (Provided on 5 1/4" KAYPRO II-SSDD Format) \$89.95

ZBASIC TRS-80 (48K) (Circle Model 1.3 or 4-6.2) \$89.95

ZBASIC Macintosh (Delivery 4th quarter) \$89.95

DEVELOPERS—BUY ALL 5, SAVE \$50. \$448.75 VALUE \$399.75

Arizona Residents Add 5% Sales Tax _____

SHIPPING: U.S. add \$5.00 per program _____

Foreign or C.O.D. add \$10.00 per program (U.S. currency only) _____

TOTAL _____

Why I recommend Logitech Modula-2

Logitech's Modula-2 compiler is a mature compiler that produces robust machine code. I have done quite a bit of work with this system creating a new product for MicroPro®. The real joy of Logitech's Modula-2 is the Run-time debugger. It helped us produce more bug-free code in less time and has saved my development team hundreds of man-hours.

And Logitech's technical support can only be described as excellent.



David W. Taylor, Lead Programmer
MicroPro International Corporation

Features:

Performance: Logitech Modula-2™ gives you direct hardware access and compiles to efficient native machine code. It includes modules for file I/O, string handling, real number math, and operating system access.

Strong Typing: Catches many programming errors that would slip past a C compiler.

Modularity: It is very easy to insulate one part of a program from changes in another.

Version Control: The compiler and linker check that versions of modules, programs and overlays are consistent.

Debugging: Run-time and post-mortem debuggers provide for both dynamic and static program examination including programs with overlays and multiple processes.

Logitech Modula-2 is a family of proven, professionally supported native code compilers and cross-compilers for VAX® and PC systems. For more information, call Christopher Gale at:

Logitech, Inc.
805 Veterans Blvd.
Redwood City, CA 94063
(415) 365-9852
In Europe, call (41) (21) 77 45 45



Trademarks: Logitech Modula-2—Logitech, Inc.
Registered Trademarks: VAX—Digital Equipment Corporation; MicroPro—MicroPro International Corporation

CHAOS MANOR

*I'm a very sloppy
typist, and writing with
computers has given
me the habit of
rewriting a lot.*

the Kaypro, and I've no immediate plans to change.

There's a reason. Make that two reasons. SideKick and SuperKey. I've become enormously dependent on them.

One of the problems with the BIX conferencing system is that in order to keep the costs reasonable, most BIXies have to connect through Tymnet. Tymnet works fine (usually), but in its very nature it has a severe defect: it sends data in bundles and packets. The bundling and packeting make it very difficult for BIX to furnish any kind of sophisticated full-screen-editor capability.

That could probably be overcome, but the multiplicity of terminals and systems employed by BIX users compounds this. They range from 40-column Apples to Liliths with 136 lines of 100 columns each. My account on the ARPANET was based on a large MIT computer that had a number of video-display support programs—Bob Frankston was kind enough to write one to support Zeke and the VDM board—but the BIX machines aren't yet that sophisticated. As a result, Al Mayer says it will be a while before BIX has anything more than a line editor.

That creates a problem. I'm a *very* sloppy typist. Moreover, writing with computers has given me the habit of rewriting a *lot*. For example, the opening sentences of this paragraph have gone through four drafts and may get changed some more before I'm done. (They just were.) Anyone watching me would go nuts, as I write trial sentences, rearrange them, strike words, move things, and generally

hack my way through until I've got my thoughts expressed as I want them.

On the old ARPANET we had EMACS, a full-screen editor written at MIT by Richard M. Stallman and put by him in the public domain. EMACS isn't my favorite editor, but it is with good reason the favorite of a lot of programmers, and it's certainly good enough for any kind of writing. Even with EMACS, though, I made a *lot* of typing mistakes, thoroughly irritating some of my fellow network addicts. Worse yet, though, a lot of what I wrote wasn't very clear and certainly wasn't concise, because at 300 baud it's nearly impossible to do the kind of rewriting I generally do.

Given BIX's inadequate editors and my sloppy habits, my first efforts on BIX were painful to watch. I had two choices: go very slowly and fall further and further behind in the conference or emulate the chap who hadn't time to write a short letter. I generally did the latter, typing like hell and hoping people didn't mind the mistakes too much. Most of my friends were polite enough to pretend they didn't mind. . . .

Then one of the BIXies thought of SideKick. It turns out that you can log onto BIX, go into SideKick with Control-Alt, use the SideKick editor to compose a message, and let SideKick squirt the message back to BIX. That sounded great, so I tried it; after which I shut down the AT&T UNIX PC machine and changed to the Kaypro 286i. The SideKick editor is nowhere near perfect, of course, but for long BIX essays I can use Zeke; the important thing is that the SideKick editor works fine for the shorter stuff that dominates BIX communications. The only thing missing is a spelling checker, and maybe I can talk Borland into adding one.

Moreover, SideKick (version 1.5) has the capability of capturing text right off the computer's screen and putting it into the SideKick editor. I can pull off chunks of someone else's message, interpolate my comments, and squirt the whole thing back—which is a sort of electronic analog of my nor-

(continued)



This will renew your trust in the phone company.

Anybody who's ever sent data over phone lines knows the problems it can present.

Information gets mumble-jumbled. \$4,000 invoices become \$40,000 invoices. And soon your company's lost a pretty penny over some modem foul-up.

Well, now you can say good-bye to all that.

©Copyright 1985 Codex Corp.

Motorola and  are trademarks of Motorola, Inc. Codex is a registered trademark of Codex Corporation.

Because Codex just came out with a Hayes-compatible modem that overcomes the inadequacies of phone line performance.

(Codex, as your friends in data processing will tell you, is the industry's acknowledged leader in state-of-the-art products, in service, in just about everything that has to do with networking.)

The Codex error-correcting pc modem is a serious business modem.

It gives you data transmissions more than 10,000 times more reliable than most other modems. Over anybody's phone lines.

A sophisticated error-correction system called MNP detects breakdowns in phone line performance and retransmits data. And the beauty is all this happens without you ever knowing it.

Just think. Data you can trust.

Now don't you feel better about those crazy phone lines?

If you're a data

communications manager responsible for purchasing modems, call **800-426-1212. Extension 225.**

Or write Codex Corporation,
Department
707-225,
20 Cabot
Boulevard,
Mansfield,
MA 02048.



*Models
available
for the IBM PC
and Apple Macintosh*

codex

 **MOTOROLA**

*If you don't have
Borland's SideKick
and SuperKey, you
don't know what
you're missing.*

mal method for answering mail, namely, to scribble comments on the letter and return it.

The only real problem with using SideKick and BIX in combination is that there are a lot of steps involved. To get text ready to send through SideKick, you must mark the beginning and end of the block, indicate which key will trigger the transmission, and tell SideKick whether to

send it in block form or another way. That's a fair number of keystrokes. After a while, though, I noticed that I always do the same thing: go to beginning of text and begin block; go to end of text and end block; tell SideKick to get ready to transmit; tell it to use Alt-P; tell it block mode. . .

I'd had SuperKey, the SideKick key-macro utility, for several weeks, but I had never used it. Why redefine keys? I have it on good authority that the IBM PC AT keyboard was designed with full awareness of my undying hatred of the original PC keyboard; the designer was told to meet most of my objections. The result was more than good enough. I'd prefer the Escape key in the traditional upper-left corner, but I can sure live with it where they put it. And while I like having the period and comma keys make periods and commas whether shifted or not—my Archive keyboard is the

only one I have that does that—I find it no great hardship to have the < and > as Shift-comma and Shift-period, respectively. There seemed to be no need for SuperKey.

Of course, this is sheer laziness. I knew in the abstract that keyboard macros—that is, being able to make a single keystroke generate a long message or control a complex series of actions—could save me a lot of time. But on the other hand, there was never time to learn how to use the darned programs, or so I told myself. Then I found myself doing a lot of BIXing, and on the last trip I went on, I stuffed the SuperKey manual into my briefcase to read on the airplane.

Wow! SuperKey does darned near *anything*. Borland actually offers your money back if SuperKey doesn't increase your productivity by 50 percent. I doubt they get many takers. Moreover, the essence of SuperKey is easy to learn. There are so many features that you may never learn to use them all—I certainly haven't—but so what? The important thing is that it's easy to *use* as well as easy to learn, a distinction that most companies, including Apple, don't seem to be able to make.

If you don't have SideKick and SuperKey, you don't know what you're missing. Get 'em. You can't possibly regret it.

TEMPTATIONS

I now find myself in a dilemma. I once said that if you use a personal computer, you'd soon become dependent on SideKick. That's just as true for SuperKey. And I write on a machine that has neither.

Writing comes first, and so far I have seen no combination of text editor and display that comes close enough to Zeke. It's worse than that. Until recently, I've seen no color display that I could work on day after day; they're all too fuzzy. Most of the monochrome PCompatible stuff I've seen looks good on a small monitor but awful on a large one. The Macintosh has too small a display and no provision for controlling things from

(continued)

PRODOS PROGRAMMERS:

*Find files fast,
add 13 new commands with Thunderclock.®*

Apple® designed ProDOS to automatically read Thunderclock. So Thunderclock can automatically time and date stamp your disk files. Every time you create or revise one. Now you can instantly identify your latest entry. Without slowing down or losing your concentration.

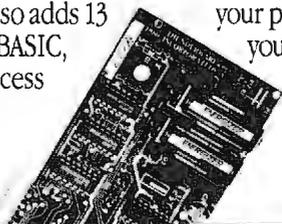
Thunderclock also adds 13 new commands to BASIC, making it easy to access

the time and date, measure intervals in milliseconds and use interrupts. That can add a new depth of functionality to your programs. Not to mention the rest of the available ProDOS-based software, like AppleWorks.

So if you've got a vacant slot, fill it with Thunderclock. For \$149, it's a great way to improve your programming, and your programs. See your dealer or contact us.

THUNDERWARE, INC.
21 Orinda Way, Orinda, CA 94563
(415) 254-6581

Apple is a registered trademark of Apple Computer, Inc. ProDOS and AppleWorks are trademarks of Apple Computer, Inc.



It's the best thing since 1-2-3.

We asked current 1-2-3® users how to get more out of 1-2-3.

And you told us.

Introducing 1-2-3 Release 2 from Lotus.®

New 1-2-3 is more powerful and a lot more versatile.

You wanted to handle larger jobs with 1-2-3. Now you can. The new 1-2-3 worksheet has been expanded to 8192 rows—4 times its original size. And your worksheet is actually more flexible because advanced memory management allocates memory more efficiently and allows data to be stored anywhere on the worksheet. When used with new expanded memory boards, new 1-2-3 can address memory beyond 640K.

New 1-2-3 is designed to support the Intel® 8087/80287 math coprocessors so you can now do many calculations faster. We've even added some features that make it possible to do things like regression analysis, string functions and string arithmetic. And new 1-2-3 comes with 40 new macro commands so you can work more efficiently and a lot more productively.

Now you can start 1-2-3 directly off a hard disk without putting a system disk in the floppy disk drive.

But we still kept things simple.

In many respects, new 1-2-3 isn't any different from the original. You wanted us to keep things simple and we did. If you're already familiar with 1-2-3, you're ready to use new 1-2-3.

You don't have to retrain. And new 1-2-3 can read and process existing 1-2-3 files so that virtually all applications already developed can easily be used.

It's even easy to upgrade to new 1-2-3.

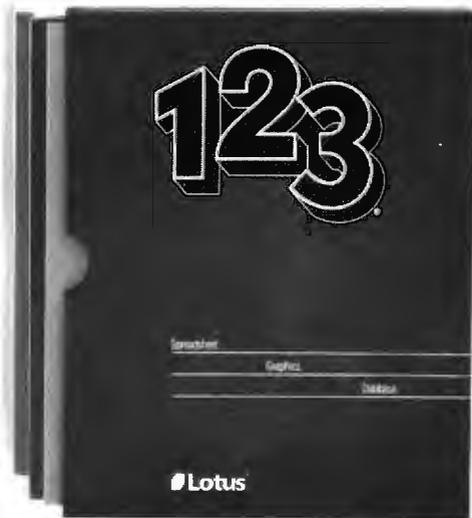
If you're a registered 1-2-3 user and want to upgrade to new 1-2-3, you'll find all the details in a mailing from Lotus. If you haven't registered yet, complete and send in your Warranty Registration Card or call 1-800-TRADEUP* so we can send you the mailing.

The cost of the Upgrade product is \$150. You are eligible for a free upgrade if you purchased 1-2-3 Release 1A on or after April 24, 1985.

And for everyone who upgrades, there's also a rebate offer of \$40 on the Intel Above™ Board, the first expanded memory board certified by Lotus.

We think you'll find new 1-2-3 the best thing since, well, 1-2-3.

*In Canada call 1-800-447-4700.



Suggested retail price of new 1-2-3 is \$495. 1-2-3 Release 2 requires 256K of memory. The minimum memory requirement for 1-2-3 Release 1A is 192K.

123

Lotus®

The PC Video board's output will do when it is piped onto a big screen.

that toy keyboard even if I piped its output to a larger screen and learned to like seeing the watch icon.

The CompuPro PC Video board was designed by Tony Pietsch. It works fine with the CompuPro 286/SPUZ. With Concurrent DOS 4.1, we can run WRITE as well as about 75 percent of the programs written for the IBM PC; indeed, with Concurrent DOS we can run both PC-DOS and CP/M-86 at the same time. The PC Video output isn't quite as nice as the VDM, but it will do when piped onto a big screen. I've

been using it with a Zenith VDM-136, which is just a little too small, and a Zenith high-resolution 19-inch color monitor (part of the Video Component System TV), and it's good enough.

Of course, I have odd requirements. I wear bifocals. If I sit close to a monitor screen, I have to tilt my head back to be able to read. I *hate* sitting in that position for hours on end. On the other hand, if I push the average monitor far enough away so I can read it through the tops of my glasses, the letters are generally too small to read. Zeke's screen sits at eye level some 30 inches away, and that's just about perfect. The PC Video board output of the CompuPro 286/SPUZ could probably be arranged to be almost as convenient and readable.

Keyboards aren't a real problem either. The Key Tronic 5151 is a perfectly acceptable keyboard for

PCompatibles, including the PC Video board. Both the Wico SmartLine SmartBoard with its trackball and the Enigma Research keyboard with its multiplicity of keys lack a few features that my Archive has, but they also have many features the Archive lacks; it would be easy to get very attached to either. Enigma also plans a model for the AT. I'll do a full review of both the AT and PCompatible Enigmas as soon as I can; certainly I'll post my observations on BIX before you read this.

So, I can get WRITE, acceptable visuals, and an acceptable keyboard if I switch over to the CompuPro 286/SPUZ system, which will also give me about 75 percent PCompatibility. It's tempting—but so far the CompuPro 286/SPUZ system will *not* run SideKick and SuperKey. Everyone keeps telling me that Concurrent DOS is better

(continued)

NEW!

TURN YOUR COMMODORE 64 INTO AN ENVIRONMENTAL CONTROL CENTER

Introducing FIRST ADE™ for Commodore 64.

Controlling the environment since 1983, FIRST ADE™, is now available for use on the Commodore 64. FIRST ADE™, a complete 8 bit data acquisition and control card that just plugs into your Commodore 64, allowing you to control the in-floor and outdoor functions of home or business.

Control your heating, lighting, small appliances, freezer, sprinkler system, pool level and temperature, and much, much more.

No special wiring required. BSR compatible by simply connecting to remote control modules.

INTRODUCTORY OFFER! \$495.95
Check/M.O./C.O.D./Visa/Mastercard
Add 3% shipping/CA add 6% Sales Tax
Allow 4 to 6 weeks delivery

SOFTWARE CONTROL CARD/INTERFACE

FIRST ADE™ features -

- 8 Analog Input Channels
- 8 Digital Input Channels
- 8 Digital Output Channels
- 8 120V 6A Relays/Receptacles
- 8 Analog Input Terminations
- 8 Digital Input Terminations
- RS 232 Port
- Real Time Clock w/battery
- 3 month warranty

FIRST ADE™ Version 1.4
Disk Based/Menu Driven
Logic Functions
Programmable Setpoints



A/D ELECTRONICS
P. O. Box 26357
Sacramento, California
95826 (916) 486-1411

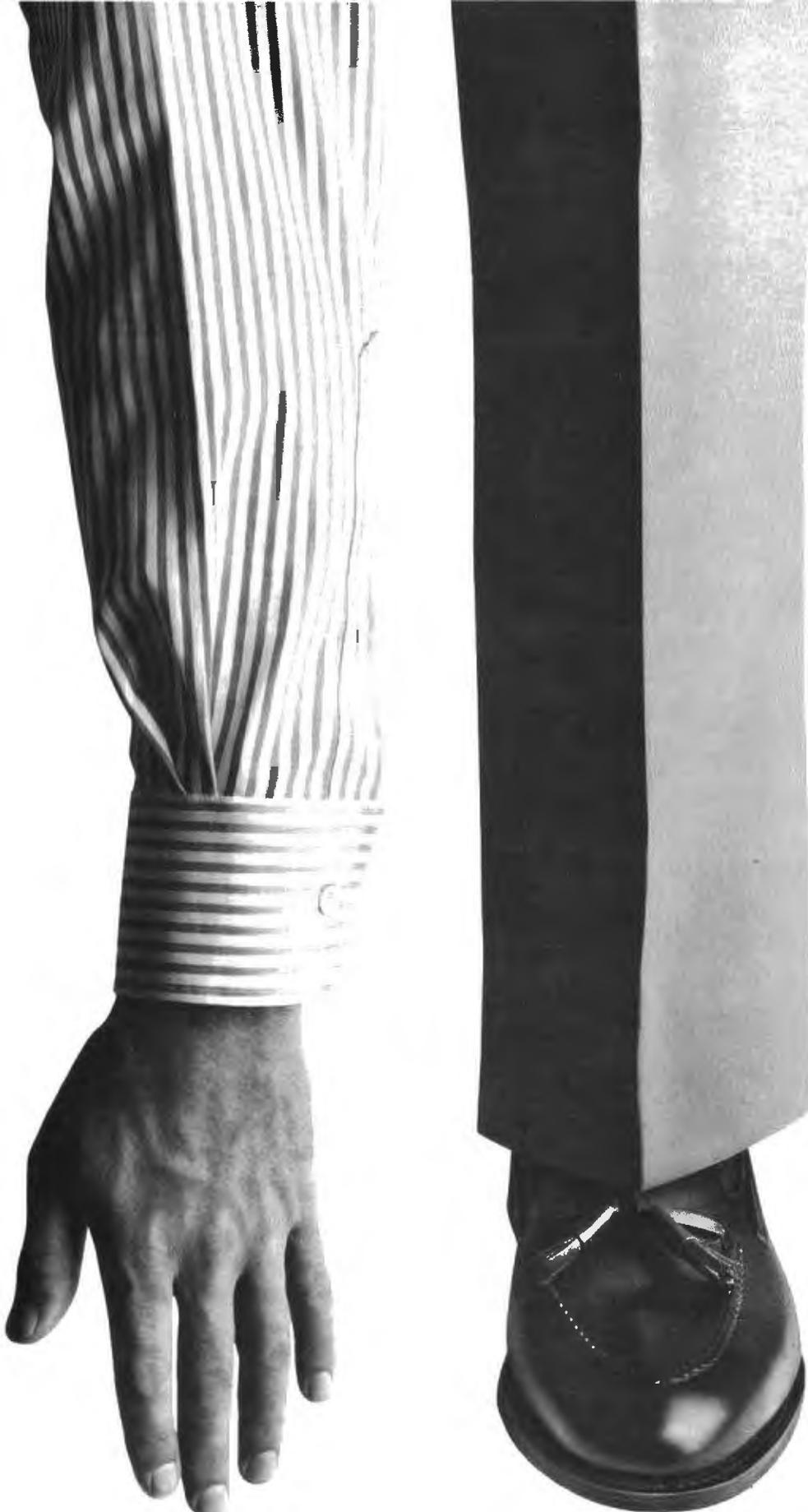
COMING SOON!

FIRST ADE™ for
IBM PC and Apple II

Distributorship available.

388 BYTE • NOVEMBER 1985

Inquiry 2



IF YOU'RE TIRED OF PAYING OUTRAGEOUS LONG DISTANCE CHARGES EVERY TIME YOUR COMPUTER TALKS ON THE PHONE, GTE TELENET OFFERS AN ALTERNATIVE. IT'S CALLED PC PURSUITS™

NOW FOR ONLY \$25 A MONTH (PLUS A ONE-TIME INSTALLATION FEE OF \$25) YOU'LL BE ABLE TO REACH OTHER PC USERS, FREE LOCAL DATABASES AND BULLETINBOARDS IN ATLANTA, BOSTON, CHICAGO, DALLAS, DENVER, DETROIT, HOUSTON, LOS ANGELES, NEW YORK (AREA CODE 212), PHILADELPHIA, SAN FRANCISCO AND WASHINGTON D.C. AND TAKE ADVANTAGE OF LOCAL SOFTWARE DOWNLOADING CAPABILITIES, AS WELL.

YOU CAN USE THE PC PURSUIT SERVICE BETWEEN 6PM AND 7AM WEEKDAYS. AND ALL DAY ON WEEKENDS. ALL YOU NEED IS AN AUTO-ANSWER MODEM AND COMMUNICATIONS SOFTWARE.

FOR MORE INFORMATION AND TO REGISTER, CALL A GTE TELENET REPRESENTATIVE AT 800-368-4215 BETWEEN 8AM AND 5PM EASTERN TIME. OR USE YOUR MODEM TO CALL 800-835-3001 FOR OUR ON-LINE USER'S GUIDE 24 HOURS A DAY.

TRY PC PURSUIT, FROM GTE TELENET—WORLD LEADER IN PUBLIC NETWORK SERVICES, INTERNATIONAL NETWORK SERVICES, PRIVATE DATA NETWORKS AND INNOVATIVE NETWORK APPLICATIONS.

FINALLY YOU CAN GET YOUR HANDS ON THE INFORMATION YOU NEED. WITHOUT PAYING AN ARM AND A LEG.

GTE Telenet

NOW YOU DON'T HAVE TO PAY THIS MUCH
TO ACCESS INFORMATION WITH YOUR HOME COMPUTER.

The most exciting thing at the 1985 NCC in Chicago was laser-disk mass storage.

anyway, and I suppose as I learn more I'll come to agree; but here comes BIX again. I need SideKick and SuperKey, or at least a very similar capability, for conferencing.

Maybe there's a way. Maybe Tony or one of the other software wizards at Viasyn will either figure out how to get SideKick and SuperKey working on the 286/SPUZ or how I can drop off line, use a text editor, and send the result out to BIX with the same convenience that I now do it on the Kaypro. I'll also need the ability to pull stuff off the screen and into the editor.

BIG KAT

Meanwhile, the Kaypro 286i gets most of the log time. He's used to test PCompatible software, and so far I've found none that he won't run. Cross-talk came with the OmniTel internal 1200-baud modem—which, by the way, gets constant use and has never had any glitches I can detect—and works quite well for BIXing. I've been programming Mrs. Pournelle's reading stuff. The PC version of Crush, Crumble, and Chomp runs in BASICA and is a bit too slow on a PC. But it

screams along something wonderful on Big Kat, and it's wonderfully relaxing to burn down Washington after a hard day.

I'm still not overly fond of the Kaypro's keyboard. The layout is the PC AT layout, which is fine; but the keyboard feels just a bit mushy to me. Do note, though, that the Kaypro is something like a sporty GM car, and my Archive is more like having a Ferrari. It's unlikely that any keyboard's feel can compare favorably to what I'm used to. I will say, too, that after a month's use I find the Kaypro's feel much better. Probably I'm just getting used to it, but it's significant that I can do that.

For the first few days the Kaypro keyboard had a really annoying habit: I'd be typing along and suddenly everything would be in capital letters, and it would stay that way until I pressed the Shift—not Shift-lock, but Shift—key again. Finally, in rage I took several drops of Tweek, dissolved it in alcohol, and blew the mixture into the system with a can of compressed air. The cure wasn't instant, but within a day the Shift-lock problem stopped, and so did some other glitches; possibly the board just needed to be broken in? Anyway, it works fine now.

There's one other irritating misfeature: there are gaps above and between the two floppy-disk drives on the Kaypro. Not only is it possible to push a disk in there in the mistaken impression that you're inserting it into the drive, but I've done it three times.

And when you do that, you can't get the disk back out. Each time I had to pick up the machine—which isn't light—and upend it to shake the disk out. It worked, and the disks were unharmed from their misadventure, but I'm thinking of putting gaffer's tape over those slots.

Don't get me wrong, though: I do like Big Kat.

Or did: in the last two days, it has developed the same kind of intermittent and capricious hard-disk errors that IBM PC AT owners report. More next month.

NCC

The 1985 NCC in Chicago had a much lower attendance than anticipated, and coming on the heels of Silicon Valley layoffs, the atmosphere alternated between frantic cheerfulness and gloom. It's just as well I have little space for the report: there wasn't much to write about. The most exciting thing there was laser-disk mass storage, and everyone else will write about that, so I don't have to.

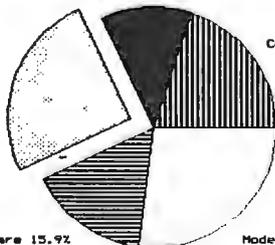
One reason for the lack of excitement was the lack of micro people. Lots of the micro outfits weren't there at all or had much-reduced booths. Given the sheer rapacity of the Chicago unions—I saw one fat, cigar-chewing rigger take 11 minutes to hang and straighten a single 2- by 3-foot picture, after first taking it down because it had been hung by the exhibitor—I don't blame the com-

(continued)

GRAPHS WITHOUT GRAPHICS?

Disk Drives 11.9%

Printers 25.4%



SALES IN 1983

No need for color monitor or graphics board. Make graphs on dot matrix printers.

Easy to Use. No Programming. CP/M 2.2, 3, 80, or 86, MS-DOS or PC-DOS. Excellent Manual. Most disk formats.

DataPlotter™

Line Graphs & Scatterplots . . . \$69

Bar Graphs & Pie Charts \$69

Both for \$99

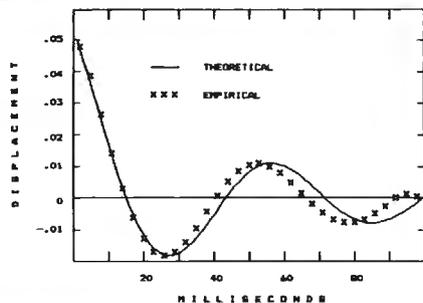
(Prices include manual)

Add \$3 shipping.

\$8 outside US and Canada.

Lark Software™
131 N. Leverett Rd.
Leverett, MA 01054

Specify type of Printer.
(413) 773-8687 Visa, M/C



Introducing the most COMPATIBLE & AFFORDABLE

Desktop Computer

American XT/AT

The Perfect Solution



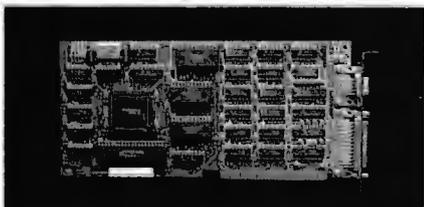
American AT Personal Computer

- 512KB user or random access memory (RAM) standard... expandable up to 4MB by adding memory feature cards.
- 64KB permanent or read only memory (ROM), which contains the BIOS.
- High-performance, high-speed, true 16 bit 80286 microprocessor.
- Eight expansion slots that allow easy system expansion by using optional plug-in adapters.
- 1.2M high capacity disk drive to support 5 1/4 inch diskette.
- 200 watts power supply 110/220V switchable.
- Battery backup for CMOS configuration table and real-time clock.
- 7-channel direct memory access (DMA).
- 16-level interrupt.
- Three programmable timers.
- Speaker for audio and music applications.
- Power-on automatic self-testing of system components.



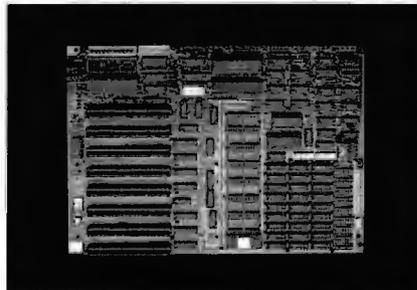
American Color Graphics Card

- RGB and composite outputs with 640 x 200 pels.
- Use state-of-the-art technology GATE ARRAY LOGIC to increase reliability and reduce cost.

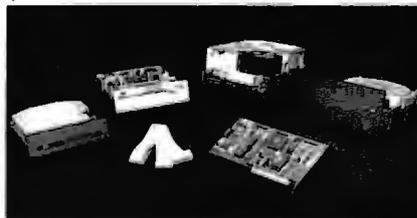


American Monochrome Card

- TTL output 720 x 350 pels with 25 lines x 80 column.
- Built-in parallel printer port.



American XT — Mother Board



American Hard Disk System

- 10MB Hard Disk System
- 20 MB Hard Disk System
- 20MB Hard Disk for AT
- 40MB Hard Disk for AT
- 1.2MB Drive for AT
- 360KB Drive for AT
- 360KB Drive for XT

American XT/AT Personal Computers & Peripherals are distributed by:		
PC. LAND, INC.,	Tustin, CA	(714) 730-6723
CTXT SYSTEMS,	Chatsworth, CA	(818) 998-6777
PC SYSTEM DESIGN,	Pasadena, CA	(818) 792-8889
RGB COMPUTING,	Glendale, CA	(818) 240-0422
ASCOT ENGINEERING, INC.,	Edmonton, Canada	(403) 438-0994
MICRO CONFIGURATION EAST INC.,	Brooklyn, NY	(718) 941-2512
COMPUTER PERIPHERAL WAREHOUSE, INC.,	Deerfield Bch., FL	(305) 481-2170
CUSTOM TECHNOLOGY,	Houston, TX	(713) 868-2835
ITM COMPANY,	Dedham, MA	(617) 329-5799
ANALYTICAL SYSTEMS CO.,	Raleigh, NC	(919) 851-8000
HOUSE OF CABLES,	Aurora, CO	(303) 699-0468



American XT Personal Computer

- 256KB user or random access memory (RAM) standard... expandable up to 640KB on the system board.
- 8KB permanent or read only memory (ROM), which contains the BIOS and 56KB user usable.
- High-performance, high-speed, 16-bit 8088 microprocessor.
- Eight expansion slots that allow easy system expansion by using optional plug-in adapters.
- Two 360KB slim line diskette drives to support single-sided or double-sided, double-density 5 1/4 inch diskettes.
- Optional 10MB or 20MB fixed disk drive.
- 135W power supply 110V/220V switchable.
- Four layer mother board to increase system reliability.
- Speaker for audio and music applications.
- Power-on automatic self-testing of system components.



American Modem AM1200B

- Fully Hayes compatible with enhanced features.
- 300/1200 Baud Bell 103/212A
- Intelligent-adaptive-auto speed dial.
- Call progress monitoring.
- Free PC-TALK software.
- Self test at power up.
- FCC approved.

Manufactured by:

American COMPUTER & PERIPHERAL, INC.

2134 S. Ritchey St., Santa Ana, CA 92705
Tel: (714) 545-2004
FAX: (714) 545-2146

VISIT US AT COMDEX
BOOTH M651 (MGM)

American XT AT HD are registered trademarks of American Computer & Peripheral, Inc.

panies for staying away. NCC has always had an ambiguous attitude toward micros; I recall when they stuffed all the micro exhibits in the basement of the Disneyland Hotel lest micros contaminate the minis and mainframes in the Anaheim Convention Center.

One impression: IBM brought out

the AT as a temporary machine, but it seems to have become "validated." There are a growing number of AT clones, and people are frantically bringing out software and accessories for it. The AT is popular with programmers and hackers (although there's also a large group of same who *hate* it). I've heard many horror stories

about Intel's 286 chips, and perhaps they're all true; but NCC convinced me that the 286 is here to stay.

I'm glad I went. I got to meet some more of AT&T's technical people, one of whom assured me that I have the wrong impression of the badge hierarchy used in their booths. Perhaps. My impression of AT&T remains unchanged: tremendous technical skills embedded in a fossilized organization that's groping its way into the marketing jungle. AT&T's pocketbook is deep enough to give them staying power, and some of their technowizards are dedicated enough to hang on until the bosses learn what they're doing. They're here to stay.

The best new program I saw at NCC was Fastback, a hard-disk backup utility running under MS-DOS; it automatically backs up your hard disk onto floppies. Easy to use. Not as fast as a tape drive, but a lot cheaper, and with Fastback you probably *will* make backups of your hard-disk work. Standardly silly licensing agreement, but no one pays attention to those anyway. Recommended.

It was also pleasant to get together with Randy Brukaradt of RR Software Inc. RR literally started developing Janus Ada in a garage; now the compiler has been accepted by the U.S. Air Force as the one to use in training USAF Ada programmers. If you're interested in Ada, you ought to learn more about Janus, which remains, as far as I can tell, the most cost-effective micro version, particularly for learning the language. Janus is distributed through Workman and Associates.

WINDING DOWN

As usual, there's too much to write about. I have a new version of Beyond Compare, my favorite PCompatible file-comparator program; it works as well as ever, but now it takes batch commands and wild cards. Neither programmers nor authors can afford to be without this program. Highly recommended.

The game of the month is BIX; computer conferencing is both enlightening and entertaining. The boys had a

(continued)

DISCOVER THE LANGUAGE OF ARTIFICIAL INTELLIGENCE

PROLOG V

At last! A Prolog with enough muscle to handle real-world applications for UNDER \$100! Discover why Japan has chosen Prolog as the vehicle for their "Fifth Generation Machine" project to design intelligent computers.

CHOOSE FROM TWO GREAT VERSIONS:

PROLOG V-Plus

\$9995

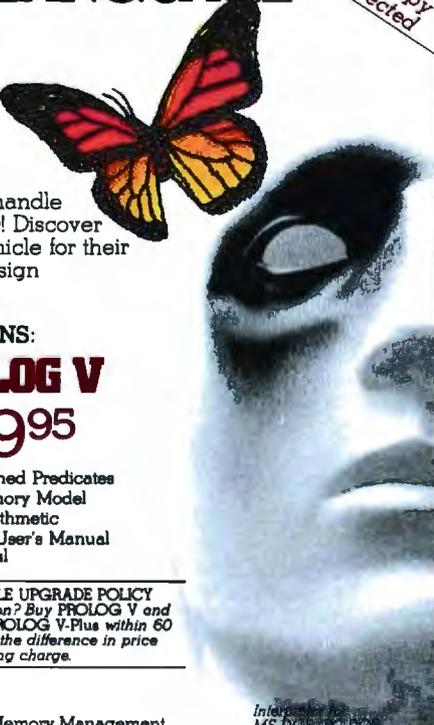
- More Than 100 Predefined Predicates
- Large Memory Model (to 640K)
- Floating Point Arithmetic
- 150-Page User's Manual and Tutorial plus Advanced Programming Documentation
- Co-Resident Program Editor
- Calls to Co-Resident Programs
- Text and Graphic Screen Manipulation

PROLOG V

\$6995

- 70 Predefined Predicates
- Small Memory Model
- Integer Arithmetic
- 122-Page User's Manual and Tutorial

UNBELIEVABLE UPGRADE POLICY
Tough decision? Buy PROLOG V and upgrade to PROLOG V-Plus within 60 days for only the difference in price plus a handling charge.



Not Copy Protected

Intel
MS-DOS

PHONE ORDER
(619) 483-8513

NO RISK OFFER
Examine the documentation at our risk for 30 days. If not fully satisfied, return with disk still sealed for full refund.

STANDARD FEATURES ON BOTH:

- Clocksin & Mellish-Standard Edinburgh Syntax.
- Extensive Interactive Debugging Facilities
- Dynamic Memory Management (garbage collection)
- Custom-Designed Binder and Slipcase

THE CHOICE OF UNIVERSITIES
Generous university site licenses and an excellent teaching tutorial and reference guide have made PROLOG V the choice of universities nationwide. Call for details.

PAYMENT ENCLOSED \$ _____

CHARGE MY: MasterCard Visa

Card No. _____ Exp. Date _____

Signature _____

Mr./Mrs./Ms. _____
(please print full name)

Address _____

City/State/Zip _____

PROLOG V-Plus \$99.95

PROLOG V 69.95

UPGRADE ONLY 40.00

Return factory diskette and \$30 plus \$10 Handling

SHIPPING:

\$ 5.00 U.S.

7.50 Canada

10.00 Carribean, Hawaii Air

20.00 Overseas Air

COD Orders Not Accepted

15 day check clearance

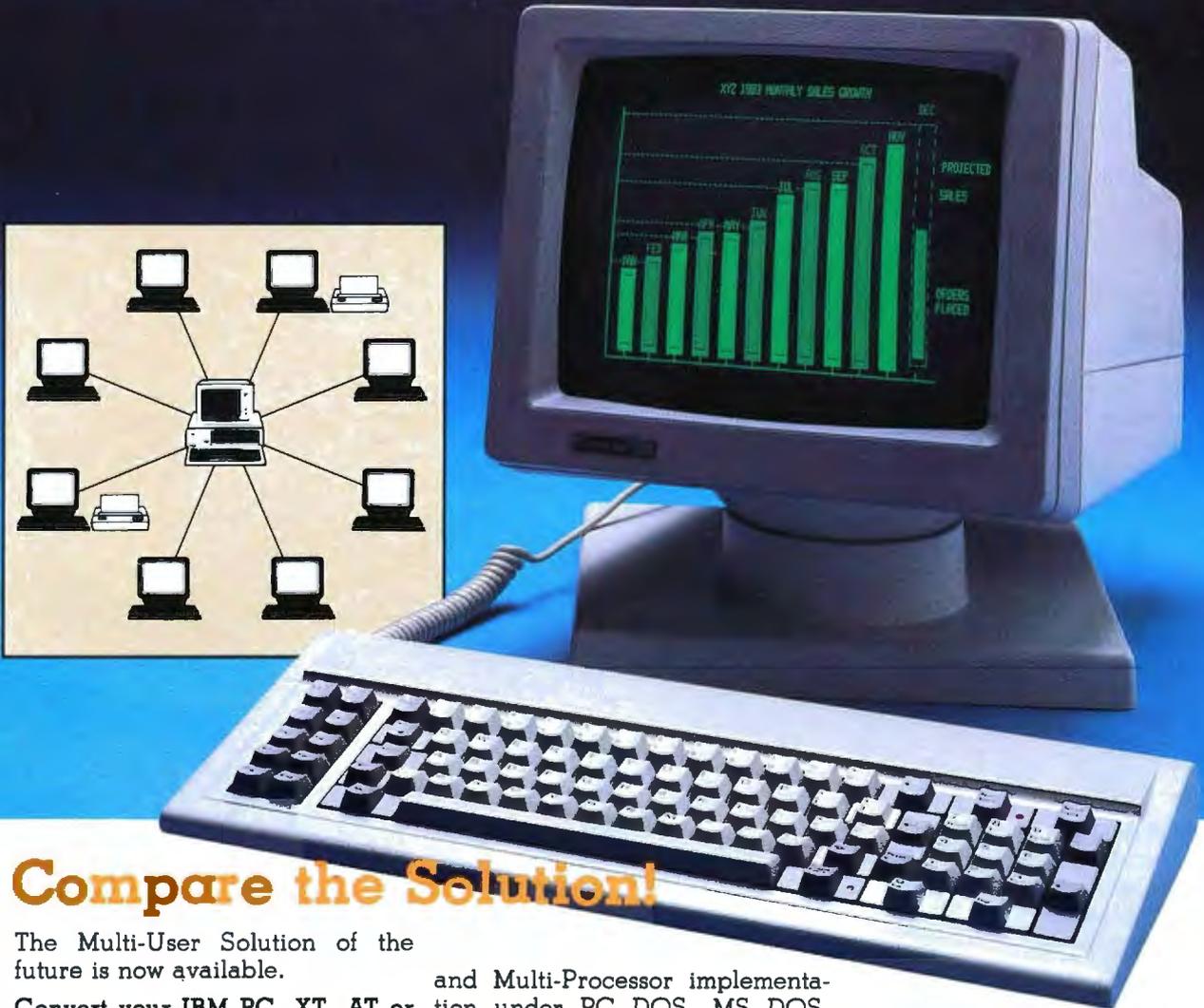


CHALCEDONY SOFTWARE

5580 LA JOLLA BLVD.
SUITE 126 B
LA JOLLA, CA
92037

Kimtron

MULTI-USER SOLUTION for IBM PC, XT, AT



Compare the Solution!

The Multi-User Solution of the future is now available.

Convert your IBM PC, XT, AT or Compatibles to a true multi-user system while maintaining display, keyboard and software compatibility.

Since the KT-7/PC display is the same as your PC monochrome monitor, with its look-alike keyboard, operators will feel they're using an IBM PC and can also use the same software manual. Kimtron's multi-user solution includes file and record locking, shared data access, and communication between users. It is the intelligent alternative.

The KT-7/PC supports Time Sharing, Enhanced Time Sharing

and Multi-Processor implementation under PC DOS, MS DOS, UNIX, XENIX, CPM 86, Multilink, Concurrent PC DOS, and other compatible multi-user operating systems.

Kimtron's multi-user solution may be tailored for cost effectiveness; as low as \$1095 for an additional user, and for speeds more than ten times faster than LAN. You can add one or as many as 31 additional users per PC. Kimtron delivers the future now by allowing an ever-widening network of multi-user PC's.

The KT-7/PC may be complemented with one (or more) I/O Card, Memory Card, 8086 Speed

Enhancer Card, 80286 AT Card, 8088 Multi-Processor Card, 80186 Speed Enhancer Card, 68000 Card, and related software.

For more information about Kimtron's Multi-User Solution, or general video data terminals for other mini or micro multi-user systems, call your local computer dealers, distributors or Kimtron Corporation Today!

(408) 286-8790
TWX 910-338-0237



1705 Junction Court
Building #160
San Jose, CA 95112

NOTE: IBM PC, XT, AT, PC DOS, MS DOS, UNIX, XENIX, CPM 86, Multi-Link, Concurrent PC DOS are registered trademarks of IBM Corporation, Microsoft Corp., Bell Labs., Digital Research Inc., Software Link Inc. respectively.



UTILITIES

FOR

Turbo Pascal™ PROGRAMMERS

**Improve Code Performance
Find Subtle Bugs
Automate Tedious Tasks**

Supports Turbo Pascal 2.0 & 3.0
IBM PC/XT/AT & True Compatibles
PCDOS 2.X & 3.X
192K RAM DSDD Drive

**If You Really Use Your
Pascal Compiler You Need
These Tools!**

- Pretty Printer
- Pascal Structure Analyzer
- Execution Profiler
- Execution Timer

**Advanced Text Processing
& Command Automation**

- Pattern Replacer
- Difference Finder
- Command Builder
- File Finder
- Super Directory

**Where Else Can You Get
500K of Integrated, Useful,
Tested, Fully Documented
Source Code for \$95?**

- 140 Page Printed User Manual
- Quick Reference Card
- Detailed Programmer's Manual on Disk
- Complete Turbo Pascal Source Code
- 6 Bonus Utilities with Source!
- Tax & U.S. Postage Included
- Executable only version \$55

MC/Visa Orders TOLL FREE

(USA) 800-538-8157 x830

(CAL) 800-672-3470 x830

**Brochures, Questions, PO's
call 408-378-3672**

Checks or Money Orders

TurboPower Software

**478 W. Hamilton Ave., Suite 196
Campbell, CA 95008 U.S.A.**

INTERNATIONAL REPRESENTATIVES —

Switzerland: Software Haus 064-512651

Japan: Southern Pacific Ltd 045-314-9514

England: The Core Store 0606-45420

Canada: Software Commodities 416-865-1600

Holland: SCOS'PC-Center 020-106922

Norway: Polysoft 03-82575

Turbo Pascal is a Trademark of Borland International

CHAOS MANOR

ITEMS DISCUSSED

BEYOND COMPARE \$30
General Transformation Company
POB 10083
Berkeley, CA 94709
(415) 644-0702

BIX (BYTE INFORMATION EXCHANGE)
for BYTE subscribers \$25
BYTE Magazine
BIX Business Office
70 Main St.
Peterborough, NH 03458
(603) 924-9281 ext. 131

COMPUPRO PC VIDEO BOARD
for S-100 systems \$495
for 286 systems \$495
Viasyn
26538 Danti Court
Hayward, CA 94545
(415) 786-0909

FASTBACK \$149
Fifth Generation Systems
7942 Picardy Ave., Suite B-350
Baton Rouge, LA 70809
(504) 767-0075

JANUS ADA
for CP/M starts at \$149.95

for MS-DOS starts at \$99.95
WRITE \$239
Workman and Associates
112 Marion Ave.
Pasadena, CA 91106
(818) 796-4401

KAYPRO 2861 starts at \$2995
Kaypro Corporation
533 Stevens Ave.
Solana Beach, CA 92075
(619) 481-4300

SEASTALKER
for Atari & Commodore 64 \$34.95
for all other machines \$39.95
Infocom
125 Cambridge Park Dr.
Cambridge, MA 02140
(617) 492-6000

SIDEKICK
copy-protected \$54.95
not copy-protected \$84.95
SUPERKEY \$69.95
Borland International
4585 Scotts Valley Dr.
Scotts Valley, CA 95066
(408) 438-8400

lot of fun with Infocom's Seastalker, which is said to be "junior level" but is quite cleverly done; I recall a couple of months ago I spent a pleasant evening with it.

It isn't the book of the month because it's mine, but the second collection of these columns is out from Baen Books (distributed by Simon and Schuster). Like the first one (*User's Guide to Small Computers*), *Adventures in Microland* is a bit more than a collection of columns. While I haven't changed the original columns, I have inserted some comments generated by hindsight.

The real book of the month is *The Inklings* by Humphrey Carpenter (Ballantine Biography, reissued 1981). The Inklings included C. S. Lewis, Maj. Warner Lewis, J. R. R. Tolkien, and Charles Williams, as well as many others, and used to meet in Lewis's

rooms at Magdalen College in Oxford. Lewis's views on science are not mine, but they're more than worth keeping in mind in these times of scientific magic. Nothing about computers, of course.

I'm now frantically trying to put together a system to take with me to Europe; it looks as if it'll be Percy, the NEC PC-8201 lapboard computer augmented with Purple Computer's wonderful SideCar memory package; lots more on that next month. Wish me a bon voyage. ■

Jerry Pournelle welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE Publications, POB 372, Hancock, NH 03449. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply.

Now there is an even better structured, compiled programming environment than PROMAL. Introducing PROMAL 2.0 for the IBM PC, the Apple II, and the Commodore 64.

Until now, the best next language for the serious programmer was PROMAL. Now, it's the new PROMAL—PROMAL 2.0.

PROMAL 2.0 provides the same sophisticated structured programming environment, the same fast one-pass compiler, the same speed of execution, the same powerful commands of the earlier release—plus a host of useful new features.

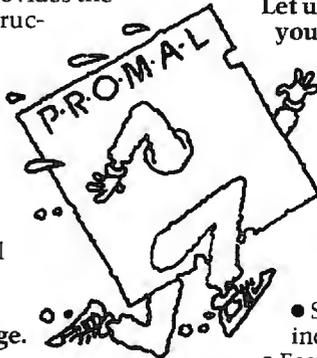
Not just a language. A complete programming environment.

PROMAL—the PROgrammer's Micro Application Language—provides you with a complete programming environment, including a structured, high level language, a powerful program Editor, and a compiler that quickly turns your source code into compact, rapidly executing object code. Plus a library of integrated machine-language subroutines for frequently used tasks. And for the Apple II and the Commodore 64, PROMAL provides a DOS-like operating system Executive.

PROMAL 2.0—Even more of a good thing.

In addition to all of the features that have made PROMAL users declare it "the best language I've ever used," PROMAL 2.0 provides:

- Overlays that can be compiled separately for modular programming.
- Program size greater than 64k. (IBM PC only).



- True machine-to-machine portability.
- True 808X object code for the IBM PC.

Let us prove that PROMAL is your best next language!

Buy PROMAL 2.0 and try it for 15 days. If you don't believe it's your best next language, just return it for a full refund.

PROMAL Features

- Structured language with indentation.
- Fast, one-pass compiler.
- Simplified syntax.
- No line numbers.
- Multi-dimensional arrays, strings and pointers.
- Long variable names.
- Global, Local variables.
- Byte, Word, Integer & Real types.
- Decimal or Hex numbers.
- Functions and procedures with passed arguments.
- Built-in I/O library.
- Control Statements: IF-ELSE, IF, WHILE, FOR, CHOOSE, BREAK, REPEAT, INCLUDE, etc.
- Compiler I/O from/to disk or memory.

Executive*

Command oriented with line editing.
Allows multiple user programs in memory at once.
Function key redefinition.
Program abort or pause.

22 resident system commands.
Unlimited user-defined commands.
Prior command recall/edit.
I/O redirection to disk or printer.
Batch jobs.

Editor

Full-screen, cursor driven.
Function key controlled.
Line insert, delete, search.
String search and replace.
Block copy/move/delete/read/write.
Auto indent, unindent support.
Edit after error.

Library

50 machine language commands.
Memory resident.
Call by name with arguments.
Formatted real output, string operations and much more.

*Apple II and Commodore 64 only. Requires one disk drive and 80-column card for Apple (Ile, Ilc only).

1-800-762-7874

In NC: 919-878-3600

Systems Management Associates
3325 Executive Drive, Dept. PB-5
Raleigh, North Carolina 27609



NEW for PROMAL The Graphics Toolbox*

Twenty fast subroutines for creating sophisticated, high-resolution graphics, including windows, clipping, scaling, and text-on graphics using scaled, rotated, user-defined fonts. \$29.95.

*Available for the Apple II and the Commodore 64

Order Form

- My system is (check one)
 IBM PC/100% compatibles Apple IIc/IIe
 Commodore 64/128
- Developer's Version—Compiler, Editor, Library, Demo disk, 280-page manual, (plus Executive for Apple and C-64) and stand-alone program generation. \$99.95 + 5.00 s/h.
- End-User System for Apple II and Commodore 64—all features of Developer's version except stand-alone program generation. \$49.95 + 5.00 s/h.
- Demo System—32-page "Meet PROMAL" manual and demonstration disk. \$10.00 + 2.50 s/h.
- Graphics Tool Box for PROMAL—Available for Apple and C-64 only. \$29.95 + 2.50 s/h.

- My check is enclosed.
 Please charge to my
 — Visa — Mastercard

Card Number _____ Expiration Date _____

Signature _____

Name _____

Address _____

City, State, Zip _____

NC residents add 4-1/2% sales tax.
Foreign orders add \$15.00 additional s/h.

Contact us for other low prices on hardware and software.
Next Day Air Extra

FREE SHIPPING
NO SURCHARGE FOR  **OR** 
Call for latest prices.

10, 20, 33 and 44 MEG INTERNAL AND EXTERNAL HARD DISK SYSTEMS

	10 MEG	20 MEG	33 MEG	44 MEG
Internal	\$395	\$495	\$929	\$1129
External	\$545	\$645	\$1029	\$1229



Half Height

Externals mounted with independent power supply and fan. Fully DOS 2.X or 3.X compatible. Both Internals and Externals boot from Hard Disk. 33 and 44 Meg Internal Disks include extender power supply. The system comes complete and ready to install with the Hard Disk, Controller, Cables, Manual, Software, and Mounting Hardware. One Year Warranty.

10, 20, and 33 Meg Hard Disks are available with combined Floppy/Hard Disk Controller Card for additional \$75.



COMPAQ

256K, 1/360K drive, 10 Meg Internal

Functional equivalent to a Compaq Plus™



\$2549

Now using 3 1/2" shock-mounted Winchester drives. The same as used in the Compaq Plus™. Also available with 2 half-height drives and 10 MEG HD- **\$2749**

Or upgrade your Compaq to a Compaq Plus™ equivalent with our 3 1/2" shock-mounted Winchester disk kit. Includes Hard Disk, Controller, Cables, Manual, software, and Mounting Hardware. One year warranty. **\$519**

Compaq is a registered trademark and Compaq Plus and Compaq Desktop are trademarks of Compaq Computer Corporation.

DISK DRIVES

MITSUBISHI
Half-Height, DS/DD

\$85

Quantities of 10 or more \$75 each

TEAC

55-B, Half-Height, DS/DD

\$95



Call us for competitive prices on larger quantities of RAM chips.



64K RAM

Set of 9 chips, 200 or 150 Nanoseconds

\$8

Quantities of 100 or more sets

\$4⁵⁰

per set.

256K RAM

Set of 9 chips

\$39

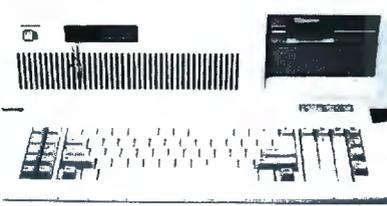
Quantities of 50 or more sets

\$29

per set.

PRICES AND MACHINES THAT OUTRUN THE COMPETITION.

PC'S LIMITED AT™ High Performance Competitive Price



\$1995

Includes: 80286-based System Unit, 1024K on Mother Board, 1/ 1.2 Meg Drive, Combined Floppy and Hard Disk Controller Card, AT Keyboard, 192W Power Supply, 2 Serials and 1 Parallel Port, and Clock/Calendar with Battery Backup, all on Mother Board.

Runs all Major Software written for the IBM PC™, PC XT™, and PC AT™. (Processor) Intel 80286 running at 6MHZ. (Expansion Slots) :8. 7 are available in above configuration. Same Bus Configuration as IBM PC AT™.



High Performance Competitive Price



\$795

Includes: System Unit, 640K on Mother Board, 1 360K Drive, Keyboard, 135W Power Supply.

Runs all Major Software written for the IBM PC™ and PC/XT™, 40% faster, without modifications. (Processor) 16-bit 8088-2, 4.77 or 6.66 MHZ Clock Speed. (Expansion Slots) :8; 7 are available in above configuration.

SOLVE YOUR POWER PROBLEM. XT™ POWER 135W



\$89

Fully XT™ compatible.
One Year Warranty.
Directly replaces power supply in PC™

25 or more
\$75 each

150W \$119

PC'S LIMITED Six Function Card



w/384K \$149

Two Year Warranty

- Upgradable to 384K
- Clock/Calendar
- Software included
- Parallel Port
- Serial Port
- Game Port

Irwin Tape Backup System

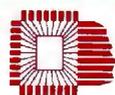


\$595

10 or more
\$495 each

- Uses Floppy Controller Card
- 10.35 Meg Formatted Capacity
- Used in Compaq Deskpro.
- Half Height
- Low Power

Terms: Due to our low prices and assurance that all merchandise is new, unused product, all sales are final. Call technical support for return authorization number on all warranty repairs. Any unauthorized return subject to a 10% restocking fee. Prepaid checks, money orders, VISA, MasterCard, American Express, or approved company purchase orders are accepted. No surcharge for VISA or MasterCard. 1% surcharge for American Express.



PC'S LIMITED

OUTSIDE TEXAS, ORDERS ONLY, CALL 1-800-426-5150

7801 N. Lamar, #E-200, Austin, Texas 78752

All sales-related calls inside Texas — (512) 452-0323.

All calls for technical support, phone

(512) 452-0372, 452-0373 or 452-0374.

Telex No. 9103808386 PC LTD



Ad number 411

Compaq, TEAC, IBM, Irwin, and Intel are trademarks of their respective companies. All brand names are registered trademarks. We are an independent sales organization.



THE ONLY ACCESSORY WE WON'T SELL YOU.



Basic AnthroCart PC
with optional slide out shelf and printer basket.

But once anyone else sees your AnthroCart, you're going to need one. Main reason is the AnthroCart makes your whole computer system so mobile that everyone can easily share it.

And it takes up so little room it can scoot into even the smallest workspace. In fact, your entire system can be stacked vertically in only 5½ sq. ft. No matter what hardware you're using (the basic AnthroCart is sturdy enough to support up to 150 lbs.) or how it will expand as your needs change. Just keep adding the shelves,

baskets and other accessories we provide to help you grow.

All but the lock. Place your order before December 31, 1985, mention this ad and we'll send one along with your order.

To get your hands on your very own AnthroCart simply call us toll free. Basic unit is just \$495. Unconditionally guaranteed for five years.

Anthro Corporation
3221 N.W. Yeon Street
Portland, OR 97210
503) 241-7113
TWX: 910) 333-6481



Toll Free:
1-800-325-3841 Ext. 501

A TEKTRONIX Company **ANTHRO Technology Furniture**

AnthroCart is a trademark and Anthro is a registered trademark of Anthro Corporation.

Editor's note: Due to space limitations, we are able to publish only a sampling of the great amount of mail Jerry receives each month.

COMPUTER WORRIES

Dear Jerry,

The story told by Lewis M. Phelps in his letter ("When Will Ada Arrive," March, page 352) is interesting and revealing. It's not the effect of battlefield EMP on aircraft computers that worries me, though. Once things have reached the stage where "Big Ones" are being used, whether in the battlefield or on cities, the fate of a few fighters is probably not of much concern.

What has me much more troubled is the possibility that a poorly designed or inadequately tested piece of software will fail at a time when someone's life, or perhaps the fate of us all, depends on it. This has happened, or come very close to happening, numerous times. Two instances I've seen cited even deal with the F-18 mentioned in the letter. We'd all do well to maintain a high level of skepticism when we hear of wondrous airplanes that can be modified by "simply reprogramming the control computer" (in Ada, which is hand-compiled into assembly language!). Anyone who would use the word "simple" in this context shouldn't be allowed to do such work.

ALAN WEISS
Carpinteria, CA

Computers aren't infallible, but they're probably more reliable than their programmers. This somewhat turns usual experience on its head: we're accustomed to fundamentally sound policies ruined by incompetent subordinates. On the other hand, we have some examples of the reverse . . .

It hardly matters. As the pace of life increases, we find ourselves willy-nilly forced to rely on computers for increasingly important decisions. Finances, transportation, communications—and finally the ultimate decisions of war and peace.

This is why I'm such a strong supporter of a strategy of assured survival, as opposed to the McNamara doctrine of mutual assured destruction, or MAD. In

my judgment, MAD leads to computerized launch on early warning. The end of that game was shown in the flawed but still valuable movie WarGames. Strategic defense will also need rules of engagement, and some of those probably have to be implemented by computers; but the cost of a mistake is a lot less. I hope there will be no mistakes, but I can't be sure of that; and I'd far rather see a rising spacecraft mistakenly shot down by nonnuclear weapons than continue down the road MAD is taking us. (If you want more of my views on this, they're in Mutual Assured Survival by Jerry Pournelle and Dean Ing, Baen Books, 1984.)

Errors will happen. You have sent me a list of them. I know of others. Try as we might, we're not going to eliminate all mistakes. We can think out the consequences of error and build systems that fail in the least dangerous ways.

Best.—Jerry

GRADING

Dear Jerry,

In regard to the letter from D.L. Fruehling ("Magazine Information," March, page 352), at least one peripheral device is already available for machine-grading multiple-choice examinations. Chatsworth Data Corporation (20710 Lassen St., Chatsworth, CA 91311, (213) 341-9200) makes such a reader. Included is software (written in BASIC for the IBM PC and clones; software for other machines may be available) for grading the answer cards. I am sure that with little effort the results from each exam could be plugged into a grading program.

R. S. NEUMAN
St. John's, Newfoundland, Canada

I'll have to look into that. Thank you.
—Jerry

HACKER DERIVATION

Dear Jerry,

Regarding your description of Hackercon in March: As one who was there when the words "hacker" and "to hack" were first applied to programming, I may be able to shed more light on the subject.

In 1965 I was at MIT, doing what amounted to postdoctoral work after getting a mathematics degree from Berkeley. I asked one day about the student sleeping on the table in the PDP-10 room. I was told that his name was Richard Greenblatt and that he was working on a chess program. In time I got to know Greenblatt and a couple of his friends, named Nelson and Gosper, and I became fascinated by the argot they spoke. For a true argot it was, as full of neologisms as any Parisian slang.

Actually, "hack" is much closer than you might think in origin to "hack writer." Greenblatt and his friends loved to write programs fast. Not programs that *run* fast, you understand, just programs that took a very short time to write. The resulting programs, as one might expect, were often rather inelegant, and they knew it; so they started referring to them as "hacks." In those days, elegance in programming meant writing in ALGOL 60, and Greenblatt's group had little interest in ALGOL 60 (which endeared me to them, since I was similarly inclined). They, then, were the outsiders, the self-described "hackers," trusting in their ability to write assembly-language artificial-intelligence programs that would outperform anything written in ALGOL 60—as, indeed, they did.

The prototypical variable names FOO and BARF served the same purpose in the argot that "John Doe" and "Richard Roe" do for lawyers. Thus, one might say, "If you have the ALGOL statement FOO:=BARF, you have to load BARF and store it in FOO." There was also "moby," meaning "big." Greenblatt was "writing this moby hack to play chess." The argot also took the place of conventional cussing. I never heard "goddammit" from Greenblatt or Nelson or Gosper; I heard "Foo! Barf!" or sometimes "Moby foo" or "Moby barf."

In time I went on to teach at Berkeley and lost contact with the hackers until I read about the success of Greenblatt's chess program, which the media called MacHack; actually, it was "MAC hack," meaning "a hack (or program) developed at Project MAC."

W. D. MAURER
Washington, DC

Fascinating. Thanks.—Jerry ■

Sometimes, it's better to put all your eggs in one basket.



AT&T International Services offer the strongest, sturdiest basket for your telecommunications needs.

Because AT&T has a long history of making international connections and developing international services.

AT&T offers a wide range of international services for your company, whether you're involved in manufacturing, distribution, marketing or any other function. AT&T International Long Distance Service, for example, helps your company build better business relationships. AT&T International 800 Service encourages the steady flow of contact between customers, salespersons and suppliers, so you can maintain a competitive edge.

But how do you choose the services that are right for you? It's simple. Just contact your Account Executive or Sales Specialist at AT&T. They're experts in a wide range of businesses, and they can offer you our entire basket to accommodate your needs. Together you and your AT&T representative can tailor services and applications that work for you.

To learn more about AT&T's state-of-the-art telecommunications and the applications they have for your business, please contact your Account Executive at AT&T Communications now. Or call a Sales Specialist at the toll-free number below.

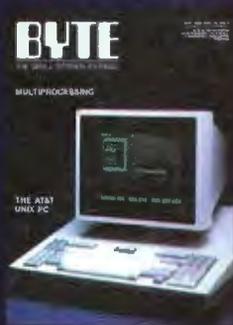
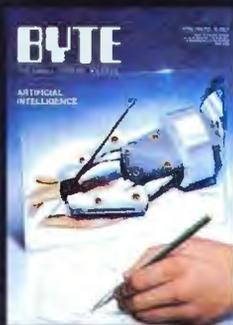
1 800 222-0400 Ext. 515



AT&T

The right choice.

SAVE 50% *



- United States One Year \$21 2 Years \$38 3 Years \$55
Canada/Mexico One Year U.S. \$23 2 Years U.S. \$42 3 Years U.S. \$61
Europe \$69 (air delivery), U.S. Funds enclosed
Worldwide \$37 (surface mail), U.S. Funds enclosed

BILL ME. If I'm not completely satisfied with my first copy, I'll simply write "cancel" across your invoice, mail it back, and my subscription will be cancelled.

Check Enclosed Bill VISA Bill Mastercard

Please allow 6-8 weeks for processing your subscription.

Name _____ 4AB5

Address _____

City/State/Zip _____

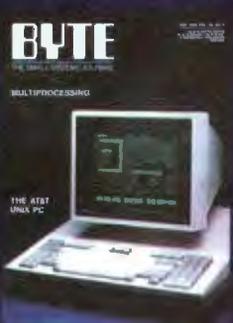
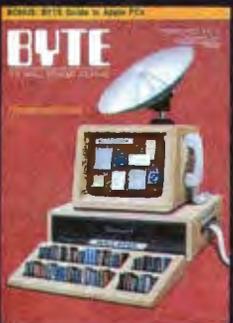
Card # _____ Expires _____

Signature _____

*off newsstand price of \$42.00



SAVE 50% *



- United States One Year \$21 2 Years \$38 3 Years \$55
Canada/Mexico One Year U.S. \$23 2 Years U.S. \$42 3 Years U.S. \$61
Europe \$69 (air delivery), U.S. Funds enclosed
Worldwide \$37 (surface mail), U.S. Funds enclosed

BILL ME. If I'm not completely satisfied with my first copy, I'll simply write "cancel" across your invoice, mail it back, and my subscription will be cancelled.

Check Enclosed Bill VISA Bill Mastercard

Please allow 6-8 weeks for processing your subscription.

Name _____ 4AB5

Address _____

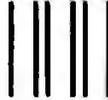
City/State/Zip _____

Card # _____ Expires _____

Signature _____

*off newsstand price of \$42.00





NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

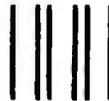
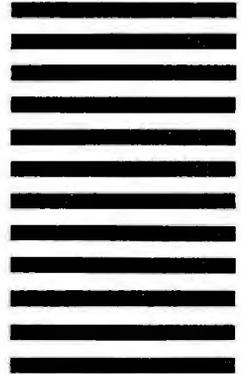
BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 39 MARTINSVILLE, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

BYTE

Subscription Dept.
P.O. Box 597
Martinsville, NJ 08836-9956



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 39 MARTINSVILLE, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

BYTE

Subscription Dept.
P.O. Box 597
Martinsville, NJ 08836-9956





A·C·C·O·R·D·I·N·G T·O· W·E·B·S·T·E·R

Memories

Monster Mac

Megamax C

Future Mac Designs

Amiga

Tecmar T-card

Atari 520ST

Proper Balance

NCC

Optical Disks

BY BRUCE WEBSTER

This column is a first for me, or more properly, a first for my Macintosh. You see, up until now I have done these columns on my Compaq portable. My usual excuse has been that I haven't had my Mac hooked up for telecommunications, i.e., cable plus modem plus telecom software. That changed some weeks back with the arrival of an Apple Modem 1200 and MacTerminal . . . but I was still reluctant to do my columns on the Mac. The Compaq was more comfortable and, with 640K bytes of RAM (random-access read/write memory), half of which went to a RAM disk, faster. So I had little incentive to change. Until now.

A week or so ago, I had my Mac upgraded to 2 megabytes. Yes, you saw that correctly: 2 *megabytes*. What's more, that does not mean that I have just a 512K-byte Mac with a 1.5-megabyte RAM disk. The full 2 megabytes is available for applications. But I get ahead of myself. Anyway, because of the upgrade I am now switching to the Mac for major word processing, instead of limiting it to correspondence. Of course, I may decide that I like things better on the Compaq anyway, but I'm willing to give it a shot.

PRODUCT OF THE MONTH: LEVCO MONSTER MAC

As you might guess, I have chosen the 2-megabyte upgrade as the product of the month. Known as the Monster Mac, the upgrade comes from Levco, a small firm located in San Diego. If you'll pardon the cliché, the only thing small about the upgrade is the price: \$900, installed, for a 512K-byte Mac. If you've got a 128K-byte Mac, Levco will do the upgrade to 512K bytes for a reduced fee of \$200. When you consider that as of right now (the start of August), Apple is still charging \$700 for an "official" upgrade to 512K bytes, the price seems downright minuscule.

The upgrade itself is a daughterboard, roughly 3 by 4 inches, that plugs into the 68000 socket on the motherboard. The 68000 processor then plugs back into the

daughterboard, which contains the 1.5-megabyte RAM, some ROMs (read-only memories), and a little more circuitry. This approach gives Levco some decided advantages. First, memory access on the daughterboard is somewhat faster. Since the video circuitry reads only the RAM on the motherboard, the 68000 doesn't need to time-slice while reading the RAM on the daughterboard.

Second, Levco can put the ROMs in there to intercept the boot sequence and make the necessary patches (relocation of video RAM, etc.) to ensure 2 megabytes of contiguous RAM. This means that you don't need any special software—especially not a custom system file—to run on the Monster Mac. You just power it on. Period.

Third, the daughterboard has a series of connectors—little holes, really—along one side, with signals coming over from the 68000. This is for planned add-on products. Believe it or not, customers have already started asking Levco about a 4-megabyte Mac. However, Levco is now working on a hardware floating-point board for the Mac. It's based on the now-available 32081 floating-point chip, while the 68000-family chip is slower, more expensive, and not available in production quantities.

Fourth, it appears that Levco is considering dropping in a higher-end 68000 processor. Unfortunately, many Mac software packages use sequences of instructions that are not allowed on the 68010, etc., so that is on hold for the time being. As the "Future Macs" section below indicates, Apple appears to be planning an upgrade to those chips as well, so the software companies better get their act together if they want their programs to run on future Mac products.

While the full 2 megabytes is available for applications, it certainly doesn't hurt to use part of it as a RAM disk. I have a boot disk with the Mac Memory Disk software from Assimilation Process on it; on power-up, it

(continued)

Bruce Webster is a consulting editor for BYTE. He can be contacted c/o BYTE, 425 Battery St., San Francisco, CA 94111.

Take Your Bus



To Greater IBM Compatibility

...And Leave the Savings to Us.

No matter how far you want to take your S100 BUS, Lomas Data Products has the IBM capability and power you need.

At a cost that won't hold you back.

Lomas Data Products is the reliability leader in 16 bit microprocessor S100 BUS products. With a 5 year reputation to prove it. Our boards can punch up your S100 BUS with 3 to 5 times the performance of an IBM-PC. Complete with IBM PC-DOS compatibility and multitasking. Our system capabilities run the distance between 8MHz 8086 and 8MHz 80286 performance. Each supporting 8MHz math co-processors.

And when it comes to prices . . . no other S100 BUS board supplier can offer so much for so little.

Get your ticket to IBM capability and 3 to 5 times the performance. From the only supplier of S100 BUS IBM-PC compatibles—Lomas Data Products.

MEGARAM: High performance high density Dynamic RAM.

Offers cost effective memory expansion in 16 bit systems. No wait states with 8086's up to 10MHz Only one wait state with 8MHz 80286 Up to two MegaBytes of memory
Price256K—\$595.00512K—\$749.00
1024K—\$1095.002048K—\$1795.00

Prices and specifications are subject to change.

COLOR MAGIC: IBM-PC compatible S100 BUS graphics board.

Gives your 16 bit S100 BUS system IBM-PC compatibility. RGB and composite outputs IBM PC keyboard port All IBM-PC display modes plus two higher resolution modes
PRICE16K—\$595.0032K—\$695.00

THUNDER 186: Single board 16 bit microprocessor offers 10MHz 8086 performance.

THUNDER requires no other support boards. 256K RAM FDC controller 2 Serial ports Parallel printer port Concurrent DOS is included
PRICE \$1195.00

LIGHTNING ONE: The standard by which other 16 bit boards are judged.

The LIGHTNING ONE offers math processing capabilities only available on large mainframes previously. Up to 10MHz operation 8MHz 8087 option Optional 8089 co-processor
PRICES start at \$425.00
8086/87 (8MHz) **\$900.00**
8086 (10MHz) **\$625.00**

LIGHTNING 286: Highest performance processor available on the S100 BUS.

This 8MHz 80286 offers performance equivalent to an 18MHz 8086. 5 times IBM-PC performance 16 Mbyte physical memory space 1 Giga byte virtual address space
PRICE80286—\$1095.00
80286/287—**\$1645.00**

Lomas Data Products, Inc.

LDP

182 Cedar Hill Street, Marlboro, MA 01752 Telephone (617) 460-0333 Telex 4996272

For orders outside the U.S., contact our exclusive dealers: Australia—LAMRON PTY. LTD., (02) 808-3666 Malaysia—EXA COMPUTER (M) SENDIRIAN BERHAD, 795284 England—RATIONAL SYSTEMS, 0908-613209 or 0908-611349

Fourth Annual Conference on

INTERACTIVE INSTRUCTION DELIVERY

in Education, Training and Job Performance

February 19-21, 1986
Hyatt Orlando Hotel
Orlando, Florida

Presentations cover applications in:

**Videodisc CD-ROM
Microcomputers
Software Development Methodology**

Pre-conference tutorials are scheduled for February 17 and 18.

Exhibits of representative technology will be available to conference registrants in an adjacent area.

For further information contact:



SALT

Society for Applied Learning Technology

50 Culpeper St. Dept. B
Warrenton, VA 22186 (703) 347-0055

ACCORDING TO WEBSTER

loaded applications (with a minimum of application RAM), you can quickly get to the desktop and back for file deletions, transfers, and so on.

Unfortunately, not every program works with the Monster Mac. One problem is that a few programs ignore the video-RAM pointer and write directly to the video-RAM region. The Monster Mac relocates the video RAM to provide contiguous application RAM, so that causes a problem. Of course, the same programs are going to have problems with upcoming Macintosh models from Apple (see "Future Macs" below), so Levco isn't alone with this problem. There is, by the way, at least one solution. If you hold down the Interrupt button (the one farthest from you) while powering on or resetting, then release it when you hear the "bong," your Monster Mac will come up as a normal 512K-byte system. A power-down/power-up or reset will give you a 2-megabyte Mac again.

Another interesting side effect of the Monster Mac is that you can challenge the assertions of various software companies that "our program would run much faster if the Mac had enough memory/faster disk drives!" The folks at Levco mentioned several examples where that turned out not to be true. Even with the entire program loaded into RAM, and any file access coming off a RAM disk, performance was still pretty mediocre. I won't mention any names until I've verified it myself, but look for some possible balloon-popping in future columns.

Incidentally, the Monster Mac runs cooler than a regular 512K-byte Mac. That's because Levco installs a piezoelectric "butterfly" fan. This fan has no moving parts, at least in the normal sense of moving. Instead, it has two strips of piezoelectric material, each roughly the size and shape of a Band-Aid, that vibrate back and forth as electric current is passed through them. The fan is quiet and apparently never wears out. An interesting note: The firm that makes the fan told Levco that they had been approached by Apple many months earlier. Apple was apparently ready to order large quantities of the fan, presumably for the Mac, but the deal was nixed at the last minute.

The Levco Monster Mac upgrade goes a long way toward turning the Mac into what it should have been in the first place: a high-powered, high-speed personal computer. Frankly, given the memory demands of a graphics-based computer and the speed bottleneck of a complex operating system, I would think that a Mac should have a *minimum* of 1 megabyte of RAM, and preferably more. It is still hard for me to understand what the folks at Apple were thinking about when they released the Mac with 128K bytes and no slots, then instituting such an outrageous fee for the upgrade to 512K bytes (which is still not enough RAM).

The Monster Mac upgrade actually comes in several sizes. You can buy the unpopulated board (i.e., everything but the RAMs) for \$500; each bank of 512K bytes costs another \$100, so the full 1.5-megabyte board costs \$800. Installation charge is another \$100. Note that you must

(continued)

PANAMAXTM Surge Suppressors

MADE IN U.S.A.

The Best Low Cost "INSURANCE" for Personal Computer and Priceless Data
UL Listed. Five-Year Unlimited Warranty
30 Days Money-back Guarantee

a. \$88
List \$119

b. \$78
List \$129

c. \$59
List \$99

d. \$56
List \$89



- a ULTRAMAXTM** 4 Receptacle, 6' line cord, on/off switch, noise protection, brown out protection, circuit breaker and undervoltage alarm.
- b TELEMATXTM 4** 4 Receptacle, 6' line cord, telecommunication surge and spike suppressor, and noise filter, 2 phone jack receptacles, RJ-45-11 compatible.
- c MAXTM 6** 6 Receptacle, 6' line cord, on/off switch, noise protection and circuit breaker.
- d MAXTM 4** 4 Receptacle, 6' line cord, on/off switch noise protection and circuit breaker.

TCK International Co. Dept. B1185
1766 Devon Dr. Glendale Hts., IL 60139 Tel. (312) 682-3130

Send Model _____ Qty _____ (UPS Shipping Included)
Enclosed check or money order \$ _____ (IL resident add 6 1/4 % tax)

Name _____
Address _____
City _____ State _____ Zip _____

At last — an expert system that's easily affordable



Now you can explore
the world of expert systems,
creating your own knowledge bases,
for only \$49.95.

Expert systems — programs that can make logical inferences from a database of rules — are among the hottest developments in software today. They greatly simplify complicated problem solving for a wide variety of professionals . . . from the engineer troubleshooting complex machinery to the investor making critical financial decisions. But they ordinarily cost thousands of dollars, which is too much for most individual users to pay.

Here for the first time is a full, open expert system at a fraction of the usual cost. MICRO EXPERT, running on Apple or IBM PC, gives you the problem-solving capabilities of systems costing thousands . . . for less than \$50!

Among its many useful features . . .

- it provides a complete expert system with rule-handling capabilities—has the capacity to store and use up to 400 rules
- it contains complete source code and descriptions of program design for easy modifications
- it overlooks nothing—makes the cross connections that people miss unless they work through every possible combination of the facts and all possible relationships
- it allows you to include Pascal functions and procedures within rules
- it lets you trace inferences, find out how any given inference was made
- it lets you find out why questions are asked and what facts have been established

An invaluable *affordable* aid to every professional who must solve problems in situations where there are a lot of possibilities, the MICRO EXPERT package includes a 74-page guide with detailed instructions on everything from starting the system to developing and writing rule bases.

Machine Specifications:

Apple II (all models), 64K RAM, one or more disk drives, printer optional
IBM PC, 128K RAM, one or more disk drives, printer optional
Apple Macintosh, 128K RAM, one or more disk drives, printer optional



MICRO EXPERT

by Beverly and William Thompson

MasterCard and Visa holders,
call 1-800-628-0004
(In New York call 212-512-2999)
Or use this handy coupon . . .

McGraw-Hill Book Company

P.O. Box 400, Hightstown, NJ 08520

YES, I want to order MICRO EXPERT, the unique new computer program that provides a complete expert system at an easily affordable price.

- APPLE II (852110-6) \$49.95
 IBM PC (852109-2) \$49.95
 APPLE MACINTOSH (852138-6) \$49.95
(available September 1985)

- My check (including local sales tax) is enclosed
 Charge my order to: VISA MasterCard

Card # _____ MC Bank # _____

Expiration Date _____

Signature _____

Orders must include payment. Make checks payable to McGraw-Hill Book Company. Disks are not returnable. Order subject to acceptance by McGraw-Hill.

Name _____

Firm _____

Address _____
(No P.O. box, please)

City _____ State _____ Zip _____

In Canada, available from McGraw-Hill Ryerson, Ltd., 340 Progress Avenue,
Scarborough, Ontario M1P 2Z5. Prices slightly higher outside the U.S.

23-D239-1000-3

New 64K SBC



Only
\$375.
4" x 6"

- Requires no terminal. Includes Video Controller and CP/M® 2.2
- Runs any size floppy drive
- Substantial OEM Discounts Available

Other models include Hard Disk Controller, CP/M® 3.0, 128K or 256K RAM, Time of Day Clock, E²PROM, Peripheral Expansion & RGB Color Video Display

64K SBC Includes:

- 6 MHz Z80B®
- Video Controller
- 2 Serial Ports
- 4 Parallel Ports
- I/O Expansion
- Source Code and Drivers included
- CP/M® 2.2

CP/M is a registered trademark of Digital Research Inc.
Z80B is a registered trademark of Zilog Inc.

Megatel Computer Technologies
Head Office and Technical Support Center
150 Turbine Drive, Weston, Ontario M9L 2S2
Telephone: (416) 745-7214 Telex: 065-27453 MEGATEL TOR.

megatel

PC Real Time A/D Signal Averaging

MODTRAC Systems introduces The **DIGITIZER**, a multi-channel, high resolution A/D board, uniquely combining: **Large, on-board memory**, where data samples are automatically stored when digitized, thereby maximizing data through-put by eliminating CPU software overhead for each sampled data point.

Signal averaging; a "piggy-back" averager board containing additional memory and special circuitry enabling simultaneous summing of the prior sweep's data while a new sweep is being acquired.

- ★ IBM® PC™ bus compatible (one slot required).
- ★ 16 single ended inputs or 8 differential inputs.
- ★ 14 bit A/D resolution.
- ★ 24 KHz conversion rate, single channel (higher rates optional).
- ★ Four digital (TTL) I/O lines.
- ★ Software selectable sampling rates, (256-24 KHz).
- ★ Programmable triggering and trigger options.
- ★ Programmable voltage over-range interrupts.

Prices start at \$1,295. AMEX or COD orders welcome. For more information and quantity discounts on this exciting new product, call or write:

MODTRAC SYSTEMS

10349 West 70th Street, Eden Prairie, MN 55344
(612) 944-2794

MODTRAC, a division of CNS, Inc. IBM-PC is a trademark of IBM Corp.

ACCORDING TO WEBSTER

have a 512K-byte Mac in order to use this board; as noted earlier, Levco will do the upgrade from 128K to 512K bytes for an additional \$200. That gives you a total upgrade price of \$900 for 512K-byte Macs and \$1100 for 128K-byte Macs—not a bad price, indeed.

FUTURE MACS

Speaking of future Macintosh designs, I received an interesting document in the mail the other day. Many months ago, I sent in my money to Apple for *Inside Macintosh* and the *Mac Software Supplement*. The latter was as important as the former because it guaranteed that I got all the updates to *Inside Macintosh*, the latest tools and supplements for Lisa and Mac development, and lots of informative notes about the Mac. Well, the latest—and last—update showed up the other day, and buried in the documentation was a six-page section entitled "Future Macintosh Architectures." Very interesting reading. Essentially, it's a questionnaire for developers who are bypassing Lisa Pascal (and, to some extent, the Toolbox) and who write lots of low-level assembly-language routines. The questions fall into the format, "Are you doing x? If so, then be aware that it might change; you should probably do y instead." The idea is to warn the developers away from practices that might make their programs incompatible with future machines.

Careful examination of the questions gives some indication of what Apple may be up to. Reading between the lines (or, in some cases, the lines themselves) suggests the following changes in future Macs:

1. A move to "higher" 68000 chips (68010, 68020, etc.)
2. More memory, i.e., greater than 1 megabyte
3. Larger screen displays
4. Higher clock speeds
5. Higher-capacity (and possibly faster) disk drives
6. Shifting around of the memory map
7. Some serious cleaning up of the operating system and Toolbox

None of this should come as much of a surprise, given the persistent rumors about the "Turbo" Mac and other future products, but it does show that Apple recognizes that it needs to come out with a high-performance machine. Good for them. I've been a strong Mac supporter all along—I consider the "real men don't use icons" argument a lot of hogwash—but it's been frustrating to see a marvelous user interface limping along in a deliberately crippled closed box. Recent changes in high-level Apple management have apparently opened the door for the reintroduction of Macintosh and Lisa technology with appropriate hardware. Unfortunately, it's about two years late, and Apple will have to suffer the consequences of some bad decisions. And maybe we'll finally see a Mac with slots and a fan.

A few months ago, I mentioned Apple's planned policy of denying 128K-byte ROM upgrades to Mac owners who

(continued)

Princeton Graphic Systems Number One Again

Sharp resolution, full compatibility, and rugged reliability. That's what you get in every Princeton Graphic Systems monitor. That's why Princeton Graphic Systems is number one in the minds of more and more personal computer owners every year.

Only Princeton Graphic Systems offers a complete family of quality personal computer

displays. Our color and monochrome monitors outperform the competition every time. That's why, for the second year in a row, our HX-12 high resolution color monitor has been voted best in the world.*

So for the very best in personal computer monitors, pick the company that's number one. Princeton Graphic Systems.

*PC WORLD Magazine's 1985 World Class Survey.



PRINCETON™

GRAPHIC SYSTEMS
AN INTELLIGENT SYSTEMS COMPANY

601 Ewing Street, Bldg. A, Princeton, NJ 08540, (609) 683-1660, Telex: 821402 PGSPRIN, (800) 221-1490 Ext. 704

HARMONY VIDEO & COMPUTERS

2357 CONEY ISLAND AVE., BROOKLYN, NY 11223
800-VIDEO84 OR 800-441-1144 OR 718-627-1000



IBM PC 256K
\$1329.95
STAR SG10
\$201.95

PANASONIC 1091
\$221.95
APPLE 2E w/DRIVE
\$780.00

"PRINTER SPECIALS"

Brother HR15 XL	307	NEC 2050	593	Powertype	275
Brother HR 35	619	NEC 3550	894	Gemini 10X	159
Citizen MSP 10	248	NEC 8550	1317	Star SG10	202
Corona Laser	2387	NEC p3	449	Star SG 15	336
Dalysy/riter	718	Okidata 192	323	Star SD 10	306
Epson LX80	213	Okidata 193	484	Star SD 15	400
Epson XJ90	467	Okidata 182	219	Star SR 10	435
Epson LQ 1500	837	Okimate 10	118	Star SR 15	543
FX 185	462	Olympal ro	250	Star SB 10	492
FX 85	334	Panasonic KXP 1091	222	Silver Reed Exp 550	354
HP Laser Jet	2652	Panasonic KXP 1090	183	Silver Reed Exp 500	231
Juki 8100	335	Panasonic KXP 1092	327	Silver Reed Exp 770	593
Mannesman Spirill 100	183	Panasonic KXP 1093	403	Tohiba 1340	515
		Panasonic KXP 3151	379	Tohiba 351	985

WOW! WOW! WOW!

APPLE	IBM	80287 Chip	180
2E w/Disk Drive	AT Enhanced	AST Advantages	354
Apple 2C	AT Unenhanced	Everex Edge	260
ImageWriter	IBM Monitor	Everex Magic	164
Addl. Drives	IBM PC 84K	MONITORS	
	from 104	Amdek 300 Green	105
ATARI	PC XT	Amdek 300 Amber	109
130 XE	PC XT Clone	310 Amber	129
800 XL	IBM Drive	Color 200	169
1027 Printer	AST Six Pack	Color 500	270
1050 Drive	Tell Graze 25 Meg	Quad Board	371
Indus. Drive	200	Color 700	385
MODEMS	Keytronics	Color 710	427
Hayes 1200 w/Smartcom	Hercules Color	Princeton HX12	360
Hayes 1200B w/Smartcom	Hercules Monochrome	SR 12	142
Hayes 300	Mitsuba Monochrome	Taxan 122A	536
Hayes 2400	Paradise 5 Pack	Taxan 220	219
Micromodem 2E	STB Graphics + 2	Taxan 420	474
Novation J-cat	STB R10 + 2	COMMODORE	
Prometheus 1200	STB Mono Board	Commodore 64	140
	Tecmar Graphics	1451 Disk Drive	181
SANYO	Tecmar Capitan	1702 Monitor	181
555 D.S.	Persyat Monocard	MPB 803	95
MBC 775	Bermoull Box	Indus. Drive	201
		Card co. Interface	37

800-441-1144

Prices reflect cash discount. For your protection we check for stolen credit cards. M/C, VISA welcome. Personal checks cause 4 week delay.

When You Want The Best, Call...

nbs inc.

National Business Software and Supplies

ORDER LINE 800-225-8800

SOFTWARE

JAZZ	CALL	SUPERCALC III	\$189
LEADING EDGE W.P.	65	WORD PERFECT 4.0	229
NUTSHELL	85	ELECTRIC DESK	189
ABILITY	295	R BASE 5000	369
TURBO PASCAL 3.0	39	NORTON UTILITIES	59
WORDSTAR 2000 +	295	SMART SOFTWARE SYS	549
MULTIPLAN	118	SUPER KEY	39
SAMNA +	349	DBASE III	CALL
DISPLAYWRITE 3	225	POWER BASE	215
CORNERSTONE	CALL	CROSS TALK XVI	99
REFLEX	329	BPI GEN. ACCT.	319

MISC.

AST 6 PAK + 64 K	\$239	PRINTERS	CALL
10MB/20MB DRIVES	CALL	DISKETTES	CALL
HAYES 1200 B	\$359	SUPPLIES	CALL

TWO LOCATIONS:

500 W. Broadway, Suite 116
Tempe, AZ 85282
(602) 966-8005

P.O. Box 23,
Painesville, OH 44077
(216) 352-1262

Monday-Friday 8am-5pm

VISA & MasterCard Welcome

Shipping & handling add \$5 per order (printers \$10 per order). VISA & M/C add 3%. AZ residents add 6%. Allow two weeks for personal or company checks to clear. Returns subject to 15% restocking fee. All items are new with manufacturer's warranty. Machine compatibility not guaranteed. Prices subject to change, product subject to availability.

11/85

ACCORDING TO WEBSTER

had non-Apple RAM upgrades. Well, since those administrative changes at Apple, the policy appears to be undergoing a reversal, and there may be a good chance that Apple will do what it can to make the upgrade available to all Mac owners. Of course, it looks like the ROM upgrade won't be made available until this coming January, and possibly not even then. Of course, I got my 2-megabyte upgrade before hearing about this, but it is nice to know that I may be able to get the new ROMs anyway.

UPDATE: AMIGA AND ATARI

The next generation of 68000-based systems is hitting the market. Commodore officially unveiled the Amiga at a press conference in New York that was very ritzy, with lots of expensive food and famous people. One of the BYTE editors who attended said it was the kind of introduction that is usually given to cover up a mediocre product. What was amazing, he reported, was that the Amiga was the most impressive part of the introduction.

It looks like the Amiga will hit the market at a price of \$1295 for a 256K-byte machine. That is too little RAM, but the upgrade to 512K bytes costs only \$200 and can be installed in a few seconds; you just plug a cartridge into the front of the machine. A smart move, and another lesson learned from Apple's mistakes. Even so, you'll probably want to add even more RAM to your system. Luckily, Tecmar has announced the T-card, a slim box that plugs into the expansion bus on the side of the Amiga.

The T-card (estimated cost of \$300 to \$500) can hold up to 1 megabyte of RAM. Also, it has a clock/calendar chip and serial and parallel/SCSI (small computer standard interface) ports on the back. These, of course, let you plug in the Tecmar 20-megabyte hard disk (about \$1000) and the Tecmar 300/1200/2400-bps modem (about \$500 to \$700) without tying up any of the Amiga's ports. You can plug together multiple Tcards, giving up to 8 megabytes of RAM (in addition to the 512K bytes inside the Amiga) and a whole lot of ports and clocks in the process. In fact, Tecmar ought to come out with another model of the T-card without the ports and clocks and holding more RAM (2 to 3 megabytes). Tecmar says that all these products (along with a 20-megabyte tape backup unit for less than \$700) will ship "when the Amiga does."

This is all nice, but I still don't have my hands on an Amiga yet. Maybe by next column. In the meantime, I'll try to control my enthusiasm until I can really use one.

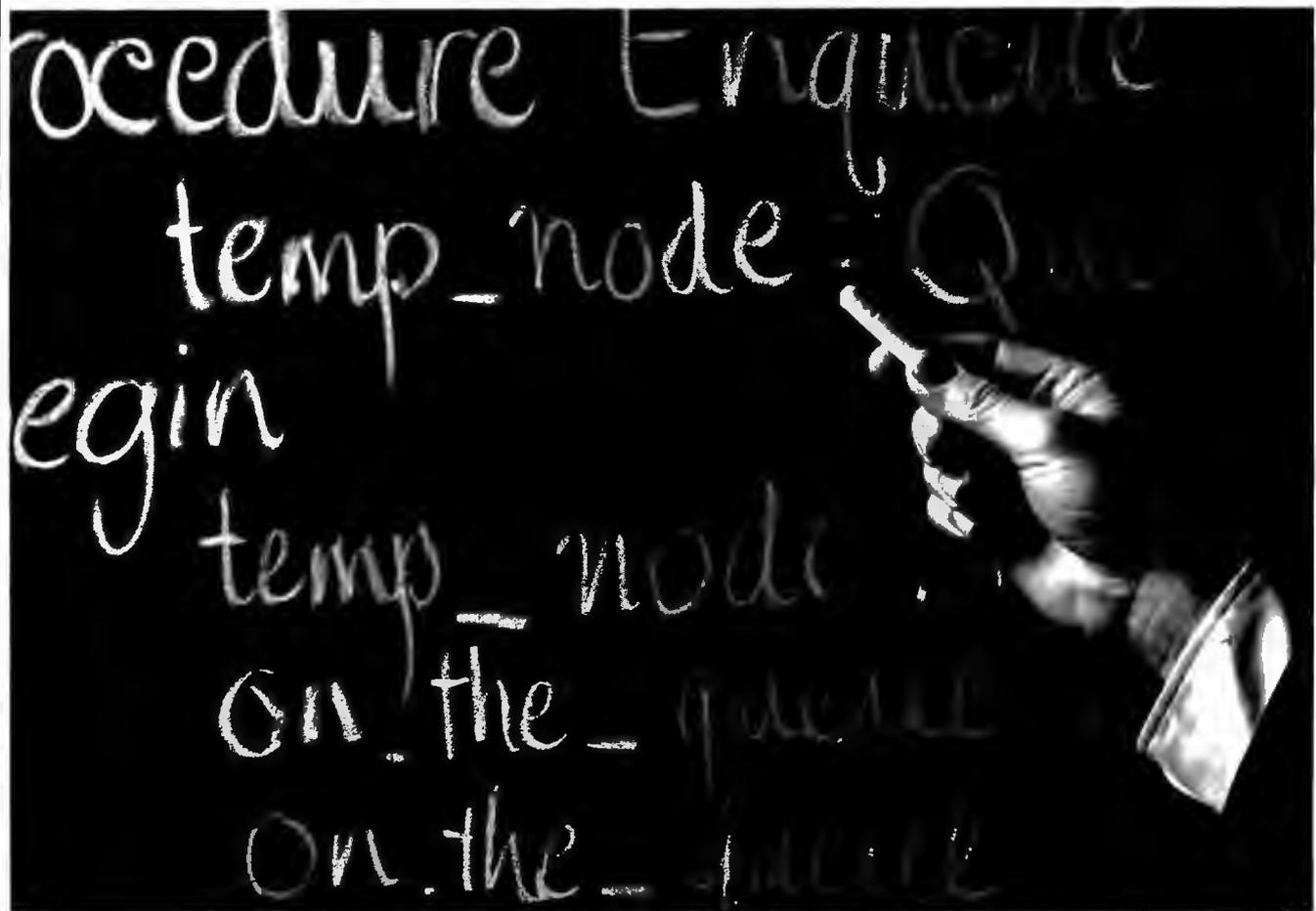
One firm that has no enthusiasm about the Amiga is Atari, which is finally starting to ship the 520ST, after missing several "firm" deadlines. I hope to get an ST soon and put it through its paces, doing some head-to-head comparisons with the Mac and the Amiga.

THE GOLDEN TRIANGLE

I harp on memory size a lot, but I am continually amazed at the lack of foresight shown by computer designers. A computer system has to correctly balance three areas: pro-

(continued)

To succeed in the future, you must learn to speak its language.



Martin Marietta Denver Aerospace is committed to a future of computer software excellence. Ada® is part of that future. But our commitment to becoming the software center of excellence requires exceptional people—people who don't wait for the future, but work to create it.

We are now looking for software and other aerospace professionals to move ahead with us, to step into the future and help lead the way. There are already many opportunities to work with Ada as we explore its many applications. We are continuing our intensive on-site software engineering education curriculum for our employees (a full-time, 13-week hands-on Ada program).

So, if you want to succeed in the future, come to where we already speak its language—Martin Marietta Denver Aerospace.

We have opportunities available for aerospace professionals with at least 3 years experience in:

- Systems • Electronics • Software • Test • Software Test
- Systems Safety • Logistics • Mechanical Engineering

- Quality Software, Electrical & Mechanical • Contracts
- Material Operations • Aerospace Program Planning
- Manufacturing • Finance Estimators

Other career opportunities exist at Martin Marietta Aerospace in Baltimore, Maryland; Orlando, Florida; & New Orleans, Louisiana.

RECENT EXPERIENCE ON GOVERNMENT/DOD STATE-OF-THE-ART PROGRAMS A REAL PLUS.

SPECIAL BACKGROUND INVESTIGATION MAY BE REQUIRED.

Please send your confidential resume to: Martin Marietta Denver Aerospace, P.O. Box 179, L1311, P909, Denver, Colorado 80201. No agencies please, we prefer talking to the individual.

U.S. Citizenship Required.

An Affirmative Action Employer Actively Seeking the Veteran and Handicapped.

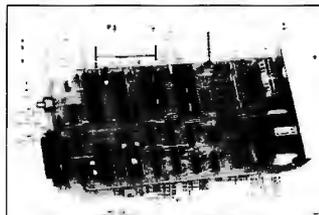
MARTIN MARIETTA

LOW COST UNIVERSAL EPROM, EEPROM, PROM PROGRAMMER

EPROMS : 2516 THRU 2564, 2716 THRU 27513, 27C16 THRU 27C512, 68732 THRU 68766, 57C256
EEPROMS : 52B16, 52B23, 52B33, 2816A, 2864A, 48202
MICROS : 8741, 8744, 8748(H), 8748(M), 8751, 8755
PROMS : CV7C 281, 282, 291, 292

1409 BASIC MODEL

NO PERSONALITY MODULES, MENU SELECTION, ONBOARD 110/220V AC POWER SUPPLY, RS232C INTERFACE, XDN-XOFF, RTS, CTS, DTR, VERIFY PROGRAM AND BLANK COMMANDS, MANUAL PROGRAMMING WITH LINE EDITING, ACCEPTS INTEL OR MOTOROLA FORMAT, USER FRIENDLY MONITOR FOR I/O DEBUGGING, FAST PROGRAMMING MODE 27168 UNDER TWO MINUTES, LOW/HIGH BYTE PROGRAMMING FOR 16 BIT BUS, EEPROM BYTK, BLOCK OR CHIP ERASE, UP/DOWN LOAD IN INTEL/MOTOROLA FORMAT, COMPLETE DOCUMENTATION INCLUDING CAD SCHEMATICS, HIGH QUALITY AMP ZIP.

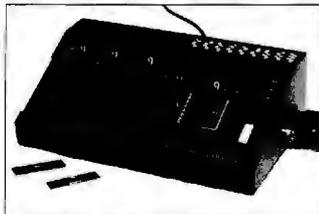


1409 KIT PRICING

11A : 8K FIRMWARE PCB, XFORMER . . . \$125
21 : 11A + 874(X) FAMILY \$150
31 : 21 + 8761, 8765 + 2" PCB . . . \$200
12A : 11A + FULL SET OF PARTS . . . \$250
22 : 21 + FULL SET OF PARTS . . . \$300
32 : 31 + FULL SET OF PARTS . . . \$400
13A : 12A ASSEMBLED AND TESTED . . . \$350
23 : 22 ASSEMBLED AND TESTED . . . \$400

1409C PACKAGED MODEL

STAND ALONE EPROM DUPLICATION GANG PROGRAMMER EXPANSION PORT BUILT-IN EPROM ERASER, CONDUCTIVE FOAM PAD, ACTIVE SOCKET LED INDICATOR



1409C PRICING

33 : 13A + EPROM DUPLICATION . . . \$650
34 : 33 + 8744, 8751, 8765 \$800
SOURCE CODE ON PC-DOS DISK . . . \$ 75
SOFTWARE DRIVERS FOR MOST PCs . . . \$ 35
CALIFORNIA RESIDENTS ADD 6% SALES TAX
ALL PRICES F.O.B. SAN JOSE, CA
MASTERCARD AND VISA ACCEPTED

B&C MICROSYSTEMS

6322 MOJAVE DRIVE, SAN JOSE, CA 95120 TEL: (408) 997-7885 TWX 4995363

ACCORDING TO WEBSTER

cessor power, RAM, and mass storage. The 128K-byte single-drive Macintosh is a prime example of a powerful processor—the 68000, with a 16-megabyte direct address space—crippled by too little RAM and mass storage. The graphics orientation of the machine, along with the large operating system, just make matters worse. Ironically, three months after the Mac appeared, Apple introduced a machine with an excellent balance: the IIc, also with 128K bytes of RAM and a single drive. For the 6502 and the body of existing Apple II software, that was plenty of room. Even so, the IIc would have been better served with a double-sided drive—140K bytes just isn't enough space—but the balance was still better than the Mac's.

There also needs to be a balance between RAM and mass storage. Specifically, too little of one can limit how useful the other is. You can usually get away with having "too much" mass storage—look at all the 10-megabyte hard disks running on 64K-byte Apple IIs—but not always. A case in point: The various hard disks for the Mac have had problems because you could create more files than the Finder could keep track of in memory. This is actually more a flaw of the Finder than of the lack of RAM, but it is a real problem.

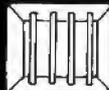
The other balance is more necessary and yet more easily compensated for. If you have lots of memory and limited mass storage, a lot of the memory tends to be wasted. A microcomputer with 2 or 3 megabytes of storage and one or two floppy-disk drives can't do much with all that memory unless, of course, you have some way of adjusting the balance. With a RAM disk, you can convert extra memory into mass storage, striking the proper balance for your needs. If you have a task that is memory-intensive, you can load up your RAM with the application and data; if you don't, you can build a RAM disk of some size and increase performance and storage at the same time. You still may have problems: A memory-intensive application may be too big to fit itself and its data onto floppies.

The 2-megabyte two-drive Mac I have now is in much better balance, though hooking it up to a Bernoulli Box would bring the mass storage up to par with the RAM. This Mac no longer gets in my way, no longer bores me with slow disk accesses or interminable waits for the desktop to appear. Had Apple come out with a 1-megabyte Mac at the start, many of the Mac's problems—performance complaints, lack of software, etc.—would never have appeared.

Perhaps the reason I'm so excited about the Amiga is because it seems to be in excellent balance right from the start. The 880K-byte built-in drive holds more than a Mac with two drives, and DMA (direct memory access) disk I/O (input/output) means that access time is much shorter. As mentioned, 256K bytes isn't really enough for the Amiga, but the 512K-byte upgrade is cheap, easy, and available now. And if Tecmar does indeed start selling its peripherals at the same time the Amiga ships, even more RAM (up to 8 megabytes) and mass storage (20 megabytes for

(continued)

What use is 68000 power
if you can't get at it?



You can with the U-MAN!

Look at these languages and tools available for the programmable 68000 power U-MAN Series 1000 supermicro

UCSD p-system with text editor, filer, many utilities.

- PASCAL
- FORTRAN 77
- BASIC
- Advanced Developers Tool Kit including 68000 Assembler

CP/M 68K with editor, many utilities, 68000 Assembler.

- C
- CBASIC
- PASCAL M.T Plus
- SVS FORTRAN
- Whitesmiths 'C'
- SVS Basic Plus
- SVS Pascal
- Cambridge LISP
- PROLOG
- FORTH
- VED 68K program editor
- XED screen editor

Where else can you get a 68000 based supermicro starting at \$2500 for an extremely well-equipped system* expandable to 1MB RAM and Winchester?

- 192K RAM
- 68000 (10MHz) and 6809
- Dual 500K floppies
- Clock & timers
- Two serial ports
- Contronic's port
- Sound generator
- Speech synthesizer
- 10 bit A/D
- 16 parallel I/O lines

Note that all the CP/M68K languages can use whatever RAM is installed—unlike CP/M86 and MS-DOS where the limit is usually only 64K.



Keyboard and 4 slot expansion system.

U-MAN LOW'S HACKS!

Although the big software houses have their parts to play we believe individuals can still make a big contribution to the software scene. If you've a program bursting to get made, needing 68000 power or U-MAN features, give us a call we can offer up to 40% off for a bona fide project!

College or University — ask about education discounts for Feb. & March.

OEM and dealer enquiries welcomed.

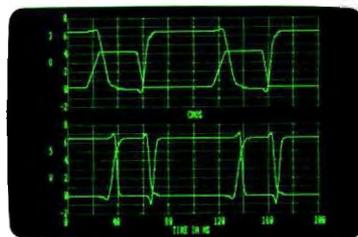
MASTERBYTE
Computers of New York
19 W. 34th St., Suite 815
New York, NY 10001
(212) 760-0340 / 1/2
TWX: 9103801502
(MASTERBYTE)

MASTERBYTE
COMPUTERS OF NEW YORK

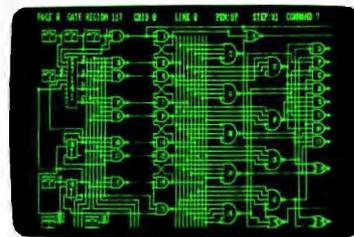
MICRO CAP and MICRO LOGIC put your engineers on line... not in line.



MY OWN WORKSTATION



"Typical MICROCAP Transient Analysis"



"Typical MICROLOGIC Diagram"

How many long unproductive hours have you spent "in line" for your simulation? Well, no more. MICROCAP and MICROLOGIC can put you on line by turning your PC into a productive and cost-effective engineering workstation.

Both of these sophisticated engineering tools provide you with quick and efficient solutions to your simulation problems. And here's how.

MICROCAP: Your Analog Solution

MICROCAP is an interactive analog circuit drawing and simulation system. It allows you to sketch a circuit diagram right on the CRT screen, then run an AC, DC, or Transient analysis. While providing you with libraries for defined models of bipolar and MOS devices, Opamps, transformers, diodes, and much more, MICROCAP also includes features not even found in SPICE.

MICROCAP II lets you be even more productive. As an advanced version, it employs sparse matrix techniques for faster simulation speed and larger net-

works. In addition, you get even more advanced device models, worst case capabilities, temperature stepping, Fourier analysis, and macro capability.

MICROLOGIC: Your Digital Solution

MICROLOGIC provides you with a similar interactive drawing and analysis environment for digital work. Using standard PC hardware, you can create logic diagrams of up to 9 pages with each containing up to 200 gates. The system automatically creates the netlist required for a timing simulation and will handle networks of up to 1800 gates. It provides you with libraries for 36 user-defined basic gate types, 36 data channels of 256 bits each, 10 user-defined clock waveforms, and up to 50 macros in each network. MICROLOGIC produces high-resolution timing diagrams showing selected waveforms and associated delays, glitches, and spikes—just like the real thing.

Reviewers Love These Solutions

Regarding MICROCAP... "A highly recommended analog design program" (PC Tech Journal 3/84). "A valuable tool for circuit designers" (Personal Software Magazine 11/83).

Regarding MICROLOGIC... "An efficient design system that does what it is supposed to do at a reasonable price" (Byte 4/84).

MICROCAP and MICROLOGIC are available for the Apple II (64k), IBM PC (128k), and HP-150 computers and priced at \$475 and \$450 respectively. Demo versions are available for \$75.

MICROCAP II is available for the Macintosh, IBM PC (256k), and HP-150 systems and is priced at \$895. Demo versions are available for \$100.

Demo prices are credited to the purchase price of the actual system.

Now, to get on line, call or write today!

Spectrum Software

1021 S. Wolfe Road, Dept. B
Sunnyvale, CA 94087
(408) 738-4387

COMPETITIVE EDGE

P.O. Box 556 — Plymouth, MI 48170 — 313-451-0665

**Compupro®, LOMAS, EARTH, TELETEK
S-100 CIRCUIT BOARDS**

CompuPro 286 CPU™	\$695.	Lomas 286 8MHz	\$821.	Color Magic 16K	\$476.
CompuPro SPU Z 256K™	276.	Lomas Nu Disk 512K	445.	Lomas 10MHz 8086	520.
CompuPro 8085/86™	245.	Lomas Octaport™ 8 Serial	320.	Lomas 4 serial	200.
CompuPro Disk 1A™	347.	Lomas LDP™ 72	206.	Lomas Nu Disk 2048K	1271.
CompuPro Disk 3™	417.	Lomas 256K Dram	445.	Lomas MSDOS™ 2.11	200.
CompuPro Ram 22™	417.	Lomas 512K Dram	562.	CompuPro MDrive H*512K	347.
CompuPro Ram 23™	175.	Lomas Ram 67™	599.	CompuPro I/O 3 port	347.
CompuPro Ram 23 128	245.	Lomas Hazilall™	244.	Teletek SBC 1 8MHz 128	375.
CompuPro CPU Z™	189.	Thunder 186™ 258K	895.	Turbodos® for Teletek	850.
CompuPro CCP/M*816*	250.	Lomas CCP/M*86™	280.	Teletek Systemmaster®	495.
System Support One™	245.	CompuPro I/O 4	255.	Systemmaster II®	795.
Teletek HD/Controller	375.	Teletek SBC 1	525.		

Earth Computer 8MHz Z80 Master, ST506 Controller \$895

Earth Computer TURBO SLAVE I 8MHz 128K \$395.

Turbo Slave I runs with Teletek, North Star Horizon, Advanced Digital and Others under Turbodos™

SYSTEMS

Lomas 286/287, 512K, 20MB, AutoCad 2™, 1024x1024 Color System	\$9695
Lomas 96/87, 512K, 20MB, AutoCad 2™, 12" Color Monitor, 1024x1024 IT Board	\$7395
CompuPro 85/88, 256K, CDDOS, SSI, I/O 4.2-96TPI DRS, 15 Slot	\$3095
CompuPro 85/88, 256K, CDDOS, SSI, I/O 4.1-86TPI, 20MB, 15 Slot	\$4295
CompuPro 286, SPUZ, 40MB, SSI, I/O 3, CDDOS, 15 Slot, 30 amp P/S	\$6995
286, 1024K, 20MB, AutoCad 2™ System — Ready to Run	\$8395
Lomas 286, 1024K, 20MB HD, 1-5", CDDOS, 6 SERIAL, 2 Par, 15 Slot	\$4395
Lomas Thunder 186, 256K, 20 MB HD, 1-5", CDDOS, 4 Slot	\$2595
Teletek 8MHz Master, 4-8MHz 128K SLVS, 1-5", 20 MB HD, TDOS	\$4795

Systems with AutoCad include ADI & ROZ, Hi-Res Color Monitor, Terminal, 1024x1024 Illuminated Technology Graphics Board.

UPGRADE YOUR IBM® PC™ !!

Earth Turbo Accel 286, 8 MHz, 512K 286 for IBM PC \$895

MONITORS	GRAPHIC BOARDS	MULTI-FUNCTION BOARDS	
Ames 300A, 1	\$159 Hercules Monochrome	\$299 AST 6 Pak 64K	\$245
Ames Color 440	\$549 Hercules Color Card	\$159 Quadram Expanded Quadboard OK	\$219
Princeton Color HP-12	\$458 Tecmat Graphics Master	\$449 Tecmat Captain 64K	\$199
Princeton Color SP-12	\$649 Paradise Graphics	\$279 Teletek 384K w-OK	\$126
386 ACCELERATOR	\$79 STB Graphx II		
Turbo Accel-286	\$895		

ALL PRICES SUBJECT TO CHANGE AND STOCK ON HAND

Compupro is a Registered Trademark of Visayn. CPU Z, Disk 1A, Disk 3, Interface 3, Interface 4, CPU 286, CPU 8085/86, System Support I, MDRIVE-H, Ram 22, Ram 23 are trademarks or registered trademarks of Visayn. DPM 2.2, CCPM, are registered trademarks of Digital Research Inc. MSDOS is a registered trademark of Microsoft. Systemmaster & Systemmaster II are registered trademarks of Teletek Enterprises. Turbodos is a registered trademark of Software 2000. IBM is a registered trademark of International Business Machines. AutoCad 2 is a registered trademark of Autodesk, Inc.

\$1000) will be there for the users. Jay Miner, one of the key designers of the Amiga, said in a recent interview that he anticipated cheap RAM three years ago and designed the machine around that assumption. Would that more computer firms were so farsighted.

Interestingly enough, the IBM PC represents a system where the processor is holding back RAM and mass storage. Hard-disk drives for the PC and compatible machines are incredibly cheap, and there isn't much excuse for not having the full 640K bytes of normally usable RAM. Indeed, the problems with the PC and its successors seem to lie more with the difficulties of MS-DOS and the processor itself to deal with large amounts of memory and disk space. Intel and Lotus recently announced their "standard" to let 1-2-3 and Symphony use up to 4 megabytes of RAM through a complex method of bank switching, which seems laughable when you consider that the 68000 can directly address 16 megabytes without a single segment or base register. The IBM PC AT, with its 80286 processor, doesn't have the 1-megabyte limit of its predecessor, but it still has the funky segments, and many of the MS-DOS programs can't take advantage of all that extra RAM.

The real irony is that Apple, with the Mac, could have penetrated into the business market by offering a machine with a large (1 to 8 megabytes) usable memory, a feature that IBM would have had a hard time matching (indeed, still has a hard time matching). Likewise, the large memory would have allowed business software to be written much more quickly, since developers wouldn't have to cram their programs into such a tiny space. Apple has finally realized that, or at least appears to have, but they've lost two years and the advantage of surprise. And, despite all the doom and gloom I've seen in the press about the Amiga coming into a tough market, I think it's going to give everyone a good run for their money. Wait and see.

THE VIEW FROM NCC

I attended National Computer Conference in Chicago a few weeks ago. I won't go through a list of the products shown—that's being covered elsewhere—but some comments are in order. First, the show itself seems to be dwindling on the vine. NCC used to be a mainframe/mini-computer show, with microcomputers relegated to the back of the bus. Now the show is dominated by micros and micro-related products, and in the process, NCC has lost its identity. The large (literally) computer people feel that the show has gone to the micros, while the micro people find the show too general, i.e., not specific enough to the micro market. And NCC is caught in the middle.

While the show itself was underattended and not terribly exciting, some interesting trends pointed a few years down the road. In particular, a lot of people were showing prototypes (and, in some cases, shipping versions) of optical-disk storage devices, laser printers, document scanners, high-resolution monitors, and graphics-oriented soft-

(continued)

Why So Long?

We've specialized in Vertical Markets...

Medical / Dental

- Appointments
- Patient Billing
- Claim Preparation
- Patient Data Base

Educational Administration

- Scheduling
- Attendance
- Grading
- Computer Literacy

Construction / Job Cost

- Payroll
- General Ledger
- Estimating

... Since 1977

Now over 110 machines including:

MS-DOS™

CMA

MICRO COMPUTER DIVISION
55722 Santa Fe Trail
Yucca Valley, CA 92284
(619) 365-9718

"I Program In BetterBASIC And I Recommend It."

"My company uses BetterBASIC to control the automation system on board ships. It gives us the excellent feature of flexibility and quick change of process dependant logic. We save the logic in E²prom (electrically erasable programmable ROM) so online changes can be made instantly. I use BetterBASIC and I recommend it."

Ken Moller • Norcontrol • Horten, Norway

640K Now you can use the full memory of your PC to develop large programs.

STRUCTURED Create well organized programs using procedures and functions that are easily identified and understood and completely reusable in future programs.

MODULAR Use procedures and functions grouped together to form "library modules" which are then available to you or anyone else for future use.

EXTENSIBLE Create your own BetterBASIC modules which contain BetterBASIC extensions. This feature coupled with the easy-to-use Assembly Language support, makes this an ideal OEM language.

INTERACTIVE BetterBASIC interpreter because it recognizes commands in an immediate mode. However each statement is actually compiled as it is entered.

COMPILED Each line of the program is compiled as it is entered into the computer's memory rather than interpreted at runtime.

RUNTIME SYSTEM The optional Runtime System generates stand alone EXE. files allowing for the distribution of products



written in BetterBASIC with no royalties.

SUPPORTS Windows, Graphics, DOS and BIOS ROM calls, Chaining, Overlays, Local and Global Variables, Recursion ... and more.

BetterBASIC Runs on IBM PC, XT, AT and all IBM-compatibles. Ask your local dealer for BetterBASIC or call 1-800-225-5800 in Canada call 416-469-5244. Also available for the Tandy 1000, 1200, AND 2000 AT Tandy/Radio Shack stores.

Summit Software Technology, Inc.™

P.O. Box 99, Babson Park
Wellesley, MA 02157

PRICES:

BetterBASIC	\$199
8087/80287 Math Module	\$99
Btrieve™ Interface	\$99
Runtime System	\$250
Sample Disk with Tutorial	\$10

Better
BASIC.

Because It's The Best.

MasterCard, Visa, Checks, Money Order, C.O.D. accepted and P.O. on approval.

BetterBASIC is a registered trademark of Summit Software Technology Inc. IBM PC, XT, AT, are registered trademarks of International Business Machines Corp. Tandy is a registered trademark of Tandy Corp. Btrieve is a registered trademark of SoftCraft Inc.

(If you're using BetterBASIC and would like to be featured in one of our ads, please write to the Director of Advertising at Summit.)

You would think when IBM needs EPROM Programmiers they would choose the best and the most expensive.

They don't. They only choose the best. GTEK.



MODEL 7956 (w/RS-232 option) \$1099
 MODEL 7956 (stand alone) \$ 979

GTEK's outstanding Gang Programmer with intelligent algorithm can copy 8 EPROMS at a time! Use the 7956 in a production environment when you need to program a large number of chips. Programs all popular chips through the 27512 EPROMS; supports CMOS EPROMS through the 27C256; supports EEPROMS through the X2864A; supports Intel's 2764A & 27128A chips. The 7956 will also program single chip processors.



MODEL 7228 \$ 599

GTEK's 7228 has all the features of the 7128, plus Intelligent Programming Algorithms! It supports the newest devices available through 512K bits. The 7228 programs 6 times as fast as standard algorithms. It programs the 2764 in one minute! Supports CMOS EPROMS through the 27C256; supports EEPROMS through the X2864A; supports Intel's 2764A & 27128A chips. Supports Tektronics, Intel, Motorola and other formats.



MODEL 7324 \$1499
 The 7324 has a built-in compiler. It programs all MMI, National and TI 20 & 24 pin PALS. It has non-volatile memory and operates stand-alone or via RS-232.



MODEL 7128 \$ 429
 The 7128 has the highest performance-to-cost-ratio of any unit. It supports the newest devices available through 256Kbits.

MODEL 7322 \$1249
 Same as Model 7324 but operates only via RS-232.

MODEL 7316 \$ 749
 This PAL PROGRAMMER programs Series 20 PALS. It has a built-in PALASM compiler.

MODEL 7283 \$1199
 This BI-POLAR PROM PROGRAMMER programs all popular BI-POLAR PROMS. It operates stand-alone (for production) or RS-232 (for development).

MODEL 705 \$ 299
 68705V3, R3, P3 PROGRAMMER.

EPROM, PROM & PAL PROGRAMMERS

— These features are standard from GTEK —

Compatible with all RS-232 serial interface ports • Auto select baud rate • With or without hand-shaking • Bidirectional Xon/Xoff • CTS/DTR supported • Read pin compatible ROMS • No personality modules • Intel, Motorola, MCS86 Hex formats • Split facility for 16 bit data paths • Read program, formatted list commands • Interrupt driven—program and verify real time while sending data • Program single byte block or whole EPROM • Intelligent diagnostics discern bad and/or unerased EPROM • Verify erasure and compare commands • Busy light • Complete with Textool zero insertion force socket and integral 120 VAC power (240 VAC/50Hz available) •

UTILITY PACKAGES

GTEK's PGX Utility Packages will allow you to specify a range of addresses to send to the programmer, verify erasure and/or set the EPROM type. The PGX Utility Package includes GHGX, a utility used to generate an Intel HEX file.

PALX Utility Package—for use with GTEK's Pal Programmers—allows transfer of PALASM* source file or ASCII HEX object code file.

Both utility packages are available for CPM,* MS-DOS,* PC-DOS,* ISIS* and TRSDOS* operating systems. Call for pricing.

CROSS ASSEMBLERS

These assemblers are available to handle the 8748, 8751, Z8, 6502, 68X and other microprocessors. They are available for CPM and MS-DOS computers. When ordering, please specify processor and computer types.

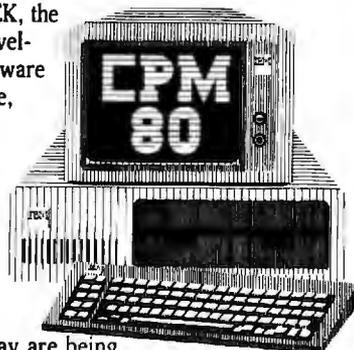
ACCESSORIES

Model 7128-L1,L2, L2A	Erasers	DE4 \$80; PE14T \$129
(OEM Quantity) \$259.		C25 \$349; C50 \$599
Model 7128-24	U/V Eraser DE-4	\$ 80.
Cross Assemblers CPM-80	RS-232 Cables	\$ 30.
MSDOS; CPM 86	8751 Adapter	\$174.
	8755 Adapter	\$135.
PGX Utilities	48 Family Adapter	\$ 98.
PALX		

"All you CPM people who wanted to move to IBM, but couldn't... now you can — and bring your CPM software with you!"

From GTEK, the leader in development hardware and software, comes the CPM user's dream.

The majority of advances being made in the computer industry today are being



made for PC-DOS and MS-DOS machines.

If you are a CPM user who wanted to convert to these operating systems but didn't because you had to abandon or rewrite your CPM programs, now you can make your move without losing or rewriting a single program!

The dream from GTEK is a package that makes your PC-DOS (IBM PC, XT, AT) or MS-DOS (IBM clones like COMPAQ, Leading Edge, Televideo) machines think they're being run by an 8080 or Z80 microprocessor with CPM!

The GTEK package contains a CPEmulator™ and CPM Conversion Utility that allows you to read and write popular CPM disk formats such as Kaypro and Osborne.

If you've been using CPM on any of these machines you can now move to PC-DOS or MS-DOS operating systems.

Kaypro • Osborne • Heath/Zenith • Radio Shack • Epson • DEC • IBM • Morrow • Xerox • HP • Sanyo • Intertec • Cromenco • Televideo • Compupro.

How easy is it to use? Two steps. (1) Use the Conversion Utility to copy the CPM program to an MS-DOS or PC-DOS diskette. (2) Use the Bind Utility to attach the CPEmulator to your program. And that's it. It's ready to run.

You won't see any difference when you run the CPM program! Now all the work you did in CPM is still valuable when you change to your PC-DOS or MS-DOS machine.

And here's the happy ending to the dream. The CPEmulator is just \$199.

Call GTEK's CPM Hotline...
 1-601-467-9019



Development Hardware/Software
 P.O. Box 289, Waveland, MS 39576
 601/467-8048; telex 315-814 (GTEK UD)
 , INC.

GTEK, PALASM, CPM, MS-DOS, PC-DOS, ISIS, TRSDOS, & CPEmulator are registered trademarks.

ACCORDING TO WEBSTER

While the optical-disk technology is fascinating, there are some serious implications, especially in telling an original from a copy.

ware. They point to the second or third generation beyond the Macintosh, personal systems that allow you to easily convert documents from paper to phosphor and back again, with no real trace of the conversion. I'm not sure the "paperless office" will ever come about—there's something too satisfying and reassuring about holding a physical document—but the technology pushing toward the market now will forever blur the distinction between a document on disk and one on bond.

While the technology is fascinating and eagerly awaited—I would love to have all my college notes on an optical disk—there are some serious implications. Combining the technology above with advances in the digital processing of photographs, you start to approach a world where there is no distinction between original and altered copy. Think about it. If you take a legal document, scan it, edit it graphically, then print it out using a laser printer on identical paper, who can tell which is the original? Already, xerographic technology has reached the point where some counterfeiters are using copiers (instead of engraved plates) to make money. As a result, the U.S. Treasury is seriously looking at issuing new currency printed on multicolored paper (possibly with metal threads woven into it). Similar or related techniques may be needed for other important documents to ensure against undetectable alterations. I always get disgusted when people mention Orwell's *Nineteen Eighty-four* and computers in the same breath, but I can't help but remember what Winston Smith's job was: altering official documents to reflect current political reality.

IN THE QUEUE

Because I'm in the process of moving, things are in a state of upheaval around here. Hopefully, I can sit down long enough to look at the small mountain of software that has been growing in my office. I won't make any promises or predictions about what I'll get to. My schedule is too unsettled, and I've usually been wrong in the past. Once I move, I hope to have a lot more things to look at (and a lot more time to look at them).

By the way, I've been getting a fair amount of mail (mostly electronically) in response to my first few columns. I appreciate the feedback; please keep it coming. However, I've found that some of the ARPANET/uucp addresses that you've given just don't work, and my replies don't get through. If you've sent me some mail via ARPANET/uucp

(continued)

NOVAS PC/XT/AT TOP OF THE LINE IBM COMPATIBLE COMPUTER



- Affordable priced PC/XT/AT Compatible
- Runs PC-DOS, MS-DOS, CPM/86
- This versatile computer runs Flight Simulator, Lotus 1-2-3, Symphony, Framework, Peachtree, D Base II & III, PC Paint, Auto C.A.D., and tons of software.

COMPUTER SYSTEMS

NOVAS PC BARE BONE 64K 8 slot mother board, case, 130W power supply, keyboard \$510.00	NOVAS PC 256K SYSTEM 256K 8 slot mother board, case, 130W power supply, 2 1/2 ht. Teac floppy drive. \$795.00	NOVAS XT 256K SYSTEM 256K 8 slot mother board, case, 130W power supply, 2 1/2 ht. Teac drive, 10MB H.D., DTC controller card. \$1295.00
--	---	---

NOVAS AT ENTRY MODEL 640K Mother board, #80286 CPU (Option 8 MHz), 195W power supply, TEAC 1.2MB floppy drive, DTC floppy/hard disk controller card. \$2495.00	NOVAS AT ENHANCED MODEL 1MB Mother board, #80286 CPU (Option 8MHz), 195W power supply, TEAC 1.2MB floppy drive, 20MB hard disk, DTC floppy/hard disk control. \$3495.00
--	---

IRWIN 10MB Tape back up system \$525.00	IRWIN 20MB Tape back up system \$850.00
EVEREX 45/60M Tape back up system \$875.00	EXTERNAL case for H.D. or Tape backup \$150.00
10MB hard disk w/DTC controller \$495.00	20MB hard disk w/DTC controller \$595.00

ADD-ON BOARDS:

6-function board (AST 6 pack compatible) with zero K.....	\$124.00
Mono-graphic (Runs Lotus 1-2-3 graphic mode)	\$135.00
EPROM Burner	\$135.00
2 serial/1 parallel card for PC or AT	\$119.00
Memory expansion board (Expandable to 576K)	\$ 75.00

NEED MORE DETAILS, PLEASE CALL NOW!

COMPUTRADE COMPANY

780 Trimble Road, Suite 605, San Jose, CA 95131
Tel: (408) 946-2442 Telex: 171605

DISKETTES

3 Locations for Quick Delivery

Dysan 5 1/4" Disks S-SIDE D-DEN. 1495 D-SIDE D-DEN. 1995 S-SIDE 96TPI 2595 D-SIDE 96TPI 3195 HIGH DEN. 4195 3 1/2" Disk S-SIDE 2695 8" Disks S-SIDE 2095 S-SIDE D-DEN. 2295 D-SIDE D-DEN. 2795	maxell 5 1/4" Disks S-SIDE 1245 D-SIDE 1695 S-SIDE 96TPI 2195 D-SIDE 96TPI 2595 HIGH DEN. 3695 3 1/2" Disks S-SIDE 2395 D-SIDE 3395 8" Disks S-SIDE 2495 D-SIDE 2695	BONUS Disks 10 pk \$9.95 per box \$7.00 ATHANA 7.95 per box \$5.00 8.95 per box \$5.00 BULK PACK 50 DISK \$40.00 \$5.00 \$45.00 \$5.00 Media Mate \$8.95 ea +2% Shipping	3M 5 1/4" Disks S-SIDE 1425 D-DEN. 1745 S-SIDE 96TPI 2065 D-SIDE 96TPI 2575 3 1/2" Disks S-SIDE 2495 8" Disks S-SIDE 1995 D-DEN 2395 D-SIDE 2795	Verbatim Datalife 5 1/4" Datalife S-SIDE 1395 D-DEN. 1745 S-SIDE 96TPI 2165 D-SIDE 96TPI 2675 3 1/2" Datalife S-SIDE 2395 8" Datalife S-SIDE 1995 D-DEN. 2195 D-SIDE 2495
---	--	---	---	--

Old Reliable ***Delaware 1-800-451-1849**
P.O. Box 10247 Wilmington, DE 19850
***Oklahoma 1-800-654-4058**
P.O. Box 1674 Bethany, OK 73008
***Nevada 1-800-621-6221**
R.O. Box 1213 Boulder City, NV 89005

TERMS: Minimum 20 disks or \$35.00 — VISA or MasterCard accepted
COD orders add 2% for special handling. SHIPPING: 3 1/4" & 5 1/4" Diskettes; Add 3% for every 100 Diskettes or any fraction thereof. 8" Diskettes; Add 4% for every 100 Diskettes or any fraction thereof. We ship UPS; orders requiring other delivery methods add shipping, plus 2% of total order.

Modula-2 for only \$150



Modula-2, the brain child of Niklaus Wirth, is fast becoming the next major programming language. This state-of-the-art language is now available for your Apple Macintosh or IBM PC computer.

The advantages:

- Structured programming language
- Separate compilation with strong type checking
- Module version checking
- Optional run time range checking
- Eliminates many Pascal deficiencies

The contents:

- Full Wirth Modula-2 compiler
- Library modules for I/O and math routines
- Software development environment and tools
- Extensive documentation with index and sample programs

No developer fees. Disks not copy-protected.

To order, call toll-free:
1-800-545-4842

Have charge card ready.

MODULA CORPORATION

Modula Corporation
950 North University Avenue
Provo, Utah 84604
(801) 375-7400

© 1985 Modula Corporation. Allow 4-6 weeks for delivery.

ACCORDING TO WEBSTER

ITEMS DISCUSSED

AMIGA \$1295
Commodore International
1200 Wilson Dr.
West Chester, PA 19380
(215) 431-9100

ATARI 520ST \$799
Atari
1196 Borregas Ave.
Sunnyvale, CA 94086
(408) 745-2000

MEGAMAX C \$299.95
Megamax Inc.
8620 Park Lane #403
Dallas, TX 75231
(214) 987-4931

MONSTER MAC \$900
Levco
6160 Lusk Blvd., Suite C-203
San Diego, CA 92121
(619) 457-2011

T-CARD Price unavailable
Tecmar Inc.
6225 Cochran Rd.
Solon, OH 44139
(216) 349-0600

a message to our subscribers

From time to time we make the BYTE subscriber list available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services, or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE Publications Inc.
Attn: Circulation Department,
70 Main St., Peterborough, NH 03458

and haven't heard from me, please write again. Here are my addresses:

uucp: {ihnp4, sdcsvax, cbosgd, noscvax}
!crash!bwebster

CompuServe: 75166.1717

MCI Mail: Bruce F. Webster (138-5892)

BIX: bwebster (ask.webster conference)

By the way, some of you have written actual physical letters. Many, many thanks, but be warned that they are the hardest to answer (and the most likely to get lost). My apologies to any of you who have had your letters vanish, never to be heard from again.

Well, that's it for this month. The column's time lag is shrinking (mostly due to my missing deadlines), but (unabashed plug) you can get more timely information by getting onto BIX. To find out more about BIX, send a letter to BYTE Information Exchange, BYTE Magazine, 70 Main St., Peterborough, NH 03458. BYTE subscribers will be receiving information in the mail about BIX (if you haven't received it already). Hang loose, and I'll see you on the bit stream. ■

It'll be a warm day in Prague before most Americans learn to spell correctly. And no wonder. "I before E unless it's preceded by C, or sounds like A" . . . It's enough to drive anyone to defect.

But now, in a burst of American ingenuity, CYMA/McGraw-Hill introduces Final Draft, the word processor that makes spelling as easy as ABC.

Well, actually, spelling correctly is as easy as S. You see, after you've completed your document, you need only press S, and Final Draft will check your spelling with its 80,000-word dictionary. Typos need never

again become an international incident.

But although the spelling check is certainly worth its weight in korunas, Final Draft also offers features like automatic red-lining and strike-out, table of contents and index, floating footnotes, thesaurus and merge-print, features you won't find in comparably-priced systems. Nor in systems twice our price.

Now you're probably wondering if power is synonymous with difficulty. Check your thesaurus and relax. Final Draft has only 35 commands. Not 305, like most of our complicated competitors. And our
Inquiry 104 for End-Users.
Inquiry 105 for DEALERS ONLY.

commands are alphabetically-assigned so that you can learn them quickly and remember them easily. You can learn Final Draft the first day and master it the second. Now *that's* American ingenuity.

So whether you're a champion speller, or just a college graduate, Final Draft will cover you. From aardvark to zymurgy. And everywhere in between. Like Czechoslovakia.

FINAL DRAFT™

The word processor
from CYMA/McGraw-Hill.
Call 800-292-CYMA.

SPELLING CZECH



Your friend in faraway places.

When you've traveled over 6,000 miles, and you've seen just about all there is to see and done just about all there is to do, the sight of a good friend sure is nice.

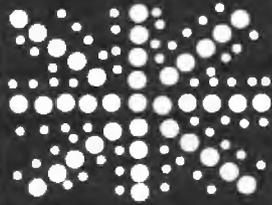
A friend who knows how to treat you right all the way home, to over 150 cities in the United States.

United Airlines Royal Pacific Service to Tokyo, and to Hong Kong. And back home again.

*You're not just flying,
you're flying the friendly skies.*



United



Living C-Personal

A real-time C debugging environment

BY DICK POUNTAIN

The C language is one of the success stories of the 1980s. From its origins as the system compiler in an (at that time) obscure minicomputer operating system, it has become the premier system (and perhaps application) programming language in the microcomputer industry. For instance, it has been adopted as the house programming language by both Microsoft and Digital Research, the leading purveyors of microcomputer operating systems.

The reasons for the acceptance of C are not hard to analyze (whether you approve of them or not). It's a modern block-structured language that provides user-defined data structures and the benefits that come from good program design. C also gives you unlimited access to the underlying machine and its memory via bit-manipulation operators and pointers. As a fairly simple language, it can be compiled into fast and efficient code, and that code can be easily hand-optimized or linked to assembler segments in those cases where it's not efficient enough. C strikes a compromise between the strongly typed rigor of Pascal and the anarchic freedom of expression of assembly language, which seems to appeal to professional programmers. It's also more portable than most supposedly machine-independent high-level languages.

The one drawback of C is that it was designed to be used in the environment provided by the UNIX operating system. This environment is multitasking, so you can edit a file (using one of the system editors) while a compilation is in progress. It includes a wide range of software tools, including a program checker (lint), a source-code management utility (make), and even some program generators (like yacc, the compiler). You can bolt all these utilities together and more or less automate their operation by writing UNIX shell programs that pipe the output of one tool into the input of the next. In such an environment, C is a very productive software-development language.

The problem is that C is now being used under more primitive microcomputer operating systems that lack these tools, like CP/M and PC-DOS, and without these tools C provides a truly horrible programming environment. To be more accurate, it provides a kit of parts and not an environment at all. Some C compilers require you to run three or more separate programs merely to compile a source file. Separate compilation figures heavily in the C programming methodology, so you soon end up with a disk full of dozens of files for a single program. When using a separate editor, it can take around 10 minutes for each pass through the compile-link-run-crash-edit-recompile cycle.

Even in the UNIX environment things are not quite perfect. C, like FORTH, can tempt programmers into writing tricky and terse code, and this code is scattered among a multitude of source files. Some C programmers also tend to the view that the source code is documentation enough. The maintenance of other people's programs is not easy, even with all those software tools, unless it has been documented by a saint.

This state of affairs has provided a powerful motive to design friendly C programming environments. In the U.S., a variety of C interpreters have emerged recently whose purpose is to allow programs to be interactively developed before final compilation.

Living C-Personal is a C editor, interpreter, animator, and tracer/debugger, all rolled into one menu-driven windowing environment. It's equally useful for teaching C, developing C programs, and maintaining existing C programs.

Living C-Personal was developed in the U.K. by Living Software Ltd. It runs under PC-DOS 2.0 and 3.0 and costs \$99.

THE ENVIRONMENT

The Living C system is constructed around a full-screen editor, whose design influences are closer to the EMACS family than to

(continued)

Dick Pountain is a technical author and software consultant living in London, England. He can be contacted c/o BYTE, POB 372, Hancock, NH 03449.

WordStar. For instance, it employs a delete buffer whose contents can be inspected, and even edited, in a window separate from the main text window.

Cursor movement is performed using the IBM cursor-pad keys. Insert or overwrite mode can be selected by pressing either Ins or End, rather than

the more usual toggling on Ins. An unusual, but nonetheless useful, feature of the editor is that it recognizes word boundaries; when you delete characters from a word it does *not* pull the rest of the line to the left but only the affected word.

As this is a program editor, there is no word wrap. Instead, long lines

cause the screen to scroll sideways. The Ctrl-B and Ctrl-Z commands jump to the left or right end of a line, scrolling the screen if necessary. Long lines are flagged by a + sign at the left or right end. A Goto Line function permits jumping directly to place in the program, though no line numbers are displayed.

Some functions that are especially useful in the formatting of C programs are provided. For instance, F8 joins the next line onto the end of the current line without the need to go and delete the end-of-line character. F9 causes the next character typed to be repeated 4, 16, or 64 times, depending on how many times you press it; it's great for adding lines of asterisks to delimit comments. F10 is an escape key that allows control characters to be entered as literals into source programs.

Editor commands are initially selected from pop-up menus invoked by pressing F1, F2, F3, and F4. Hitting the space bar kills any menu that is no longer required. However, the mode of command selection can be customized to the user's level of experience using the help-level menu of F2.

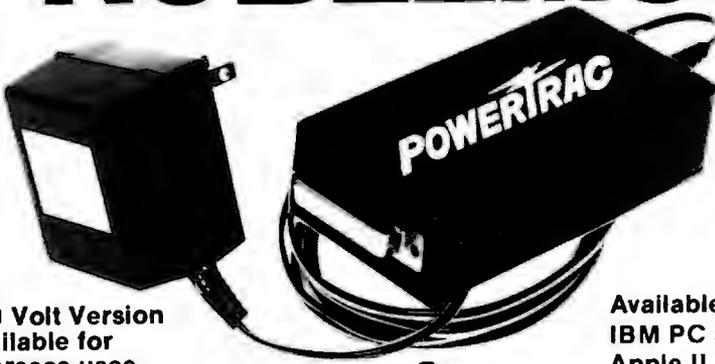
In the default Full Help mode, all menu selections must be made by typing a letter to move to a selection and then pressing the carriage return. Choosing the Quick Select option removes the need for the carriage return, making selection faster but allowing no time for afterthoughts.

The next level is Command Line Help, usable once you have learned the names of the commands in all the menus. This dispenses with the menus altogether and enables you to press the appropriate function key followed by the single-character command. A certain amount of help is still given, as your command will elicit a prompt phrase on the command line. The least-help level, No Help, dispenses even with these prompts.

F1 brings up the help menu. From there you can choose help texts that explain the options on the other menus, activate or deactivate error

(continued)

POWER PROBLEMS?



220 Volt Version available for overseas uses.

Available for IBM PC and Apple II.

POWERTRAC™ COMPUTERIZED POWERLINE MONITOR

Powertrac now allows you to troubleshoot your computer's power problems. Powertrac easily monitors, analyzes and records the power that feeds your sensitive computer.

Powertrac, a state-of-the-art combination of hardware and software that monitors your power while you work and displays your precise problem at a glance. Includes audible power alarm.

Powertrac allows you to do some simple inexpensive diagnostic testing before you order expensive power equipment.

Powertrac monitors single-phase AC power and detects problems like: line voltage too high or too low, voltage spikes and drops (sags, brownouts, etc.), high-frequency noise. Powertrac monitors powerline condition as a foreground or background task on your computer. In the foreground, you may visually observe RMS line voltage and transients in an oscilloscope or chart recorder format. In the background, Powertrac records and monitors the line voltage while the computer runs other programs. Powerline condition is stored in a disk file for later analysis. Visual and audible alarms warn of transients, noise, high or low levels.

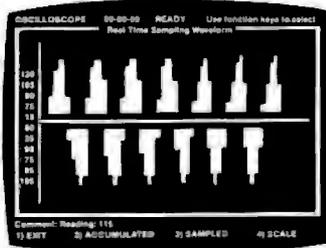
ONLY \$9995

Plus \$4.50 shipping & handling. (CA res. add sales tax.)

Vertex (213) 938-0857
systems Inc.

6022 W. Pico Blvd.
Los Angeles, CA 90035

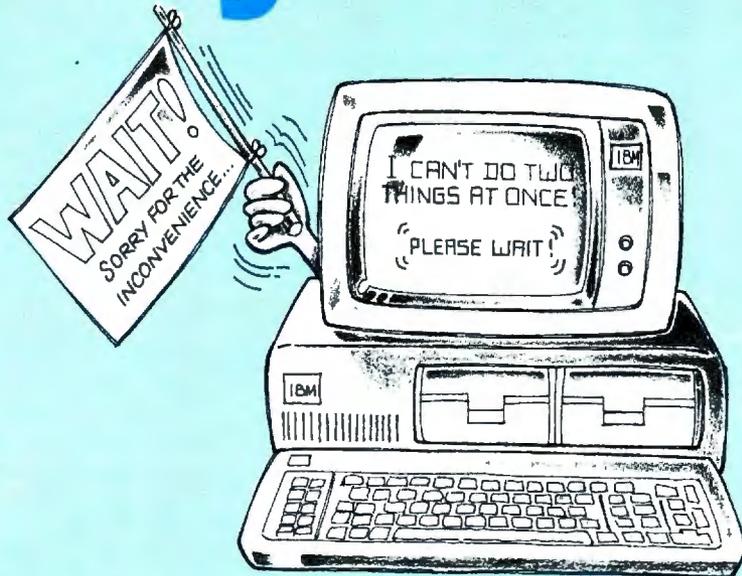
IBM PC is a registered trademark of International Business Machines Corporation



APPLE is a registered trademark

Inquiry 410 for End-Users.
Inquiry 411 for DEALERS ONLY.

Tired of waiting for your PC?



Special Offer
Only

\$49.95*

This SPECIAL PRICE OFFER
absolutely ends
on December 15, 1985.

End the wait!... DOUBLEDOS DOUBLEDOS

Multi-tasking, concurrent processing using today's software and your PC, XT, or AT system!

No matter how good your IBM PC is, you still have to wait while it processes and calculates for a long report, spread sheet, payroll, or whatever. This waiting is costing you time and money.

Now, DoubleDOS lets your PC actually run programs concurrently!

Think of the ways DoubleDOS will save you time and money:

- **BUSINESS.** Run a spreadsheet, and at the same time, print the payroll checks or accounting reports.
- **WORD PROCESSING.** Work on another document while printing or spell checking previous work.
- **PROGRAMMING.** Compile programs while starting new ones immediately.
- **COMMUNICATIONS.** Receive or send information while you use the PC to do other tasks. DoubleDOS has endless applications!

Listen to what users are saying about DoubleDOS:

- "It let's me get more done. Lotus and dBase run together like they were made that way and it only takes 30K in RAM!"
- "Great product! It is solid, painless, and bulletproof!"
- "Simply the best program I've ever had."
- "I'm thoroughly impressed. Fantastic . . . great value-to-cost, too!"
- "Excellent product at an excellent price (hard to find today)."
- "Great stuff! I use it to do compiles and links while editing. Saves a lot of time!"
- "Your programming staff deserves a standing ovation for their efforts and results!"
- "I can't believe how fast it works, rarely notice slow-down when using 2 programs."

*Plus \$5.00 Shipping & Handling.

SOFTLOGIC Satisfaction
SOLUTIONS Guaranteed!

Creators of the Disk Optimizer

530 Chestnut St., Manchester, NH 03101

1-800-272-9900. In NH, call 627-9900.

DoubleDOS works with PC-DOS and your existing software. Also supports many compatibles using MS-DOS.

Order Toll-Free:
1-800-272-9900



messages, and summon help on C-language errors. It also contains the Next Error command for use in debugging. Error messages are displayed on the command line at the foot of the main window, while help messages appear in pop-up windows.

The block buffer permits all the usual cut and paste operations on blocks of code, which are defined by start and end markers placed from the F3 menu. Unfortunately, marked text is not highlighted in any way. Marked text must be explicitly copied to or from the block buffer. The contents of this buffer can be displayed in a window below the main text window and directly edited or written to a file. Extra text can be appended to the end of the buffer.

Search and replace of a simple kind is provided. Replacement can be performed globally or within the currently marked block with or without prompting, but no wide cards are permitted.

Pressing the Escape key summons up the file menu, from which you can exit the editor, with or without updating the current file. Other options let you read, write files, or change to a new file (useful for writing include files). On exiting the editor, you are placed into the main menu, from which you can run and debug programs.

COMPILING, ANIMATING, AND TRACING

The main menu contains the option Run. When this option is activated, Living C compiles your program into an intermediate code, which is then executed by a built-in interpreter. If any syntax errors are encountered, Living C will report them one at a time, unlike the average C compiler,

which can be tripped into issuing a huge stream of error messages by a single missing semicolon.

When an error message is received, pressing F1 brings up the help menu. Pressing the carriage return selects the default option, which is "help with the latest error," displaying a window that explains what the error was and the correct C usage (occasionally you will encounter a syntax error too obscure to analyze, whereupon F1 apologizes for not being precise enough). Help for any error can always be had by entering its error number from the F1 menu.

After the program detects an error, it will return to the editor with the cursor pointing at or near the source of the error so you can correct it. Once this error is dealt with, selecting the Next Error command will take you on to find the next one. Errors are thus caught and corrected in a highly civilized step-by-step fashion. If preferred, you can set a compiler option that scans a whole file and reports all the errors at once, writing the messages to a file.

Once the program is free of syntax errors, the source code reappears accompanied by a new menu (see figure 1), while the command line informs that the program is "interrupted by startup in yourfile.c." This interrupt menu is the control panel for debugging operations. The message merely means that Living C has automatically set a breakpoint at the beginning of the program to give you the opportunity to choose one of the above options before it runs. You can return to the interrupt menu at almost any time during program execution by hitting the Break key; it doesn't work when the program is waiting for I/O (input/output), though.

*Help for any error
can always be had
by entering its
error number
from the F1 menu.*

Continue runs the program in animation mode. The source code is displayed on screen and the cursor hops around pointing to the statement currently being executed, like one of those bouncing balls that traced out song lyrics for sing-alongs. The speed of animation can be altered by the Trace speed option, which is measured in "ticks" of around 100 milliseconds.

Zoom stops the animated display and makes the program run ahead at full speed, while Single step executes one step and then waits for a key press before executing another.

When first using the animator, I was surprised at the way the cursor weaves around in a quite convoluted fashion rather than proceeding forward smoothly through the source code. For instance, if it encountered the expression $a = b + c$;, the sequence of cursor movements would be:

$a = b + c$; $a = b + c$; $a = b + c$;
 $a = b + c$; $a = b + c$;

This behavior arises because the animation must precisely follow the order of C-expression evaluation; in the preceding example it describes a tree-like path in which operators are identified, then their left operands, and finally their right operands.

As a result, it's not as straightforward as you might expect to follow what's happening in a program; many of the cursor movements are redundant from the point of view of someone interested in the flow of control.

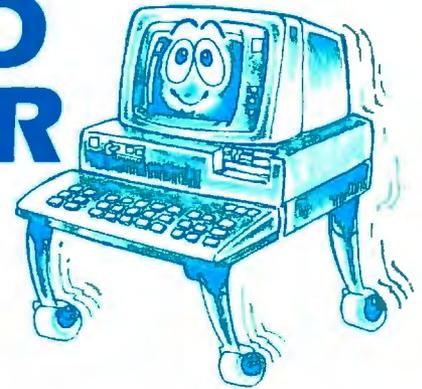
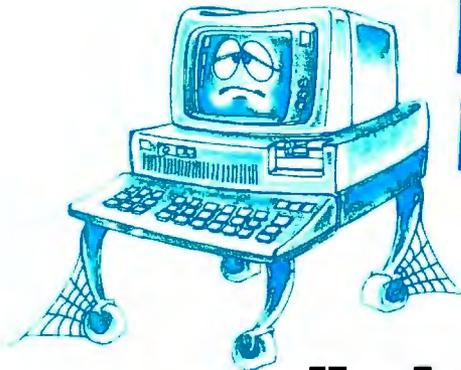
The Variable and Alter data options permit inspection or alteration of the

(continued)

Interrupt Code			
C Continue	S Single step	Z Zoom	D set Debug
V Variable	A Alter data	T Trace speed	F Function level
Q Quit execution	X Exit Living C		

Figure 1: Living C-Personal's interrupt menu. This is the control panel for debugging operations.

SHIFT YOUR HARD DISK BACK INTO HIGH GEAR



with



ONLY

\$49.95*

Special Introductory Price

Tunes Your Disk Files For Highest Performance

The Disk Optimizer organizes your disk to make your PC run faster. You'll discover faster program loading, faster file loading and sorting, faster file creation, faster backups to diskette. And the disk Optimizer reduces the chances of error during your disk I/O.

A	CC	AA	DDD	D	E	BB	F	FF	GG	AAA	H	BB	JJ	JJJ	AAA	BBBB
A	CC	AA	DDD	D	E	BB	F	FF	GG	AAA	H	BB	JJ	JJJ	AAA	BBBB

AAAAAAA	BBBBBBB	CC	DDDD	E	FFF	GG	H	JJJJJ
AAAAAAA	BBBBBBB	CC	DDDD	E	FFF	GG	H	JJJJJ

DOS IS SLOWING YOU DOWN!

Whether you realize it or not, the more you use your hard disk, the slower it is likely to react. This is because the operating system (PC-DOS/MS-DOS) stores things (programs, overlays, batches, etc.) randomly, wherever unused disk space is available. Your operating system doesn't keep pieces of the same file together. This means slower access time. Lost speed. Lost productivity.

TURN THE THROTTLE BACK UP!

Now, the Disk Optimizer puts the zip back into your hard disk! The Disk Optimizer collects all the scattered pieces of your files and re-stores them together in neat, well-organized areas on your disk. The result: immediate performance improvement . . . faster loading programs (and their overlays) . . . faster sorting . . . faster loading and storing spreadsheets or document files.

BONUS EXTRAS — at no extra cost

- ✓ **DISK ANALYZER**
Displays a visual performance analysis . . . shown in percentages . . . for any disk or diskette.
- ✓ **PERSONAL FILE SECURITY**
Password protect any file or program.
- ✓ **FILE PEEKER**
Now you can visually examine any file on your system.

\$49.95*

*Plus \$5.00 Shipping & Handling

SOFTLOGIC
SOLUTIONS
Creators of DoubleDOS

Inquiry 415

530 Chestnut Street, Manchester, NH 03101
1-800-272-9900. In NH, call 627-9900
Disk Optimizer works with IBM PC's and true compatibles.

Order Toll-Free:
1-800-272-9900



YOUR SMALL BUSINESS COULDN'T HAVE A BETTER CONNECTION.

It's the Small Business Connection of AT&T. Where you'll find the kind of advanced equipment that can help a small business make it big. And the kind of equipment that can help your small business save time, effort and—most important of all—money.

For starters, they've got telephones. Traditional telephones and electronic marvels like the MERLIN™ Communications System.

The MERLIN

Get the total telephone for small business.



System is the total telephone system for a small business. It offers dozens of features like conference calling, speed dialing, and an intercom. Each phone in the system can be individually programmed with just the features you need now—and then reprogrammed as those needs change. The entire system comes in five different sizes, and can be customized for absolutely any business with one to 70 telephones.

When you decide to make computers part of your company, AT&T's Small Business Connection has computers today that won't be obsolete tomorrow.



Send stacks of tracts in a flash with this FAX.

Because they have the future built in.

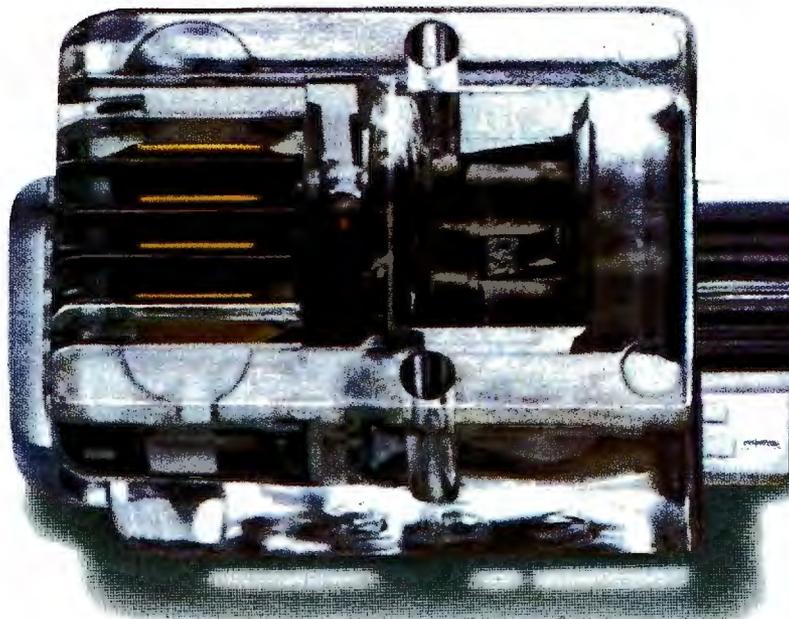
AT&T's PC 6300, for instance, is a personal computer that's fully compatible with the IBM PC.

And yet, the PC 6300 is twice as fast as their model, is quieter, has more expansion slots, higher-resolution graphics and takes up less desk-top space.

Then there's the brand-new AT&T UNIX™ PC. It offers you extraordinary power, a massive memory (expandable to two megabytes) and unrivaled flexibility for your small



AT&T gives you a hand—with its free consultation.



business. What's more, it's as easy to use as anything in the computer kingdom.

And the UNIX PC has a built-in modem, which means it can talk to your telephone —so, for the first time, you'll have electronic records of all incoming and outgoing calls.

AT&T's Small Business Connection also has a way to let you send info electronically. The AT&T FAX 3510D is a super-sophisticated facsimile machine that can transmit time-sensitive documents from Manhattan to Malibu in twenty seconds. (And transmit 9600 bits per second, if you want to get technical about it.) It's not only industry com-

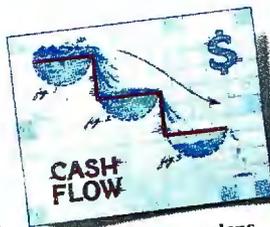


Service-Plus is just one of the plusses.

patible, but portable and totally automatic. Which means it even works unattended.

There's something else. The Small Business Connection stands behind its equipment with a variety of service packages, including Service-Plus. With it, you only have to make a single call when your telephone system needs attention. Just think of Service-Plus as the ultimate "insurance" for your system.

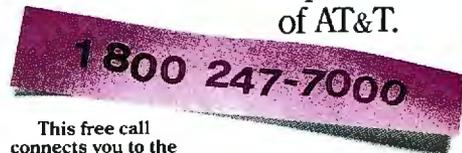
Plus, they offer a wide array of financing plans, whether you wish to buy your business equipment or pay on an extended basis. But they will also give you



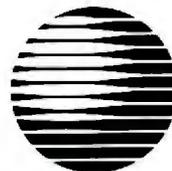
Their payment plans won't use up all your liquid assets.

one thing you can't buy: the full support of AT&T, a company with a proven past and a guaranteed future.

After all, the Small Business Connection has only one concern: small businesses like your own. So whether you need a state-of-the-art device or some expert advice, simply call 1 800 247-7000, Ext. 202. For a free consultation with the small business specialists of AT&T.



This free call connects you to the office nearest you.



AT&T

The right choice.

Since the monitor and I/O windows are separate, debugging information is clearly distinguished from normal program output.

value of any variable in the program by entering its name. Function level enables you to set the depth of nested function calls that are to be traced.

When a program has been set running, any input or output takes place through a standard I/O window that opens up at the top of the screen.

This window acts as the console during tracing.

DEBUGGING

You can perform a tracing of a more selective nature than that just described by inserting markers to set breakpoints, data monitors, and ranges. These markers are inserted by choosing the set Debug option, which presents the source code as if in the editor. Markers can be placed using the F4 menu commands, but the source itself cannot be altered. Markers are visible in the text as a letter followed by a digit (e.g., <B1> for breakpoint 1) and can be hidden or revealed by the O command on the interrupt menu.

A breakpoint behaves just like the Break key, stopping the program and displaying the interrupt menu. Breakpoints must be set at points that the cursor will touch during its journey,

that is, on a variable name or an operator.

A data monitor is a marker attached to the name of a variable that causes the value of that variable to be continuously displayed in a special data-monitor window when the program is traced. Monitors can only be applied to scalar variables, not to arrays or structures. Since the monitor and I/O windows are separate, debugging information is clearly distinguished from normal program output.

A range is set by placing a start and end marker, like those for block moves. Tracing is then confined to the code between the markers, the rest of the program proceeding at full Zoom speed. This feature is enormously time-saving, since you do not need to sit for minutes watching the animation of parts of the program you are not interested in.

(continued)

3M
diskettes

Everything that goes into a 3M diskette is manufactured and/or controlled by specifications set by 3M. From unique substrates and oxides, to hole punching and jacket fabrication, 3M does it all and does it well. With confidence in your complete satisfaction, 3M diskettes are certified to be error free and have an unlimited warranty against defects in workmanship or materials. Day in and day out 3M gives you one less thing to worry about.

What separates us from our competition? Simply a combination of the best service in the industry, highly competitive pricing, and an ever widening range of products. Above all we care about our reputation and are willing to work on a lower margin while delivering what others only claim—and we do it all on a day-in day-out basis.

This fall ¼ million subscribers to **Byte** magazine will be receiving our catalog with a special discount offer on the cover. We strongly feel that if you try us just once you'll join our list of satisfied confident customers. Lyben Computer Systems wants to be your source for computer supplies and accessories.

1050 E. MAPLE RD. • TROY, MI 48083 • (313) 589-3440



**Lyben
Computer
Systems**

**WATCH
FOR
OUR
FALL
CATALOG**

"SwyftCard™ is an incredible addition to my Apple® IIe."

Steve Wozniak,
Apple IIe user

This new \$89.95 plug-in card gives you an amazingly easy, blindingly fast way to write, file, communicate and calculate.

You've never seen an Apple IIe do word processing, filing, communicating and calculating the way it does with a SwyftCard.

Steve Wozniak calls it revolutionary, adding "If I had thought of the SwyftCard while creating the Apple II, I would have built it in." Fomenting revolutions comes naturally to SwyftCard inventor Jef Raskin, whose previous efforts to make computers simple and useful include creating the Macintosh™ project at Apple.



SwyftCard creator Jef Raskin and
Apple II creator Steve Wozniak

SwyftCard transforms the Apple IIe into the computer it ought to be.

The SwyftCard creates a 40K-byte working space, or "universe," capable of holding about 20 pages of single-spaced text. The universe accepts whatever you put in — text, numbers and data, in any form you choose, without you having to switch programs or modes.

Throughout your workday, you can enter information into the universe in free form: a report, names and addresses, daily to-do list, new telephone numbers, client list — anything you're working on.

A universe resides in memory while you are using it, and when you are done you save it to a disk. An unlimited number of universes can be created, each kept on a separate disk.

The secret to working in a SwyftCard universe is the patent-pending cursor. It works faster than control keys or a mouse, and doesn't make you take your hands off the keyboard.

SwyftCard is a better solution to your day in, day out word processing and data management needs. It is faster, easier and more useful.

How much faster is SwyftCard?

From a power-off start, SwyftCard loads a universe and displays exactly where you were last working in just six seconds, automatically, with no commands.

SwyftCard finds and displays any piece of information in your universe in less than 300 milliseconds.

SwyftCard saves an entire universe to a disk in just eight seconds, including automatic formatting if necessary.

How much easier is SwyftCard?

For all it does, SwyftCard uses only seven commands. And each is available immediately by pressing a single key once.

To start using SwyftCard, simply plug the card into Slot 3 (which most other cards can't use), turn the Apple IIe power on, wait six seconds and begin typing.

To use an Apple program, just load it in; SwyftCard turns itself off and won't interfere.

How much more does SwyftCard do?

SwyftCard communicates with data services without you having to learn their editors, and lets you directly edit information you bring in without special commands or file transfers.

SwyftCard is great with numbers, performing calculations — including scientific work — anywhere in your universe.

Using the SwyftCard-ProDos utility disk, which is included, you can transfer information developed in SwyftCard to other programs, and vice versa.

SwyftCard is not a spreadsheet, nor will it do everything for everybody. But no other system delivers the common sense utility of SwyftCard.

Of course, SwyftCard comes with a complete manual and an on-screen tutorial.

Try SwyftCard for 30 days.

Everyone we've shown this ad to has said SwyftCard sounds too good to be true. Maybe you feel that way too. But everyone we've then shown the SwyftCard to says it's better than the ad claims. So we want you to try it at our risk.

If we sent you product literature or tried to answer your questions by phone,

we would just repeat this ad. The only practical way to find out if SwyftCard will help you is to accept the 30-day, no questions asked, money-back trial offer. If you don't like your SwyftCard, return it within 30 days and we'll send you your money back.

To order, call us at:

**800-982-5600 in the U.S.
800-562-7400 in Calif.**

Computer system requirements

Apple IIe, regular or extended 80-column card, 80-column monitor, one disk drive with controller. For communications: 300 or 1200 baud modems and Super Serial card. To transfer data between SwyftCard and Apple programs with ProDos utility: extended 80-column card or two drives. To print: any Apple, Brother, C.Itoh, Centronics, Epson, HP, NEC, Okidata, Panasonic, Qume, Star, Toshiba and most other printers.

Apple is a registered trademark of and Macintosh is a trademark licensed to Apple Computer Inc.

**Order SwyftCard on a 30-day money-back trial offer. Call toll-free:
800-982-5600 in the U.S.,
800-562-7400 in California. Or use this coupon.**

Name _____

Address _____

City _____

State _____ Zip _____

Phone (_____) _____

Send _____ SwyftCards at \$89.95* plus \$3.50 U.S. or \$10.00 foreign shipping and handling each, totalling \$_____. I prefer to pay as follows:

My check or money order is enclosed (payable to Information Appliance Inc.)

Please bill my credit card account: Visa MasterCard

Card # _____

Expiration Date _____

Signature _____

*California residents please add \$6.30 for sales tax.

Mail to: Information Appliance Inc., 530 University Ave., Palo Alto, CA 94301.

Information Appliance Inc.

There are limits on how many of these markers can be used, though. Only one data monitor, two breakpoints, and two ranges may be set at any one time.

COMMAND LINES AND FILES

Living C supports the full Kernighan and Ritchie model of the language, in-

cluding all the preprocessor commands (see *The C Programming Language* by Brian Kernighan and Dennis Ritchie, Prentice-Hall, 1983). However, it is a monolithic, interactive environment, whereas normal C is a "kit of parts" based on separate files used at the DOS level. This calls for some special tricks in Living C to maintain

full compatibility with normal C.

Compiler directives normally issued on the command line are simulated by a file called LC__CMDS that can be edited from the main menu using the standard editor. This file is passed as a command line when you enter Living C. Among the compiler directives it supports are:

- I <dir> Look for #include files in directory <dir>.
- D <name> Treat <name> as if it has been #defined to value 1.
- S Don't stop on errors; put them all in a file.
- E <filename> Put errors in this file.

Other directives set the maximum space available for static data, local variable frames, and external references. All the directives have sensible default values so the feature is optional.

A similar facility using the file LC__UCMD permits a simulated command line to be passed to a compiled program at run time, containing arguments to be bound to argc and argv.

Living C directly supports top-down coding of programs, as it can compile and run a program with unresolved external references. When such a reference is encountered during program tracing, execution stops and a prompt on the command line requests a value. If you enter a value, Living C pretends that this value has been returned by the external function and carries on executing happily.

Source files are given the default extension .c, and the compiled pseudo-code files extension .t. When the Run command is given, the source file is compiled to a .t file that is kept on disk. Subsequent runs will not need to be compiled, unless the editor detects that the source file has been changed. There is a complication, however, because Living C supports the inclusion of source files with #include, and they are separately

(continued)

LATTICE® WORKS

**LATTICE TO MARKET
db_VISTA**

Lattice now offers programmers db_VISTA, a new database management system designed for C language applications programming.

db_VISTA will reduce your program development time by eliminating the need for file handlers, ISAMs (dBASE-format), record retrieval systems, or index managers. db_VISTA consists of a Data Definition Language (DDL) processor and library of C functions. The database structure is specified by the programmer in the DDL. The DDL processor compiles the DDL specification into a set of tables to be used by the db_VISTA library functions.

Contact us to order the db_VISTA package for \$495, including documentation, source code, unlimited run-time distribution license, and support from Lattice. Without the source code, db_VISTA is available for \$395.

**LATTICE TOPVIEW
TOOLBASKET RELEASED**

If you develop programs oriented to take advantage of IBM's TopView multi-tasking window environment, you need the Lattice TopView Toolbasket.

The Lattice TopView Toolbasket is a library of more than 70 C functions to control window, cursor, and pointer functions, along with printer controls, cut and paste functions, debugging, and general utilities. It also includes an assembler interface and master file and data definition headers.

This new Lattice product speeds your program development with its documented tips on handling I/O and dispatch routines, plus its sample programs with source code and batch files your programs can be patterned after.

The Lattice TopView Toolbasket runs on the IBM PC, XT, AT, and compatible systems with 256K (512K and TopView Toolkit from IBM recommended). The Lattice TopView Toolbasket is available

for \$250. Binary and Source Code available for \$500. The Lattice TopView Toolbasket was developed for Lattice by Strawberry Software.

Speed your TopView program's release. Order the Lattice TopView Toolbasket today!

**dBC III NOW AVAILABLE
FROM LATTICE**

The new Lattice dBC III Library of C functions lets you create, access, and update files that are compatible with dBASE III.

dBC III provides an alternative to programming in the dBASE III interpretive language. You do not need dBASE III in order to use dBC III, since dBC III is a complete Indexed Sequential Access Method (ISAM) package by itself.

Lattice dBC III provides 37 functions that easily add, update, delete, retrieve, and organize records and their corresponding indexes. In addition, dBC III lets you take advantage of the many C libraries that support screen and window management, graphics, statistical analysis, and more.

Lattice dBC III is available for \$250 to run on MS-DOS and PC-DOS systems with 128Kb memory. dBC III with source code is \$500. No runtime object license fees are required. Lattice also offers dBC II for dBASE II compatibility.

Order today and make your database programming as easy as dBC!

**ASK ABOUT OUR "TRADE
UP TO LATTICE C POLICY"**



Lattice, Inc.
P.O. Box 3072
Glen Ellyn, IL 60138
Phone: (312) 858-7950
TWX: 910-291-2190

"We Practice Portability"

International Sales Offices:
Benelux: De Vooght. Phone: (32)-2-720.91.28.
England: Roundhill, Phone: (0672) 54675.
Japan: Lifeboat, Inc., Phone: (03) 293-4711.

Working With You To Stay Ahead.

NOVEMBER SPECIALS

Open Systems
All Acct'g.
Programs ... ea. \$335

Software Group
Enable \$419

Alpha Software
ESP \$499

Quadram
Quadjet printer... \$395
Quadboard 64K (Clik/
Cal, S & P) 199
w/384K 244
Quad Jr. Exp.
Chassis \$470

Microlog
Baby Blue II \$519

C.D.C.
Half Hi drives \$ 99

Amdek
300 A Amber \$129

Innovative
Flip 'n' File 50.... \$ 15
Flip 'n' File 15.... 7

Hayes
Smartmodem 1200. \$375

Ultramagnetics
diskettes
5 1/4" DS, DD
(Box of 10) \$ 25
**BUY 3 BOXES,
GET 1 BOX
FREE!!!!**

Micro Pro
Pro-Pak \$359

Microstuf
Crosstalk \$109

Northwest Analytical
Statpak \$365

Supersoft
Disk Doctor 86 \$ 74

BOARDS APPLE

ALS
CP/M Card \$269
Smarterm II 119
Z-Engine 139

CCS
7711 Asynch Serial .. \$119

Microtek Call

Orange Micro
Grappler + \$109

Prometheus
Versacard \$159

IBM/PC

AST Research
Six Pak + w/64K ... \$229

Hercules Cards Call

Tecmar Call

Memory Chips Call

DISK DRIVES

FULL HEIGHT —
CDC, Tandon
HALF HIGH Call

HARD DISK —
I-Omega Bernoulli Box,
Maynard Electronics,
Mountain, Inc. Call

Shugart
10MB HD Dr. \$369
w/controller 475
20MB HD Dr. 599
w/controller 689

Tandon
10MB HD Dr. \$489
w/controller 669

MONITORS

Amdek
310A Call
710 Clr 649

PGS
HX 12 RGB CLR
monitor \$479

MAX 12 179
SR12 (690 x 480 Res) 639
Doubler Card 175

Quadram Call
Zenith Call

APPLE

Alpha Software
Apple-IBM
Connection \$169

Dow Jones
Market Analyzer ... \$229
Market Manager ... 189
Spreadsheet Link .. 179

Software Publishing
PFS products Call

*Plus many more...
PLEASE CALL!*

CP/M

All prices below are for
8" standard.

Ashton-Tate
dBase II Call

Digital Research
*Please call for prices
and available products.*

Infocom
All Games Call

PRINTERS

C. Itoh Electronics, Inc.,
Diablo, Epson, NEC,
Okidata, Quadram,
Star Micronics Call

Ribbons Call
Cables Call

MISC.

Hauppauge
8087 w/o software .. \$149
80287 AT Chip
w/o 269

Kensington
Masterpiece \$109

Keytronic
KB 5151 Jr. \$169
KB 5150 169
KB 5151 Dvorak ... 173
KB 5151 keyboard .. 169
KB 5149 Jr. numeric
Keypad 89

Quadram
Quad Jr. Exp.
Mem Bd.
(for chassis) 128K .. \$199

Touchtone Technology
Touchtone II \$169

MODEMS

Hayes
Smartmodem 300 .. \$159
Smartmodem 1200B .. 369
Smartmodem 2400 .. Call

US Robotics
S-100 Modem \$349
Password M or F ... 309

**This is only a sample of the nearly
10,000 products we carry. If
you're interested in something not
listed, PLEASE CALL! And don't
forget to ask our sales people
about our unadvertised specials.**



1 800 826-1589

WITHIN WISCONSIN **1 800 472-3535**

INT'L TELEX: 260181 ORYX SYS WAU

Technical Support/Order Status/Customer Service:
Call (715) 848-1374.

POLICY:

- ▶ Wisconsin residents add 5% for sales tax.
- ▶ Minimum \$4.00 for shipping, handling and insurance for orders to \$200.
- ▶ For orders over \$200, add 2½% for shipping, handling and insurance.
- ▶ For cash prepayment of orders \$200 or more, add ONLY 2% for shipping, handling and insurance.
- ▶ Prices are subject to change without notice.
- ▶ All items subject to availability.



WE WELCOME:

- ▶ Visa, MasterCard and American Express. (No charge for credit cards.)
- ▶ Corporate, government, educational or volume purchasers, please ask for special accounts desk for additional discount.
- ▶ COD (Add \$2.00 per box/parcel. Cash or certified check required.)
- ▶ Checks, (Allow 1-2 weeks for clearing.)

INTERNATIONAL POLICY:

We welcome foreign orders. Shipping and handling charges per order are actual shipping costs plus \$50. international handling fee. Canadian orders — please call Telex: 260181 ORYX SYS WAU

WORKING HOURS:

Monday-Friday 8:30-6:00 • Saturday 10:00-2:00 • Central Time



T.M.

BYAD1185

A Division of Oryx Systems, Inc.

Oryx Micro Supply

CRAFTSMEN OF THE NEW TECHNOLOGY

425 First Street • P.O. Box 1961 • Wausau, Wisconsin 54401

compiled to .t files. The editor cannot detect that an included file has been updated if the main file has not. For this reason the main menu contains an option to make .t files manually in these cases.

CONCLUSIONS

The version of Living C-Personal that I reviewed was an early beta release (version 1.02) that still contained some obvious bugs and some loose ends, such as unsightly screen updating in the editor. I'm assured by Living Software that all of these have been dealt with in the final-release version, which may also contain enhancements not mentioned here.

That being the case, I am impressed by Living C. It provides a tool for teaching and learning the C language, which I feel is otherwise a miserable chore. The animation facility is such a powerful aid to comprehension that

SOFTWARE MENTIONED

Information on Living C-Personal can be obtained from:

LIVING SOFTWARE
 250 North Orange Ave.
 Suite 820
 Orlando, FL 32801
 (800) 826-2612
 Price: \$99

all serious languages ought to have one.

Living C can be used equally as an environment for testing and developing programs prior to compiling them for production using one of the industry-standard compilers. I had

neither the resources nor the time to check the claims for compatibility, but Kernighan and Ritchie is a pretty safe starting point.

Perhaps the most interesting application for Living C, though, is in the maintenance of existing programs. C does not encourage the writing of particularly readable programs, but now you can always understand how someone else's otherwise obscure code works by animating it and watching the bouncing ball.

Living C-Personal is the first of a family of Living C programs. A UNIX version of the program is likely to follow soon, and more tools aimed at professional programmers including source code and version control would not be too surprising.

At its price of \$99, I foresee a future for Living C up there with Turbo Pascal and the other software bargains of our time. ■

DRIVE ENCLOSURES

FLOPPY-WINCHESTER-TAPE

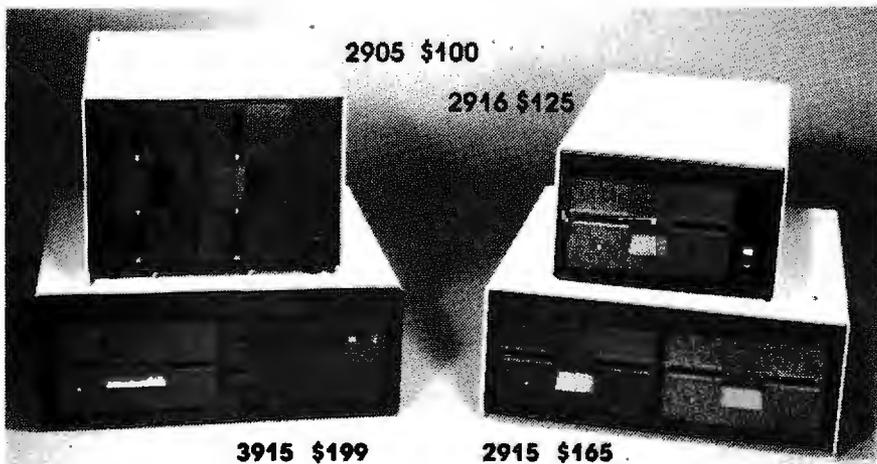
FROM \$80⁰⁰

(Includes Power Supply)

FLOPPY
8" & 5"

TAPE
5" & 8"

WINCHESTER
5" & 8"



- Desktop & Rack
- Heavy Duty All Metal Cabinet
- Fan & Dust Filter*
- Hefty Power Supplies
- Full or Slim Drives
- Power Harness From Supply To Drives
- Line Fuse, EMI Filter*, Detachable Line Cord
- Cabinets & Supplies Available Separately

* = Most Models (Disk drives not included)

INTEGRAND

RESEARCH CORPORATION

8620 Roosevelt Ave./Visalla, CA 93291

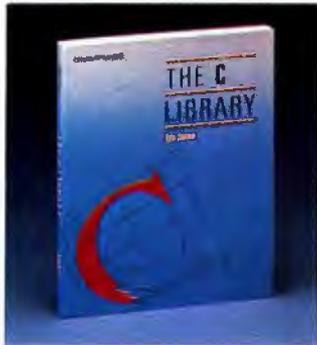
209/651-1203

Write or call for our brochure which includes our application note:
 "Making micros, better than any ol' box computer"

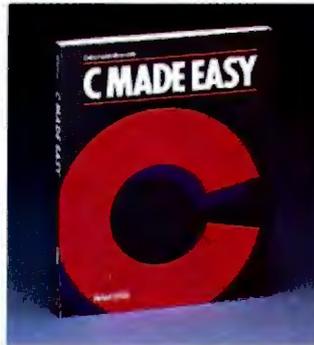
32 Page Free Fakt Pakt Catalog

Frustration Insurance

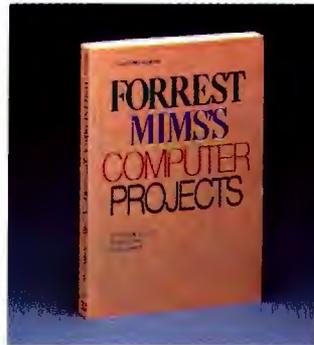
Computer Books from Osborne/McGraw-Hill.



• **The C Library**
Jamsa
\$18.95 **Order #881110-4**
Experienced C programmers will find over 125 routines ranging from macros to actual UNIX™ utilities. There are tools for string manipulation, pointers, input/output, array manipulation, recursion and more!



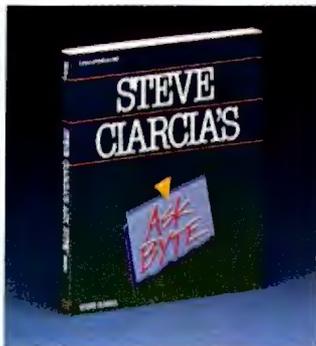
• **C Made Easy**
Schildt
\$18.95 **Order #881178-3**
Learn C programming in no time at all with this easy-to-use tutorial which introduces general concepts, functions, libraries, disk input/output and a wide range of other facts about the C programming environment and UNIX operating system.



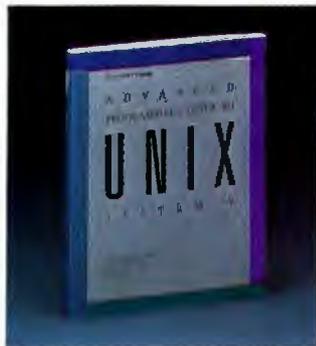
• **Forrest Mims's Computer Projects**
Mims
\$14.95 **Order #881193-7**
Forrest Mims III, noted author, has amassed a collection of computer projects which include computerized security alarms, psychological testing, experimenting with computer art and how to use your computer as a storage oscilloscope.



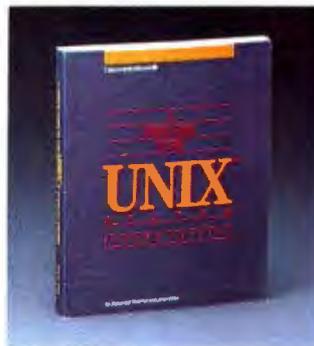
• **Using Turbo Pascal™**
Wood
\$19.95 **Order #881148-1**
Maximize your advanced programming skills with this thorough volume which covers Turbo Pascal, including version 3.0 for the experienced programmer.



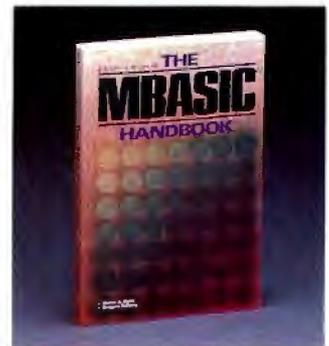
• **Steve Ciarcia's ASK BYTE**
Ciarcia
\$14.95 **Order #881200-3**
Steve Ciarcia provides insightful solutions to your exasperating hardware and software problems including how to troubleshoot difficulties that affect your peripherals, accessories, and operating systems



• **Advanced Programmer's Guide to UNIX™ System V**
Thomas, Rogers, and Yates
\$21.95 **Order #881211-9**
C programmers who already know UNIX fundamentals can use this guide to write more effective programs with the software tools in UNIX System V.



• **A User Guide to the UNIX™ System (2nd Edition)**
Thomas and Yates
\$18.95 **Order # 881109-0**
Now the best-selling **User Guide to the UNIX™ System** has been revised and expanded to cover applications of the UNIX operating system for Bell Laboratories New System V and Berkeley UNIX.



• **The MBASIC Handbook**
Ettlin
\$18.95 **Order #881102-3**
Gain a better understanding of programming while you learn to develop and customize programs with this fundamental guide to Microsoft™ BASIC.

Osborne/McGraw-Hill books are available at bookstores and computer stores everywhere. To order any of these titles by mail, complete the coupon and mail to McGraw-Hill, P. O. Box 400, Hightstown, NJ 08520. All orders must be prepaid. Checks, money orders, VISA and MasterCard are acceptable for payment. No postage or handling charges are required, but please include appropriate tax if applicable in your shipping area. All books will be shipped via UPS. Allow 4-6 weeks for delivery. Books will not be delivered to post office boxes. This offer is valid only in the Continental United States and is subject to change without notice.

NAME		
ADDRESS		
CITY		
STATE	ZIP	
INDICATE METHOD OF PAYMENT <input type="checkbox"/> CHECK/MONEY ORDER		
<input type="checkbox"/> VISA/EXP DATE	<input type="checkbox"/> MASTERCARD/EXP DATE	
CARD #		
SIGNATURE		
QTY	ORDER #	PRICE
SUBTOTAL		
TAX		
TOTAL		

McGraw-Hill
P. O. Box 400
Hightstown, NJ 08520



Osborne McGraw-Hill

Inquiry 288

Your System/Controller should fit you like a good suit.



LET MICROMINT CUSTOM FIT YOU

Whether it's suits or system controllers, you can't buy off the rack when you need a custom fit.

That's why Micromint individualizes its system controllers to meet your particular needs and budget. What's most important to you? Software compatibility? Speed? Everything on one board? Economical computing power?

#1: "I want software compatibility."

Solution:

THE SB180 COMPUTER/CONTROLLER

The SB180, only 4" by 7½", offers a Z80 compatible CPU running at 6MHz, 256K bytes of RAM, up to 32K bytes of ROM, two serial ports, a parallel port, Z80/6800 I/O expansion bus, and an industry standard 765A-compatible disk controller for up to four disk drives — any combinations of 3½", 5¼" or 8" drives. The SB180 is based on the Hitachi HD64180 CPU, a microcoded CMOS chip which provides high performance, reduced system cost, and low power operation while maintaining complete compatibility with the large base of standard CP/M software.

SB180-1 w/8K ROM monitor... \$369.00
SB180-5 w/8K ROM monitor, BIOS source and Z-system... \$418.00

#2: "I need speed."

Solution:

THE Z8 FORTH SYSTEM/CONTROLLER

The Z8 FORTH System/Controller is only 4" by 4½" and includes a custom masked Z8 version of the FORTH

language with a full screen editor, cassette I/O driver primitives, EPROM programmer primitives, and other utility words. It also contains up to 4K bytes of RAM or EPROM, an RS-232 serial port with selectable baud rates, and two parallel ports. Additional Z8 peripheral boards include memory expansion, a smart terminal board, serial and parallel I/O, real time clock an A/D converter, and an EPROM programmer. It's perfect for data reduction and high speed control applications.

BCC21 w/utilities... \$225.00

#3: "Let me have an entire development system on one board."

Solution:

THE BCC52 SYSTEM/CONTROLLER

The BCC52 is a new stand alone single board microcomputer which is bus compatible with the Micromint BCC11/BCC21 Z8 System/Controllers and expansion boards. The BCC52 features the Intel 8052AH-BASIC microprocessor which includes a ROM resident 8K byte floating point BASIC inter-

preter with extensions for process control work. It contains sockets for up to 48K bytes of RAM/EPROM, an "intelligent" 2764/128 EPROM programmer, 3 parallel ports, a serial terminal port, and a serial printer port.

BCC52... \$239.00

#4: "Give me lots of economical computing power."

Solution:

THE BCC11 BASIC SYSTEM/CONTROLLER

The Z8 BASIC System/Controller is nearly identical to the FORTH System/Controller but contains a tiny BASIC interpreter, up to 6K bytes of RAM and EPROM, an RS-232 serial port with switch selectable baud rates, and two parallel ports. Add a power supply and terminal to start programming in BASIC or machine language. Programs can be transferred to 2732 EPROMS with the optional EPROM programmer for auto-start applications. It can also use any of the expansion boards mentioned under the Z8 FORTH System/Controller.

BCC11... \$149.00

Additional information on peripheral boards and OEM pricing is available.



For a System Controller suited to your needs, give us a call.

Order Toll Free

1-800-635-3355

In Connecticut call: 1-871-6170



MICROMINT, INC.
25 Terrace Drive
Vernon, CT 06066



M·A·T·H·E·M·A·T·I·C·A·L R·E·C·R·E·A·T·I·O·N·S

Repeating Decimals

Cycles,
sequences,
and late
repeaters

BY ROBERT T.
KUROSAKA

Early in our educational career, we all discovered that $1/3 = 0.33333\dots$ (abbreviated to $0.\bar{3}$ in this column) and that $2/3 = 0.\bar{6}$. Some of us went even further and found that $1/7 = 0.142857$ and $1/11 = 0.09$. While some fractions have terminating decimals ($1/16 = 0.0625$), most fractions have nonterminating decimals with a portion, or cycle, that repeats endlessly. (Actually, there are a countably infinite number of each kind of fraction, but it's best not to think too much about paradoxes of infinity. For our purposes, I'll say that there are more of the second kind and pretend that I know what I'm saying.) It has been proven that all fractions have either terminating decimals or cyclically repeating decimals.

The English mathematician William Shanks calculated the cycle lengths for all prime denominators less than 120,000. Shanks is known for his prodigious work in calculating π to 707 places in the 1870s. He is even better known for having an error in the 528th place (found by another Englishman, Ferguson, in 1947).

This month's column will explore some of the properties of repeating decimals. While I will limit the discussion to unit fractions (those with a numerator of 1), the program in listing 1 deals with any fractions that have a positive whole-number numerator and denominator, up to the limit of your computer's memory.

In base 10, only fractions with denominators of the form $2^a 5^b$ will have terminating decimals; that is, the denominator is composed of factors of 2 and 5 only, such as 2, 4, 5, 8, 16, 20, 25, 32, 40, 50, and so on. The length of the terminating decimal will be either a or b , whichever is larger. All other denominators will have repeating decimals. In other bases, those denominators that are of the form $p_1^{a_1} p_2^{a_2} \dots p_n^{a_n}$ where the p s are prime-number factors of the base, will terminate. For example, in base 14, denominators that are expressible as $2^a 7^b$ will form terminating decimals.

We have noted that $1/7$ has a 6-digit cycle. If we divide out $1/17$, we find a 16-digit cycle: 0.0588235294117647. Similarly, we see that $1/19$ has an 18-digit cycle: 0.052631578947368421. Boldly, then, we conjecture that for any prime p , the decimal of $1/p$ will have $p-1$ digits in its cycle. But we are wrong—we overlooked two earlier examples: $1/3 = 0.\bar{3}$ and $1/11 = 0.0\bar{9}$.

Fractions with composite (nonprime) denominators will also have repeating decimals, but denominators containing factors of 2 or 5 will repeat only after a few decimals that are not part of the cycle ($1/88 = 0.011\bar{36}$, $1/75 = 0.01\bar{3}$). These decimals are called late repeaters. If we express these denominators as $2^a \times 5^b \times p_1^{c_1} \dots p_n^{c_n}$, the length of the delay will equal either a or b , whichever is larger (sound familiar?). For example, $88 = 2^3 \times 5^0 \times 11^1$, $a=3$, $b=0$, $3 > 0$, so the cycling portion begins after the first three digits. Further, in the simple case where the denominator can be expressed as $2^a \times 5^b \times p^c$, the length of the cycle will be equal to the length of the cycle of $1/p^c$ (for example, $1/88$'s cycle length equals the cycle length of $1/11$).

Thus, the question arises: What rule governs the lengths of the cycles? We can answer part of this question with a little thought. Consider the successive steps in the division of $1/13$, as shown in table 1. Each subtraction leaves a remainder: After the 1, we have 10, 9, 12, 3, . . . We can expect to see a maximum of 12 different remainders (1, 2, 3, . . . , 12); we will not see a remainder of 0 since we know that the decimal will not terminate. If we continue to divide to 12 decimal places, one of two things will happen. We will see all 12 remainders and the next division will produce a previously seen remainder, or a previously seen remainder will appear before the twelfth division. In either case, we will have found the repeating cycle in, at most, 12 divisions. We have found the maximum length of the cycle. In general, for any

(continued)

Robert T. Kurosaka teaches mathematics in the Massachusetts State College system. He invites your correspondence to BYTE, POB 372, Hancock, NH 03449.

Table 1: The first four steps in turning 1/13 into a decimal number.

0.	0.0	0.07	0.076
13 | 1.00000	13 | 1.00000	13 | 1.00000	13 | 1.00000
0	0	0	0
—	—	—	—
1	10	10	10
	0	0	0
	—	—	—
	10	100	100
		91	91
		—	—
		9	90
			78
			—
			12

Listing 1: A program to calculate the cycle for repeating decimals.

```

10 '*****
20 '*   FRACTION-CYCLE GENERATOR   *
30 '*       BY BOB KUROSAKA       *
40 '*****
50 CLS
60 PRINT "THIS PROGRAM CALCULATES THE CYCLE OF REPEATING
  DECIMALS"
70 PRINT "FOR POSITIVE FRACTIONS. ANSWERS ARE PRINTED AS
  #.#_#.#..."
80 PRINT "WHERE THE NUMBERS BETWEEN '_' AND '...' ARE REPEATED
  INFINITELY."
90 PRINT :PRINT
100 INPUT "ENTER THE FRACTION'S NUMERATOR";N:NUMERATOR=ABS(N)
110 INPUT "ENTER THE FRACTION'S DENOMINATOR";D:DENOMINATOR=ABS(D)
120 REM 'TERM' HOLDS THE VALUE OF EACH DIGIT IN THE DECIMAL.
  'REMAINDER' HOLDS THE LOCATION OF THE FIRST OCCURRENCE OF A
  REMAINDER, I.E., REMAINDER(1)=9 MEANS THE REMAINDER 1 WAS
  FIRST USED TO CALCULATE THE NINTH TERM.
130 DIM TERM(DENOMINATOR), REMAINDER(DENOMINATOR)
140 REM CALCULATE THE WHOLE-NUMBER PART, STORE IN TERM(0).
150 TERM(0)=INT(NUMERATOR/DENOMINATOR)
160 REM CALCULATE THE REMAINDER, FLAG THAT NUMBER'S FIRST
  OCCURRENCE AS 1.
170 REMAINDER=NUMERATOR-TERM(0)*DENOMINATOR:REMAINDER
  (REMAINDER)=1
180 REM WHEN WE'VE SEEN A REMAINDER BEFORE, NEW.REMAINDER$
  WILL BE SET TO 'NO.'
190 NEW.REMAINDER$="YES"
200 WHILE NEW.REMAINDER$="YES"
210   REM 'DIGIT' KEEPS TRACK OF THE DECIMAL PLACE OF THE TERM.
220   DIGIT=DIGIT+1
230   DIVIDEND=10*REMAINDER
240   TERM(DIGIT)=INT(DIVIDEND/DENOMINATOR)
250   REMAINDER=DIVIDEND-TERM(DIGIT)*DENOMINATOR

```

(continued)

denominator d of a repeating decimal, the decimal $1/d$ will repeat in, at most, $d-1$ places.

Our next question is which denominators have cycles of length $d-1$ and which have shorter cycles. Sorry, there is no concise answer to this question. This is one opportunity for some personal exploration with the program in listing 1 (available for downloading from BYTEnet Listings; call (617) 861-9774 before November 1 and (617) 861-9764 thereafter).

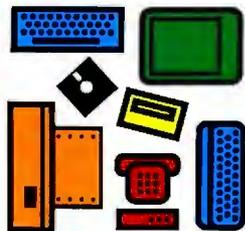
The program works in a manner analogous to what we did with the fraction 1/13 in table 1. In general, since the repeating cycle will exceed the precision of our computer, some extended precision is required. In our program, the digits of the decimal expansion are stored in the array TERM, one at a time as they are determined. The remainder is tested after each division to see if it equals one we have had before. To do this, we use a flag array REMAINDER, where the subscript of the array element corresponds to the remainder and the contents of the array element correspond to the first occurrence of that remainder. In table 1, remainder 1 was used to calculate the first digit. Therefore, REMAINDER(1) will be set equal to 1. Remainder 10 was used to calculate the second term, so REMAINDER(10)=2, etc. When the remainder finally equals one we have had before, as indicated by the relevant REMAINDER element being nonzero, the contents of the TERM array are printed out and the beginning of the cycle (the term denoted by the contents of REMAINDER (REMAINDER)) is marked.

The size of the denominator you can handle is limited by the available memory. If you're feeling ambitious, you can use the information presented on delay length for late repeaters to eliminate the REMAINDER array, thereby nearly doubling the available memory. If, in addition, you print out each term as it is calculated rather than storing it in an array, you can deal with denominators as large as precision or time will allow.

(continued)



Now you can simplify personal computer management decisions.



Future Directions makes it easier for personal computer managers and buyers to make corporate computer strategy decisions.

Future Directions is a new loose-leaf information service that provides managers and buyers with critical information on computer industry issues and trends. And it's published by the premier information source in the personal computer industry, Future Computing.

Future Directions provides answers.

It's a management decision tool that answers the computer automation questions you have today and addresses the issues you may not have begun to consider. *Future Directions* examines personal computer compatibility and brings you up-to-date on current and future technology trends. You'll use *Future Directions* to:

- simplify product selections
- discover how to take advantage of new technology
- keep on top of the latest trends and issues
- investigate purchasing alternatives.

Future Directions saves time.

It's a ready resource that provides objective information on personal computer automation alternatives, without overwhelming you with lengthy product evaluations.

In 250 pages of easy-to-read charts, tables, and text, *Future Directions* presents a wealth of research data you need for sound business decisions. You can use the charts to support your decisions in management presentations. And a comprehensive index helps you find the information you need quickly.

Future Directions saves money.

It eliminates costly mistakes in personal computer product selection. It provides strategies to incorporate your current computer systems into new technology trends such as local area networks and multiuser systems. *Future Directions* also helps you to select products that fit your company's specific automation needs.

Future Directions is affordable.

At \$495 per year, you can't afford not to subscribe to *Future Directions*. Each subscription includes a

comprehensive loose-leaf report covering current issues and technology trends in the computer industry. Updates on new product strategies and technologies are sent every other month. Each subscription also includes a monthly newsletter providing Future Computing's authoritative opinions on new products and a barometer of industry activity based on our surveys of computer dealers and personal computer users.

Special Introductory Offer.

To make *Future Directions* even more affordable, we're offering a special introductory price of \$449. To subscribe to *Future Directions* at the low introductory price, call a Marketing Representative at 214 437-2400. Or send the coupon today.



Enter my subscription to *Future Directions* at the introductory price of \$449.

Please send more information about *Future Directions*.

Sales Support
Future Computing Incorporated
8111 LBJ Freeway
Dallas, Texas 75251

Please allow 6-8 weeks for delivery.

Name _____

Title _____

Company _____

Address _____

City/State/Zip _____

Phone (____) _____

ROSE DATA SWITCHES



SHARE computers, printers, any parallel or serial device
ELIMINATE cable swapping
INEXPENSIVE way to network
COMPATIBLE with all computers.
 Businesses, Schools, Homes

WE ALSO OFFER:
 Data Buffers, Line Drivers, Modems, Protocol Converters, Parallel - Serial Converters, Cables, Computers, Printers, Disk Drives, and more.

AUTOMATIC - CARETAKER is ideal for a business or school to share a printer or modem among many computers. Operation is fully automatic with no software required.

Parallel or Serial 4 channels - \$295 8 channels - \$395
MANUAL - HARD SWITCH is operated with the flip of a switch. 2:2 and 2:4 models allow simultaneous communication.

Serial 1:2 - \$99 1:4 - \$159 2:2 - \$189 2:4 - \$279
 Parallel 1:2 - \$79 1:4 - \$139 2:2 - \$119 2:4 - \$199

CODE ACTIVATED - PORTER connects one computer to multiple peripherals. A software code selects the peripheral. Parallel or Serial 4 channels - \$295 8 channels - \$395
 Buffer option 64K - \$100 256K - \$250

REMOTE - TELEPATH connects multiple computers to multiple peripherals. A selector at each computer or terminal chooses up to 4 peripherals and displays busy status.
 4:4 - \$495 4:8 - \$795 selector - \$39

Give a Rose to your computer

ROSE ELECTRONICS (713) 933-7673
 P.O. BOX 742571 MC & VISA Accepted
 HOUSTON, TX 77274 Dealer Inquiries Invited
CALL US FOR ALL YOUR INTERFACE NEEDS

Inquiry 330

5 1/4" **BASF** FLEXYDISKS

	10-90	100 +
SS / DD Soft	\$.92 ea.	\$.89 ea.
DS / DD Soft	\$ 1.02 ea.	\$.99 ea.
High Density (IBM - AT)	\$ 3.15 ea.	\$ 3.05 ea.
3.5 / SS Micro	\$ 2.10 ea.	\$ 2.05 ea.

In Stock - Immediate Shipment.
 Mastercard, VISA, Check or Money Order.
 Add \$3.00 shipping charges per each 100 or part.
 Add \$2.50 additional for C.O.D. shipments.
 N.J. residents add 6% sales tax.

Data Exchange
 Dept. B, P.O. Box 993
 178 Route 206 South
 Somerville, N.J. 08876
(201) 874-5050

Inquiry 109

64K ■ 128K ■ 256K DRAMS

80287-8 ■ 80287-3

8087-3 ■ 8087-2

8087-1

BITTNER



899 SOUTH COAST HIGHWAY
 LAGUNA BEACH, CA 92651
(714) 497-6200
 CALL NOW FOR **FREE CATALOG**

Inquiry 38

DECIMAL CYCLES

```

260 REM IF THE DECIMAL TERMINATES, SET THE 'EXACT$' FLAG AND
    PREPARE THE 'REMAINDER' ARRAY TO TERMINATE THE LOOP AT
    LINE 290.
270 IF REMAINDER = 0 THEN EXACT$ = "YES":REMAINDER(REMAINDER)
    = DIGIT
280 REM IF THIS IS A NEW REMAINDER, STORE THE TERM IT'S
    ASSOCIATED WITH IN THE APPROPRIATE 'REMAINDER' ARRAY
    LOCATION. OTHERWISE, WE'VE COMPLETED ONE TRIP AROUND
    THE CYCLE AND CLOSE THE WHILE/WEND LOOP.
290 IF REMAINDER(REMAINDER) = 0 THEN REMAINDER(REMAINDER) =
    DIGIT + 1 ELSE NEW.REMAINDERS$ = "NO"

300 WEND
310 REM PRINT RESULTS.
320 PRINT NUMERATOR;" / ";DENOMINATOR;" = ";
330 REM FIRST, THE WHOLE-NUMBER PART.
340 PRINT TERM(0);". ";
350 REM THEN THE PART BEFORE THE CYCLE, SUPPRESSING LEADING
    BLANKS.
360 FOR I = 1 TO REMAINDER(REMAINDER) - 1
370 PRINT USING "#";TERM(I);
380 NEXT I
390 REM IF THE DECIMAL CYCLES, MARK THE BEGINNING OF CYCLE WITH
    '_'.
400 IF EXACT$ <> "YES" THEN PRINT "_";
410 REM NOW PRINT THE CYCLIC PART.
420 FOR I = REMAINDER(REMAINDER) TO DIGIT
430 PRINT USING "#";TERM(I);
440 NEXT I
450 REM PRINT THE CYCLE LENGTH.
460 IF EXACT$ <> "YES" THEN PRINT "...":PRINT : PRINT "THE CYCLE
    LENGTH IS";DIGIT-REMAINDER(REMAINDER) + 1
470 REM IF THE DECIMAL DOES NOT REPEAT, SAY SO.
480 IF EXACT$ = "YES" THEN PRINT:PRINT:PRINT "THIS IS A NONREPEATING
    DECIMAL."
490 END
    
```

Here are some well-known properties of repeating decimals:

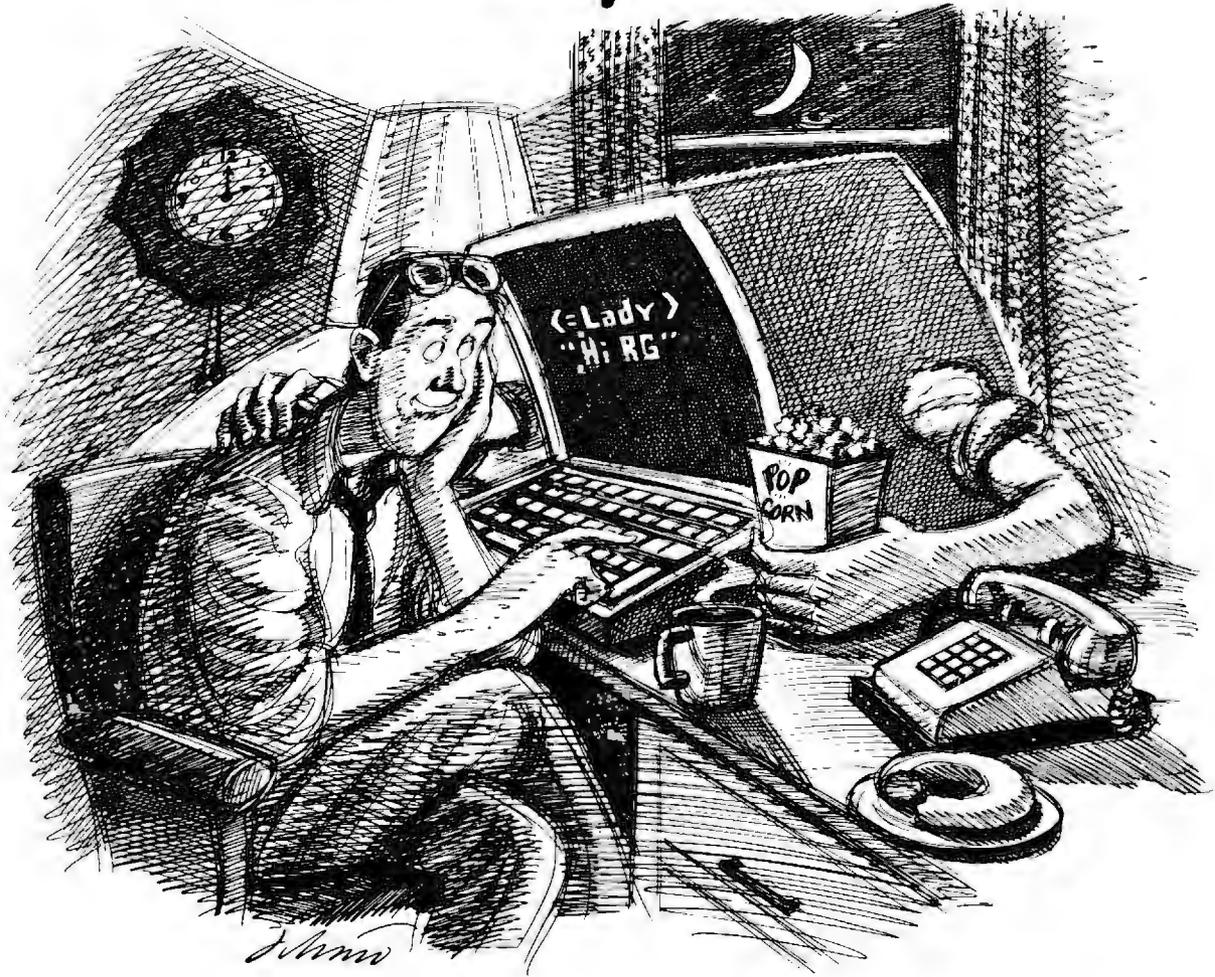
- While 1/97 has a 96-digit cycle and 1/1861 has an 1860-digit cycle, some large denominators have remarkably short cycles: 4649 has a 7-digit cycle; 513,329 has an 11-digit cycle; and 265,371,653 has a mere 13-digit cycle.
- Since 1/11 has a 2-digit cycle and 1/37 has a 3-digit cycle, it is not surprising that their product, 1/407, has a 6-digit cycle (0.002457). But while 1/7 has a 6-digit cycle and 1/101 has a 4-digit cycle, their product, 1/707, does not have a 24-digit cycle but a 12-digit cycle. It seems that the length of the product's cycle is the least common multiple of the two cycle lengths, but I have not seen a proof of this.
- If a prime-number denominator's cycle has an even number of digits, such as 1/13 = 0.076923, the cycle

can be "bisected" into 076 and 923, and the two halves add up to "999." That is, in any even-digit cycle of prime denominators, the two halves are 9-conjugates of each other. If we know the first half of a cycle, we can immediately find the second half—just perform a "subtract from 9" for each digit of the first half. But first we must know when we've reached the middle of the cycle, and we must know in advance that the cycle has an even number of digits. Any suggestions? With composite denominators, this bisection may or may not apply. For example, the cycle of composite denominator 407 discussed in point 2 is even but does not bisect into two 9-conjugates.

- If the denominator is a power of a prime, yet another pattern emerges. For example, 1/7 has a 6-digit cycle;

(continued)

GE introduces GENie. Your low cost way to get on-line, and stay there.*



Imagine having access to quality personal computing SIGs, software, CB simulation, E-Mail and games at 1200 baud. But paying only a 300 baud rate.

Here's GENie™!

GENie stands for the General Electric Network for Information Exchange. It's a part of General Electric Information Services — the world's largest commercial tele-processing network. And now the power of GENie is available to the home computer user.

The High Speed GENie.

GENie can take you to new highs in speed and keep you there. Because our non-prime time rate for 300 or

1200 baud is only \$5.00* an hour. That's up to 60% less than you're paying now.

So when you're wrapped up in a computer group, or heavily into serious conversation, you can keep your eyes on the screen, not on the clock. (More good news: no minimum monthly charges, the sign up fee is just \$18.00 and new subscribers get three free hours until December 31, 1985.)

What wishes Can GENie grant?

GENie has most everything. Including LiveWire™ CB simulator, RoundTable™ SIGs, bulletin boards, GE Mail™ classic games like CastleQuest™ and BlackDragon™ conference rooms, newsletters and more.

**Sign up from your keyboard:
1-800-638-8369.**

Just have your VISA, MasterCard or checking account number ready. Set your modem for half duplex, 300 or 1200 baud. Upon connection enter HHH then press RETURN. At the U#=prompt enter VJM11953, GENie and press RETURN. (For additional information or assistance call 1-800-638-9636, ext. 21.)

Then get on-line with GENie. And stay longer, for less.



**INFORMATION
SERVICES**

General Electric Information Services Company, U.S.A.

*Rate applies to 300 or 1200 baud, Mon.-Fri., 6PM to 8AM local time, all day Sat., Sun. and nat'l holidays. Subject to service availability.

ATTENTION BERNOULLI BOXERS

Give your IOMEGA a Boot!

**FIXT/B PLUS for
IBM AT, XT, PC and compatibles**

FIXT/B PLUS gives you the utility of a bootable hard disk while preserving the performance of your Bernoulli Box. You can have it all with FIXT/B PLUS!

Golden Bow Systems

\$95-\$110
Add \$3 for shipping/handling
California residents add 6% sales tax



3388 Second Ave., Suite F
San Diego, CA 92103
(619) 298-9349

Inquiry 168

LIONHEART

BUSINESS & STATISTICAL SOFTWARE

Explanatory books with professional compiled software, the new standard for statistical use. The influential Seybold Report on Professional Computing has this to say about Lionheart: "...our sentimental favorite because of its pragmatic approach to the basic statistical concepts... The thinking is that the computer merely facilitates the calculations; the important thing is to be able to formulate a problem correctly and to determine what type of analysis will be most valuable."

- BUSINESS STATISTICS \$145
- EXPERIMENTAL STATISTICS 145
- MULTIVARIATE ANALYSIS 150
- QUALITY CONTROL & INDUSTRIAL EXPERIMENTS 125
- FORECASTING AND TIME SERIES 145
- SALES AND MARKET FORECASTING 145
- DECISION ANALYSIS TECHNIQUES 110
- LINEAR & NON-LINEAR PROGRAMMING ... 95
- PERT & CRITICAL PATH TECHNIQUES 95
- MONTE CARLO SIMULATION 125
- OPTIMIZATION 110

PC/MS-DOS, Amiga, Macintosh, some CP/M

VISA, MasterCard, AMEX, Check

P.O. Box 379, ALBURY, VT 05440
(514) 933-4918

Inquiry 222

DATA ACQUISITION TO GO INTERFACE FOR ANY COMPUTER



Connects via RS-232. Built-in BASIC. Stand alone capability. Expandable. Battery Option. Basic system: 16 ch. 12 bit A/D, 2 ch. D/A, 32 bit Digital I/O. Expansion boards available. Direct Bus units for many computers.

SPECIALISTS IN PORTABLE APPLICATIONS

(201) 299-1615

P.O. Box 246, Morris Plains, NJ 07950

ELEXOR

Inquiry 147

its square, $1/49$, has a 42-digit cycle; and its cube, $1/343$, has a 294-digit cycle. The pattern becomes clear when we note that $42=7 \times 6$ and $294=7^2 \times 6$. Similarly, $1/11$ has a 2-digit cycle; its square, $1/121$, has a 22-digit cycle ($22=11 \times 2$); its cube, $1/1331$, has a 242-digit cycle ($242=11^2 \times 2$); and its fourth power, $1/14641$, has a 2662-digit cycle ($2662=11^3 \times 2$). In general, if the denominator is a power of a prime, p^n , and $1/p$ has a k -digit cycle,

$1/p^n$ will have $p^{n-1} \times k$ digits in its cycle. Unfortunately, there are exceptions to this rule: $1/3$ and $1/9$ have a 1-digit cycle, and $1/487$ has a 486-digit cycle, as does its square, $1/237169$. These are the only primes less than 1000 with this property.

At this point, it seems reasonable to stop, catch our breath, and ask what good all this may be. I do have *(continued)*

Table 2: By "stacking" the Fibonacci sequence, beginning with 0.01 and moving one place to the right each time, then adding the numbers up, we get the fraction $1/89$. The decimal representation of $1/89$ has a 44-digit cycle, only part of which is reproduced in the table.

0.01	
1	
2	
3	
5	
8	
13	
21	
34	
55	
89	
144	
233	
377	
610	
.....	
<hr style="width: 20%; margin-left: 0;"/>	
0.011235955056.....	= 1/89

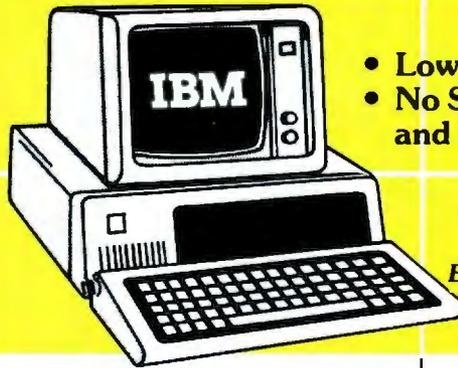
Table 3a: The algebraic method of converting repeating decimals to the corresponding fraction, demonstrated for $0.\overline{123}$.

- | | |
|------------------------------------|-------------------------------|
| 1. Let $x =$ the repeating decimal | $x = 0.123123123 \dots$ |
| 2. Multiply 1. by 1000 (this time) | $1000x = 123.123123123 \dots$ |
| 3. Subtract 1. from 2. | $999x = 123$ |
| 4. Solve for x and reduce | $x = 123/999 = 41/333$ |

Table 3b: The method of table 3a applied to the late-repeating decimal 0.1327 . Notice that you will generally have to multiply the numerator and denominator by some power of 10 to clear the decimal in the numerator before reducing the fraction.

- | | |
|-----------------------------------|-------------------------------------|
| 1. Let $x =$ the late repeater | $x = 0.132727 \dots$ |
| 2. Multiply 1. by 100 (this time) | $100x = 13.272727 \dots$ |
| 3. Subtract 1. from 2. | $99x = 13.14$ |
| 4. Solve for x and reduce | $x = 13.14/99 = 1314/9900 = 73/550$ |

Save



- Low Low Prices
- No Surcharge for MasterCard and VISA

1-800-231-9842
WESTERN REGIONAL ORDERS

1-800-237-4048
EASTERN REGIONAL ORDERS

• COMPUTERS •

IBM ENHANCED AT	5355
IBM ENTRY LEVEL AT . .	3298
IBM PC, 1 DSDD DR, 256K	1501
IBM PC, 2 DSDD DR, 256K	1616
IBM PC, NO DRIVES, 64K	1293
IBM PC, 2 HALF/HYTES, 256K	1631
IBM XT, 1DSDD DR/10MB, 256K	3355
IBM XT, 1DSDD DR/ TANDON HD, 256K	2491
COMPAQ, 2 DSDD, 256K	2153
COMPAQ PORTABLE 286 MODEL 2	5292
COMPAQ DESK PRO MODEL 3	3304
COMPAQ DESKPRO MODEL 2	2156

• MONITORS •

AMDEK 300G	116
AMDEK 300A	132
AMDEK 310A	140
AMDEK 600 RGB COLOR	409
AMDEK 710 SUPER HI RES COLOR	447
IBM COLOR	616
IBM MONOCHROME . . .	235
PRINCETON MAX-12 E . .	162
PRINCETON HX-12 RGB COLOR	446
PRINCETON SR-12	575
PRINCETON HX-12E COLOR	510
QUADRAM AMBERCHROME	150

QUADRAM QUADCHROME II	426
----------------------------------	-----

• DISPLAY CARDS •

STB SUPER HI RES 400 .	402
HERCULES COLOR	145
IBM MONOCHROME	215
IBM COLOR	226
EVEREX GRAPHICS EDGE	328
GENOA SPECTRUM	289
TECMAR GRAPHICS MASTER	459
PARADISE MODULAR GRAPHICS	261

• BOARDS •

AST SIX PACK PLUS, 64K	223
AST MEGAPLUS, 64K . . .	281
AST MP-2, 64K	228
AST ADVANTAGE, 128K .	384
AST I/O PLUS	122
JRAM-2	169
QUADRAM QUADBOARD ØK	186
QUADSPRINT	418
TECMAR CAPTAIN, ØK . .	162
TECMAR FIRST MATE, ØK	200
TECMAR WAVE XT, 64K .	187
TECMAR JR CAPTAIN, 128K	295

• MODEMS •

HAYES 2400	627
HAYES 300	138
HAYES 300/1200	407
HAYES 1200B w/ SOFTWARE	380
HAYES 1200B	351
VEN-TEL HALF CARD . . .	374
VEN-TEL 300/1200 INTERNAL	341
AST REACH HALF CARD 1200	362

• PRINTERS •

OKIDATA 83A, WIDE CARRIAGE	545
OKIDATA 84P, WIDE CARRIAGE	660
OKIDATA 92P	392
OKIDATA 93P, WIDE CARRIAGE	597
OKIDATA 2410P	1782
OKIDATA 182	215
OKIDATA 192	363
OKIDATA 182S	259
OKIDATA 184	660
EPSON FX-80, TRACTOR	371
EPSON LX-80	248
EPSON FX-185, WIDE CARRIAGE	517
EPSON FX-100, WIDE CARRIAGE	531
EPSON JX-80 COLOR PRINTER	531
EPSON LQ-1500 PARALLEL	1002
NEC 2050	682
NEC 3550	1045
NEC 8850	1458
JUKI 6100	362
JUKI 6300	695

• ACCESSORIES •

OKIDATA 82/92 TRACTOR	44
NEC BI-DIRECTIONAL TRACTOR	151
NEC CUT SHEET GUIDE .	63
JUKI 6100 BI-DIRECTIONAL TRACTOR	105
JUKI 6300 BI-DIRECTIONAL TRACTOR	124
MEMORY, 64K CHIPS . . .	8
MEMORY, 256K CHIPS . .	39
PRINTER CABLE	10
MICROFAZER BUFFER, 8K	131



COMPUTER MART

1901 S. TAMiami TRAIL, VENICE, FL 33595
2820 W. CHARLESTON, LAS VEGAS, NV 89102

Call for non-advertised and lower current prices. IBM is a registered Trademark of International Business Machines. Prices subject to change. We accept all major credit cards, money orders, and personal checks. 2% surcharge for shipping, handling and COD shipments, and purchase orders \$100 minimum. Returns are subject to a 15% restocking fee. All sales final.
IN FLORIDA CALL 813-493-2736
IN NEVADA CALL 702-877-3988

a few suggestions. First, a decimal with a long cycle, like $1/1861$, may be a convenient source of pseudo-random numbers. One word of caution—if you use this approach, remember that the first few digits will always be 0s. Therefore, don't use the first few terms as part of the random sequence.

Second, particular repeating decimals have some interesting and potentially useful properties. For example, $1/89$ has a 44-digit cycle that can be formed by "stacking" the numbers in the Fibonacci sequence, as shown in table 2. The question arises: Since we know that the decimal "encodes" the Fibonacci terms, and since we also know the values of as many of the digits in the decimal as we want, can we exploit this information to retrieve the n th term of the Fibonacci sequence without actually expanding the sequence?

(Notice that the expansion begins with the zeroth term of the sequence, so that the 440th to 442nd digits of the decimal expansion are 0,1,1. This is not the same numbering system we used for the terms in our program, where the first 0 was called the first term.) This question has considerable generality. Repeating decimals can always be viewed as encoding some infinite series in a similar manner.

As you explore these possibilities, you may find it useful to be able to reconstruct the fraction from the repeating decimal. I have not written a program to do this, but the algorithm is quite simple. Here are the steps, using the repeating decimal $0.\overline{123}$ as an example (see table 3a). First, let x equal the repeating decimal. Next, multiply both sides of the equation by 10 to the length-of-the-cycle power (in the example, the cycle length is 3, so multiply both

sides of the equation by 10^3 , or 1000). Subtract the first equation from the second, thus clearing the repeating part of the decimal. The denominator of the possibly unreduced fraction will be the coefficient of x , and the numerator will be the value on the right-hand side. All that remains to be done is to reduce the fraction by eliminating common factors of each. By the way, this algorithm works for late repeaters as well, although you may have to multiply the numerator and denominator by some power of 10 to clear decimal values before reduction (see table 3b).

I hope that you are already eager to explore the realm of repeating decimals on your own so that you can discover many of the fascinating patterns. One exciting side trip is examining repeating decimals in bases other than 10. I look forward to hearing of your findings. ■

PURCHASE ORDERS & BILL REQUESTS WELCOME

Compu\$ave

Call Toll Free: 1-800-624-8949

ARIZONA RESIDENTS CALL (602) 967-3532

WE ACCEPT MAJOR CHARGE CARDS

SUPER SPECIALS

New Zenith ZF158-21 Computer.....	\$1549
Televideo 955 Terminal.....	\$ 449
Mitsubishi 20M Hard Drive Subsystem.....	\$ 569
AST Six Pac Plus.....	\$ 215
US Robotics Courier 2400 Modem.....	\$ 429
Amdek Color 500 Monitor.....	\$ 283
Panasonic KXP1091 Printer.....	\$ 235

CALL FOR LOW PRICES

BOARDS: AST, Amdek, Cardco, Hercules, Microtek, Microsoft, Orange Micro, Paradise, Persyst, Quadram, STB, Tecmar, Videx

COMPUTERS: Altos, Apple, Compaq, IBM, Televideo, Wyse, Zenith

DISK DRIVES: Alloy, NEC, Amdek, AST, Rodime, Corvus, Gamma, OMEGA, Maynard, Microsci, Mitsubishi, Alpha Omega, Priam, Qubie, Rana, Control Data, Seagate, Tallgrass, Tandon, Teac

MODEMS: AST, AT&T, Anchor, Hayes, Microcom, Novation, Prometheus, Qubie, Racal-Vadic, Transend, US Robotics, Ven-Tel

MONITORS: Amdek, NEC, Panasonic, Princeton, Quadram, Qubie, Samsung, Tatung, Taxan, Televideo, Wyse, Zenith

PRINTERS: Abati, Amdek, Anadex, CIE, Citizen, C. Itoh, Data Products, Diablo, Epson, Juki, NEC, Okidata, Panasonic, Quadram, Qume, Silver-Reed, Star-Micronics, Talley, Toshiba

TERMINALS: Adds, Alloy, Altos, Ampex, CIE, C. Itoh, Digital, Hazeltine, Liberty, Qume, Televideo, Visual, Wyse, Zenith

OTHER: Cables, Chips, Digitizers, Diskettes, Joysticks, Keyboards, Mouse, Power Supplies, Plotters, Power Surge Protectors, Sheet Feeders, Software, Stands, Switch Boxes, Tractors

HOURS: MON - FRI 8AM - 6PM / SAT 9AM - 2PM

CompuSave 3010 S 48th St, Suite 8, Phoenix, AZ 85040 (602) 967-3532
Purchase Orders and All Major Credit Cards Welcome
Prices Reflect Cash Discounts. Minimum Shipping Charge \$4
A Division of Adlanko Corporation

THE IMPERSONATOR: FLEXIBILITY IN COMMUNICATIONS.



The most adaptable communications tool and

asynchronous terminal emulator written.

Built-in communications language allows you to modify the emulations provided or custom design your own. For IBM PC/PC-XT, PC-AT and compatibles. **Pre-configured emulations for:** ADM-3A, VT52 & VT100, IBM 3101 (Model 10 & 20), Hazeltine Esprit, Televideo 912 & 950, Teletype, Dasher D 210. **Features:** XMODEM protocol, captures and transfers files, 60 help screens, 9600 Baud w/o data loss and easy to use.  **Directaid**

FOR MORE INFORMATION CALL 1 800 443 8080

Also available at participating ComputerLands.

Direct Aid P.O. Box 4420 Boulder, CO 80306 (303) 442-8080

A Telecommunications Engineering Revolution in Progress from Atlanta & San Francisco

The time is now and the company is Hayes Microcomputer Products, Inc. Atlanta or San Francisco... America's emerging super high technology arena.

Here at Hayes we've designed and supported an engineering environment free of constraints. We've promoted an atmosphere that encourages each individual's unique ability to make a contribution—to see a project through from concept to completion.

For those among you who look to achieve, perhaps it's time to take a good hard look at Hayes. There's a future in it.

- VLSI/DSP DEVELOPMENT ENGINEERS
- HARDWARE/SOFTWARE DESIGN ENGINEERS
- SOFTWARE PROGRAMMERS & ANALYSTS
- MANUFACTURING/TEST ENGINEERS
- PRODUCT DEVELOPMENT ENGINEERS
- QUALITY/RELIABILITY ENGINEERS

Interested, qualified candidates should forward a confidential resume to: HAYES MICROCOMPUTER PRODUCTS, INC., Dept. 92-272, P.O. Box 105203, Atlanta, GA 30348. An Equal Opportunity Employer, M/F.

Hayes

Innovative products
for enterprising people

Inquiry 179



Introducing The B



ADVANCED TECHNOLOGY COMPUTER BT/AT

44 Mb Hard Disk Drive.
640K Internal RAM.
8 I/O Expansion Slots.
1.2 Mb Floppy Disk Drive.
2 Asynch Serial
Communication Ports.
2 Parallel Printer Ports.

Monochrome Graphics
Adapter (720 x 348).
Monochrome Monitor (Green).
Tilt/Swivel Monitor Base.
IBM PC AT Hardware and
Software Compatibility.
GW-BASIC and MS-DOS 3.1.



HIGH RESOLUTION COLOR MONITORS HR31 200 HR31 350 (Enhanced)

.31mm Dot Pitch.
14" Diagonal Screen.
Black Matrix Picture Tube
Plugs Into IBM Color/Graphics or
Compatible Adapter Card.
Resolution (640 x 200).
Enhanced (640 x 350).
Tilt/Swivel Base.

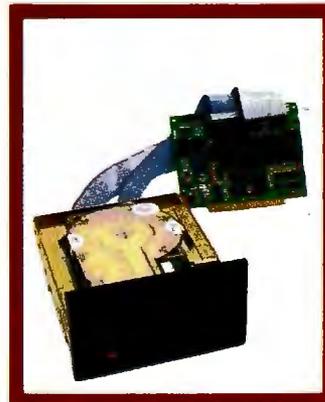
HIGH RESOLUTION MONOCHROME MONITORS HR 39 (Green) HR 134 (Amber)

Plugs Into The IBM Monochrome
or Compatible Adapter.
720 x 350 Resolution.
12" Diagonal Screen.
Super Crisp Text Capability.
High Resolution TTL.
Tilt/Swivel Base.



PC KEYBOARD BT5151 AT KEYBOARD BT5161

Solid State Capacitive
Key Switches.
3-Position Height Adjustment.
Keys In Standard Type-
writer Positions.
Separate Cursor Control
and Numeric Keypads.
Easy-To-Read Key Legends
LED Indicators For All Lock Keys.

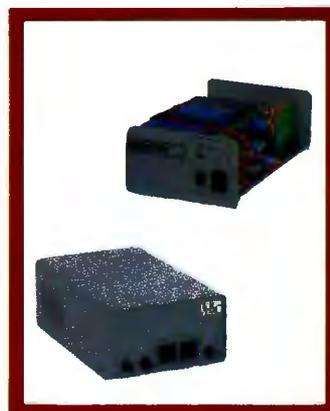


PC HARD DISK SUBSYSTEMS BT20 (Internal) BT20E (External)

20 Megabyte Capacity.
Boot From The Hard Disk--No
Software Patches or Drivers.
Runs All The Popular Software
Designed For The XT.
High Reliability and Durability--
Specially Plated Drives.
Includes 1dir "Visual Shell" and
Xydex Software, Bezels.

BACKUP POWER SOURCE AT800 XT300 SB200

Battery Powered Up To
30 Minutes.
Surge Suppression/
Noise Filtering.
Brownout Protection.
800, 300, 200 Watt Models.



MONOCHROME CARD HR720 COLOR CARD HR640

Complete IBM Compatibility.
High Resolution Graphics
Capabilities.



T/Integrator Series



PC MULTIFUNCTION CARD BT6Plus

Add 64K To 384K.
Parallel Printer Port.
Serial Communications Port.
Clock/Calendar.
BTPak Software--BTDive
(Electronic Disk Emulation) and
BTSpool (Print Spooling)
Optional Game Port



AT MULTIFUNCTION CARD AT4X4Plus

Add 128K To 4 Mb.
Double Split Memory Addressing.
1 To 4 Serial Ports.
Parallel Printer Port.
Optional Game Port.

EXTERNAL MODEM BT212A/1200E

Auto-dial, Auto-Answer.
300/1200 Baud Operation.
Runs All Hayes Compatible Soft-
ware Like Crosstalk, Relay,
Smartcom II, and Sidekick.
RS-232C Compatible.
Snap Hatch For Switch Access.
Eight Status Indicator Lamps.
External Volume Control Knob.



INTERNAL MODEM PC212A/1200

Auto-dial, Auto-Answer.
300/1200 Baud Operation.
Runs All Hayes Compatible Soft-
ware Like Crosstalk, Relay,
Smartcom II, and Sidekick.
Two Phone Jacks.
Includes PC-TALK III Software,
Modular Phone Cord.



SPOOLING TAPE BACKUP BT/SP10E

10 Megabyte Capacity Reels.
Backs Up 20 Megs In 30 Min.
File By File Recovery.
Uses Standard 1/4" Tape Reels.



CARTRIDGE TAPE BACKUP BT60Streamer

60 Megabyte Capacity.
Backs Up 20 Megs In 12 Min.
Image Backup Capability.
File By File Recovery.
Uses 1/4" Data Cartridge.

AT ENHANCEMENT KIT-1 BT44 (44 Megabyte) BT70 (70 Megabyte)

Combined With The
AT4X4Plus-512K.
No Other Chips Needed.
Runs All The Popular Software
Designed For The AT.
High Reliability and Durability.
Faster Access Time
Than AT--30 msec.



Peripherals designed to enhance systems and sales. Basic Time products are the latest technology and highest quality available today, at prices that will make you competitive. We only sell to VARs, VADs and integrators--end users, contact your dealer for more information.

3350 Scott Blvd., Bldg. 52
Santa Clara, California 95054

Inside California
(800) 841-2474

Outside California
(800) 323-8437

basic time

We wrote the books on C...



Ecosoft's Eco-C88 C Compiler. \$49.95

This has to be one of the best values on the market today. Eco-C88 has all operators and data types (except bit fields), has 8087 support, and comes with one of the most complete libraries available - over 180 functions including functions for color and memory files. The compiler produces fast, efficient code (as shown in the table) at one-tenth the cost of other compilers.

You also get a UNIX-like cc with "mini-make" that makes the compiler a snap to use. For a limited time, you will also get the Eco-C88 editor (described below) free of charge. Works with all IBM PC's and MSDOS machines.

	Eco-C88	L (1)	C86 (1)	MS (1)	MW (1)
slve	12	11	13	11	12
fib	43	58	46	109	—
deref	14	13	—	10	11
matrix	22	29	27	28	29

1. Computer Language, Feb., 1985, p. 79. Reproduced with permission.

The employees at Ecosoft think everyone should explore what C has to offer. To further that goal, the books listed at right were written by the employees at Ecosoft to get you up and going as quickly as possible and to expand your understanding of C. Over 100,000 readers have placed two of the books on the best sellers list.



The C Programming Guide (Purdum, Que Corp.). \$20.00

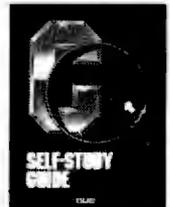
This best seller walks you through the C language in an easy-to-read manner. All aspects of the language are covered with plenty of examples. Many of the error messages issued by the Eco-C88 compiler have page numbers that reference this book making the compiler and book perfect for the beginning C programmer.

The ECOSOFT family of C products ORDER FORM

- C Compiler \$49.95 _____
- Programming Guide \$20.00 _____
- Self-Study Guide \$17.00 _____
- Programmer's Library \$20.00 _____
- Program Editor \$29.95 _____
- Total* (Ind. res. add 5% tax) _____
- *Please add \$4.00 for shipping.
- Payment: VISA MC AE Check _____
- Credit card expir. date _____
- Card # _____
- Name _____
- Address _____
- City, state _____
- Zip _____ Phone _____

The C Self-Study Guide (Purdum, Que Corp.). \$17.00

This new book is designed for the individual that is learning C on their own. The book is filled with questions-answers and many examples about C and illustrates many of the tips, traps, and techniques in C that may take years to learn otherwise. Although written to complement the Guide, it can be used with any introductory C text.



The C Programmer's Library (Purdum, Leslie, Stegemoller, Que Corp.). \$20.00

This best seller is an intermediate text designed to teach you how to write functions in a generalized fashion. The book contains many useful library additions, including a complete ISAM file handler, plus sections on several advanced C topics.



CED Program Editor. \$29.95

You're gonna love CED (pronounced "said"). It was written specifically for use with the Eco-C88 compiler. (CED creates a programming environment similar to that of Turbo Pascal.) You create the source file with CED, compile the program and, if there are any errors, CED automatically reloads the source file and places the cursor on the offending section of code. CED also has windows for editing multiple files, macro capability, and is configurable to suit your needs. CED is fast and has many features found only in editors costing up to ten times as much. Perfect for use with Eco-C88.

Ecosoft, Inc.
6413 N. College Ave.
Indianapolis, IN 46220
(317) 255-6476 • 8:30-4:30



TRADEMARKS: ECO-C88, ECOSOFT, TURBO PASCAL, BORLAND INTL.

Comparing Fujitsus

The Fujitsu FM-16 β
and an update on
the NEC PC-9801M2

BY WILLIAM M. RAIKE

I did it. I bought myself a new computer! I took delivery on my new Fujitsu FM-16 β the Friday before last and was using it for daily production the next day. You'll recall that I was enthusiastic when I got my Fujitsu FM-11BS (see January BYTE, page 429). Well, I'm even more enthusiastic about the FM-16 β .

One of the more reassuring things about the FM-16 β is that nearly every piece of software I own and ran on my old Fujitsu runs perfectly (and a lot faster) on the FM-16 β . The FM-16 β 's floppy-disk format is identical to that of the older computer, and its main processor, an 80186, is totally software-compatible with the 8088-2 in the FM-11BS. The CP/M-86 Level 4 operating system on the new machine is practically identical to the Level 3 that was supplied with the FM-11BS. The only differences between the two machines seem to be a few extensions to the BIOS (Fujitsu basic input/output system) to provide access to the calendar/clock, timer, interrupt, and hard-disk features. And the CP/M-86 error messages in this version are displayed in Japanese instead of English.

QUIRKS

But there are always quirks. One had to do with the FM-16 β 's cursor. Just as in my FM-11BS, the FM-16 β "wakes up" with an underline cursor after the power comes on. I happen to prefer a blinking block cursor—it's a lot easier to see. It was easy to change the cursor style on the FM-11BS: to reset the cursor attributes, it was only necessary to TYPE a file (I called it CURSOR.SYS) containing a 4-byte sequence of control characters. To do that automatically, I added the line TYPE CURSOR.SYS to the AUTO-EXEC.SUB file that gets run immediately after power-up. The same trick and the same file worked fine on the FM-16 β ; the only problem was that every time a program ended and returned control to the operating system, the system displayed the prompt (A>) and then proceeded to reset

itself to an underline cursor!

After an hour or two of frustration and annoyance, I decided to do something. It turned out that many critical parts of the operating system were contained in a disk file named CPM.SYS. Using my debugger, I searched through that file to try to locate the 4-byte sequence that set up the underline cursor. Success! Changing one byte of that sequence gave me the block cursor I wanted.

Another of the FM-16 β 's quirks has to do with Fujitsu's documentation, not the hardware or software itself. Japanese products have been known for the poor quality of their documentation, which is often vague, poorly written, and incomplete. In this case, the key word is "incomplete." For example, even though the FM-16 β contains over 6000 Japanese characters in kanji ROM (read-only memory), and the CP/M-86 operating system supports Japanese-language input and output through Digital Research's Foreign Language System Extension called FSX-86, the manuals contain little valuable information, other than terse descriptions of certain features of Fujitsu's FBASIC dialect. The manuals do tell you how to use these features from application programs, how to issue operating-system calls to get Japanese characters from the keyboard, and so on. But the net result of the documentation is to reduce vast areas of the operating system to "undocumented features."

The situation is similar regarding graphics: Digital Research's Graphics System Extension (GSX-86) is supplied, but there is absolutely no information regarding its capabilities or how to use it. For a machine with such powerful graphics and Japanese-language features, Fujitsu's cavalier approach to documentation is disappointing.

GRAPHICS CAPABILITIES

Besides the 80186 main processor, running at 8 MHz, this machine, like the FM-11BS, has an MBL68B09 coprocessor to manage

(continued)

William M. Raikes, who has a Ph.D. in applied mathematics from Northwestern University, has taught operations research and computer science in Austin, Texas, and Monterey, California. He holds a patent on a voice scrambler and was formerly an officer of Cryptext Corporation in the United States. In 1980, he went to Japan looking for 64K-bit RAMs. He has been there ever since as a technical translator and a software developer. He can be contacted at BYTE, POB 372, Hancock, NH 03449.

the keyboard, screen, and other peripheral chores. But for some reason, the FM-16 β manages to update the screen much faster.

The difference is obvious when you are using a screen editor. I don't personally have very much to do with graphics, but a graphics demonstration program comes with the computer. This machine has several custom LSI (large-scale integration) chips for speeding up graphics processing, and the result is, almost literally, blindingly fast. The quality is excellent, too; the resolution is 640 dots horizontally by 400 dots vertically. And, in addition to the 512K bytes of standard memory, you get 192K bytes of graphics video RAM (random-access read/write memory).

To let you exploit at least some of the graphics abilities of the FM-16 β , Fujitsu includes a program called β -Paint. Written in BASIC, it lets you use a mouse (a mouse interface is standard) to draw pictures, set up various fonts, etc. It's similar to the MacPaint program written for the Macintosh—pull-down menus and all. I didn't buy

a mouse, but Fujitsu includes a demonstration program that shows some of β -Paint's features.

THE HARD-DISK MODEL

The FM-16 β comes in three versions: the FD, SD, and HD models. The most common is the FD version, which includes two built-in 1-megabyte 5¼-inch floppy-disk drives. Main memory is expandable to a full megabyte, and kanji-character support is excellent—both the JIS No. 1 and No. 2 standard character sets are supported from ROM, giving a total of over 6800 characters in addition to the full alphanumeric and kana character sets. This version sells for just under \$1700. The SD is a stripped-down version with less Japanese-language capability, less memory, and less expandability; it sells for about \$300 less than the FD model. I bought the HD model, which has a thin 5¼-inch 10-megabyte hard-disk drive that replaces the topmost floppy-disk drive. The hard-disk interface occupies one of the four expansion slots but also leaves open the possibility of directly connecting an

additional external hard-disk drive.

This is my first personal computer with a hard disk, but after only 10 days or so, I wonder how I ever managed without it. When I want to power up the computer, I don't have to look through boxes of disks to find and insert the appropriate ones—I just turn on the machine. Fujitsu supplies a utility program that lets you configure the FM-16 β to boot up from the hard disk if there's no floppy disk in the machine or if there's a floppy disk that doesn't contain the operating-system tracks. Another easy-to-use utility lets you "partition" the hard disk into several (up to seven) subdisks.

I decided to partition my hard disk into five disks and assign them to logical drives A through E. Drive A is a 2-megabyte partition that contains all my system utilities, word processor, editor, debugger, etc. Drive B is another 2-megabyte disk that contains language processors, software-development tools, and the like. Drives C, D, and E are archive disks, with respective capacities of 3, 2, and 1 megabyte. I may change this organization in the future, but it seems to group my files conveniently according to function while keeping the total number of files on any single disk (and the size of the directory) down to a manageable level. It also makes it fairly painless to back up files onto floppy disks at regular intervals, since most of the files in drives A and B will change only rarely.

The floppy-disk drive is assigned to drive F, while the RAM disk, or memory disk, is drive M. This computer comes with 512K bytes of RAM, and until my 512K-byte expansion board arrives next month, I've got 256K bytes allocated to the RAM disk. That's not as much as I want for program development, but on the FM-16 β my compiler runs just about as fast using the hard disk as it did from the RAM disk on the FM-11BS.

BENCHMARKING REMARKS

Just for fun, I ran some impromptu benchmarks on the old FM-11BS. Using my trusty stopwatch as a timer

(continued)

UPDATE ON THE NEC PC-9801M2

A reader from Osaka pointed out a couple of errors in my description of NEC's popular PC-9801M2 in the May BYTE Japan (page 355). I said that all 256K bytes of standard RAM (up from 128K bytes in the earlier PC-9801F2 machine) were on the main board. I was wrong; a 128K-byte memory board is installed at the factory in one of the PC-9801M2's expansion slots. For owners who don't want to use up scarce expansion slots for memory boards, there are 512K-byte memory boards available from several manufacturers. I can't say for certain, but it's highly likely that they will also work in NEC's APC III sold in the U.S.

I've remarked several times that the maximum of 640K bytes of memory that the PC-9801 series allows really isn't enough if you want to use 512K

bytes as a RAM disk. Well, there are several ways around this limitation. A Japanese technical magazine recently carried an article describing user-installed device drivers running under the MS-DOS operating system, and it gave an interesting example: It showed how to write and install a device driver that lets you use the 192K bytes of graphics video RAM included in the NEC machine as an additional RAM disk. In another approach, the same Osaka reader recently sent me information on some commercial RAM-disk software from Megasoft Inc. that accomplishes the same thing and more. Using boards from another Japanese vendor, it can manage up to 15 banks of 512K bytes each under MS-DOS, giving a maximum of 7.5 megabytes of RAM-disk space.

WOULD YOU BUY A PACEMAKER FROM MATTEL?

IBM/PC-based LOGIC LINE-1™ artificial intelligence software is so advanced, that competitive products are toys by comparison.

There aren't very many who'd stake their lives on a toy-store pacemaker. Luckily, we won't have to worry about their rancid cells polluting mankind's gene pool very long anyhow. Such brain-damaged geeks tend to die young.

If you've recently spent money on artificial intelligence software, you might be wishing a few programmers had croaked before writing that blithering swill they named AI and palmed off onto you. What they call an "inference engine" is nothing more than an IF-THEN decision tree that can't even do a very good job of arithmetic.*

We're Clarity Software, and we're introducing a product that can take a massive amount of text from any machine-readable source, and mathematically distill thought processes for query and analysis. This process, as distinguished from *expert systems*, is referred to as *natural-language intelligence*.

In this ad, we're going to explain to you why you'd be crazy not to have our package in your portfolio of data-manipulation assets.

DERIVE THE DNA/RNA OF ANY WRITER'S THOUGHT PROCESSES.

LOGIC LINE-1 was the result of the interaction between a couple of cyberneticists and a physicist, with combined experience in high-performance learning and pattern-recognition programming. The physicist was responsible for one of the first DNA/RNA-tracking systems (the *RNA-of-thought* assertion is more than just an advertising creation). We are not your ordinary bunch of yahoos.

Imagine having the collected thoughts of Voltaire online. If you were interested in viewing Voltaire's thoughts on "job security," you would enter that term in the search menu.

Now you're thinking: "Nuts! These yahoos are trying to sell me something my supposedly *toy* text editor can do with a search command. Right?"

Wrong, pussycat. Your inference process was a little quick on the trigger. Never, in any of Voltaire's writing, was there ever the phrase "job security."

"Ok," you reply. "You have a dictionary of synonyms, eh?" Wrong again. LOGIC LINE-1 has no dictionary. Interesting?

Essentially, LOGIC LINE-1 uses a series of mathematical transformations on text, the out-

put of which is cataloged in a database analogous to a biological DNA/RNA imprint of that text.

There are approximately one dozen parameters that make up a *thought's DNA/RNA*. Some transformations fingerprint syntax patterns; some look at subject/predicate relationships via a small dictionary of several dozen *noise* words.

After setting up the above Voltaire "job security" query, LOGIC LINE-1 will present you with high-possibility "hits." You will type "Y" when they are relevant, and "S" for skip, when they are not.

The first several "hits" might be rejected, since the term "job security" will not be found. Once you get an acceptable entry, however, and lock onto an acceptable *RNA-of-thought* pattern, the accuracy of LOGIC LINE-1 will be staggering. Or we'll refund your money. Simple enough?

"I'M NOT INTO VOLTAIRE," YOU SAY. "WHY DO I NEED LOGIC LINE-1?"

How would you like to be able to turn any textbase into an expert system? For example, most PC users rely upon word processing. The problem is, we store our correspondence in files with names like "LT062185" or "REJECT21" or "RANDOMTH." As a result, we reinvent the wheel with each letter we compose. Why do this?

Using LOGIC LINE-1, you can append all your written correspondence into one textbase file. Sure, any word processor could do a straight search for a term like "quality." But none can do this search as fast as LOGIC LINE-1. And none could turn up the "quality" references if queried for the term "workmanship!"

Thus, when writing letters and speeches, use LOGIC LINE-1 to collect previously articulated thoughts on any given subject. Whatever your profession, be it law, medicine, engineering or information management, LOGIC LINE-1 is an indispensable tool for true thought processing.

Now that thousands of textbases are publicly available, LOGIC LINE-1 is the key to their intelligent use. Once the computer establishes associative links in a large body of material, many creative applications are possible.

TRUE AI! CLONE THE GREAT MINDS ON YOUR PC.

Did Bacon write Shakespeare? Did Albert Einstein have anything relevant to say on the subject of "generation gap?" How many congressmen consistently contradict themselves in the *Congressional Record*?

The uses of LOGIC LINE-1 are limited only by the availability of textbases, and by your imagination.

Do you dare send a student to college without LOGIC LINE-1 and a PC? Would YOU care to compete in business with someone else who has this leading-edge, decision-support software?

Einstein should write your papers on relativity. Alfred North Whitehead should write your papers on philosophy. And Shakespeare should write your love letters.

1985'S SPECIAL \$100 LIMITED-TIME OFFER WILL BE HISTORY IN 1986.

This is our very first, and only, announcement ad. For the rest of this year, you may obtain LOGIC LINE-1 for only \$100 (note, we didn't try to fool you with a \$99.95 price tag; we *do* give you, as well as your computer, some credit for intelligence). As of January 1, 1986, LOGIC LINE-1 will retail for \$250.

To find out more about LOGIC LINE-1, call 216/729-1132. You may order by phone by calling 800/621-5839 (or in Illinois, call 800/972-5855). Return the product for any reason whatsoever within 30 days for a full refund. If you are with the US government or one of the intelligence *spook shops*, LOGIC LINE-1 is available to federal/DOD buyers through IBIS Corporation, 131 Elden Street, Herndon, VA 22070 (call 800/532-3344 or 703/478-0300).

You COULD spend your next \$100 for other software. You could also ask Weird Al Yankovic to install that terrific new pacemaker from your kids' *Young Doctor* toy kit. Call today and save more than just money.

 **CLARITY SOFTWARE®**

A Div. of EXPANSION PGMS INT'L, Inc.
PO BOX 839 • Chesterland, OH 44026 • USA
(216)729-1132

*The only other package out there worthy of the label "artificial intelligence" is from Teknowledge in Palo Alto, and we don't compete with them. They build "expert systems" while our emphasis is on "natural language" systems. We mention them in passing, because they're one of the few "good guys." Copyright © 1985 by Clarity Software. LOGIC LINE-1™ is a trademark of Clarity Software, and requires a 128K IBM PC with at least one diskette drive and runs under MS/DOS 2.1 and up. IBM™ IBM Corp. MATTEL™ Mattel. We hope the swell people at Mattel can take a joke. Advertising & PR by TRBA, 408/258-2708.

*An 80286 board
will be available
for the FM-16β
this autumn.*

(meaning that the measurements were accurate only to within ¼ second or so), I measured the average time it took to copy files among the various disk drives on each of the machines as well as the time needed to compile my communications program (written in C) and the time WordStar took to move from the beginning to the end of a medium-size text file. Since the floppy-disk drive on the FM-16β is identical to the ones on the FM-11BS, the measurements gave me a rough idea of the increased speed of the 80186 processor and also of the speed advantage of the hard disk.

For the file-copy measurements, I used a text file 28K bytes long and copied it (using the CP/M-86 PIP utility) from both the floppy disk and from the hard disk into the RAM disk. On the FM-11BS, it took 6.02 seconds to copy the file from floppy disk to the RAM disk. On the new computer, that time was 4.34 seconds. It took only 2.40 seconds to copy the same file from the hard disk to the RAM disk. So, for this kind of common task, the hard disk gives me approximately double the speed of a floppy-disk

drive, the 80186 processor is about 25 percent faster than the 8088-2 (both running at 8 MHz), and the new computer is about 2½ times faster than the old one. I ran several other programs on both machines using the floppy disk in both cases; all the tests seemed to confirm these rough speed ratios.

For the same 28K-byte text file, I measured how long WordStar took to move from the beginning to the end of the file. In all cases, the WordStar program itself resided in the RAM disk. On my older machine, it took 10.86 seconds. On the FM-16β, that time went down to 7 seconds when the text file was located on the floppy disk and to only 3.89 seconds when it was on the hard disk. When I use a word processor, I find that this task, along with saving the current text on the disk, occurs frequently, so the difference in speed is noticeable in everyday use.

Finally, I measured the time it took for the Digital Research C compiler to compile my communications program. On the FM-11BS, I had 512K bytes available for the RAM disk, while I was limited to 256K bytes in the FM-16β. That was enough for the compiler files but not enough for the linker and standard library files, so the times I got are for compilation only and don't include linkage editing. With all the files located in the RAM disk, including the source file and the object (output) file, the old computer took 45.24 seconds to compile the

program. The FM-16β managed it in 21.3 seconds, less than half the time, which indicates that the difference between the speeds of the 8088-2 and 80186 processor is much greater than 25 percent for a central-processor-intensive task like this one. By comparison, with all files on the hard disk instead of the RAM disk, the FM-16β performed the compilation in only 42.3 seconds—even faster than the old computer working out of the RAM disk. All in all, I expect to save a lot of time using the new computer. And it's just as quiet as the old one.

Even though I had no trouble rationalizing the purchase on the basis of speed and convenience, one of my major reasons for buying the FM-16β was that an 80286 board will be available for it this autumn, along with ASCII-Microsoft's XENIX enhancement of UNIX. I hope that this will give me a UNIX machine without my having to abandon all my existing applications software; I think UNIX is going to be the operating system of the future here in Japan for computers at all levels—from microcomputers all the way to mainframes.

The best news is that, after a 25 percent discount (not hard to find), I paid only about \$2250 for the machine.

COMING UP

Next month, I'm off to Taiwan to report on the Computex '85 computer show. I also plan to explore the issue of software piracy in that country. ■

AUTUMN SALE

LAP Portable Computer.

The Ultra® Osborne® 3. RUNS: Lotus® dBase® MS-Dos® V2.11.

2 X360 DSDD Drives. 80 x 16 LCD Screen. **512K RAM** **\$995**

Full Movement Keyboard, Optional. 25 x 80 Monitor Driver (\$150.00)

Osborne® Vixen \$995.00. Printer 100 c.p.s. \$199.00

Call "COMPUTERS"—212-732-2258

PUBLIC DOMAIN SOFTWARE COPYING CO. 33 Gold Street, New York, N.Y. 10038

Brief Catalogue & sample Disk (2 sided) \$12. MS Dos CP/M C-64 Apple II.

Major Charge Cards. Call us about rentals, Telex/Twix and bulk disks.



Store this in your memory: buy two packs of Xerox Floppy Diskettes and get one pack free.

It's true. When you buy two packs of our new 3½" micro diskettes or selected 5¼" diskettes, you'll receive an additional pack absolutely free.* It's our way of introducing you to our superior new floppies.

Try them out on your IBM-PC, PC-AT, Macintosh, Compaq, AT&T, ITT, Olivetti, HP or on our own PC's and word processors. You'll see how superior they are, both in quality and performance. And they're packed in a durable library case as well.

To get your free diskettes (or for more information) simply call 1-800-822-2200 Dept. 20 and order any of the items specified below:

- 11R66003: 5¼" double-sided/double density diskettes (10 per pack) for your IBM-PC or IBM-compatible PC
- 8R2467: 5¼" high density diskettes (10 per pack) for your IBM-AT
- 8R2466: 3½" single-sided micro diskettes (5 per pack) for your Apple Macintosh



This offer ends December 31, 1985 and is limited to five free packs per customer.

So remember, call 1-800-822-2200 Dept. 20 and order your free diskettes today. That's a pretty memorable offer!

*Your free pack will be of comparable or lesser value than the two you purchase. XEROX® is a trademark of XEROX CORPORATION.

For more information from Xerox, Circle 393 on the Reader Service card.



Conducted by Steve Ciarcia

GLITCHES?

Dear Steve,

In regard to "Understanding Linear Power Supplies" (January BYTE, page 98), specifically the uppermost section of figure 1 on page 100, have you invented a new basic circuit for getting DC from AC without a rectifier? Or could it be that a diode got left out of the drawing?

Also, figure 3 on page 101 might have been clearer if the sine wave on the output side of the transformer had been shown with a smaller amplitude. Better yet, the primary side could have been shown with much greater amplitude than it was.

ELBERT S. MALONEY
Pompano Beach, FL

Thanks for the feedback. That diode must be one of the new micro-micro units! As you correctly observe, a diode is needed between the transformer and the load resistor in the top leg of that circuit.

Figure 3 is an illustration of the transformer-rectifier-capacitor filter relationship. As such, it could be a step-down, step-up, or one-to-one transformer. Granted, these days we usually use step-down transformers, but only a few years ago you would have expected the output voltage to be larger. It is not usual practice to make the waveform symbols proportional to the relative voltages but rather to label the input and output lines with the correct voltages.—Steve

READING FOR POWER

Dear Steve,

Thanks for your article on power supplies in the January BYTE. I have a great deal of interest in the subject. In fact, I would like to try reaching an expert level in power supplies. Could you please recommend additional reading?

MIKE HELF
Seal Beach, CA

Several interesting books on power supplies have been published. Regulated Power Supplies, 3rd edition, by Irving M. Gottlieb discusses linear and switching power supplies and the operation and architecture of solid-state regulators. You

can obtain a copy of this book from

*Priority One Electronics
9161 Deering Ave.
Chatsworth, CA 91311-5887
(800) 423-5922*

Another book that provides a good source of information on three-terminal regulators is Voltage Regulator Handbook, published by National Semiconductor. It offers extended-use applications for three-terminal regulators and discusses power-transformer and filter specifications. You can obtain a copy of this book from one of the following:

*Digi-Key Corporation
Highway 32 South
POB 677
Thief River Falls, MN 56701
(800) 346-5144*

*National Semiconductor Corporation
2900 Semiconductor Dr.
Santa Clara, CA 95051
(408) 721-5000*

—Steve

DESPERATELY SEEKING SWITCH

Dear Steve,

In "Understanding Linear Power Supplies" in the January BYTE, you mention using a thermostatic switch to control a fan that would supply additional cooling when the heatsink temperature rises above 130°F.

I have tried several electronics supply stores in my area, but none of them seem to have or understand what I am looking for. If you could give me the part number for this switch, or for an equivalent device that operates at 90°F, I would greatly appreciate it.

PAUL W. SMITH
Muncie, IN

Thermostatic switches used to control cooling fans in power supplies are similar to the ones used to control common household floor or attic fans. They are usually a simple bimetallic strip that bends as the ambient temperature increases until a preset temperature is met and a switch is closed or opened.

You can obtain a switch of this type from

*John J. Meshna Jr. Inc.
POB 62
East Lynn, MA 01904
(617) 595-2275*

The Meshna part number for the normally open thermostat is SP-94C; the part number for the normally closed thermostat is SP-94D. Call the company for further information on the availability of these devices.

Also, check with an appliance outlet that sells floor or attic fans.—Steve

SCHEMATIC QUERIES

Dear Steve,

I enjoyed reading "Build the Power I/O System" (December 1984, page 105), and I have a couple of questions about the schematics. Performing a logical AND operation with the zero-voltage switch and the port output is a super idea, but will the output of the zero-crossing detector really drive all those 7438s? You indicate eight of them in figure 19 on page 112.

DAVID KLINGENSMITH
Burnaby, British Columbia, Canada

Most TTL devices can drive several similar devices. To determine the "fan out" capability of a particular device, you have to do some calculations from the specification sheets. First, divide the logic 0 output current of the source device by the logic 0 input current of the destination device. Next, find the same ratio for the currents that corresponds to a logic 1. The lower of these two ratios is the number of inputs that the source device can reliably drive. A typical ratio for most TTL devices is 10.—Steve ■

Over the years I have presented many different projects in BYTE. I know many of you have built them and are making use of them in many ways.

I am interested in hearing from any of you telling me what you've done with these projects or how you may have been influenced by the basic ideas. Write me at Circuit Cellar Feedback, POB 582, Glastonbury, CT 06033, and fill me in on your applications. All letters and photographs become the property of Steve Ciarcia and cannot be returned.

MICROWAY'S 8087 RUNS 1-2-3™!

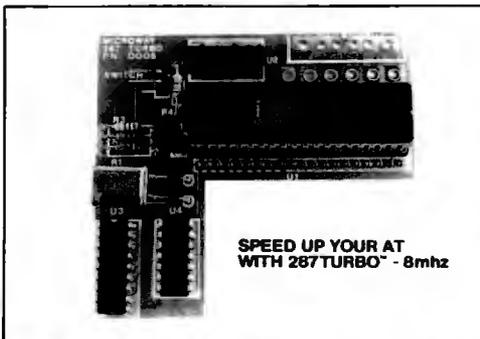
MicroWay is the world's leading retailer of 8087s and high performance PC upgrades. We stock a complete selection of 8087s that run at 5 and 8mhz. All of our coprocessors are shipped with a diagnostic disk and the best warranty in the business - one year! We also offer daughterboards for socketless computers such as the NEC PC and PCjr, and a board which increases the clock speed of the 80287 from 4 to 8 mhz. Our NUMBER SMASHER™ includes 512K ram. It will run the IBM PC at clock speeds up to 10mhz and achieves a throughput of .1 megaflops

with 87BASIC/INLINE, Intel Fortran, or Microsoft Fortran. Software reviewers consistently cite MicroWay software as the best in the industry! Our customers frequently write to thank us for recommending the correct software and hardware to meet their specific needs. They also thank us for our same day shipping! In addition to our own products which support the 8087 and 80287, we stock the largest supply of specialized software available anywhere. For information call us at

617-746-7341

FASTBREAK™ . . . MicroWay's software turns on your 8087 during 1-2-3™ execution. Recalculations run up to 36 times faster. When used with the NUMBER SMASHER™ it can provide a total increase in 1-2-3™ execution speed of up to 79 to 1. FASTBREAK provides you with the unique capability for running other programs on top of 1-2-3. These programs can be written in BASIC, PASCAL, Fortran or C and can access the current values in your 1-2-3 worksheet. **\$79**

FASTBREAK & NUMBER SMASHER \$1099



MicroWay® 8087 Support

For the IBM PC, PC XT, PC AT and Compatibles.

NUMBER SMASHER™ The World's Fastest Accelerator Card for the IBM PC, XT, and Compatibles! Includes an 8086 and 8087 pair tested to 10mhz, and 512K bytes of high speed ram. Compatible with all software, operating systems and hardware! Your program speed is increased by a factor of 2.5 to 4.0. Floating point programs run up to 2.8 times faster on the PC than on an 80287 equipped PC AT **\$1049**

MATRIXPAK™ manages a **MEGABYTE!** Written in assembly language, our runtime package accurately manipulates large matrices at very fast speeds. Includes matrix inversion and the solution of simultaneous linear equations. Callable from MS Fortran 3.3, 87MACRO, and 87BASIC/INLINE each **\$150**

87FFT™ Written in assembly language, performs Forward and Inverse FFTs on real and complex arrays which occupy up to 512K bytes of RAM. Also does convolutions, auto correlations, hamming, complex vector multiplication, and complex to radial conversions. Callable from MS Fortran, 87MACRO, C, TURBO PASCAL or 87BASIC/INLINE **\$200**

87FFT-2™ performs two-dimensional FFTs. Ideal for image processing. Requires 87FFT **\$100**

GRAPHICS PACKAGES

Grafmatic for Fortran or Pascal. **\$125**
Plotmatic for Grafmatic. **\$125**
MultiHalo (one language) **\$189**

DFixer™ - Eliminates the AT hard disk problem! A disk which thoroughly checks PC or AT hard disks for bad sectors and updates the MS DOS file allocation table accordingly. **\$149**

EPSILON™ - our favorite in-house editor lets you simultaneously edit up to 11 source files and concurrently run a compiler or linker. A real timesaver! **\$185**

87BASIC/INLINE™ converts the output of the IBM Basic Compiler into optimized 8087 inline code which executes up to seven times faster than 87BASIC. Supports separately compiled inline subroutines which are located in their own segments and can contain up to 64K bytes of code. This allows programs greater than 128K! Requires the IBM Basic Compiler and Macro Assembler. Includes 87BASIC **\$200**

87BASIC™ includes patches to the IBM Basic Compiler and both runtime libraries for USER TRANSPARENT 8087 support. Provides super fast performance for all numeric operations including trigonometrics, transcendentals, addition, subtraction, multiplication, and division. . . . **\$150**

87MACRO/DEBUG™ - contains all the pieces needed for writing 8087/80287 assembly code including 8087 macros, object libraries for commonly used functions, including transcendentals, trigonometrics and conversions between strings and real numbers. Our 87DEBUG completes the package **\$199**

OBJ-ASM™ - a multipass object module translator and disassembler. Produces assembly language listings which include public symbols, external symbols, and labels commented with cross references. Ideal for patching object modules for which source is not available **\$200**

RTOS - REAL TIME OPERATING SYSTEM

RTOS is a multi-user, multi-tasking real time operating system. It includes a configured version of Intel's iRMX-86, LINK-86, LOC-86, LIB-86, OH-86, and MicroWay's 87DEBUG. Runs on the IBM-PC, XT, PC-AT and COMPAQ. **\$400**

INTEL COMPILERS¹

FORTAN-86 **\$750**
PASCAL-86 **\$750**
PL/M-86 **\$500**
ASM-86 **\$200**

¹Requires RTOS or iRMX-86. All Intel compiler names and iRMX-86 TM Intel Corp.

8087 5mhz \$109
Including DIAGNOSTICS and one-year warranty For IBM PC and compatibles.

8087-3 5mhz \$175
For the Tandy 1200.

8087-2 8mhz \$175
For Wang, AT&T, DeskPro, NEC, Leading Edge.

80287-3 5mhz \$199
For the IBM PC AT and Compaq DeskPro 286.

287Turbo™ 8 mhz \$395
With Reset Button and Diagnostics.

64K RAM Set \$8

256K RAM Set \$29

256K CMOS RAM Set . . \$39

128K RAM Set PC AT . . \$150

AST Advantage™ \$439

JRAM-2™ (ØK) \$169

JRAM™ AT (ØK) \$229

JRAM-3™ (128K) \$275

MAYNARD ACCENT \$225

FORTRAN, C and BASIC

Microsoft Fortran Version 3.3 **\$229**
IBM Professional Fortran **545**
Ryan-McFarland Fortran **399**
FORLIB+ or STRINGS and THINGS **65**
Lattice C or Microsoft C Version 3.0 **299**
FLOAT87 **150**
IBM Basic Compiler Version 2.0 **445**
Microsoft Quick Basic **89**
Summit BetterBASIC™ **175**
True Basic **105**

MACRO ASSEMBLERS

IBM Assembler with Librarian V. 2.0 **155**
Microsoft Assembler Version 3.01 **125**

PASCAL and APL

Microsoft Pascal Version 3.3 **199**
Borland Turbo with 8087 Support **85**
STSC APL★PLUS/PC **450**
STATGRAPHICS **595**
COSMOS Revelation **750**
Phoenix Plink86 **295**
SPSS/PC **595**

FASTBREAK and NUMBER SMASHER are trademarks of MicroWay, Inc. Lotus and 1-2-3 are trademarks of Lotus Development Corp.

European Customers: Please call MicroWay in London at 01-223-7662.

MicroWay

P.O. Box 79
Kingston, Mass.
02364 USA
(617) 746-7341

*The World Leader
in 8087 Support!*

NEW SYSTEMS

Dasher/One from Data General

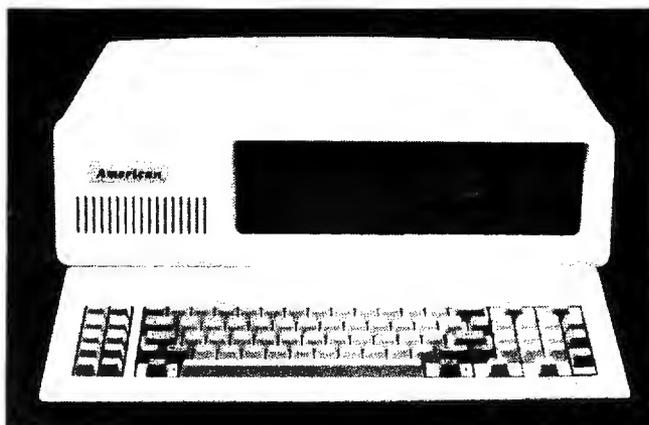
Data General's Dasher/One workstation provides an MS-DOS environment for the company's CEO (Comprehensive Electronic Office) products. MS-DOS support lets the machine run applications software written for the IBM PC.

The Dasher/One is compatible with Data General's Eclipse/MV processor product line and the Data General/One portable computer. You can use it as a workstation within a cluster to let you share peripherals and applications with other users.

Standard RAM is 256K to 640K bytes. The basic machine offers three expansion slots, an asynchronous RS-232C/422 communications port, a standard parallel printer port, and a choice of a single 3½-inch floppy-disk drive with an optional second floppy disk or a 3½-inch 10-megabyte hard disk. The Dasher/One has a tilt-and-swivel display and a 12-inch bit-mapped monochrome monitor. The Model 1 provides 640- by 200-pixel resolution in text and graphics modes; the Model 2 has a resolution of 640 by 400 pixels in text mode.

The Dasher/One is available in six configurations with varying amounts of memory and storage. All models have a choice of two detachable keyboards: an IBM PC AT-compatible keyboard or a CEO-compatible keyboard. Both keyboards are available in foreign-language versions.

The Model 1 costs \$2100; the Model 2 is \$2415. Contact Data General Corp., In-



American Computer and Peripheral's XT system.

formation Systems Division, 4400 Computer Dr., Westboro, MA 01581, (617) 366-8911. Inquiry **620**.

IBM PC XT-Compatible

American Computer and Peripheral's XT system is functionally compatible with the IBM PC XT. It is built around the 16-bit 8088 microprocessor. The XT features 256K bytes of RAM expandable to 640K bytes on the system board, and it has socket space for 56K bytes of user PROMs.

Two 360K-byte 5¼-inch disk drives are standard; 10- and 20-megabyte hard disks are also available. The 84-key keyboard includes a numeric keypad and 10 function keys. The XT also has eight expansion slots, a 135-watt power supply, an integral speaker, and an automatic self-test of system components.

Retail prices range from \$1150 for a 256K-byte system with two floppy-disk drives to \$2595 for a 640K-byte system with two floppy-disk drives, a 20-megabyte

hard disk, a serial port, a game port, a parallel port, a real-time clock, and a color-graphics card. Contact American Computer and Peripheral Inc., 2134 South Ritchey, Santa Ana, CA 92705, (714) 545-2004. Inquiry **621**.

Turbo PC

PC's Limited has introduced its Turbo PC, a system that features a 16-bit 8088-2 with a 4.77- or 6.66-MHz clock speed. The unit has 640K bytes of memory on the motherboard, one 360K-byte disk drive, a 5151 keyboard, a 135-watt power supply, and eight expansion slots.

The Turbo PC reportedly runs software written for the IBM PC and the PC XT 40 percent faster than a standard PC.

The Turbo PC sells for \$795. Contact PC's Limited, 7801 North Lamar, #E-200, Austin, TX 78752, (512) 452-0323.

Inquiry **622**.

Wang Advanced Professional Computer

The Wang APC is based on the 8-MHz 16-bit 80286 microprocessor. The entry-level model has 512K bytes of RAM, expandable to 2 megabytes. The APC supports the MS-DOS, XENIX, and IN/ix operating systems and features PC-DOS compatibility. It is also software- and hardware-compatible with the Wang PC.

You can have up to three disk drives in a combination of two half-height disk drives and one Winchester drive. Options include 360K-byte or 1.2-megabyte disk drives and 20-, 30-, or 67-megabyte Winchester drives. A 43-megabyte streaming-cartridge tape drive provides mass-storage backup and recovery.

The Advanced Professional features zero wait states for memory addressing to increase processing speed. It can support up to four workstations in its multiuser mode with XENIX or IN/ix. An 80287 numeric coprocessor is optional.

Wang Professional Computer users can upgrade to the APC by replacing their main system board with the APC system board set. An optional CGI (character/graphics/IBM emulation) card lets the APC combine Wang monochrome characters, Wang monochrome graphics, and IBM monochrome emulation and keyboard control.

Pricing for the Wang APC starts at \$3465 for a single-user system. Contact Wang Laboratories Inc., One Industrial Ave., Lowell, MA 01851, (617) 459-5000. Inquiry **623**.

(continued)

AN IBM AT THE OFFICE AND AN APPLE AT HOME?

TURNOVER

A "wireless file transfer" package for the IBM PC to Apple II and back, and back again. **TURNOVER** is a firmware board which fits into any slot in the IBM PC or compatible, and software running under MS-DOS. No modems, no serial links, no hassles, no problems, **TURNOVER** will format Apple CP/M and Apple DOS 3.3 disks. Leave your IBM and Apple Computers where they are. Simply bring your Apple disk to work and transfer your file to a PC-DOS disk. Allows for modification to text and data files. It's a simple, inexpensive, fast high performance alternative to complicated serial links and modems.

XENO-COPY PLUS

(No Longer Copy Protected)

A "wireless file transfer" software program for your IBM PC and most PC look-a-likes. **XENO-COPY PLUS** formats, writes to and copies from over 100 different disk formats including 40 and 80 track 5 1/4 inch CP/M disk formats, as well as Turbo-DOS, TRS-DOS, p-System and NEC-DOS formats. An uncomplicated and inexpensive way to transfer text and data files. Also, allows for modifications to text and data files. **XENO-COPY PLUS** can be up-graded to **XENO-DISK** for the price difference.

XENO-DISK

(No Longer Copy Protected)

The high performance model of **XENO-COPY PLUS**, **XENO-DISK** also formats, writes to, and copies from over 100 different disk formats including 40 and 80 track 5 1/4 inch disks. **XENO-DISK** contains a powerful table driven text translator, "Text-Tran." For low volume disk production, **XENO-DISK** includes a track-by-track disk duplicator (which is faster than file by file duplication). Gives you the option to input disk format parameters which allows you to utilize uncommon disk formats.

See your dealer or
Call for information:

(213) 938-0857

Vertex
systems inc.

6022 W. Pico Blvd.
Los Angeles, CA 90035

Innovation in
microcomputer products

Inquiry 412 for End-Users. Inquiry 413 for DEALERS ONLY.

TURNOVER, XENO-COPY PLUS, XENO-DISK are registered trademarks of Vertex Systems, Incorporated. IBM PC & PC-DOS is a registered trademark of International Business Machines Corporation. APPLE is a registered trademark of Apple Computer, Inc. MS-DOS is a registered trademark of Microsoft Corporation. CP/M is a registered trademark of Digital Research Incorporated.

NEW SYSTEMS

Low-Cost Two-Drive System from Apricot

The Apricot F2 micro-computer is an MS-DOS machine based on a 4.67-MHz Intel 8086. It comes with 512K bytes of RAM and two 3½-inch half-height 720K-byte disk drives. The keyboard has a full QWERTY layout, a numeric

keypad, and programmable function keys. The standard keyboard and trackball/mouse input device interface to the main system with infrared transmitters. A monitor is not included. The complete system weighs 13½ pounds and, although not designed as a portable, has an optional carrying bag. The F2 has a footprint

of 16.5 by 8.7 inches.

The F2 comes with the GEM Collection—GEM Write, GEM Paint, and GEM Desktop—as well as GW-BASIC, an asynchronous file-transfer utility, an asynchronous communications package, an IBM PC emulator, and Apricot's MS-DOS system software (which includes the GSX graphics layer).

Inside the F2 are two proprietary expansion slots; on the back are a Centronics and an RS-232C port. An IBM 3278 emulation card is available as an option.

The F2 costs \$1495. Contact Apricot Inc., 47173 Benicia St., Fremont, CA 94537-5117, (415) 659-8500. **Inquiry 624.**

Dual Disk Drive for Commodore

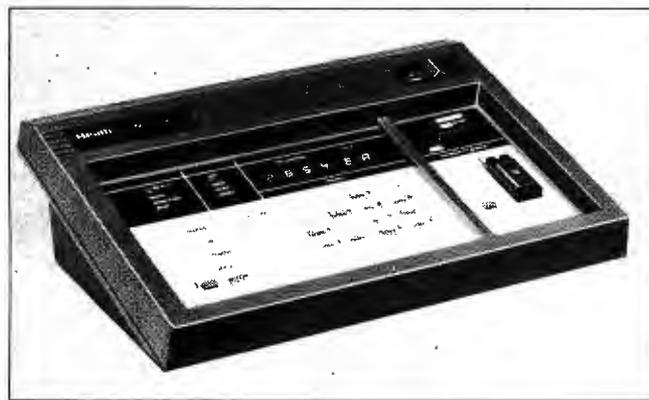
The Clone dual disk drive from HBH Sales lets Commodore 64 users format, copy, and verify a 5¼-inch single-sided single-density disk in less than 2 minutes. Its 6K-byte buffer memory and microprocessor let the computer continue working while the drive is operating.

The Clone has a total capacity of 340K bytes. It is compatible with most Commodore 64 software and includes a utility program for converting incompatible programs to a compatible format.

Suggested retail price for the Clone is \$499. Contact HBH Sales Co., 225 West Main, Collinsville, IL 62234, (800) 448-5819; in Illinois, (618) 344-7912. **Inquiry 625.**

Heath EPROM Programmer Kit

Heath's ID-4801 EPROM programmer kit can be used on 2500 and 2700 series EPROMs and other compatible devices up to 16K bytes that use a single power supply. The ID-4801 performs 10 functions, some of which require user-wired personality modules for different EPROM configura-



Heath's ID-4801 EPROM programmer kit.

tions. These modules are supplied with the kit.

This programmer lets you load an EPROM with data stored in its RAM and verify the transfer. You can also load data from an existing EPROM into the programmer's RAM. The ID-4801 can emulate ROM in an external device when connected by an appropriately wired cable.

You can transmit and receive data between the EPROM programmer and a computer through an RS-232C port. The port allows transfer of data in an Intel hexadecimal format at a rate of 9600 bps. The keypad lets you select any memory address to examine,

delete, change, or enter data.

The ID-4801 has a 2K-byte by 8-bit system ROM and 2K-byte by 8-bit system RAM that you can expand to 16K bytes. Six LEDs indicate function selections and six seven-segment LEDs display addresses, data, and prompts.

The ID-4801 kit sells for \$349.95. Contact Heath Co., Benton Harbor, MI 49022, (616) 982-3210. **Inquiry 626.**

Series 1500 Graphics Display Terminals

Cleveland Codonics' Series 1500 Graphics Display Terminals provide a Tektronix 4010/4014 graphics display. Alphanumeric dis-

play features include a 14-inch amber or green screen with 24 rows by 80 or 132 columns. You can select any one of four scrolling speeds.

Other features include a tilt-and-swivel screen, a detached keyboard with 16 programmable function keys, block-mode transmission, data-transmission speeds up to 38,400 bps, and a printer port.

The model 1575 Graphics Display Terminal costs \$2395 and is compatible with the DEC VT102; the model 1550 costs \$2295 and is compatible with ADM, TVI, ADDS, and Hazeltine terminals. Contact Cleveland Codonics Inc., 18001 Englewood Dr., Cleveland, OH 44130, (216) 243-1198. **Inquiry 627.**

Apple II Touch Window

Personal Touch's Touch Window is a four-in-one touchscreen input device for the Apple II series. You mount Touch Window directly on your monitor to convert any Apple II into a see-through touchscreen system. You can easily remove

(continued)

SOME FLOPPY DISKS WILL GIVE YOU A BYTE YOU'LL NEVER FORGET.



You'll find them lurking in stores wherever floppy disks are sold. Those evil denizens of computer drives that are eagerly waiting to devour your valuable information, bit by bit. What they can do to you and your business is too painful to print.

At TDK, we grimace at that thought. Which is why we took great pains to develop an absolutely flawless disk. One that is made with such technical superiority that it meets or exceeds the most rigid industry standards.

Whether you choose our 8-inch, 5.25-inch standard, 5.25-inch High Density or 3.5-inch No-Risk Disks, you'll be assured of consistent error-free performance, through years of extended usage. And although you'll probably never need it, it's nice to know that all our disks are covered by a lifetime replacement warranty.

It's also nice to know that our disks share both the technology and dedication to quality that have made TDK the world's largest manufacturer of magnetic media—including our higher-performance audio and video recording tapes. The fact that millions of people rely on our products is a true testament to our 50 year heritage in the industry.

So, the next time you enter the cluttered jungle of floppy disks, don't pick up something hazardous to your company's health. Avoid a bad byte. Use the TDK No-Risk Disk.



© 1985 TDK Electronics Corp.

THE NO-RISK DISK. TDK®

it for use as a graphics tablet, input pad, or interactive book pad.

Included is the Master Touch I disk, which contains six touchscreen applications. TouchWriter I is a word processor. TouchGraphics is a picture/graphics creator. Expense Account Manager is a spreadsheet application. Bishop's Square is a puzzle. Touch Checkers is a board game, and Window Test is a testing and recalibration program.

Interactive Book I, also included with Touch Window, has illustrated activities. You

place Touch Window over or under the book's pages and interact by touching the page. The computer responds with sound, animation, calculations, clues, scores, and instructions.

Touch Window sells for \$199.95. Contact Personal Touch Corp., 4320 Stevens Creek Blvd., San Jose, CA 95129, (408) 246-8822. Inquiry 628.

Desktop Scanners

CompuScan's PCS 230 and PCS 240 scanners read information into IBM

PCs and compatibles. The PCS 230 page reader uses advanced OCR technology to enter text. The PCS 240 adds image scanning for handling both text and graphics.

The devices let you scan documents and convert them into a format compatible with IBM PC software packages such as WordStar, MultiMate, Word, and Volkswriter. The PCS 230 and PCS 240 read and recognize a standard page in about 30 seconds. Features include fixed-pitch font recognition and automatic adjustment for right justifica-

tion, proportional spacing, and special symbols.

The PCS 240 enters graphics in the form of bit-mapped images. Using the software provided, you can scan graphics up to full-page size; display, store, and manipulate the image; annotate the image with comments or legends; and produce composite text and graphics documents.

Pricing for the PCS 230 and PCS 240 scanners starts at \$5695. Contact CompuScan Inc., 81 Two Bridges Rd., Bldg. 2, Fairfield, NJ 07006, (201) 575-0500. Inquiry 629.

ADD-INS

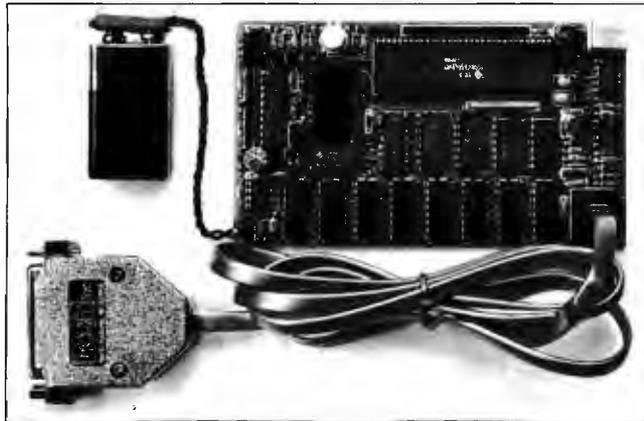
Tattletale Data Logger

Onset Computer Corporation's Tattletale Model II is a 3- by 5-inch data logger. It has eight channels of 8-bit A/D, including on-board temperature and battery sensing, 14 I/O lines, a hardware UART with RS-232C drivers, and a 224K-byte data capacity. Tattletale is designed to run off a 9-volt battery.

This logger comes with an RS-232C interface cable that connects to an IBM PC or compatible. Its prototyping card allows signal conditioning for the analog and digital circuits.

Tattletale runs a 32-bit integer BASIC with over 4100 variables plus data-logging and math functions. Its BASIC interpreter lets Tattletale measure and store the eight analog channels up to 100 times per second.

The data logger supports XMODEM protocol for data transfer to a variety of computers. You can also use BASIC commands to print out formatted results.



Tattletale Model II from Onset Computer.

Pricing for Tattletale is set at \$895. Contact Onset Computer Corp., 199 Main St., North Falmouth, MA 02556, (617) 563-2267. Inquiry 630.

Fiber-Optic Modem for the IBM PC

ICS has announced the FOCI fiber-optic modem. This plug-in card for the IBM PC features transmission

rates up to 19,200 bps and automatic detection of signal loss due to a cable break or failed LED.

The FOCI functions in the same manner as a PC communications port, so you can use standard software to transfer data between PCs or remote devices. The modem supports full RTS/CTS handshaking.

The FOCI plug-in card costs \$249. The FOCI-K kit, available for \$750, contains two FOCI cards and 250 feet of terminated fiber-optic

cable for connecting two IBM PCs. Contact ICS Inc., 8601 Aero Dr., San Diego, CA 92123, (619) 279-0084. Inquiry 631.

HyperDrive 20 for the Macintosh

General Computer Company's HyperDrive 20 is a 20-megabyte internal hard-disk drive for the Apple Macintosh. As with the older HyperDrive (a 10-megabyte model), Apple Computer has agreed that a HyperDrive 20 properly installed by an authorized General Computer dealer will not void its 90-day warranty or AppleCare coverage on the Macintosh. General Computer offers a 90-day warranty on the HyperDrive, as well as an extended HyperCare warranty that lasts up to three years.

The HyperDrive 20 comes with four disk-management utility programs: Manager, Security, Disk Backup, and

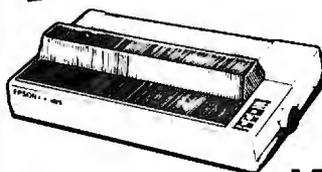
(continued)

PRINTERS

800-562-2727

User-Friendly Prices

NEW! From **EPSON FX-85**



\$339.
WITH NLQ (REPLACES FX-80+)
Suggested Retail \$499.

FX-185 WITH NLQ
WIDE CARRIAGE
(REPLACES FX100+)

\$459.
Suggested Retail \$699.

- 160 CPS
- NLQ MODE • 8K BUFFER
- SELECTYPE™ • 160 TYPESTYLES
- ONE YEAR WARRANTY

EPSON LQ-1500



\$827.

Suggested Retail \$1295.

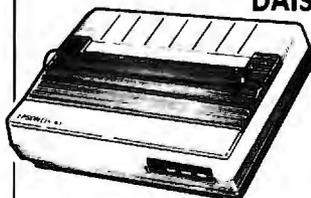
**DRAFT TO LETTER QUALITY
IN ONE AMAZING PRINTER**

- 24 Pin Printer
- 200 CPS Draft Mode
- Over 200 Typesyles
- Ultra-High Resolution Graphics
- Four Times Faster than the Average Daisy Wheel at 67 CPS — Letter Quality

New Low Prices On Options

NEW!

**DIABLO COMPATIBLE
DAISYWHEEL PRINTERS**



Standard Epson Code
To Work With Most
Popular Computers

EPSON-DX-10

- 10 CPS • 1 YEAR WARRANTY

\$234.

Suggested Retail \$299.

EPSON-DX-20

- 20 CPS • 110 COLUMN
- ALL-PURPOSE INTERFACE

\$339.

Suggested Retail \$499.

**Quantity
Pricing
Available
Upon
Request**

NEW!

EPSON AP-80

for APPLE'S Macintosh - IIC - IIE

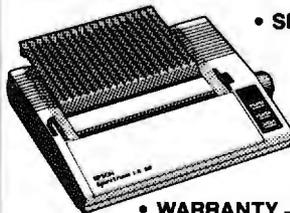
- WITH NLQ • IMAGE WRITER
- TRACTOR FEED • COMPATIBLE

Call For Price

EPSON LX-80

Suggested
Retail Price \$299.

\$214.



- **SPEED** — 100 characters per second
- **QUALITY** — Near letter quality mode
- **EASE-OF-USE** — Choose popular typesyles from top control panel with SelectType™
- **VERSATILITY** — Over 160 possible typesyles — Mix text and graphics on the same line
- **WARRANTY** — Epson's one year warranty

LX-90

Suggested
Retail Price \$329.

\$225. WITH TRACTOR
FEED

PIC Cable Interfaces Available For:

- IBM JR. & PC • ATARI • APPLE IIC • GENERIC PARALLEL • COMMODORE

**Special Pricing For
DEALERS... VARS and other
Qualified Resellers**

DAISYWHEEL PRINTER

**ComRiter
CR-IIE**

Suggested Retail \$599.

Special Price

\$266.

EPSON SQ-2000

\$1,459.

LETTERJET

H5-80 \$319.

**Qualified Corporate & Educational
Purchase Orders Accepted**

1-800-562-2727

Or in Missouri call: 1-314-227-4371

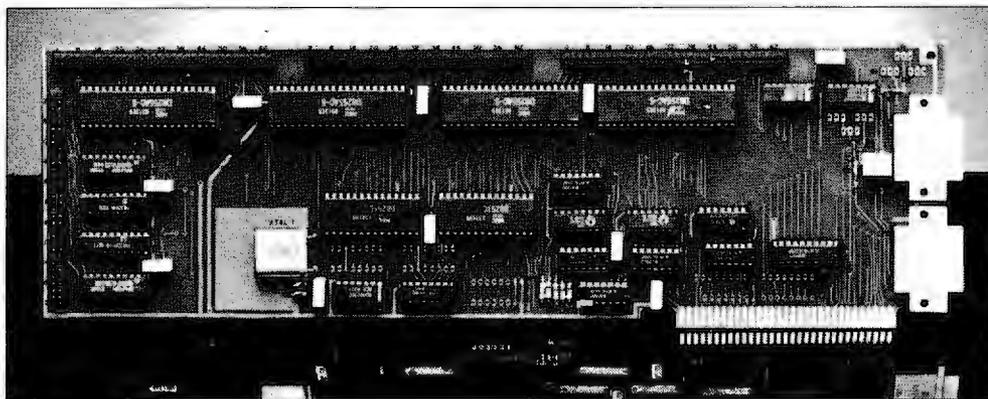


PRINTERS PLUS /910 Clayton Rd., #217, Ballwin, MO 63011



SHIPPING AND HANDLING AT ADDITIONAL COST. (MC AND VISA AT NO ADDITIONAL CHARGE.) OFFER GOOD WHILE SUPPLY LASTS.
PRICES ARE IN EFFECT UNTIL DECEMBER 31, 1985. SOME ITEMS MAY NOT BE AVAILABLE ON PUBLICATION DATE.

ADD-INS



The Model 1018 Multi-I/O Board from Industrial Computer Designs.

Print Spooler. Manager can divide the disk into 32 file drawers (each shown as a separate icon) and can assign a password to each drawer. Security can encrypt files. Disk Backup offers three ways to back up hard-disk data to floppies: full backup (copies entire sections of the disk), incremental backup (copies all files created or modified since last backup), and individual backup (copies specified files). Print Spooler lets the machine print while performing some other task.

Disk Backup and Print Spooler will also be provided free to HyperDrive owners. A new \$49 extension of HyperCare guarantees that all software enhancements and new HyperDrive software packages will be mailed directly to the user.

The HyperDrive 20 sells for \$2795. Starting December 6, HyperDrive owners can upgrade to the 20-megabyte capacity for \$895. Contact General Computer Co., 215 First St., Cambridge, MA 02142, (617) 492-5500. Inquiry 632.

Model 1018 Multi-I/O Board

Industrial Computer Designs' Model 1018 Multi-I/O Board gives 96 parallel I/O channels to the IBM PC and bus-compatible microcomputers. The board can address 12 individually programmable 8-bit parallel I/O ports. It has dual serial ports with jumper-selectable data rates and four 8-bit parallel input channels.

The Model 1018 supports full bus interrupts and incorporates a crystal-controlled clock for communications timing. It connects to external devices via plug-on connectors with attached ribbon cabling.

The Model 1018 Multi-I/O board is available for \$495. Contact Industrial Computer Designs Inc., 31264 La Baya Dr., Westlake Village, CA 91362, (818) 889-3179. Inquiry 633.

Color Graphics for the Apple II Line

Video-7 has announced three graphics and text adapters for the Apple II family. The two packages from the Enhancer Series let Apples work with IBM-compatible RGB monitors.

The Color Enhancer and the Screen Enhancer are compatible with all Apple II software.

The Color Enhancer provides 16 levels of color and 16 shades of gray on the Apple IIe and IIc. You can display 80-column text and 16-color graphics on the same monitor.

The Screen Enhancer gives 16 shades of gray to the monochrome monitor. The IIe model also adds 64K bytes of internal memory and 80-column text capability. The IIc model brings "colors" to the monochrome monitor through gray-scale differentiation.

The third package, an enhanced version of Dazzle Draw from Broderbund Software Inc., comes bundled with the Color Enhancer. Dazzle Draw is a graphics and illustration package for the IIc and 128K-byte IIe line. It lets you create pictures, graphs, and charts in 16 colors and 30 patterns.

The Color Enhancer with Dazzle Draw for the Apple IIe is \$179.95; the same package for the IIc is

\$129.95. The IIe model of the Screen Enhancer costs \$129.95; the IIc version is \$79.95. Contact Video-7 Inc., 550 Sycamore Dr., Milpitas, CA 95035, (408) 943-0101. Inquiry 634.

IntroVoice IV for the IBM PC XT

IntroVoice IV from The Voice Connection is an IBM PC XT-compatible voice-recognition expansion card. It features response to as many as 500 user-defined spoken words or phrases with up to 1000 corresponding key replacements per word or phrase. You can call up to 32,000 words in sets of 500 from the hard disk in less than 5 seconds.

The system has recognition accuracy of more than 98 percent for typical vocabularies and a response time of less than 200 milliseconds. It dynamically subtracts background noise for optimum operation. You can use IntroVoice IV in conjunction with the keyboard. It works with any MS-PC-DOS application program and has multiuser capability.

Six microphone options, including wireless, are available with IntroVoice IV. The system comes with utility software for vocabulary building, training, and testing. It lets you adjust speaking level, word-match rejection threshold, and word-boundary detection. The system disk contains several predesigned vocabularies for popular software.

With a hand-held microphone, IntroVoice IV costs \$895. Contact The Voice Connection, Suite C, 17835 Skypark Circle, Irvine, CA 92714, (714) 261-2366. Inquiry 635.

(continued)

NEW from Byte Books/McGraw-Hill . . .

Inexpensive, practical references to help you take full advantage of today's hottest computer developments

JAZZ™: The Inside Track

by T. Berry. 256 pp., 75 illus., softbound A worthy successor to Lotus' enormously successful 1-2-3™, Jazz matches the needs of business-oriented PC users to the accessibility of the Apple Macintosh user interface. This comprehensive book shows how to get the most out of all five areas of Jazz: spreadsheeting, word processing, graphics, communications, and data base management. \$18.95

INSIDE THE IBM® PC AT™

by T.J. Byers. 288 pp., 60 illus., softbound Exploring in depth the many features of IBM's exciting new PC AT — the next step up toward office networks with multi-user and file-sharing capabilities—this Byte Book delivers information that's essential to all computing and business professionals. \$19.95

THE C PRIMER, 2nd Ed.

by L. Hancock and M. Krieger. 268 pp., 25 illus., softbound Packed with helpful examples, this new edition of a classic best-seller explains the features of the increasingly popular C language and shows you how to read and write programs in C. New to this fully updated edition: expanded coverage of structures and patterns. \$17.95

MacFONTS

by D. H. Leserman. 128 pp., illus., softbound A type specimen book for the Apple® Macintosh™ fonts, this much-needed volume helps you determine which fonts, type styles, sizes, and printing options are best suited for a given document. It's a must for anyone who wants to make the most of the Mac's text presentation abilities. \$9.95



At your bookstore. Or use this handy coupon to examine any — or all — for 15 days without obligation.

PROGRAMMING WITH TURBO PASCAL™

by D. Carroll. 256 pp., 40 illus., softbound (includes disk) An invaluable aid to mastering Borland's Turbo Pascal, the most successful compiler in the micro marketplace, this combined book/disk fills in the many blanks left by the Turbo Pascal manual [the one weak point in the package] — and helps you take full advantage of Turbo Pascal's outstanding performance and pricing. \$34.95

INTRODUCING dBASE III™

by L. Barnes. 288 pp., 60 illus., softbound Complete coverage of the features of dBase III — to give you full mastery of its rich but complex command language. \$18.95

SCIENTIFIC AND TECHNICAL TEXT PROCESSING USING WORDSTAR®

A Guide for Beginning and Advanced Users

by C. P. McKeague. 160 pp., 69 illus., softbound How to take advantage of the advanced formatting capabilities of today's most widely used microcomputer-based word processing program — detailed guidance you simply won't find elsewhere. \$16.95

PROGRAMMING THE IBM® PC USER INTERFACE

by H. K. Simpson. 288 pp., 197 illus., softbound Drawing upon disciplines from cognitive psychology and human factors to computer science, this hands-on book provides clear guidelines for designing and developing user-friendly software for the IBM PC family. \$14.95

USING THE MICROSOFT® BUSINESS BASIC COMPILER ON THE IBM® PC

by M. L. Lesser. 256 pp., 25 illus., softbound A unique step-by-step guide to program development and operating system interfacing for Microsoft's compiled BASIC on the IBM PC machines. \$18.95



McGraw-Hill Book Company

P.O. Box 400, Hightstown, NJ 08520

Please send the books checked for 15 days' free examination. At the end of that time I will pay for those books I keep, plus postage, handling, and local tax, and return any unwanted books postpaid without further obligation.

SAVE MONEY!

Remit in full with this order, plus local tax, and McGraw-Hill pays all regular postage and handling costs. Return books in 15 days for full refund if not completely satisfied.

- 005064-3 Berry: JAZZ: The Inside Track \$18.95.
 009520-5 Byers: INSIDE THE IBM PC AT \$19.95
 025995-X Hancock & Krieger: THE C PRIMER, 2nd Ed. \$17.95
 037400-7 Leserman: MacFONTS \$9.95
 852908-5 Carroll: PROGRAMMING WITH TURBO PASCAL (book/disk) \$34.95
 003777-9 Barnes: INTRODUCING dBASE III \$18.95
 044391-2 McKeague: SCIENTIFIC AND TECHNICAL TEXT PROCESSING USING WORDSTAR \$16.95
 057297-6 Simpson: PROGRAMMING THE IBM PC USER INTERFACE \$14.95
 037299-3 Lesser: USING THE MICROSOFT BUSINESS BASIC COMPILER ON THE IBM PC \$18.95

Bill my company Bill me

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

Signature _____

Offer good only in U.S.A.—For prices overseas or in Canada, write B. Mutinsky, 1221 Ave of the Americas, NY, NY 10020 23-D240-100-3

Text Retriever Works with Optical Disks

Reference Technology has added to its Clasix family with STA/F Text, a text-retrieval program for use with databases stored on read-only optical disks. The package lets you use an IBM PC or compatible to quickly search large text databases on optical devices, such as CD-ROM systems.

STA/F Text provides immediate access to documents of any size, in any format, and containing any combination of textual information. The system maintains a detailed index and knows the location of every word in every document.

The program bases its search upon indexes for every word (excluding predefined stop words) in any document in the database. You can perform free-text or structured searches and retrieve documents that contain selected words, phrases, or numbers. The program uses a menu-driven format.

The software works in conjunction with another Clasix package, STA/F File, designed to raise PC data capacity to mainframe levels. STA/F Text also works with the Clasix DataDrive Series 2000 read-only optical-disk drive (using the 12-inch DataPlate) and the DataDrive Series 500 CD-ROM system (using the 12-cm DataPlate). Other requirements are a PC or compatible with at least 384K bytes of memory (512K bytes with a fixed disk drive is recommended) and PC-DOS 2.0 or later.

Distributed on a read-only optical disk, STA/F Text costs \$395 (quantity discounts

available). Contact Reference Technology Inc., 1832 North 55th St., Boulder, CO 80301, (303) 449-4157. Inquiry 636.

Cost Modeling for Semiconductor Parts

A trio of cost-modeling and expert-system packages from Fountain Hills Software is designed to help the user avoid paying excessive prices for semiconductor and electronics parts. You can then use this information for planning and budgeting and for purchasing negotiations. The algorithms and equations used in the calculations reportedly are based on actual costs of manufacturing and were checked at semiconductor vendors around the world.

The first program is called Passport. It's a cost/price-modeling package for standard semiconductor parts and sells for \$145. The software provides detailed cost data and suggested fair-market prices. You can specify three levels of testing and screening.

Fair-Cost is an expert-system cost/price program for custom circuits. It sells for \$495. The package provides the same information as Passport plus details on tooling and prototype costs and market prices. Time schedules and risk factors are also provided. Displays of total system cost compare arrays, cell libraries, and modular and full custom approaches with the circuit quantity required.

VLSI-Cost is similar to Fair-Cost but is specifically designed to assist in planning and budgeting for custom military VLSI and VHSIC circuits. The program has three-dimensional and multiparameter graphics for instant display of minimum

program cost. You can display these graphics as a function of any variable (for example, the number of units, size of facility, and so forth). VLSI-Cost is available on a lease basis and includes continuous updating and support services.

All three programs run on the IBM PC and true compatibles. Contact Fountain Hills Software Inc., Suite 1000, 6900 East Camelback Rd., Scottsdale, AZ 85251, (602) 945-0261. Inquiry 637.

Thai/English Word Processor

Duangjan is a bilingual word processor for Thai and English text. It requires an IBM PC or compatible with 128K bytes and a color/graphics adapter, or a Sanyo MBC-550/555 with MS-DOS 2.0 or higher. An Epson RX/FX or compatible graphics printer is required for output.

Duangjan is \$19.75 plus \$3.25 postage; the price includes manuals in both Thai and English. For more information, contact Megachomp Co., 3524 Cottman Ave., Philadelphia, PA 19149, (215) 331-2748 or 331-8138. Inquiry 638.

Programs for Chemists

The Chemist's Personal Software Series from Molecular Design Ltd. consists of a database manager, a word processor, and communications software.

ChemBase (\$3500) is a database manager for compounds and reactions.

Cousin to MDL's mainframe programs (MACCS, REACCS, and DATACCS), ChemBase gives you the capability to create databases for storing and retrieving molecules, reactions, and associated data. It consists of components, or editors, for drawing molecules and preparing structure or sub-structure search queries, for creating forms used to display a single molecule or reaction and associated data, for creating tables used to display data for one or more entries, and for editing text.

ChemText (\$1500) is a graphics-based word processor with two main sets of tools: one for composing and formatting text and one for preparing, sizing, and positioning images within the text. Fonts provide math symbols and Greek characters. The Formula Editor is for preparing multiline math and chemical equations.

ChemTalk (\$1000) links a PC and a host computer running MDL mainframe software. The package is designed to function as a user-friendly front end. A terminal emulator turns a PC into a graphics terminal. In conjunction with ChemBase, you can use ChemTalk to transfer portions of databases from the PC to the mainframe and vice versa.

The series runs on the PC, XT, or AT with at least 512K bytes of memory, a color or monochrome monitor, a graphics card, a mouse, and two floppy-disk drives (a hard disk is recommended). The three programs are available collectively for \$5500 (a Spring 1986 release date is anticipated). Contact Molecular Design Ltd., 2132 Farallon Dr., San Leandro, CA 94577, (415) 895-1313.

Inquiry 639.

Apple-to-Mac Translator

Abaton Technology's Abaton Transform automatically regenerates Apple II applications for use on the Macintosh. This "transliteration" product converts programs, including screen graphics, at the object-code level regardless of the original's source language. The company says the process takes from 15 minutes to 6 hours, depending on the complexity of the application.

To port a program, you first install the Abaton card in the Apple II and link the Apple with a 512K-byte Mac. After loading the target application into the Apple, you begin executing it on the Macintosh, continuing this process until all the decision points have been exercised. Next, you perform a reset using the Mac interrupt control. At this point, a compile-option menu appears on the screen. Following compilation, the program is complete and ready to run on any Mac.

Abaton Transform works only with software that is not copy-protected. Translated programs can be copied.

Besides the add-in card, the package consists of a 5¼-inch disk and a 3½-inch disk and sells for \$1995. Contact Abaton Technology Corp., 1526 Cloverfield Blvd., Santa Monica, CA 90404, (818) 905-9399. Inquiry 640.

DOS for Apple IIs

Foscil FDOS is a disk operating system for Apple IIe and IIc machines. It provides five extra tracks

for each disk made in its format and gives the user 20K bytes of the upper 64K bytes on a 128K-byte system.

The program comes with user-friendly prompting, a help function that lists the most commonly used commands, and a BASIC interpreter. FDOS works with DOS 3.3 commands and has a setup similar to that of MS-DOS.

Suggested retail price of FDOS is \$29.95. For more information, contact Foscil Labs/Datacom Media, 406 East 73rd St., New York, NY 10021.

Inquiry 641.

Pascal Pop-up

Running on the Apple II line, *Monitor doubles as a pop-up program and a system monitor for Apple Pascal. It has capabilities found in other convenience programs as well as features of the Apple II ROM monitor.

*Monitor appears within any Pascal program, or from the operating system, at the touch of a key. You invoke its functions with English commands as displayed in a help list. You can keep a notepad and enter notes as keyboard macros. A floating-point calculator offers power, square-root, trigonometric, log, and exponentiation operations. You can enter numbers in hexadecimal or decimal form.

The software's disk-filer functions include a directory list and file load, save, and purge operations. With the editing capabilities, you can recover lost or garbled data and debug programs. The package's mini-assembler and disassembler let you interactively assemble, disassemble, and execute machine code.

*Monitor takes up 5K bytes of RAM. It lists for \$49 and requires Apple Pascal 1.1 or 1.2. For more information, contact dogStar Software, POB 302, Bloomington, IN 47402. (812) 333-5616. Inquiry 642.

Animated Simulation

Stella is an animated simulation program that runs on the 512K-byte Macintosh and lets you describe a model, view its behavior, and test alternate hypotheses. It provides an environment that displays the model as a set of interconnected graphical elements; the display changes to reflect the current value of the elements. If a model doesn't mimic a known system behavior, you can analyze the model's deficiencies.

The program can be used to create business models, simulate effects of various factors, or explore subjects as diverse as urban growth and ecological change.

Stella is available for \$200 and comes with a user's guide that includes tutorials. Contact High-Performance Systems, POB B1167, Hanover, NH 03755, (603) 643-1228. Inquiry 643.

Structural Analysis with Mac

MacFrame2D from Design Source Software uses stiffness matrix methods to analyze two-dimensional structural frames. The program, intended to simplify input,

storage, and editing of frame and loading data, has a scope of 20 joints and 30 members.

With MacFrame2D, you can verify frame geometry using the screen plot with numbered joints. Printed output includes joint and member input data, member end forces and moments, deflections, and reactions.

The package sells for \$150 and comes with a manual that contains examples. Contact Design Source Software, POB 91219, Houston, TX 77291-1219, (713) 820-7026. Inquiry 644.

Duo for Recording, Graphing Data

Stats Tool Kit, a Macintosh program geared toward researchers, scientists, and physicians, records research data and generates statistical analysis reports. The package allows generation of random-number files for experimentation and simulation and provides methods for entering, modifying, and saving data.

The program features chi-square, Mann-Whitney U, Wilcoxon's signed rank, and distribution tests, as well as Spearman's rank correlation and Kendall's tau coefficient.

Process Control Chart Tool Kit records numeric-sample data and translates it into charts and graphs based on Deming's philosophy of statistical quality-control systems. Besides P, NP, U, and C control charts, the program generates Pareto charts, trend charts, and histograms.

Both packages run on any Mac with Microsoft BASIC 2.0. They sell for \$99 each. Contact SofWare Tools, POB 8751, Boise, ID 83707, (208) 343-1437. Inquiry 645.

(continued)

SOFTWARE • OTHER COMPUTERS

Assembler, Debugger, Communications for Hitachi Chip

Echelon has released three programs that support Hitachi's high-integration 8-bit chip, the HD64180. All three run on Z80-, NSC800-, and HD64180-based microcomputers.

ZAS is a machine-code relocating macro assembler that produces Intel-compatible HEX and Microsoft REL files. It's compatible with Digital Research's ASM, MAC, and RMAC assemblers, with Microsoft's Macro-80, and with Xitan's TDL. The program converts HD64180 instructions into machine operation codes. ZAS handles the complete Zilog Z80 instruction set. Among its features are nestable conditionals and full expression handling, complete macro expansion, and library insert capabilities.

ZAS sells for \$69 and comes with a REL file-linking loader, an Intel-to-Zilog mnemonic translator, a relative-code-file librarian, and a symbol-to-line cross-reference generator.

ZDM is a debugger and monitor for development and maintenance of HD64180 assembly-language code. It has 21 commands for object-code debugging and hardware-port exercising. Capabilities include string searches in hexadecimal and ASCII, verification of identical memory blocks, sending and receiving of I/O port bytes, enable/disable interrupts, and math in hexadecimal. The debugger/monitor sells for \$50.

ZAS and ZDM work with CP/M, MP/M, and Z.

Term III is a communications package for Z-System

users. It offers interactive communications with remote computers, file transfers between a host and a remote system, control of an auto-dial/auto-answer modem, and access control for remote-system applications. Protocols available are XMODEM with checksum, XMODEM with CRC, and Kermit. Term III sells for \$99.

Contact Echelon Inc., 101 First St., Los Altos, CA 94022, (415) 948-3820. Inquiry **646**.

Traveling ROM

Traveling Software has put three of its programs on a ROM chip for laptop computers. Called the Ultimate ROM, the single chip holds Idea!, an outline processor; T-base, a database manager; and TWriter, a text formatter. The chip plugs into the Tandy 100 and 200 and the NEC PC-8201.

Idea! is described as similar to Living Videotext's ThinkTank. It can organize documents ranging from lists to outlines and offers word-processing and database functions. (With a conversion program that sells for \$19.95, you can use Idea! and ThinkTank files interchangeably.)

T-base lets you design relational databases and set up screen files. The program performs math computations

and can borrow information from fields in other databases.

TWriter prints documents written with the chip's built-in Text program. It's capable of justification, underlining, italics, and boldface and can produce form letters and mailing labels. A program called TMerge inserts text from a second file into a form letter or other boilerplate document.

The Ultimate ROM costs \$229.85, which gets you the chip, an overview of the program on audio cassette, a manual, and the Traveling Memory Manager, designed to help you utilize the Tandy or NEC machine memory. The package comes with a 30-day money-back guarantee. Contact Traveling Software Inc., 11050 Fifth Ave. NE, Seattle, WA 98125, (206) 367-8090. Inquiry **647**.

Math Subroutine Library

Quantitative Technology's Math Advantage is a collection of math algorithms for engineering and scientific applications. It's available in object code for either FORTRAN or C. The package contains more than 180 subroutines for use in real/integer-vector, complex-vector, matrix, and signal- and image-processing operations.

Math Advantage runs on a

variety of machines, ranging from microcomputers to supercomputers. Source-code licensing agreements are available for large systems. Pricing varies according to the target computer, but microcomputer implementations cost \$495 for the IBM PC, XT, and AT; the Hewlett-Packard Integral, and the DEC Professional.

Contact Quantitative Technology Corp., Suite D, 8700 Southwest Creekside Place, Beaverton, OR 97005, (503) 626-3081. Inquiry **648**.

Features Added to Paint Program

Dr. Halo II adds a number of capabilities to Media Cybernetics' paint program. A virtual-page feature lets you merge text and graphics files on-screen. An undo feature, scaling, and several new type fonts have also been added. Dr. Halo II works with IBM's Enhanced Graphics Adapter and laser printers from Hewlett-Packard and Corona. A new "smart eraser" capability lets you delete pixels of only a specified color.

Dr. Halo II runs on the AT&T 6300, the Texas Instruments Professional, and the IBM PC, XT, AT, PCjr, 3270 PC, and compatibles. It is priced at \$139.95; owners of earlier versions of Dr. Halo can upgrade for \$40.

For more information, contact Media Cybernetics Inc., 7050 Carroll Ave., Takoma Park, MD 20912, (301) 270-0240. Inquiry **649**.

WHERE DO NEW PRODUCT ITEMS COME FROM?

The new products listed in this section of BYTE are chosen from the thousands of press releases, letters, and telephone calls we receive each month from manufacturers, distributors, designers, and readers. The basic criteria for selection for publication are: (a) does a product match our readers' interests? and (b) is it new or is it simply a reintroduction of an old item? Because of the volume of submissions we must sort through every month, the items we publish are based on vendors' statements and are not individually verified. If you want your product to be considered for publication (at no charge), send full information about it, including its price and an address and telephone number where a reader can get further information, to New Products Editor, BYTE, 425 Battery St., San Francisco, CA 94111.

THE BUYER'S MART

A Directory of Products and Services

THE BUYER'S MART is a new monthly advertising section which enables readers to easily locate suppliers by product category. As a unique feature, each BUYER'S MART ad includes a Reader Service number to assist interested readers in requesting information from participating advertisers.

RATES: 1x—\$350 3x—\$325 6x—\$300
Prepayment must accompany each insertion.

AD FORMAT: Each ad will be designed and typeset by BYTE. Advertisers must

furnish typewritten copy. Ads can include headline (23 characters maximum), descriptive text (250 characters maximum), plus company name, address and telephone number. Do not send logos or camera-ready artwork.

DEADLINE: Ad copy is due 2 months prior to issue date. For example: December issue closes on October 1. Send your copy and payment to THE BUYER'S MART, BYTE magazine, 70 Main Street, Peterborough, NH 03458. For more information call Karen Burgess at BYTE 603-924-9281.

ACCESSORIES

SOFTWARE PACKAGING, DISKS

Cloth binders & slips like IBM's. Vinyl binders, boxes, and folders—many sizes. Disk pages, envelopes, & labels. Low qty. imprinting. Bulk & branded disks. Much More! Low prices. Fast service. Call or write for FREE CATALOG.

Anthropomorphic Systems Limited
376-B East St. Charles Road
Lombard, IL 60148
1-800-DEAL-NOW (312) 629-5160

Inquiry 701

ACCESSORIES

VERBATIM DATALIFE

SS/DD 10 PACK IN A PLASTIC BOX

NOW ONLY **\$16.50**

WHILE SUPPLIES LAST
MASTERCARD AND VISA ACCEPTED

CALL TOLL FREE

950-1088-78775437

LOCAL: (313) 363-0100

Inquiry 710

BOOKS / DISKS / VIDEOS

Flash Course in Computer Engineering

μ Vol. I Line cord to peripheral slots, compatibles/power supplies and motherboards. Theory, wavetforms, timing, schematics & data sheets. Entry to engineering level \$29.95 μ Vol. II Compatible peripherals. Incl. Assembly lang. disk \$29.95 Free Public Domain software. Catalog disk. \$6 MAC UPGRADE KIT. \$200 complete.

COMPUTER TIMES

197 Marion Dr., McMurray, PA 15317
(412) 941-1188

Inquiry 711

DYSAN DISKS

Free Shipping & Handling

Boxes	5 1/4" DSDD (1042D)	5 1/4" IBM AT (UHR II)
1	\$27.90 each	\$47.90 each
2	\$26.90 each	\$46.90 each
10	\$25.90 each	\$45.90 each
20	\$23.90 each	\$43.90 each

Large Orders call for quote

WGGB

316 North Owen Street Mount Prospect, IL 60056
312-392-2621

Inquiry 778

1-2-3" VIDEO TRAINING!!!

FREE TRIAL!!!

From beginner to MACROS! In use by: IBM, Exxon, U.S. Army, General Electric, Travelers Insurance & MANY MORE!

CALL NOW! **1-800-LEARN-PC**

(1-800-532-7672)

Learn-PC Video Systems

7430 W. 27th St., Mpls, MN 55426

Inquiry 739

BUSINESS OPPORTUNITIES

Vertical Market Opportunity

If you develop software for the Advertising, Publishing or Broadcast industries, call us. We're Interactive Market Systems. We have 10,000 clients in those industries World-Wide. If your product can benefit our client base, we'll provide marketing and sales support. If you currently have a product or are about to develop one, give us a call. Contact Tammi Peterson.

IMS Micros 212-576-3508
55 Fifth Ave., New York, N.Y. 10003

Inquiry 712

COMMUNICATION

SMART ANSWERING MACHINE

SAM transforms your IBM PC into an intelligent phone answering & real-voice messaging center. FEATURES: 999 personal messages, call screening, message forwarding, timed or grouped message delivery, sortable phonebook/autodialer, time/date log, voice prompted remote access, AND MORE!! All hardware & software included. Retail \$295. VISA/MC.

DIALECTRON, INC.

2035 California St., Ste #17, Mountain View, CA 94040
(415) 960-3040

Inquiry 713

SILENCE & COOL YOUR PC

Stop irritating fan noise & overheating problems with the SILENCER cooling system. It utilizes a super quiet (84% less noise), West German, all metal, 4 1/2" fan. Provides up to 100% more cooling. Mounts on the back of the IBM PC. \$79.95 + \$4 s/h VISA/MC

PC COOLING SYSTEMS

31510 Via Ararat Dr., Bonsall, CA 92003
(619) 723-9513

Inquiry 756

DATA CABLES & PARTS

EIA RS232-C Data Cables - standard, extended distance, RS232-C Teflon Assemblies. Also Centronics (parallel), Coaxial (RG59U, RG62A/U, Dual Wang, Twin-axial), Ethernet, Ribbon, IBM, DEC Compatible cables, AB switches, connector parts, bulk cable, tools & hardware (wall plates). Send for Catalog.

Communication Cable Co.

POB 600-B, Wayne, PA 19087

215-644-1900

Inquiry 708

TURBO/COMMUNICATIONS

Asynchronous communications program written in Turbo Pascal™ • Communicate with main frame or another macro • Documented source code included • Great for learning • Use it to interface with other programs written in Turbo Pascal™ • For CP/M and MS-DOS. Price: \$30.00

Larry Chryskos

6500 South Washtenaw, Chicago, IL 60629

Turbo Pascal is a trademark of Borland International

Inquiry 738

KEY TRONIC 5151 TEMPLATES

Keyboard overlays for the Key Tronic™ 5151 keyboard. A one-sided template with all the commands and function controls to your favorite software like Lotus, Wordperfect 4.0, etc. Priced at \$14.20 each + \$1.80 shp/hdl

INTERSTATE SOFTWARE, INC.

P.O. Box 40398 — Raleigh, NC 27629
(919) 266-5608

Inquiry 733

Self-Inking Printer Ribbon

For users of Okidata and other open spool ribbon printers. Controlled Printout Devices are a new kind of printing ribbon that re-ink themselves, and will last 15 times longer than the ribbon you are now using. For further information please call or write.

CONTROLLED PRINTOUT DEVICES, INC.

POB 869, Baldwin Rd., Arden, NC 28704

(704) 684-9044

Inquiry 712

APPAREL

SWEATSHIRTS

Quality silkscreened slogans

BYTE ME, I'm user friendly or PC POWER

White lettering on navy sweatshirts.

S • M • L • XL

Visa/MC/COD/CHK Send \$18.95 to:

STAR MARKETING

13824 Crestway Dr.

Brook Park, OH 44142

Inquiry 769

CONTRACTS

FOR ENTREPRENEURS

Legal contracts for hardware/software developers. Employee agreement, non-disclosure form, contracts for sale (hardware and/or software), consulting, development, hardware & software maintenance, non-competition, project delivery & more.

\$50 Waters Publishing \$50

— 8235 Douglas — Suite 1000 —

Dallas, TX 75225

(214) 369-8108

Inquiry 776

BLANK FUNCTION KEY TEMPLATES

Write convenient commands next to your function keys on reversible plastic templates. Styles to fit IBM-PC. Compatibles. HP-150. Keytronic 5151, and others. Custom also available.

\$4.95 Pkg. of 3 (Plus \$1 s&h)

1-800-231-5413

In CA 1-800-523-5441

Free catalog of other helpful products available by circling number below on inquiry card.

Inquiry 713

THE BUYER'S MART

DISK CONVERSION

CONVERSION SERVICES

Convert any 9 track magnetic tape to or from over 300 formats including 3 1/2", 5 1/4", 8" disk formats & word processors. Disk to disk conversions also available. Call for more info. (312) 459-6010

Pivar Computing Services, Inc.

★ ★ 47 W. Dundee Road ★ ★
Wheeling, IL 60090

Inquiry 758

INCOMPATIBLE WORD PROCESSORS?

We convert to and from: XEROX, DEC, IBM, LANIER, WANG, PC-DOS, CONVERGENT TECHNOLOGY, WORDSTAR, MULTIMATE, STRAIGHT ASCII, MICOM.

Also most CP/M systems.

LOWEST PRICES

DATA CONVERSION INC.

8310 Caballero Blvd. • Buena Park, CA 90620
(714) 522-7762 (800) 824-4851 in CA.

Inquiry 715

DOCUMENTATION

Computer Assembly Manuals

BIG BLUE SEED for IBM® BUILDERS: parts list, placement diagrams, instructions for assembling over 55 IBM-compatible bare cards - \$14.95.

APPLE SEED II for APPLE® BUILDERS: in the style of the **BIG BLUE SEED** with instructions for assembling 70 Apple-compatible bare cards - \$12.95.

BOTH ASSEMBLY MANUALS FOR \$25.00

NuScope Associates

P.O. Box 790 • Lewiston NY • 14092

Inquiry 752

DUPLICATING SERVICES

WESTERN TRANSDATA, INC.

Why risk duplicating your important programs on your computer when our equipment is designed solely to duplicate disks & verify their perfection 100%? Over 600 formats 3 1/2", 5 1/4" & 8" Plus serialization, copy protection, labeling, packaging, shrink-wrapping and fast, personalized service.

WESTERN TRANSDATA, INC.

1701 E. Edinger Ave. A-7
Santa Ana, CA 92705
714/547-3383 (collect)

Inquiry 777

ENTERTAINMENT

PC COLOR SPECTRUM

REAL TIME KALEIDOSCOPE patterns on your RGB display & color/graphics adapter. Full video frames (complete screens) at 10 FRAMES/SECOND. —178— Shades & Colors. DYNAMIC & BEAUTIFUL. \$35. Unprotected with Batch options \$44. IBM PC/PCjr.

AFFIRMware

P.O. Box 586, Drexel Hill, PA 19026
(215) 449-6875

Inquiry 700

GRAPHICS SOFTWARE

ATTENTION ENGINEERS

Easy-to-use graphics software for the IBM PC, XT, AT, and compatibles. Full 2-D and 3-D screen graphing capabilities including contours. No programming needed! Interface to pen-plotter.

OMNILOT [S] \$195
OMNILOT [P] \$195
BOTH \$295

MICROCOMPATIBLES

301 Prelude Drive • Silver Spring, MD 20901
(301) 593-0683

Inquiry 748

GRAPHICS SOFTWARE

THE DGI TYPE SHOP

Turn your IBM or APPLE computer and HEWLETT-PACKARD plotter into a desktop publishing system. THE DGI TYPE SHOP offers a quick and economical alternative to typesetting — PLOTSETTING. Price \$175. Ten optional fonts that range from a very formal script to Greek-Scientific are \$25 to \$50 each.

DECISION GRAPHICS, INC.

P.O. Box 2776-B, Littleton, Colorado 80161
Phone (303) 796-0341

Inquiry 716

HARDWARE

★ ★ MODEMS★ ★

We've got just what you need to get the most out of your personal computer. ANCHOR AUTOMATION MODEMS! Now offering a 5 year warranty at no extra cost. SALE

* VOLKSMODEM 12 (300/1200 Baud) \$199.00

* LIGHTNING 24 (300/1200/2400 Baud) \$399.00

ORDER NOW FOR IMMEDIATE DELIVERY - UPS COD

Mastercard & Visa Accepted

MAGNETIC MEDIA OF N.E.

POB 780, Beverly, MA 01915

(800) 992-0123 (outside MA)

(617) 927-0905 • (617) 921-0303 • (617) 921-0353 ★

Inquiry 742

TURBOCHARGER FOR IBM

✓ Increases processing speed over 300%

✓ Full software compatibility with PC and XT

✓ Supports Intel 10 MHz 8087 coprocessor

Everett/Charles® Marketing Services

6101 Cherry Avenue

Fontana, CA 92335

800-443-1860 Calif. 800-821-0589

Inquiry 727

1/2 IN. 9 TRACK COUPLER

READ and WRITE 1/2 in. magnetic tape with formatted 9 track drives. Runs all speeds and densities in PC, XT, & AT running MS-DOS or IBM XENIX. Data transfers up to 904K bytes/second. Couplers start at \$880. Complete sub-systems start at \$2995.

Overland Data, Inc.

5644 Kearny Mesa Rd., Ste. A, San Diego, CA 92111

(619)-571-5555 and TELEX 754923 OVERLAND

Inquiry 753

USED APPLES & IBM's

APPLE II+ as low as \$300.00

APPLE IIe as low as \$575.00

Motherboards & accessories — call

We really do buy and sell used computers! Trade in your apple for an IBM or compatible.

SHREVE SYSTEMS

845 Lark Ave., Shreveport, LA 71105

318-865-6743 4-8 p.m. C.S.T.

Inquiry 766

8097 PROTOTYPING BOARD

Develop applications for the Intel 8096 Family of Microprocessors with the CSC-8097 Board - the ONLY board available for development with Intel's 8097 16-bit single chip microcontroller. Price: \$750

Caldwell Systems Corp.

POB 617, San Ramon, CA, 94583

415-833-1850

Inquiry 707

HARDWARE

POWERLINE GREMLINS?? POWER FAILURES??

The MERICK STANDBY POWER SYSTEM is the TOTAL SOLUTION to your powerline problems.

240 watt system - \$385. 400 watt system - \$495.
800 watt system - \$795

MERICK Inc., POWER SYSTEMS DIV.

Box 298, Frisco, CO 80443 303-668-3251

Inquiry 744

PCjr ADD-ON DRIVES

Upgrade your PCjr with our user-installed add-on drive system. It includes a replacement disk controller (operates up to 3 drives), a 2 drive cable, external 360K drive(s) & software for operating the extra drives. Prerequisite: DOS 2.1, \$295 (one drive), \$449 (2 drives), \$149 (controller only), \$6 shipping.

Call (505) 292-4182

J & M Systems, Ltd.

15100-A Central SE, Albuquerque, NM 87123

Inquiry 735

METAL ENCLOSURE IBM COLOR 1/2

High- TWO Disk-Tape Slots -Under CRT

Includes: -40 Watt Switching P.S.

• 6 Switched/Filtered Pwr. Outlets

• CRT Swivel •••• All for \$249.

10 Meg. Tape-Backup \$695. w/Box pkg.

S.D.I.

Suite 128, 904 Bob Wallace Ave.

Huntsville, AL. 35801 • (205) 539-6461

Circle 764 on inquiry card

Inquiry 764

BUYING A PROGRAMMER?

Information on EPROM programmers for Engineering, Production and Field Service.

Specifications and prices upon request.

SHERMAN PIRKLE, INC.

617-861-8688

Inquiry 765

SOFTWARE

★ FORECASTING ★ MODELING ★ PLANNING ★

Compatible with IBM PC & Apple II

MICRO-BJ™ **NUMATRICS™**

• Box-Jenkins ARIMA • Econometrics package

• Identify, estimate, forecast \$195.00

XTRAPOLATOR™ **PROFESSIONALS CHOICE**

• Automatic forecasting \$195.00

• Link to Lotus, Visicalc

Multiple order discounts 50% off Apple II orders

STRATIX

P.O. Box 4413 • Burlingame, CA 94011

(415) 697-0573 MC/VISA

Inquiry 771

SIGN MAKER \$46.50

Print Letters from 5/8 inch to 83 feet tall Horizontal or Sideways banners to 12 inches tall. Very Fast. 2 fonts. Perfect for Store signs, posters, etc. Okidata 92-3, 192-3 Epson FX80, 100, Star Micronics. MS-DOS, CP/M-80.

WOODSMITH SOFTWARE

Rt. 3-Box 550A, Nashville, IN 47448

(612) 988-2137

Inquiry 779

THE BUYER'S MART

SOFTWARE

Ada for Micros

Now you can use the language of the future on your IBM PC, Zenith, etc. The C-Pak includes the Janus/Ada Compiler, Linker, Libraries, Example Programs, User Manual, and more. Great for learning Ada and for serious programming. . . . \$98
CAI Ada Tutorial. \$99

A-OK Systems

816 Easley St., Silver Spring, MD 20910
(301) 585-5105(8)

Inquiry 702

SOFTWARE

AI for the IBM PC

TOPSI is a full version of OPSS which runs under MS-DOS, Unix or CP/M. A fast, efficient expert system development tool.

Prototyping: \$75
Production: \$175
C version, add \$20 Shipping, add \$5

DYNAMIC MASTER SYSTEMS

POB 566456, Atlanta, GA 30356
(404) 585-0771

Inquiry 721

SOFTWARE

HALLEY'S COMET

KNOW WHEN AND WHERE TO LOOK WITH OR WITHOUT A TELESCOPE!

Provides sky locations of the comet, moon, and major planets for any place and time in 1985-86. Apple, IBM, TRS-80 (I) versions open (in BASIC), with explanatory booklet. \$30 plus s/h and tax in CA. VISA/MC

MSAR Software Co.

360 Moore St., Santa Cruz, CA 95060
To Order Call Now 408-426-7019

Inquiry 751

Finally. BSW-Make.

The Boston Software Works now brings a complete implementation of the Unix "make" facility to MS-DOS. No more recompiling every file in sight after a small edit. Just type "make" and BSW-Make automatically builds your product quickly, efficiently and correctly. BSW-Make supports: • most compilers and assemblers • MS-DOS or PC-DOS v2.00 or later • macros for parameterized builds • default rules.

Only \$69.95 postpaid (Mass. residents add 5% sales tax)

The Boston Software Works
120 Fulton Street, Boston, MA 02109
(617) 387-8846

Inquiry 705

TAX-PREP™ '85 TRIAL

Multiplan or 1-2-3 users, easily prepare totally professional tax returns. Try TAX-PREP '85 (for 84 returns) thru November for \$15 + 3 s/h and we'll give you \$15 off TAX-PREP '86, avail. in Jan. for \$129.95. YES, it has the features you want!!! FREE info.

EZWare Corporation

29 Bala Ave. Dept. G., Bala Cynwyd, PA 19004
(215) 667-4064

Inquiry 728

DATA ENTRY SYSTEM

Hands-down data entry with two-pass verification for the PC/XT/AT & compatibles. Loaded with features like: Auto dup & skip, verify bypass, range checks, & table lookups. Fully menu driven only \$395
Call for free 30 day trial period.

COMPUTER KEYS

6519 193 SW, Lynnwood, WA 98036
(206) 776-6443

Inquiry 709

THE MASTER MENU

IBM Compatible HD Organizer.

Password Security - Time Log Recorder - DOS Shell Batch File Generator - On Line Help - Time Mgr. Scratch Pad Utility - Non Memory Resident - Fast Color or B&W - and More! \$142.50 + \$5 S&H
Dealers Nationwide!

MicroConcepts
(219) 432-8088

Inquiry 749

KEYBOARD MAPPER

Softkey™ allows user to redefine keyboard keys to other characters or character strings. Pictorial editor lets you see what keys have been redefined. Unlimited number of different keyboards can be made. For IBM PC's and compatibles.

Price \$49.95 + \$3. S/H.

TRISYSTEMS

74 Northeastern Blvd., Nashua, NH 03062
(603) 883-0558

Inquiry 773

CROSS ASSEMBLERS with "UNIVERSAL" LINKER and POWERFUL LIBRARIANS for IBM PC MS-DOS

Full featured for most microprocessors

ENERTEC, INC.

BOX 1312, Lansdale, PA 19446
215-362-0966 MC/VISA

Inquiry 725

BIBLIOG2

Software for the accessible library. The technology explosion has made journals a major source of information. BIBLIOG2 makes that information accessible. Easy to use. Quick to retrieve. Especially made for the IBM PC and IBM PC compatibles MS-DOS 2.0. Price \$79.50 Check/MC/VISA

MICRO-DYNAMICS OF TEXAS

P.O. Box 40691, Houston, TX 77240
Outside TX 800-892-9957
In TX 713-896-9957

Inquiry 750

Minnesota SNOBOL4 Language

Powerful string & data handling facilities. Interpreter compatible with mainframe SNOBOL4. 32K strings, 32 bit integers, 8087 for float & large memory model. Sample pgms include ELIZA. For >128K IBM PC/MS DOS or compatible. Authoritative "green" book by Griswold available.

Guide + 5 1/4" diskette \$44.95
Guide + green book + disk \$39.95
Green book only \$24.95
Postpaid in USA. In NY add tax. VISA/MC (914) 271-5855

BERTIS INTERNATIONAL
POB 441, Millwood, NY 10520

Inquiry 704

FORMAT-1-2-3

- * Loads ANY ASCII data into Lotus™1
- * 1-2-3 and Symphony Utility!
- * Send spreadsheets using E-Mail!
- * On-Line Help System!
- * Runs on PC/XT/AT, compatibles, AT&T & T.J. Professional
- * Extended Warranty Available
- * DOS 2.0+ with 64K, 1 drive
- * \$150 MC, VISA, CK

RELIABLE SOFTWARE COMPANY

(305) 267-2043 (800) 235-6646 Ext. 581
800-235-6647 Ext. 581 (CA)

Inquiry 761

Complete Money Management • Checks & Balances™

* Comprehensive Budgeting Tool that lets you plan ahead. * Professional looking Financial Statements when you want them. * Complete checking, savings & credit card management. * Sharp Graphics that keep you in control.

CPA designed. IBM PC/XT & Compatibles

\$69.95 with DOS 2.x and 192K. VISA/MC

PARSONS TECHNOLOGY

8925 Surrey Dr. NE., Cedar Rapids, IA 52402
(319) 373-0197

Inquiry 755

MICRO BEATS RACETRACK!!

Earn profits to afford peripherals and goodies to build the "System of Your Dreams." Dick Mitchell did it. A Winning Thoroughbred Strategy, book and software program \$59.95. Book only, \$29.95. Send for literature and review.

Cynthia Publishing Company

4455 Los Feliz Blvd., Suite 1106B
Los Angeles, California 90027
(213) 664-3165

Inquiry 714

MCFORMAT \$50

Don't let DOS waste your disk space! Add up to 50% more hard disk capacity to your IBM PC, XT, AT or 100% compatible by selecting format parameters, including cluster & directory size. Fully DOS compatible (3.0 or 3.1). VISA/MC.

MICROCOMPUTER CONCEPTS, INC.

9715 SE 43 St., Mercer Island, WA 98040
(800) 722-8088 (206) 238-2300

Inquiry 747

DISK DRIVE DIAGNOSTIC

Memory Minder, from J & M Systems, is a disk diagnostic program for the IBM PC, PCjr, & IBM compatibles. It checks your drives for head alignment, spindle speed, hysteresis, azimuth & more. And, you can use Memory Minder to actually align your disk drives! \$99 plus \$4 shipping.

J & M Systems, Ltd.

15100-A Central SE, Albuquerque, NM 87123
(505) 292-4182

Inquiry 736

BYSO® LSP

for IBM PC

INTERPRETER \$150

(includes Visual Syntax®)

COMPILER \$395

for stand alone expert systems, etc.

Levien Instrument Co.

POB 31, McDowell, VA 24458
(703) 396-3345

Inquiry 740

WINDOWING FOR dBASE III

dWINDOW™ is a unique utility program (9K) that dramatically enhances the screen presentations of dBASE. By patching itself into memory dWINDOW adds a series of new commands and functions to the dBASE repertoire. THE EFFECT IS SPECTACULAR! \$99 plus shipping.

Liberty Bell Publishing

618 NW Glisan, Suite 203, Portland, OR 97209
(800) 547-3000 (Dept. 604)

Inquiry 741

SOFTWARE

BASIC Cross Reference

XREFMaster creates cross reference listings for your CBASIC, CB80, or MBASIC programs. This single package can be configured to your printer and will create similar easy-to-read print-outs for any of your programs. Runs on CPM or MP/M systems of 48K. Only \$99.95.

Practical Solutions, Inc.

134 S. Central Ave., Valley Stream, NY 11580
For INFO. CALL: 1-516-561-0566
TO ORDER: 1-(800)-227-3800, ext. 983

Inquiry 759

SOFTWARE

MY WORD!® is just \$35.00

Complete word processing plus sort, add rows & columns, mergeprint, quickprint, macros, math, micro-justified, use all 256 char. Source: add \$35. 150 page printed manual. 30-day money-back guarantee. IBM PC or compatible, 128K, one drive, any printer.

T.N.T. SOFTWARE, INC.

34069 Hainesville Road, Round Lake, IL 60073
(312) 223-8595

Inquiry 772

SOFTWARE

LP88-LINEAR PROGRAMMING

A powerful menu-driven system for solving linear programs w/ up to 255 constraints & 2255 variables. Features include interactive & batch operation, spreadsheet-style input & editing, storage of problems & bases, Simplex Algorithm restart, report generator, sensitivity analysis. Req. IBM PC. 192K. \$99 w/8087 support, user's guide. VISA/MC.

EASTERN SOFTWARE PRODUCTS INC.

P.O. Box 15328, Alexandria, VA 22309
(703) 549-5469

Inquiry 723

CONFIDENTIAL CRYPTON

Protect Confidentiality

- Encrypt/Decrypt PC Files
- Under Password Control
- With Menu-Driven Software

Only \$35 C.O.D. or VISA/MC
To order call/write: (206) 842-8196

ARC Corp

721 Park Ave., Winslow, WA 98110

Inquiry 703

PERSONAL RESEARCH STATISTICS

APPLE & IBM program will calculate totals, means (averages), standard deviations, medians, averages, and much more. Calculates a least square linear regression when drawing scatter graphs. Data totals, displays, prints \$199.00 VISA/MC/COD. CALL FOR FREE ELECTRONIC MAIL BOXES

SOFTWEST PROGRAMMING

4418 E. CHAPMAN - SUITE 156
ORANGE, CALIFORNIA 92667
800-441-8666
I.D. #7068000 • TELEX 8502502780 MCI • E-MAIL 250-2780

Inquiry 767

MILP88-MIXED INTEGER LP

A general-purpose system for solving mixed integer linear programs with up to 65 integers, 255 constraints, 1255 variables. Solves problems by applying the branch and bound method. Menu-driven with many useful features similar to LP88. Req. IBM PC, 192K, \$99 with 8087 support, user's guide. VISA/MC.

EASTERN SOFTWARE PRODUCTS, INC.

POB 15328, Alexandria, VA 22309
(703) 549-5469

Inquiry 724

THE GREENLEAF C FUNCTIONS

Library of over 200 C functions has every capability of the IBM PC for all popular C Compilers, all memory models. Strength in DOS, Disk, Printer, Color Text, Extended Keyboard, and Time/Date. Also has video effects, cursor, equipment interfaces, and serial I/O. \$185.

Greenleaf Software Inc.

1411 LeMay Drive, Suite 101, Dept. B, Carrollton, TX 75007
(214) 446-8641

Inquiry 730

DATA REPORTER I

APPLE & IBM program can create any database. Manipulate data quickly and easily. No programming knowledge necessary. Data is processed in RAM and on disk. Sorts in less than 5 seconds. Search less than 3 seconds. \$99.00 VISA/MC/COD/CHECK. CALL FOR FREE ELECTRONIC MAIL BOXES

SOFTWEST PROGRAMMING

4418 E. CHAPMAN - SUITE 156
ORANGE, CALIFORNIA 92667
800-441-8666
I.D. #7068000 • TELEX 8502502780 MCI • E-MAIL 250-2780

Inquiry 768

STANDARD FORMS

Easy to use with on screen step by step prompts. Prints data required in proper spaces on any preprinted form that fits in your printer. Free phone support. \$79 (VISA/MC/AMEX). MS-DOS/CPM-80. Other original software. FREE catalogue.

MICRO-ART PROGRAMMERS

173 Birch Avenue, Cayucos, CA 93430
(805) 995-2329 (24 hours)

Inquiry 745

ENHANCE YOUR PRINTER!!

Print in a variety of fonts and sizes with your Epson (or compatible) printer. Prints SIDEWAYS too. Great for letters, spreadsheets, . . . even signs and banners! Create your own fonts to print. DigiCon Print Package—\$49.95 (for IBM PC).

Digital Concepts, Inc.

P.O. Box 8345, Pittsburgh, PA 15218
(412) 823-8314

Inquiry 718

ABACUS

ONLY FROM SUNSOFT Complete Accounting System for \$4995 plus S&H. SOURCE CODE only \$20 extra! Complete documentation. Runs on CPM & PC-DOS systems with CBASIC. 2.5¼" DSDD min.

* completely menu driven

* full file maintenance

* G/L, A/P, A/R, P/R, C/A

SUNSOFT Inc.

P.O. 1168, Marquette, MI 49855
For orders: 1-800-824-7008 For info: (906) 226-3370

Inquiry 770

▶ TIME & BILLING ◀

400 clients/20 partners/80 job & 40 out of pocket categories/20 areas of practice/fix fee or hourly/more! Prints billing/statements/aged rec's/more! Free phone support. \$149 (VISA/MC/AMEX). MS-DOS/CPM-80. Other original software. FREE catalogue.

MICRO-ART PROGRAMMERS

173 Birch Avenue, Cayucos, CA 93430
(805) 995-2329 (24 hours)

Inquiry 746

Affordable Engineering Software

CALL or WRITE for FREE CATALOG
Circuit Analysis • Root Locus • Thermal Analysis • Matrix Manipulation • Signal Processing • Filter Design • Graphics • Text Proofreader

BV Engineering

2200 Business Way Suite 207, Riverside, CA 92501
VISA/MC (714) 781-0252

Inquiry 706

dFELLER Inventory

A business inventory program written in modifiable dBASE source code. The menu-driven program lets you locate items by inventory name or number. It keeps track of reorder points, vendors, average cost, and other info. Requires dBASE II or III. PC-DOS/CPM \$150.

Feller Associates

550 CR PPA, Route 3, Ishpeming, MI 49849
(906) 486-6024

Inquiry 729

MicroGANTT®

Control your project! You describe the work, MicroGANTT calculates the schedule and budget. Optimize the schedule interactively. Customize the reports. Sub-tasking, fixed and variable costs, multi-project resource allocation, unlimited size and scope. GANTT, PERT, CP M, DOD-7000. Call or write for free catalog.

Earth Data Corporation

P.O. Box 13168, Richmond, VA 23225
(604) 231-0300

Inquiry 722

RATS!

RATS is a fast, accurate & complete regression package with unsurpassed POWER. Has both time-series & cross section analysis. Includes Box-Jenkins, logit & probit. Spectral analysis & graphics also available. Requires 256K RAM, IBM PC or compatible. \$200. MC/Visa.

VAR Econometrics

P.O. Box 19334, Minneapolis, MN 55419
(612) 822-8690

Inquiry 774

PC ARRAY PROCESSING!!!

VECTOR87 has 57 array processor subroutines: FFT (fastest in the world?), convolution, dot product, complex vector operations, random number gen, etc. Up to 15x faster than compiled code. For Pro Fort, IBM/MS Fort/Pascal, Lat C.

All 3 obj libs \$99 US.

Vectorplex Data Systems Ltd.

Box 138 Station M, Calgary, Alberta T2P 2H6, Canada
(403) 248-1250

Inquiry 775

EXPERT CHOICE®

Designed for today's decision makers—gain the competitive edge. Facilitates complex decisions based on both objective & subjective factors about criteria & alternatives. Uses: procurement, resource allocation, strategic planning, R&D, marketing, finance, employee selection & evaluation. DEMO AVAILABLE \$10.

Decision Support Software, Inc.

1300 Vincent Place-Dept. B, McLean, VA 22101
(703) 442-7900 (800) 386-2022

Inquiry 717

THE BUYER'S MART

SOFTWARE

Don't Re-Key - Use PIK'r!

**** The magic micro-mainframe data editor ****
 Selectively reformat mainframe ASCII report data into spreadsheets, databases. Lotus, dBASE, Multiplan, Visicalc, word processors. Cut & Paste, edit, merge, transpose. \$95.

SAMKHYA Corp.

47 Sixth St., Suite 3000, POB 142
 Petaluma, CA 94953

(800) 442-0012 US, (800) 442-5544 CA

Inquiry 763.

SYSTEMS SOFTWARE

pcSHARE MULTI-USER O/S

pcSHARE allows your IBM-XT/AT or compatible to support up to 5 users running 1-2-3, dBASE, WordStar, etc. on inexpensive serial CRTs. For software developers, pcSHARE efficiently runs compiled Basic, Pascal & C programs with full DOS 3.0 compatible record locking.

DIGITROL COMPUTERS INC.

440 Phillip Street
 Waterloo, Ontario, CAN, N2L 5R9
 (519) 884-4541

Inquiry 720.

UTILITIES

TOPVIEW SPOOLER

TVSPOOL is a user-friendly printer spooler for the TopView environment providing: Disk Resident Queue, Page buffer, Banner Processor, Delete After, Multiple Copies, and more. Introductory Price is \$60.00 (Visa/MC)

(714) 261-0440

RIX Softworks, Inc.

17971-F Skypark Circle, Irvine, CA 92714

Inquiry 762

PC-Write™ Shareware

Fast, friendly, flexible word processor and text editor for IBM PC. Easy to use. Advanced features like macros, split screen, footnotes, mailmerge. Many good reviews, thousands sold. All software, manual on disk \$10. OK to copy! Register for full manual, support, source \$75.

Quicksoft (206) 282-0452 Visa/MC
 219 First N. #224J, Seattle, WA 98109

Inquiry 760

UTILITIES

ZERODISK

ZeroDisk runs dozens of copyprotected business packages from your hard disk without floppies. Call for the latest list of software it handles. Needs IBM AT, XT, PC, or compatible, DOS 2.0 or higher. ZeroDisk is revised monthly and is not copy protected. \$75 US. Check or Credit Cards accepted.

QUAID SOFTWARE LIMITED

45 Charles St. E. 3rd Fl.
 Toronto, Ontario, Canada M4Y 1S2
 (416) 961-8243

Inquiry 732.

MEDIA MASTER PLUS

READ, WRITE, and FORMAT over 60 CP/M disks and run most CP/M-80 programs on your IBM PC! Two program package includes ZP/EM, a CP/M-80 emulator program that transforms your IBM PC into a 1-2 MHz CP/M 2.2 computer. \$59.95 + \$3.00 S/H (CA 6%)

INTERSECTING CONCEPTS, INC.

4573 Heatherglen Ct. Ste. 10
 Moorpark, CA 93021
 (805) 529-5073

Inquiry 732.

CBTREE for C Programmers

Provides enhanced file handling calls directly into C programs. Maintains balanced B-trees, supports unlimited number of keys, data records, and key lengths. Fast, Flexible, Efficient. No royalties. Source Code Included.

New Low Price: \$99

PEACOCK SYSTEMS, INC.

2009 Hileman Rd., Falls Church, VA 22043
 (703) 893-0118

Inquiry 757

REFER SAVES YOU HOURS

Cross-references any language (ADA, BASIC, C, Cobol, Pascal, dBASE, etc.). Locates all variables, values, keywords, line numbers and labels. Fast. Source code & examples. \$39.

(815) 725-0346

James Halstead & Asc.

1551 Plainfield, Joliet, IL 60435

Inquiry 734

THE C UTILITY LIBRARY

Make C program development easy on PC & AT. 300 documented, tested functions: pop-up windows, fast graphics, data-entry, time/date math, much more. SOURCE (95% in C) included. NO ROYALTIES. Most compilers, memory models. \$185.

Essential Software, Inc.

P.O. Box 1003, Maplewood, N.J. 07040
 (914) 762-6605

Inquiry 726

FORTRAN PROGRAMMERS

Discover F77L

A Full FORTRAN 77 Language System
 for the IBM PC and Compatibles

"THE PROGRAMMER'S FORTRAN"

Lahay Computer Systems Inc.

31244 Palos Verdes Dr. West, Suite 243
 Rancho Palos Verdes, CA 90274
 213-541-1200

Inquiry 737

Programmers on IBM™ PC!

Super Tools™ for Turbo Pascal™

Tested source code for rapid program development!
 Window Management \$45
 Math Expression Evaluator \$35
 System & File Information \$30
 All of the above for only \$75
 Organize your files with DiskOrder™ \$25

See our ad in July BYTE, page 387 for more details

Paragon Courseware

4954 Sun Valley Rd., DelMar, CA 92014
 (619) 481-1477

Inquiry 754.

\$50 PASCAL & dBASE SCREENS & FORMS

"Paint" fields, prompts, lines, boxes on your screen and ZIP™ writes dBASE III/II or Turbo Pascal source code for 24x80 mono & color screens or 88x132 printouts. Professional screens and reports are now quick and easy. DOS 2.0 + IBM/Compaq/Corona/Tandy \$50 ea \$75 both +\$3 S&H (+tax in CA) Visa/MC/COD/check

MAGNUM DATA INC.

627 S. Plymouth Boulevard, Los Angeles, CA 90005
 1-800-437-5200, op. 199 (orders only)
 (MD: 1-800-638-8880, op. 199)

Inquiry 743

Subscription Problems?



We want to help!

If you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.

BYTE

Subscriber Service

P.O. Box 328

Hancock, NH 03449

CCT-4 SYSTEM SERIES

The latest CCT implementation of the new generation Intel 16-Bit Processor technology. This means extreme speed, unequalled power, and the ultimate in reliability, and of course, the innovators at CCT behind it. Inquiry 102

This series in the CCT line exploits the speed and power of the Intel 80286 and Zilog Z-80H (8MHz), on the 286Z CPU board. This combination, along with CompuPro DMA controllers and I/O boards, yields a dramatic improvement in system throughput speeds, from basic CP/M operation, up to large powerful multi-user/multi-tasking machines. The CCT-4 represents the most advanced hardware presently available in a microcomputer to run the thousands of CP/M type software programs on the market, and with CONCURRENT DOS 8-16 and the CompuPro PC Graphics board (when available), all software written for the IBM PC machines. This series is for the serious business/scientific user.

CCT-4A State-of-the-art power in it's basic form. Consists of CCT-286Z CPU board and CCT-M256 (256K), along with CompuPro: Enclosure 2 Desk (21 slot MF), Disk 1A, System Support 1, Interfacer 4, the CCT-2.4 floppy drive system, and CP/M 8-16, and with SF-200 surge suppressor system. **\$5,269.00**

CCT-4B Single-user/hard disk power. As the 4A, except priced without the CCT-2.4, to add in your choice of CCT hard/floppy combination drive subsystem, at the published pricing. **\$4,149.00**
(Example: CCT-4B Mainframe with CCT-10/1 = \$6,198.00) Plus cost of selected drive subsystem

CCT-4C Multi-user/hard disk power. As the 4B, with the CCT-M512 (512K static RAM board) instead of M256; Interfacer 3 instead of Interfacer 4; SF-400 instead of SF-200, plus Concur. DOS 8-16 O.S. (4 to 6 user system) **\$4,999.00**
(Example: CCT-4C Mainframe with CCT-40/1 = \$8,048.00) Plus cost of selected drive subsystem

BATTERY BACK-UP ON CCT RAM!

Limited Time Offer - FREE 80287 and Supercalc 86 with any CCT-4!

The above systems include all necessary cabling, assembly, testing, minimum 20 hour burn-in, and the CCT unconditional 12 month direct warranty.

HUGE PRICE CUTS!

CCT-M512 WORLD'S TOP SELLING CCT STATIC RAM. IEEE Standard 12MHz. 512K in one slot! — **Special Price: \$799**

CCT-M256 256K version of M512 upgradeable to full 512K. Perfect 256K RAM board for any CompuPro system **\$439**

CUSTOM COMPUTER TECHNOLOGY / BOX 4160 / SEDONA, ARIZONA 86340

TOLL FREE ORDERING: 800-222-8686 / For technical support / service: 602-282-6299

How a software engineer got to captain the lunar landing module.

The Computer Museum is everything you'd expect, and a lot of things you wouldn't.

Of course, the museum contains a collection of the most significant accomplishments in the history of information processing. But it's not just a great place to see things, it's also a great place to do things.

There are over twenty interactive exhibits at The Computer Museum. You can design a car, create your own fractal landscape, or even captain the lunar landing



module on the Apollo flight simulator.

So, the next time you're in Boston, stop by The Computer Museum. You'll discover it's more than a lot of machines, it's also a lot of fun.

For more information, or to become a Museum Member, write The Computer Museum, or call (617) 423-6758.

The Computer Museum

B O S T O N
 There's something in it for everyone.

300 Congress Street, Boston, MA 02210

**TOLL-FREE
ORDERING:
800-222-8686**

CCT[®] CUSTOM COMPUTER TECHNOLOGY

A
PAT
MARTINI
COMPANY

**FOR TECHNICAL SUPPORT/
SERVICE / IN ARIZONA:
602-282-6299**

1 CCT PLAZA — P.O. BOX 4160 — SEDONA, ARIZONA 86340

Purchase your Hardware and Software directly from an OEM / Systems Integrator. Take advantage of our buying power! We stock a full line of Board Level Components, Software and Peripherals. Call for your needs. We'll give you the Lowest Prices, and the Technical Support and Know-How we are quickly becoming well-known for. Satisfied Customers Nationwide. The Nation's Custom Systems House for Business, Education and Science. Call for a system quote. CCT implements tomorrow's technology today!TM

• FOREMOST QUALITY • ADVANCED SUPPORT • REASONABLE COST •



80286 NOW!

□ **CCT-286Z** is our model designation for the **MI-286** dual processor board from **Macrotech**. It features the super high speed combination of Z-80H and 80286, with provision for the 80287 math chip. Directly replaces 8085/88 and 8086 CPUs running CP/M, MP/M Concurrent DOS, and MS-DOS, at throughput increases of 3X to 5X!

SPECIAL PRICE - \$795
80287 Option - Installed - \$250

**SEE THE CCT-4 SERIES
USING THIS BOARD
DETAILED ON THE FACING PAGE**

**NOW!
BATTERY BACK-UP
ON
CCT RAM BOARDS!
VOLATILE PRICES
CALL FOR QUOTE**

LIBERTY TERMINALS
• Superior Reliability •

110-14" GREEN-80/132 Column . . . CLOSE
110-14" AMBER OUT
200-14" GREEN-80/132 Super Deluxe . . . PRICES
200-14" AMBER CALL!!

OKIDATA PRINTERS - Top Quality

82 - 80 Col . . . CALL 83 - 132 Col . . . CALL
92 - 80 Col . . . CALL 93 - 132 Col . . . CALL
84 - 132 Col/200cps—Top of the Line . . . CALL
For Serial Interfaces CALL

TOSHIBA P351 - 288 CPS/24 PIN - \$1499

DIABLO — Letter Quality Series
Model 620 . . . \$969 Model 630 . . . \$1799

WE HAVE ALL SOFTWARE—CALL

\$ ACROSS THE BOARD PRICE REDUCTIONS \$

INDUSTRIAL GRADE SUPERIOR QUALITY CCT DISK DRIVE SYSTEMS ROLLS ROYCES OF THE INDUSTRY
S-100 HARD DISK SUBSYSTEMS

Professionally engineered ST-506 type systems for the business market S-100 Computer user. Includes industry top quality drives, CompuPro Disk 3 DMA controller, all cabling, A&T, formatted, burned-in. Provisions for up to two hard disks in each system. We include operating system update. CP/M 80, CP/M 86, CP/M 8-16, CCP/M 8-16, CP/M 68K. (†1 Systems are CCT innovated hard/floppy combinations, with Mitsubishi DSDD 8" drive.) 12 month warranty.

CCT-10 (11 + MEG)	\$1499	CCT-10/1	\$2049
CCT-20 (22 + MEG)	\$2019	CCT-20/1	\$2569
CCT-40 (36 + MEG)	\$2499	CCT-40/1	\$3049
CCT-60 (58 + MEG)	\$3699	CCT-60/1	\$4249
CCT-90 (87 + MEG)	\$4909	CCT-90/1	\$5459
CCT-125 (123 + MEG)	\$6099	CCT-125/1	\$6649

HOT NEW CCT BOARD PRINTERFACER 1™ - Print buffer I/O Board. Up to 1 Meg. RAM on board. Looks as/works with Interfacer 3/4. Single or Multiuser/Interrupt driven or polled. Super-slick design handles one serial, one parallel, software switchable. Also for Zenith and Alpha. Intro Price — \$349.

FLOPPY SYSTEMS

CCT-2.4 • Dual 8" DSDD Mitsubishi 2.4 Megabyte in Extra Heavy horizontal enclosure, IBM Compatible Mitsubishi 360K. Extra Heavy Cabinet removeable filter air system, all cabling, A&T, Burned in. The accommodates two drives, hard or floppy. All cabling, A&T, fastest system available: \$1229 Burned-in. Perfect for our Concurrent DOS Package . \$399

CCT-8/5 • FULL IBM COMPATIBILITY

One Mitsubishi 8" DSDD (1.2 Meg)/One 5-1/4" DSDD (360K) IBM Drive
For Concurrent DOS and PC DOS \$1029

★ SUPER PRICES ★ COMPUPRO COMPONENTS ★ IN STOCK ★

CPU-Z - \$229 • Disk 1A - \$399 • Disk 1A w/CP/M - \$499 • CPU 8086/10 - \$359 • SPU-Z - ?
CPU 8085/88 - \$229 • CPU 286 - \$849 • CPU 68K - 10Mhz - \$359
Disk 3 - \$459 • RAM 22 (256K) - ? • RAM 23/64K - \$229/128K - \$299

SUPER SALE — M-Drive/H - 512K - \$399 / 2 Meg - \$899

Enclosure 2 Desk - \$699/Rack - \$749 • Interfacer 3 - \$409 • Interfacer 4 - \$289 • System Support 1 - \$299
Concurrent DOS 8-16 (CCTCMX) - \$309 • CP/M 80 (CCTHMX) - \$125 • CP/M 86 (CCTTMX) - \$175
CP/M 8-16 (CCTTMX) - \$199 • CP/M 68K (CCTCX) - \$279 • Operating System Updates/Remakes - \$30

16 Bit Upgrade Kit: CP/M 86, RAM 23, System Support 1, Cable \$649 □ CP/M 8-16 - Kit - \$673

CCT-1 — ENTRY LEVEL S-100 BUSINESS SYSTEM

- Enclosure 2-Desk-21 Slot Mainframe •
- CPU-Z - 6 Mhz Z-80 CPU Board •
- Disk 1A - DMA Floppy Disk Controller •
- RAM 23 - 64K Static RAM - 12Mhz •
- Interfacer 4 - 3 Serial/2 Parallel I/O •
- CCT-2.4-Dual 8" Mitsubishi DSDD Drive System - 2.4 Megabytes •
- CP/M 80 - 2.2 HMx - CCT Modified •
- All Cabling, Complete CCT Assembly, Testing, and Minimum 20 Hour Burn-in •

**SPECIAL PRICE
\$3,150**

RUNS ALL STANDARD 8" CP/M SOFTWARE - INCLUDES OUR EXCLUSIVE 12 MONTH DIRECT WARRANTY

Prices & availability subject to change. All products new, and carry full manufacturer's warranties. Call for catalog. Free technical help to anyone. All products we sell are CCT individually tested and set up for your system - Plug-In & Go! Arizona residents add sales tax CCT[®] Trademark — Custom Computer Technology; MS-DOS[®] Trademark — Microsoft; IBM[®] Trademark — International Business Machines; CompuPro[®] Trademark — W.J. Godbout; CP/M[®] MP/M[®] Trademarks — Digital Research HERCULES[™] Trademark — Hercules Computer Technology

DISK WORLD! is proud to introduce the lowest-priced, LIFETIME-WARRANTY diskettes ever!

And they're BRAND NAME PRODUCT to boot!

5.25" SSDD → .69 ea. 5.25" DSDD → .79 ea.

5.25" DSDD-HD → \$2.25 ea.

3.50" SSDD → \$2.09 ea. 3.50" DSDD → \$2.55 ea.

Based on multiples of 100 each.
Boxed in 10's with heavy-duty cardboard sleeves, user ID labels,
reinforced hubs (where appropriate) and write-protect tabs.

Introducing Wabash Pinnacle Series Diskettes.

Two years ago, if you'd told me I'd be writing this ad, I would have laughed.

At that time, Wabash diskettes were synonymous with "s-t".

Just saying that quality control was poor would be charitable.

So much was wrong that DISK WORLD wouldn't sell them.

That was yesterday.

Kearney-National Inc., a \$202-million division of a much larger company, came into Wabash.

Out went the old management, the old methods, the old production techniques... and in went a lot of new people, ideas, production lines and some really imaginative thinking.

The end result.

Today, I'm proud to offer you the Wabash Pinnacle Series of diskettes at the prices shown.

This isn't evolution in diskette manufacturing: it's revolution.

Here's what you get.

Wabash Pinnacle diskettes are

... certified 100% Error Free

... are covered by a LIFETIME WARRANTY

... meet or exceed all industry specifications (by quite some distance)

... and are simply the best value in diskettes available today.

The torture test.

Considering Wabash's earlier dubious reputation, I wasn't exactly a true believer when their Director of Marketing came into my office with samples.

So I took a box at random, selected a disk, bent the thing every which way and slipped it into my IBM-PC.

It formatted. It booted. It stored and retrieved data.

That wasn't enough.

I gave samples of the diskettes to Curt Rostenbach and, in turn, to Tom Streit, both hackers of long experience and members of the Waukegan (Illinois) Apple Users Group.

Tom really went at it.

He took a quartz-halogen lamp, aimed it at the diskette until it started to smoke (and melt)... and then formatted, booted the diskette and stored and retrieved data!

The same terribly (and intentionally) mutilated diskette ran on an IIT, Corona and IBM.

Curt was nicer.

He simply bent the diskette every which way...and it still formatted, booted and ran on his Apple.

The best buy I've ever seen.

DISK WORLD!, Inc. sells more flexible magnetic media by mail-order than anyone else in the world.

I, as President of the corporation, won't tolerate a product with a failure rate of more than 1/1000th of 1 percent.

I also don't like companies who try to milk a "quality" or "premium" image for a higher price like Dysan and Verbatim did... until they failed.

As President of DISK WORLD!, Inc., my motto is simple: "the best diskette for the least amount of money."

Wabash is it.

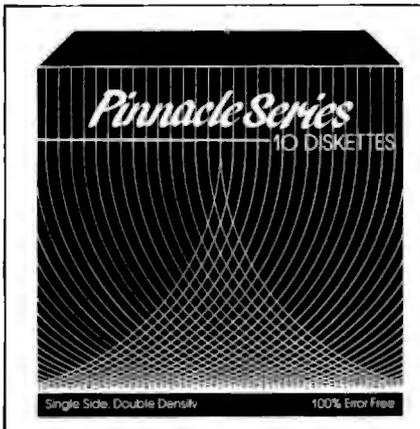
Right now, there is no better value than the Wabash Pinnacle Series of diskettes.

Granted, you have to buy a hundred at a time, but so what? Split the order with friends, relatives, co-workers or even your worst enemies.

The key thing is to get the most diskette for the money.

And this is it.

(Incidentally, as a corporation, we put our money where our



mouth is. Our first order for Wabash Pinnacle Diskettes was 1.5-million units.)

That's an awful lot of faith and confidence.

But, then again, I have the diskette that Tom Streit literally melted... and kept on running.

The truth about \$1.00 or less diskettes.

More and more ads are popping up offering diskettes for \$1.00 or less.

By the same token, more and more people who were selling used cars a few months ago are now selling diskettes by mail.

We did a little survey of current ads for diskettes advertised for a dollar or less and did some analysis of the market and here's what we found as it applies to 5.25" DSDD diskettes "supposedly" selling for a dollar or less.

VENDOR:	ADVERTISED LOW PRICE:	ACTUAL PRICE PER 100:	ACTUAL MFG.:
Unitech	.89 ea.	.92 ea.	Unspecified.
Datatech	.99 ea.	.99 ea.	Unspecified.
Computer Club	.95 ea.	.98 ea.	Unspecified.
	.99 ea.	1.02 ea.	Unspecified.
Communications & Electronics	.49 ea.	.80 ea.	Unspecified.
Precision Data	.89 ea.	.93 ea.	Unspecified.
Diskette Connec.	.93 ea.	.93 ea.	Unspecified.
Comp Soft Serv.	.77 ea.	.77 ea.	Unspecified.
		+ shpg.	
Computer/Computer	.99 ea.	.99 ea.	Unspecified.
DISK WORLD	.89 ea.	.92 ea.	Wabash Datatech

The real truth about \$1.00 or less diskettes.

It costs all diskette manufacturers about the same to produce a diskette. Some may charge more because they want to project a "premium quality" image, ala the late, lamented Dysan who bought their basic media from 3M.

Some charge less because they sell a sub-standard product... and we're not foolish enough to name names here.

But here's the truth about the \$1.00 or less diskette market.

It falls into four categories:

1. The DISK WORLD's of the universe who simply are so big that they can buy first quality product in massive quantities and choose to pass on the savings to you. (Precision Data and Diskette Connection on BRAND NAME products also fall into this category.)

2. The people who buy "cosmos"... stuff from major manufacturers that usually hits quality control standards, but is cosmetically blemished and thus can't be packaged and sold under the manufacturer's own name.

3. "Duplicator Quality": Uncertified media, usually below manufacturer's own standards and frequently below ANSI and IBM standards. Sold on an "as-is" basis with the understanding that the manufacturer's name will never be divulged. Usually about a 20% reject rate... as compared to DISK WORLD's standard of less than 1/1000th of 1% reject/return rate. Next to garbage, this is the source of most diskettes advertised at a dollar or less.

They may work... and then again they may not. (Frankly, the odds at the Blackjack table in Las Vegas are more in your favor.)

4. Garbage. Stuff that shouldn't be sold at all. But some manufacturers are hurting for cash, so they sell it anyway. (After all, they want to meet their payroll. Look what happens when you don't: you become a Dysan or Verbatim. Lots of history, but no money.) More and more garbage is being dumped into the market as manufacturers become pressed for cash and are motivated into selling anything and everything they can manufacture. (Read the article in FORBES about Verbatim and its "Bonus" brand.)

Finally, the Taiwanese counterfeiters are moving into the act. Perfect duplicates of the packaging of major manufacturers with one exception: the quality isn't there.

The Critical Factor.

Only DISK WORLD!, Inc. offers fully brand-identified, LIFETIME-WARRANTY product for less than a dollar.

Every one else offering 5.25" product for less than a buck doesn't tell you who makes it.

We do.

And that ought to tell you a lot right there.

Ordering & Shipping Instructions

SHIPPING: Wabash Pinnacle Diskettes are sold in multiples of 100 only. Shipping charges are \$3.00 per 100, regardless of type or size.

PAYMENT: VISA, MASTERCARD and PREPAID orders accepted. Corporations rated 3A2 or better and government and quasi-government open accounts are accepted on a NET 15 basis.

C.O.D. orders are subject to a \$5.00 special handling charge. (Sorry for the increase, but too many people have been refusing C.O.D. orders or using bad checks. It's a classic example of a few "bad eggs" making life more expensive for everyone else.)

APD, FPO, AK, HI & PR ORDERS: include shipping as shown and an additional 5% of the total amount of the order to cover PAL and insurance.

No other non-continental U.S. orders are accepted.

TAXES: Illinois residents only, add 7%.

MINIMUM ORDER: \$35.00

All orders subject to acceptance.
Not responsible for typographical errors.

ORDERS ONLY:

1-800-621-6827

(In Illinois: 1-312-256-7140)

INQUIRIES & INFORMATION

1-312-256-7140

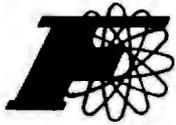
FOR FASTEST SERVICE, USE MCI MAIL:

Just address "DISKORDER"

(24-hour shipping on any item in stock if you order via MCI MAIL.)

DISK WORLD!, Inc.

629 Green Bay Road
Wilmette, Illinois 60091



FORTRON CORPORATION

3255A SELDON COURT, FREMONT, CA 94538

INFORMATION & CALIF. RESIDENTS

[415] 490-8171
TLX: 559291 FORTRON
FAX: [415] 490 9156



When choosing a POWER SUPPLY for your PC, XT, AT or Compatibles please consider this. . .

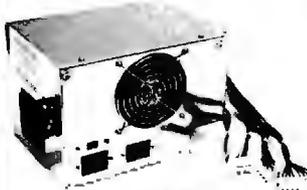
"All look-alike supplies come with some type of warranty, only Fortron's power supplies come with a guarantee backed by a full U.L. rating. Your PC represents a substantial investment, it does not make sense to risk costly downtime due to bargain power supplies, when for a few dollars more you can have the confidence of Fortron quality."

Trust in Fortron quality without compromise.



PC/XT

- FC 135-40** [140 W. max.] **129⁰⁰**
- For upgrade IBM PC to XT same pin out, same dimension as IBM PC, XT
 - or 8 pin output connectors for Faraday CPU board
 - With 4 drives connectors
 - Low noise DC fan, 110/230 VAC convertible
 - Over current, over voltage, short circuit, thermostat protections
 - U.L. recognition, one year warranty



PC/AT

- FC 5192** [200 W. max.] **189⁰⁰**
- Identical dimension & pin-out to IBM AT power supply
 - Faraday type pin-out available
 - W/4 drives connectors
 - High air flow, low noise DC fan, 110/230 VAC convertible
 - OCP, OVP, short circuit, thermostat protections
 - U.L. recognition, one year warranty



PC/XT

- FC 130-40** [130 W. max.] **119⁰⁰**
- For Faraday, DTC megaboards, XT compatibles
 - OCP, OVP, short circuit protections
 - Match our computer chassis FC-630
 - DC fan, 110/230 VAC convertible
 - U.L. recognition, one year warranty

ORDER TOLL FREE [800] 821-9771

Attractive Prices for Dealers/OEM's Please Call for Current Prices!

COMPUTER CHASSIS & KEYBOARD

<p>FC 630 78⁰⁰</p>  <ul style="list-style-type: none"> • For Faraday DTC BRD • Rear side switch • To use FC 130-40 power supply • Complete mounting hardware 	<p>FC 630 A2 99⁰⁰</p>  <ul style="list-style-type: none"> • IBM XT identical • To use FC 135-40 power supply • Side switch • Complete mounting parts 	<p>FC 630 AT 139⁰⁰</p>  <ul style="list-style-type: none"> • IBM AT identical • Complete mounting hardware • LED lamps, speaker optional 	<p>FC 640 269⁰⁰</p>  <p>Expansion Chassis Ext./Rcv. Adaptor 179⁰⁰</p> <ul style="list-style-type: none"> • Comes with 5 slot mother brd., 100 W. power supply, cooling fan • Two 1/2 height drive bracket • Dia. 15 1/4" x 12" x 6 1/4" • Ext./Rcv. Adaptor optional 	<p>FC A27 89⁰⁰</p>  <ul style="list-style-type: none"> • IBM XT keyboard compatible • Enlarged return key • Light and num. lock keys 	<p>FC 527 129⁰⁰</p>  <ul style="list-style-type: none"> • IBM AT keyboard compatible • Enlarged return shift key • Capacitance low profile key switch
--	--	---	--	---	--

<p>FC 230 Floppy Disk Controller</p> <ul style="list-style-type: none"> • Drives 4 x 5 1/4" FDD • IBM compatible • w/cable  <p>59⁰⁰</p>	<p>FC330 Hard Disk Controller</p> <ul style="list-style-type: none"> • Up to 2 Hard Disk Drives • Fully Buffered I/O Bus • Built-in ECC  <p>149⁰⁰</p>	<p>CT-6020 Color/Graphic/Printer</p> <ul style="list-style-type: none"> • 80 x 25 Hi-Res • 40 x 25 Low-Res • 320 x 200 Dots • Comp. video output • Light pen conn.  <p>99⁰⁰</p>	<p>FC940 RS232/Real Time Clock</p> <ul style="list-style-type: none"> • To 9600 Baud • Battery back-up  <p>69⁰⁰ 59⁰⁰ Clock only</p>	<p>FC 830 512K Memory Expansion</p> <ul style="list-style-type: none"> • From 64K to 512K • Parity-checked memory for error detection  <p>89⁰⁰ (8K)</p>	<p>A GREAT GIFT Listed 199⁰⁰ for Him or Her your cost now 99⁰⁰ Call for Qty. Price.</p> <p>Thermo Printer</p>  <ul style="list-style-type: none"> • 80 characters/line • Battery back-up • Centronic Parallel Interface
--	--	--	---	--	---

Low Low Cost for IBM PC, XT, AT Add-On Cards

<p>FC 930 RS232/Parallel Port</p> <ul style="list-style-type: none"> • RS232 serial • Parallel interface  <p>89⁰⁰</p>	<p>FC 530 Monochrome/Printer</p> <ul style="list-style-type: none"> • 8 x 25 screen • 7 x 9 character • TTL Level of output  <p>99⁰⁰</p>	<p>CT-6040 Monochrome/Graphic/Printer</p> <ul style="list-style-type: none"> • 80 x 25 text mode • 720 x 348 graphic mode • Runs Lotus 1-2-3 • 64K Graphic Display Mem.  <p>119⁰⁰</p>	<p>FC 730 (CT-6050C) 384K Multifunctions</p> <ul style="list-style-type: none"> • Memory Expansion to 384K • Clock/Calendar • Serial, parallel interface • Game port  <p>139⁰⁰</p>	<p>INTERNAL MODEM only 179⁰⁰</p>  <ul style="list-style-type: none"> • Free PC-Talk Software • 300/1200 Baud • Auto. Busy Redial, Auto. Answer • Dual phone jack plus RS232 port • Self test
---	---	---	---	---

<p>MONITORS</p> <ul style="list-style-type: none"> • w/Swivels • Hi-Res for IBM PC  <p>12" Green: 99⁰⁰ 12" Amber: 109⁰⁰</p>	<p>CABLES</p> <ul style="list-style-type: none"> • Hard Disk Drive Cable (34p-34p) 19⁰⁰ • Floppy Drive Cable 11⁰⁰ • 9 pin D type to 25 pin D type for PCAT 19⁰⁰ • Printer cable 25 DB to Centronics 19⁰⁰ • RS232 to RS232 cable 19⁰⁰ • Power cord w/female socket 2⁰⁰ 	<p>RAM CHIPS DRIVES</p> <p>64K 8⁰⁰/9 pcs. 128K 53⁰⁰/9 pcs. piggy back 256K 33⁰⁰/9 pcs.</p>	<p>Hard Disk Drives</p> <p>TEAC Half Height 5 1/4" Floppy Drives</p> <p>TEAC 55BV 89⁰⁰</p> <p>10 MB 449⁰⁰ 20 MB 559⁰⁰ (w/cable controller)</p>	<p>TERMS</p> <ul style="list-style-type: none"> • Min. shipping & handling \$6.00. • Can be more for actual cost. • CA. Res. add 6.5% tax. • No return merchandise without a RMA No. • Restocking charge 15%. • Prices subject to change w/o notice.
---	--	---	---	---

CALL 1-800-245-2235 AND YOUR SEARCH IS OVER

If you are seeking hard to find part numbers at hard to find low prices.

You are probably already familiar with our low pricing and large inventory of popular ICs, but a big part of our story is what doesn't appear in our ads.

PC boards are the primary source of our IC inventory. As you know our patented process enables us to remove ICs from boards without any degradation of the ICs. We obtain the boards from a wide variety of sources, which enables us to process a wide variety of ICs. Some of the boards we obtain consist of obsolescent technology. This results in a reasonable stock of replacement parts for products that might not be otherwise available.

**SPECIAL
64K DRAM
FULLY FUNCTIONAL
WITH SLIGHTLY
SHORTER LEADS
200 NS OR FASTER**

4164 .45
4416 .90

**GROUP PRICED
EPROMS**

2708, 2716, 2732,
2764, 27128

250NS 3.50
300NS 3.00
350NS 2.75
450NS 2.25
650NS 1.75

Inquiry 213 for End-Users.
Inquiry 214 for DEALERS ONLY.

GROUP PRICED LOGIC-TTL

74XX, 74LSXX .25
741XX, 74LS1XX, 74SXX .35
742XX, 74LS2XX .50
743XX, 74LS3XX .50
74S2XX, 74S3XX .60

GROUP PRICED LOGIC

ECL 10K 1.00
ECL 100K 5.00
CMOS 40XX .25
CMOS 45XX .50

ADC-0804 3.50
DAC-0808 1.50
ADC-0809 3.50
TL082 .50
AY5-1013 1.50
AY3-1015 1.50
TIL117 .50
MC1414 .70
1400-100 2.00
1420-55 2.00
MC1458 .40
MC1472 .50
MC1488 .50
MC1489 .50
FD1793 5.00
ULN2003 .50
2006 .70
DG201 .25
ULN2074 2.00
2101-250 .50
2102-450 .50
DG211 1.00
2111-250 1.00
2111-450 1.00
2114-150 .80
2114-200 .80
2114-250 .80
2114-300 .50
2114-450 .50
2115-70 3.00
2118-120 1.00
2118-150 .75
2118-200 .50
2125-45 3.00
2141-150 .80
2147-45 2.00
2147-55 2.00
2147-70 2.00
2148-55 2.00
2149-49 2.00
X2212 1.00
MPQ2222 .75
25LS2519 .50
25S10 .60
25S18 .60
2532-450 2.25
2651 4.00
2661 4.00
26LS31 1.00
26S10 .60
2708-500 2.00
2708-550 2.00
27128-200 5.00
FSA2719 1.25
27S03 .50
AM2901 3.00
LM2901 .75
AM2903 5.00
AM2905 1.50
Q2T2905 1.50
LM2907 1.25
LM2907(8 pin) 1.25
FPQ2907 .75
AM2910 5.00
AM2911 5.00
LM2917 1.25
AM2940 2.00
UDN2957 .50
AM2965 .75
AM2966 .75
LM301(8 pin) .25
TP3040 5.00

CA3054 .50
LM308(8 pin) .50
CA3080(8 pin) .50
LM310(8 pin) 1.00
LM311(8 pin) .25
LM319 1.25
LM324 .25
D3232 1.00
D3242 4.00
LM3302 1.00
3341 2.00
MC3346 .70
F3357 1.50
LM3399 .45
MC3401 .50
MC3403 .50
3441 1.00
3450 1.00
3453 2.00
LM348 .45
3486 1.00
3487 1.50
351 .25
LF353 .50
DS3612 .50
MB3614 .75
3900 .50
3906 1.00
LM393 .35
LM393(8 pin) .50
40161 .80
MC4024 2.00
4027-250 .35
4027-300 .35
MC4044 2.00
4044-200 .80
4044-300 .50
40L45-450 .50
TMS4050 .50
TMS4060 .50
CD4104 1.00
4116-120 1.00
4116-150 .75
4116-200 .50
4116-250 .35
41288-150 5.00
4164-120 1.75
4164-150 .95
4164-200 .85
4164-200 .45
4164-SPECIAL
MB425 2.00
4332-200 2.00
4416-150 1.50
4416-SPECIAL .90
MC4741 .75
IHS5010 2.50
IHS5011 1.25
CRT-5027 3.00
CRT-5037 5.00

MM5060 2.00
MK5116 .25
TMS5220 5.00
5257-450 .50
LM531(8 pin) .75
TMS5501 12.00
NE555(8 pin) .35
NE558 .75
LM566 1.00
MSM5832 2.75
MM5837 .50
NE592 .25
6116-100 2.00
6116-120 1.75
6116-150 1.25
6116-200 .90
6116-250 .85
6204-150 6.00
MPQ6502 1.00
6822 3.00
6522A 4.00
6802 2.00
6809 2.00
6810 .75
6821 2.00
6840 2.00
6845 2.00
6850 2.00
6852 2.00
68A10 1.25
68A21 2.50
68A45 2.50
68A52 2.50
68B09 3.00
68B29 3.00
68B45 3.00
6N138 .50
MB7052 .50
LM710 .40
LM733 .40
LM741(8 pin) .30
LM748(8 pin) .50
74C00 .50
74F00 .35
74F04 .35
74F08 .35
74F157 .45
74F245 .60
74F32 .35
74F373 .60
74F374 .60
74F374 .60
74F74 .35
74HC138 .45
74HC244 .60
74HC245 .60
74HC373 .60
74HC374 .60
74HCT08 .35
74HCT244 .60

75107 .50
75110 .50
75113 .50
75138 .50
75141 .50
75150 .50
75154 .50
75160 .50
75161 .50
7524 1.00
75322 .50
75365 .50
75427 .50
75450 .50
75451 .50
75452 .50
75453 .50
75454 .50
75461 .50
75462 .50
75497 .50
D765 4.00
8017 1.75
8031 5.00
8056 4.00
8080A .75
8086-2 5.00
8123 1.00
8200 2.50
8202A 14.00
8212 1.00
8216 1.00
8220 2.00
8224 2.00
8226 2.00
8234 1.50
8237-4 3.00
8237A 3.00
8238 2.50
8243 1.50
8250 4.00
8251 2.00
8251A 2.00
8253 2.00
8253-5 2.00
8255A 2.00
8255A-5 2.00
8257 2.00
8257-5 2.00
8259A 2.00
8262 1.75
8266 1.75
D8274 9.00
N8274 2.50
8279-5 3.50
8286 4.00
8289 4.00
82S16 1.00
82S62 2.00

MC840 .75
MC8506 10.00
8641 1.00
DS8820 .50
DS8832 .50
DS8833 .50
MB8861 .50
MB8874 .50
AY3-8910 2.00
AY3-8912 2.00
8T09 .50
8T14 .50
8T20 .50
8T23 .50
8T24 .50
8T26 .50
8T28 .50
8T37 .50
8T38 .50
FD8216 5.00
9312 .80
9314 .60
9321 .75
9328 1.00
9338 1.00
93419 3.00
93422 3.00
93425 3.00
936 2.00
93L22 .50
93L24 .75
93L422 3.00
93S16 .50
93S46 2.00
93S48 .80
9401 5.00
9602 .75
9614 .75
9615 .75
96L02 1.50
96LS02 1.50
TMS9900 3.00
TMS9901 1.50
TMS9904 3.00
TMS9914 3.00
TMS9918 20.00
TMS9980 10.00
Z8001 7.50
Z80ACPU 2.00
Z80ACTC 2.00
Z80ADMA 4.50
Z80APIO 2.00
Z80ASIO0 3.75
Z80ASIO/2 4.50
Z80BCPU 3.00
Z80CPU 1.00
Z80CTC 1.00
Z80PIO 1.00
Z80SIO0 3.00

OUR POLICY

Shipments: Orders normally shipped within 2 business days. Add \$3 for UPS ground \$6 & under. Add \$4 for UPS late fee, 26 & under; for each additional air pound add \$1. Arizona residents add 6% sales tax.

Payment: VISA, MC, Cashiers check, certified check, money order, personal check accepted (allow 10 days for personal checks to clear) No surcharge on credit card orders. CODs welcome with cash, certified check, cashiers check or money order. Add \$3 COD handling charge.

Pricing: Minimum order \$20. 30% discount on orders over \$500. Prices subject to change without notice. All orders limited to stock on hand.

We reserve the right to limit quantities.

KRUEGER Technology, Inc.

2219 South 48th Street • Tempe, AZ 85282

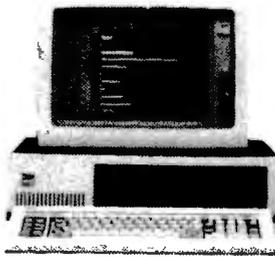
800-245-2235

In Arizona 602-438-1570

HOURS: 7 a.m. - 5:00 p.m.
(MOUNTAIN TIME)
Monday Thru Friday



IBM



IBM PC, 256K, One Half Height 320K Disk Drive DS/DD, Persyst Color Card With Printer Port, Taxan Green Monitor, DOS 2.1, PLUS a 10MB Hard Disk Sub System All For:

\$2599.

IBM PC, 256K, Two Half Height Drives DS/DD, Persyst Color Card With Printer Port, Taxan Green Monitor, DOS 2.1, 130 Watt Power Supply PLUS a 10MB Hard Disk Sub System All For:

\$2899.

IBM PC, 256K, Two Half Height Drives DS/DD, Persyst Color Card With Printer Port, Taxan Green Monitor, DOS 2.1, 130 Watt Power Supply, 10MB Hard Disk Sub System, PLUS 10MB Tape Back Up System All For:

\$3499.

IBM PC, 256K, Two Half Height Drives DS/DD, Persyst Color Card With Printer Port, Taxan Green Monitor, DOS 2.1, 130 Watt Power Supply, 20MB Hard Disk Sub System All For:

\$3299.

IBM PC, 256K, Two Half Height Drives DS/DD, Persyst Color Card With Printer Port, Taxan Green Monitor, DOS 2.1, 130 Watt Power Supply, 20MB Hard Disk Sub System, PLUS 10MB Tape Back Up System All For:

\$3899.

MONITORS

AMDEK 300 Green	\$135.00
AMDEK 300 Amber	\$149.00
AMDEK 310 Amber W/TTL Plug	\$165.00
PGS HX-12	\$465.00
PGS MAX-12	\$185.00
PGS SR-12	\$625.00
TAXAN #115 Green Composit	\$125.00
TAXAN #116 Amber Composit	\$135.00
TAXAN #121 Green W/TTL Plug	\$149.00
TAXAN #122 Amber W/TTL Plug	\$159.00
TAXAN #425 COLOR MONITOR	\$449.00
TAXAN #440 COLOR MONITOR	\$569.00
IBM MONOCHROME DISPLAY	\$260.00
IBM COLOR DISPLAY	\$590.00

COMPAQ

COMPAQ DESKPRO

**CALL
FOR DIFFERENT
CONFIGURATIONS**

PRINTERS

NEC PINWRITER 80 COL.	\$699.00
NEC PINWRITER 136 COL.	\$899.00
EPSON LX 80	\$249.00
EPSON FX 80	\$399.00
EPSON FX 100	\$525.00
EPSON RX 100	\$399.00
EPSON JX 80	\$525.00
EPSON LQ 1500	\$925.00
COMREX CR 420	\$1895.00
TOSHIBA 351	\$1275.00
STAR MICRONICS SG 10	\$259.00
STAR MICRONICS SG 15	\$395.00
CITIZEN PRINTER MSP-10	\$349.00
CITIZEN PRINTER MSP-15	\$485.00
CITIZEN PRINTER MSP-20	\$499.00
CITIZEN PRINTER MSP-25	\$699.00
JUKI LQ 6100	\$425.00
JUKI LQ 6300	\$745.00
BROTHER HR-25	\$665.00
BROTHER HR-35	\$895.00
DYNAX DX 15XL	\$389.00
OKIDATA	CALL

**SPECIAL
13" RGB MONITOR
COMREX 6600**

\$169.00

MODEMS

HAYES SMART MODEM 1200	\$459.00
HAYES SMART MODEM 300	\$209.00
HAYES 1200B PLUG IN CARD	\$399.00
HAYES 2400 BAUD MODEM	\$699.00
POP COM 1200 EXTERNAL	\$375.00
AST REACH MODEM	\$389.00
QIC MODEM INTERNAL	\$275.00

DRIVES

TANDON TM-100-2 DS/DD	\$155.00
TOSHIBA SLIMLINE DS/DD	\$139.00
TEAC SLIMLINE DS/DD	\$139.00

HARD DISKS

10MB SUB SYSTEM INTERNAL	\$750.00
EXTERNAL	\$925.00
20MB SUB SYSTEM INTERNAL	\$975.00
EXTERNAL	\$1150.00
40MB SUB SYSTEM INTERNAL	\$1295.00
EXTERNAL	\$1475.00

HARD DISKS & TAPE BACK-UP UNITS (EXTERNAL)

10MB HARD DISK W/10MB TAPE BACK UP	\$1250.00
20MB HARD DISK W/10MB TAPE BACK UP	\$1475.00
40MB HARD DISK W/10MB TAPE BACK UP	\$1795.00

CONQUEST

**PC
TURBO**



CONQUEST PC TURBO 256K Two Half Height Drives, Floppy Disk Controller 135 Watt Power Supply, Serial Port, Parallel Port (IBM Standard), Enhanced Keyboard, Monochrome or Color Adapter with Green or Amber Monitor All for:

\$1545.

Above System With 10MB Internal Hard Disk:

\$2295.

With 20MB Internal Hard Disk:

\$2520.

With 40MB Internal Hard Disk:

\$2840.

Tape Back Up Systems Are Also Available for the Conquest PC Turbo at a Nominal Price.

MULTIFUNCTION BOARDS

AST I/O MINI CARD, 1-SER.	\$150.00
AST SIX PACK 64K, 1-SER., 1-PAR	\$259.00
AST PREVIEW	\$309.00
AST ADVANTAGE CARD	
128K FOR AT	\$495.00
ALR CHALLENGER CARD	
128K FOR AT	\$395.00
PERSYST COLOR	
PRINTER ADAPTER	\$179.00
PERSYST MONOCHROME	
PRINTER ADAPTER	\$199.00
PERSYST BOB CARD	\$395.00
HERCULES COLOR	
PRINTER ADAPTER	\$179.00
HERCULES GRAPHIC	
PRINTER ADAPTER	\$319.00
STB GRAPHIC PLUS II	\$325.00
IBM COLOR GRAPHIC ADAPTER	\$225.00
IBM MONO PRINTER ADAPTER	\$230.00
GENOA SPECTRUM GRAPHIC CARD	\$349.00

GENERAL

MAXELL DISKETTES MD2	\$35.00/box
MAXELL MD2-HDM FOR AT	\$65.00/box
CONTROL DATA DISKETTES	\$24.00
KEYTRONIC KEYBOARD KB 5151	\$179.00

IBM PC-XT AND PC-AT

**Different configurations
available.**

CALL FOR PRICES.

Microshop

COMPUTER PRODUCTS

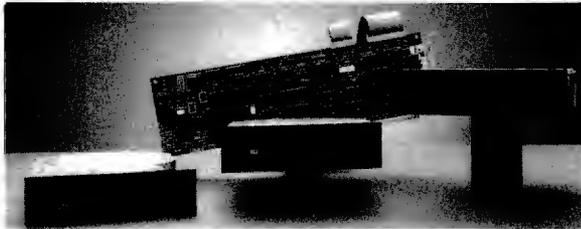
(714) 838-7530

2630 Walnut Avenue, Unit C, Tustin, California 92680

Prices & availability subject to change without notice—IBM is a registered trademark of IBM Corporation. COMPAQ is a registered trademark of COMPAQ Computer Corporation. Conquest is a registered trademark of Conquest Computer Industries.



TOP QUALITY ENHANCEMENT PRODUCTS FOR IBM AND COMPATIBLE COMPUTERS

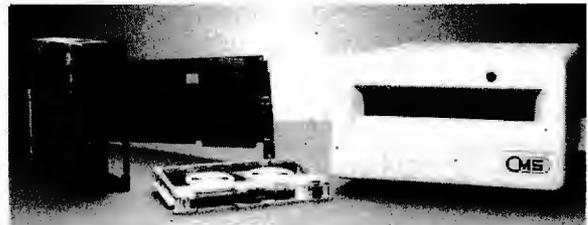


Hard Disk Subsystems

- 10, 20, 30, 44, 65, 70, 120 MB
- High Performance Models For 286 Class Machines
- Formatted and Tested
- Easy Installation

Tape Backup Subsystems

- 10 to 60 MB
- Internally Mounted or Free-standing
- High Speed



Expansion Cards

- AT Multifunction
- AT RAM
- Four Function I/O (Short Slot)

Accessories

- 640K Motherboard Upgrade
- Power Center™ Power Distribution



WE BACK YOU UP

Specialists In Quality Add-on Products
And Accessories For IBM, Compaq, AT&T Personal Computers

Our products are now available to dealers through **SOFTSEL** and **MICRO D.**

401 W. Dyer Rd., Santa Ana, CA 92707 • (714) 549-9111

IBM is a trademark of International Business Machines Corp.
Compaq is a trademark of Compaq Computer Corporation
AT&T is a trademark of American Telephone and Telegraph

Super DiskTM Diskettes

Now...Diskettes you can swear by, not swear at.

Lucky for you, the diskette buyer, there are many diskette brands to choose from. Some brands are good, some not as good, and some you wouldn't think of trusting with even one byte of your valuable data. Sadly, some manufacturers have put their profit motive ahead of creating quality products. This has resulted in an abundance of low quality but rather expensive diskettes in the marketplace.

A NEW COMPANY WAS NEEDED AND STARTED

Fortunately, other people in the diskette industry recognized that making ultra-high quality diskettes required the best and newest manufacturing equipment as well as the best people to operate this equipment. Since most manufacturers seemed satisfied to give you only the everyday quality now available, an assemblage of quality conscious individuals decided to start a new company to give you a new and better diskette. They called this product the *Super Disk* diskette, and you're going to love them. Now you have a product you can swear by, not swear at.

HOW THEY MADE THE BEST DISKETTES EVEN BETTER

The management of *Super Disk* diskettes then hired all the top brains in the diskette industry to make the *Super Disk* product. Then these top bananas (sometimes called floppy freaks) created a new standard of diskette quality and reliability. To learn the "manufacturing secrets" of the top diskette makers, they've also hired the remaining "magnetic media moguls" from competitors around the world. Then all these world class, top-dollar engineers, physicists, research scientists and production experts (if they've missed you, send in your resume to *Super Disk*) were given one directive...to pool all their manufacturing know-how and create a new, better diskette.

HOW SUPER DISK DISKETTES ARE MANUFACTURED

The *Super Disk* crew then assembled the newest, totally quality monitored, automated production line in the industry. Since the manufacturing equipment at *Super Disk* is new, it's easy for *Super Disk* to consistently make better diskettes. You can always be assured of ultra-tight tolerances and superb dependability when you use *Super Disk* diskettes. If all this manufacturing mumbo-jumbo doesn't impress you, we're sure that at least one of these other benefits from using *Super Disk* diskettes will:

- TOTAL SURFACE TESTING** - For maximum reliability, and to lessen the likelihood of disk errors, all diskettes must be totally surface tested. At *Super Disk*, each diskette is 100% surface tested. *Super Disk* is so picky in their testing, they even test the tracks that are in between the regular tracks.
- COMPLETE LINE OF PRODUCTS** - For a diskette to be useful to you and your computer, it must be compatible physically. *Super Disk* has an entire line of 5 1/4-inch diskettes for your computer.
- SPECIALLY LUBRICATED DISK** - *Super Disk* uses a special oxide lubricant which is added to the base media in the production of their diskettes. This gives you a better disk drive head to media contact and longer head and disk life.
- HIGH TEMPERATURE/LOW-MARRING JACKET** - A unique high temperature and low-marring vinyl jacket allows use of their product where other diskettes won't work. This special jacket is more rigid than other diskettes and helps eliminate dust on the jacket.
- REINFORCED HUB RINGS** - Standard on all *Super Disk* mini-disks, to strengthen the center hub hole. This increases the life of the disk to save you money and increase overall diskette reliability.
- DISK DURABILITY** - *Super Disk* diskettes will beat all industry standards for reliability since they will give you more than 75% of the original signal amplitude remaining even after an average (Weibul B-50) of 30 million passes. They are compatible with all industry specifications as established by ANSI, ECMA, ISO, IBM and JIS.
- CUSTOMER ORIENTED PACKAGING** - All *Super Disk* disks are packaged 10 disks to a carton and 10 cartons to a case. The economy bulk pack is packaged 100 disks to a case without envelopes or labels.
- LIFETIME WARRANTY** - If all else fails, remember, all disks made by *Super Disk* Inc., have a lifetime warranty. If any *Super Disk* diskette fails to meet factory specifications, *Super Disk* Inc. will replace them under the terms of the *Super Disk* warranty.
- SUPERB VALUE** - With *Super Disk*'s automated production line, high-quality, error-free disks are yours without the high cost.

NOW...NAME BRAND QUALITY AT SUPER CE PRICES

Now, you can buy *Super Disk* brand diskettes directly from Communications Electronics at prices less than "unbranded" generic diskettes. Your data is valuable, so why take chances using a diskette that could be so unreliable that the manufacturer refuses to put their name on it. To save you even more, we also offer *Super Disk* bulk product where 100 diskettes are packed in the same box without envelopes or labels. Since we save packaging costs, these savings are passed on to you. Diskette envelopes are also available from us. These super strong and tear resistant envelopes are only 8¢ each. Use order # EV-5 and specify the quantity of 5 1/4" diskette envelopes that you want.

39¢ per disk Quantity One

Our diskettes are packed 10 disks to a carton and 10 cartons to a case. The economy bulk pack is packaged 100 disks to a case without envelopes or labels. For best value, you should order in increments of 100 diskettes. Almost all diskettes are immediately available from *Super Disk*. With our efficient warehouse facilities, your order is normally shipped in less than a day.

SAVE ON SUPER DISK™ DISKETTES

Product Description	Part #	Super Disk price per disc (\$)
5 1/4" SSSD Soft Sector w/Hub Ring	6431-BA	0.54
5 1/4" Same as above, but bulk pack w/o envelope	6437-BA	0.39
5 1/4" SSDD Soft Sector w/Hub Ring	6481-BA	0.58
5 1/4" Same as above, but bulk pack w/o envelope	6487-BA	0.43
5 1/4" DSDD Soft Sector w/Hub Ring	6491-BA	0.64
5 1/4" Same as above, but bulk pack w/o envelope	6497-BA	0.49
5 1/4" DSQD Soft Sector w/Hub Ring (96 TPI)	6501-BA	1.49

SSSD = Single Sided Single Density; SSDD = Single Sided Double Density; DSDD = Double Sided Double Density; DSQD = Double Sided Quad Density. TPI = Tracks per inch.

BUY YOUR DISKETTES FROM CE WITH CONFIDENCE

To get the fastest delivery of your diskettes, phone your order directly to our order desk and charge it to your credit card. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. For maximum savings, your order should be prepaid. All sales are subject to availability, acceptance and verification. All sales are final. All prices are in U.S. dollars. Prices, terms and specifications are subject to change without notice. Out of stock items may be placed on backorder or substituted for equivalent product unless we are instructed differently. A \$5.00 additional handling fee will be charged for all orders with a merchandise total under \$50.00. All shipments are F.O.B. CE warehouse in Ann Arbor, Michigan. COD terms are available, in U.S. UPS areas for \$5.00 extra, and are payable with cash or certified check. Michigan residents add 4% sales tax.

For shipping charges add \$6.00 per 100 diskettes and/or any fraction of 100 5 1/4-inch diskettes for U.P.S. ground shipping and handling in the continental U.S. For 1,000 or more disks shipped to the continental U.S., shipping charges are \$3.00 per hundred diskettes. UPS 2nd day air rates are three times continental U.S. rates. For Canada, Puerto Rico, Hawaii, Alaska, or APO/FPO delivery, shipping is three times the continental U.S. rate.

Mail orders to: Communications Electronics Inc., Box 1045, Ann Arbor, Michigan 48106-1045 U.S.A. If you have a Visa or Master Card, you may call and place a credit card order. Order toll-free in the U.S. Dial 800-USA-DISK. In Canada, order toll-free by calling 800-CA1-DISK. If you are outside the U.S. or in Michigan dial 313-973-8888. Telex anytime 810-223-2422. Order your *Super Disk* diskettes now.

Copyright © 1986 Communications Electronics Inc.

Ad #102585-BA



Now 39¢ a disk

Order toll free 800-USA-DISK

THE MEGA KIT™

BUILD YOUR OWN PC-XT



\$1295.00

SYSTEM KIT INCLUDES:

MOTHER BOARD

Fully assembled and tested Mega Board with 256 K RAM. Mega board is 100% hardware compatible and the capacity for a full Mega Byte on Board.

Mega Bios Rom runs all the XT programs except BASICA. The ROM is an exclusive copyright on Display Telecommunications Corporation.

Complete Users Manual-fully illustrated

ENCLOSURE

Mega Case is specifically designed to accommodate our Mega Board XT. The case has a special bus expansion slot and requires power supply with a switch in the rear.

POWER SUPPLY

130 Watt/Switching

DATA STORAGE

DD/DS Floppy Disk Drive/Disk Drive Controller Card

KEYBOARD

Full feature advanced keyboard.

MEGA-BOARD ON DISPLAY
AT THE FOLLOWING LOCATIONS:

ELECTRONICS PROJECTS INCORPORATED
30 AIRPORT BLVD.
MOBILE, ALABAMA 36608
(205) 342-4565

HAWAIIAN INDUSTRIAL INSTRUMENTS
1154 FORT STREET MALL SUITE 200
HONOLULU, HAWAII 96813
TEL: (808) 533-4312

90 Day Warranty on the Mega Kit (Monitor & Video Card not included)

DTCTM DISPLAY
TELECOMMUNICATIONS
CORPORATION

INTERFIRST PLACE
8445 FREEPORT PARKWAY SUITE 445
P.O. BOX 27
IRVING, TEXAS 75062

PHONE: (214) 607-1382



TELEX: 510600176 DTC UD

Inquiry 133

NOVEMBER 1985 • B Y T E 477



SUNTRONICS CO., INC.

12603 Crenshaw Blvd., Hawthorne, CA 90250

1-800-421-5775 (Order Only)

(213) 644-1140 (CA Order & Info)

STORE HOURS

Mon-Fri 9 a.m. to 6 p.m.
Sat 10 a.m. to 5 p.m.

TERMS: VISA, MASTERCARD, C.O.D. (Cash or Certified Check Required). Check (Allow 2-3 Weeks for Clearing). Shipping & H.C. \$3.00 for 3 lbs. (plus \$5.00 for each add'l lb. CAH residents add Calif. Sales Tax \$10.00 Minimum Order). IBM and Apple are registered trademarks of IBM & Apple.

SUN-XT COMPUTER (IBM PC/XT COMPATIBLE)



- RAM EXPANDABLE TO 640 K
 - USES MS & PC-DOS OPERATING SYSTEMS
 - RUN LOTUS 1-2-3 FLIGHT SIMULATOR SYMPHONY DBASE II & III AUTO CAT, WORD STAR, MULTI PLAN... ETC.
- (DOES NOT RUN PROG. REQUIRE ROM BASIC.)

- CPU BOARD W/256 K RAM
- COMPUTER CABINET
- FULL FUNCTION KEYBOARD
- 135 W/POWER SUPPLY
- 2 DSDD DISK DRIVES
- FDC W/CABLE
- TTL MONITOR (AMBER OR GREEN)
- MONOCHROME GRAPHICS CARD W/PARALLEL PRINTER PORT.
- FULLY A & T (MEETS FCC CLASS "A" REG., FOR IND. & BUS. USE)

ONLY \$895.00

DEALER & OEM INQUIRES INVITED!!

SUN-XT CPU

- 8088 CPU (8087 OPTION)
- RAM EXPANDABLE TO 640K
- FULLY IBM COMPATIBLE
- DIMENSION SAME AS IBM PC/XT
- NO RAM INCLUDED
- 8 EXPANSION SLOTS

\$175.00

MONOCHROME GRAPHIC CARD

- HIGH-RES CHARACTER
- 720(H) x 348(V)
- 80 x 25 TEXT MODE
- RUN LOTUS 1-2-3 ETC.
- WITH PARALLEL PRINTER PORT

\$120.00

135W POWER SUPPLY **\$89.00**

150W POWER SUPPLY **\$109.00**

6 OUTLET SURGE SUPPRESSOR (MIDLAND ROSS IND.) **\$14.50**

10MB HARD DISK w/CONT **\$495.00**

20MB HARD DISK w/CONT **\$595.00**

ASYNC RS232 **\$59.00**

PARALLEL PRINTER CARD **\$39.00**

TEAC 558 DISK DRIVE **\$89.00**

HARD DISK DRIVE CONTROLLER (10MB OR 20MB) **\$159.00**

64K RAM KIT (9 EA) **\$8.50/KIT**

256K RAM KIT (9 EA) **\$39.00/KIT**

APPARAT EPROM BLASTER (FOR IBM) **\$129.00**

CITIZEN MSP-10 PRINTER **\$299.00**

TOHIBA 1340 PRINTER **\$599.00**

DSDD 5 1/4 DISKETTE **\$12.95/per 10 ea**

PARALLEL PRINTER CABLE **\$15.00**

FLOPPY DISK CONTROLLER

- STANDARD DOUBLE SIDE DOUBLE DENSITY
- RUN 2 INTERNAL & 2 EXTERNAL
- WITH CABLE

\$59.00

MULTI-FUNCTION BOARD

- RAM EXPANDABLE TO 384(K)
- SERIAL/PARALLEL PORT
- CLOCK CALENDAR W/BATTERY BACKUP
- GAME PORT
- SPOOL & RAM DISK

\$129.00

IBM STYLE CABINET

- 8 SLOT BACK PANEL
- COMES WITH MOUNTING BRACKET & HARDWARE
- FITS IBM POWER SUPPLY

\$59.00

MULTI-I/O BOARD

- FLOPPY DISK DRIVE CONTROLLER
- PARALLEL PRINTER PORT
- SERIAL I/O PORT (OPTION DUAL)
- CLOCK CALENDAR W/BATTERY BACKUP
- GAMEPORT

\$149.00

COLOR GRAPHIC CARD

- RGB & COMPOSITE VIDEO
- 640 x 200 HIGH-RES
- 320 x 200 LO-RES
- 80 x 25 TEXTMODE
- LIGHT PEN INTERFACE

\$99.00

RGB COLOR MONITOR

- 14" DISPLAY DB-9 CONNECTOR
- 640 x 240 HIGH-RES
- 2500 CHARACTERS (80 x 32)
- RGB TTL LEVEL, INTENSITY SIGNAL
- 0.39 mm DOT PITCH
- H-SCANNING 14.5K-17.8KHZ

\$365.00

"SAM SUNG" MONOCHROME MONITOR

- 12" AMBER OR GREEN
- 1000 LINES AT CENTER
- 30MHZ BAND WIDTH
- SEPARATE TTL SIGNAL INPUT
- DUAL INTENSITY SIGNAL LEVEL
- HIGH PERFORMANCE SHARP IMAGES

\$105.00

FULL FUNCTION KEYBOARD

- 83 KEY FULL FUNCTION
- POWER, CAPS, NUM LIGHT INDICATOR
- MECHANICAL TYPE SWITCH
- WITH CABLE

\$79.00

BMC* AMBER MONITOR \$65.00	TEAC* FLOPPY DRIVES \$85.00
*We are able to supply dealers with unlimited quantity of these items!	
HEXACE COLOR CARD with Parallel Port \$89.00	TANDON 100-2 Floppy Drives \$90.00
KOALA Speed Key System \$99.00	Touch Tablet with Software \$89.00
Master Piece from Kensington \$92.00	135 WATT Power Supply \$99.00
DOS 2.1 \$59.00	DOS 3.1 \$69.00

WANTED!

DEALERS - SCHOOLS
UNIVERSITIES
(Large & Small)
CORPORATIONS

\$ REWARD \$

YOU CAN STILL GET
COMPUTER PRODUCTS
FOR UNDER \$100.00

Here's 21 Unbelievable Specials!

IBM Compatible DRIVE CONTROLLER \$55.00	INTEL 8087 \$99.00
64K Upgrades 3 Set Minimum \$4.00	FLIP & FILE DISK TUB \$13.99
Monitor Stand TILT & SWIVAL \$13.44	CABLE IBM PARALLEL \$9.50
Surge Protector Voltguard \$29.00	Keytronics 5151 Compatible Keyboard \$89.00
SOME OVER \$100 SUPER SPECIALS	
SEAGATE Hard Disks With Controller 10Mb 20Mb \$399 \$549	CPU's Multi-Function Same as AST Sixpac With 384K \$159.00
Generic DS/DD Box of 10 \$10.00	DYSAN DS/DD Box of 10 \$27.99
Maxell DS/DD Box of 10 \$17.00	

ORDERS INSIDE CALIF. AND CUSTOMER SERVICE
213-679-1861

REWARD HOTLINE
800-228-4615
ORDERS ONLY

COMPUTER PRODUCTS UNLIMITED
1251 W. Sepulveda, Suite 135, Torrance, CA 90502

Transfers. No surcharge for credit cards. UPS, Fed-X and Emery shipping available. CA residents add 6% sales tax. Prices subject to change without notice. Not responsible for typos.

Incredible value!

Nashua™ Diskettes

LIFETIME WARRANTY!

85¢ ea. 5¼" SSDD Qty 50 **97¢** ea. 5¼" DSDD Qty 50

These are poly-bagged diskettes packaged with Tyvek sleeves, reinforced hubs, user identification labels and write-protect tabs. NASHUA Corporation is a half-billion dollar corporation and a recognized leader in magnetic media.

SOFT SECTOR ONLY! Sold in multiples of 50 only!

FOR ORDERS ONLY: 1-800-621-6827 (In Illinois: 1-312-256-7140)
INFORMATION & INQUIRIES: 1-312-256-7140

HOURS: 8AM-5PM Central Time, Monday-Friday
WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

DISK WORLD!, Inc.
629 Green Bay Road • Wilmette, Illinois 60091

DISK WORLD!

Authorized Distributor **NASHUA MAGNETIC MEDIA**

FANTASTIC LOW PRICES ON

BASF

QUALIMETRIC DISKETTES!

LIFETIME WARRANTY!

Buy in bulk and save 150 to the carton with envelopes, write-protect tabs and user ID labels. Boxed product is the same, except in cardboard boxes of 10

5.25" SSDD	Qty. 50	Qty. 150
5.25" DSDD	83 ea.	.80 ea.
5.25" DSDD-HD	94 ea.	.92 ea.
5.25" SSDD-96TPI	2.13 ea.	N/A
5.25" DSDD-96TPI	94 ea.	N/A
3.50 SSDD-135TPI	1.06 ea.	N/A
3.50 DSDD-135TPI	1.84 ea.	1.68 ea.
	2.40 ea.	2.28 ea.

NOTE: 3.50" diskettes in Quantity 50 are packed in plastic library cases. That's why they appear to be a better buy. But there are only 5 diskettes to a case... so the bulk diskettes are really a better deal, unless you like expensive little library cases.

FOR ORDERS ONLY: 1-800-621-6827 (In Illinois: 1-312-256-7140)
INFORMATION & INQUIRIES: 1-312-256-7140

HOURS: 8AM-5PM Central Time, Monday-Friday
WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

DISK WORLD!

Authorized Reseller
Information Processing **BASF**
Media

ATHANA DISKETTES

The great unknown!

79¢ ea. 5¼" SSDD Qty. 50 **85¢** ea. 5¼" DSDD Qty. 50

You've used these diskettes hundreds of times... as copy-protected originals on some of the most popular software packages. They're packed in poly-bags of 25 with Tyvek sleeves, reinforced hubs, user identification labels and write-protect tabs.

LIFETIME WARRANTY!

SOFT SECTOR ONLY! Sold in multiples of 50 only.

FOR ORDERS ONLY: 1-800-621-6827 (In Illinois: 1-312-256-7140)
INFORMATION & INQUIRIES: 1-312-256-7140

HOURS: 8AM-5PM Central Time, Monday-Friday
WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

DISK WORLD!, Inc.
629 Green Bay Road • Wilmette, Illinois 60091

DISK WORLD!

Authorized Distributor **ATHANA MAGNETIC MEDIA**

DISK WORLD! Ordering & Shipping Instructions

Shipping: 5¼" & 3½" DISKETTES—Add \$3.00 per each 100 or fewer diskettes. Other Items: Add shipping charges as shown in addition to other shipping charges. Payment: VISA and MASTER-CARD accepted. COD Orders: Add additional \$5.00 Special Handling charge. APO, FPO, AK, HI & PR Orders: Include shipping charges as shown and additional 5% of total order amount to cover PAL and insurance. Taxes: Illinois residents only, add 7% sales tax.

Prices subject to change without notice.
This ad supercedes all other ads.
Not responsible for typographical errors.
MINIMUM TOTAL ORDER: \$35.00

FOR ORDERS ONLY: 1-800-621-6827 (In Illinois: 1-312-256-7140)
INFORMATION & INQUIRIES: 1-312-256-7140

HOURS: 8AM-5PM Central Time
Monday-Friday

WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

DISK WORLD!, Inc.
629 Green Bay Road • Wilmette, Illinois 60091

DISK WORLD!

DISKETTE STORAGE CASES

AMARAY MEDIA-MATE 50: A REVOLUTION IN DISKETTE STORAGE

Every once in a while, someone takes the simple and makes it elegant! This unit holds 50 5¼" diskettes, has grooves for easy stacking, inside nipples to keep diskettes from slipping and several other features. We like it!

\$9.69 ea. + \$2.00 Shpng.

DISKETTE 70 STORAGE: STILL A GREAT BUY. Dust-free storage for 70 5¼" diskettes. Six dividers included. An excellent value.

\$9.95 ea. + \$3.00 Shpng.

DISK CADDIES The original flip-up holder for 10 5¼" diskettes. Beige or grey only. **\$1.65** ea. + 20¢ Shpng.

FOR ORDERS ONLY: 1-800-621-6827 (In Illinois: 1-312-256-7140)
INFORMATION & INQUIRIES: 1-312-256-7140

HOURS: 8AM-5PM Central Time, Monday-Friday
WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

DISK WORLD!, Inc.
629 Green Bay Road • Wilmette, Illinois 60091

DISK WORLD!

The value leader in
Computer supplies
And accessories.

PRINTER RIBBONS:

at
extraordinary prices!

Brand new ribbons, manufactured to Original Equipment Manufacturer's specifications, in housings. (Not re-inked or spools only.)

LIFETIME WARRANTY!

Epson MX-70/80 . . . \$2.70 ea. + 25¢ Shpng.
Epson MX-100 . . . \$4.08 ea. + 25¢ Shpng.
Okidata Micro83 . . \$1.37 ea. + 25¢ Shpng.
Okidata Micro84 . . \$2.98 ea. + 25¢ Shpng.

FOR ORDERS ONLY: 1-800-621-6827 (In Illinois: 1-312-256-7140)
INFORMATION & INQUIRIES: 1-312-256-7140

HOURS: 8AM-5PM Central Time, Monday-Friday
WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

DISK WORLD!, Inc.
629 Green Bay Road • Wilmette, Illinois 60091

DISK WORLD!



Now, the lowest prices ever on

3M Scotch® DISKETTES

LIFETIME WARRANTY!

The best deal on 3M diskettes you've ever seen!
FREE!
FLIP 'N FILE 15 with every order for 5.25" SSDD and DSDD.



\$1.36 ea. 5.25" SSDD with FREE Flip 'n File 15
5.25" DSDD with FREE Flip 'n File 15... \$1.67 ea.

MINIMUM ORDER: 50 Diskettes
(Orders less than 50 are \$1.39 and \$1.70, respectively.)

100% LIFETIME WARRANTY!

This is a Super Special Promotion. It was supposed to end May 31, 1985.

But we decided to buy more than 1,000,000 3M diskettes packed in the FREE Flip 'n File 15... and give you the benefits of this terrific value.

One word of warning: this offer is limited only to supplies on hand. Once this inventory is gone, that's it. The prices stay the same... but there's no FREE Flip 'n File.

The last time we ran an offer like this, everything sold out in about six weeks.

So don't wait. Order now.

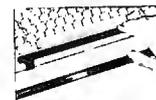
Other 3M diskettes	Qty. 20	Qty. 50
5.25" SSDD-96TPI	\$2.07 ea.	\$2.04 ea.
5.25" DSDD-96TPI	\$2.51 ea.	\$2.48 ea.
5.25" DSDD-HD FOR AT	\$3.18 ea.	\$3.14 ea.
3.50"SSDD-135TPI (Mac)	\$2.29 ea.	\$2.26 ea.

DATA CARTRIDGES

100% certified 3M data cartridges

DC-1000	\$12.62 ea.
DC-300XLP	\$19.38 ea.
DC-600A	\$20.61 ea.

Sold in cases of 10 only.
Add \$5.00 shipping per 10 data cartridges.



FIRST TOUCH KEYBOARD STRIP

The best way we've ever seen to avoid static danger. Adheres to the front ledge of your keyboard. Overpriced at \$19.95, so we cut the price to \$10.95 + \$1.50 Shipping.



A VERY SPECIAL OFFER

3M POST-IT NOTES & DISPENSER
Suggested Retail: \$20.95 Includes dispenser, 12 pads of 3" x 5" Post-It notes and Pilot Ball Point Pen. Order it with 50 3M diskettes or 10 data cartridges and it's only \$9.75 + \$3.00 Shipping.

DISK WORLD!

Authorized Distributor
Information Processing
Products



BUY NOW FOR XMAS

Be Sure of Stock & Delivery

COMPUTER CONNECTION
TOLL FREE ORDER LINE

PRINTERS

OKIDATA	
ML182P 120 cps	\$ 219
ML182 IBM Graphics Comp	219
ML182S 10" Carriage	259
ML192P, 160 cps	355
ML192 IBM Graphics Comp	355
ML192S, 160 cps	425
ML193P, 160 cps	499
ML193 IBM Graphics Comp	499
ML193S, 160 cps	569
ML84P, 200 cps	659
ML84 IBM	659
ML84S, 200 cps	775
Okimate 20	125
STAR MICRONICS	
SG-10, 120 cps, 2K buffer	\$ 219
SG-15, 120 cps, 2K buffer	389
SD-10, 180 cps, 10" carriage	359
SD-15, 160 cps, Corr. Qual.	475
SB-10 Draft & NLQ 24 wire printhead	625
EPSON	
LX80, 100 cps, 10" carriage	Call
FX80+, 160 cps, 10" carriage	Us
RX100, 100 cps, 15" carriage	First
FX100+, 160 cps, 15" carriage	For
LQ1500 Draft NLQ	Lowest
SQ2000, All New	Prices

*We Are An Authorized Dealer

BROTHER	
HR-25	\$ 435
HR-35	635
DYNAX	
DX15XL, 20 cps By Brother	\$ 365
DH-45 Dual Head, LQ & Dot Matrix	929
JUKI	
6100, L.Q. 18 cps w/proportional spc.	\$ 359
6300 L.Q. 40 cps	695
TOSHIBA	
P1340 P	\$ 525
P1340 S	525
P351 P, Faster than 1351	1125
P351 P/S, Faster and More Versatile	1145
PANASONIC	
1091 w/Tractor, 120 cps, 1 yr. war.	\$ 255
1092, 10" carriage, 180 cps	375
1093, 15" carriage, 160 cps	535

HARD DISK DRIVES

MICRO-SCI	
10 Meg w/cont. formatted for IBM	\$ 535
20 Meg w/cont. formatted for IBM	795
ALPHA OMEGA	
10 Meg w/Controller Card	\$ 545
20 Meg w/Controller Card	749
30 Meg w/Controller Card	999
20 Meg for AT	565
33 Meg for AT	799

DISK DRIVES

TANDON	
TM100-2 for IBM PC	\$ 85
MITSUBISHI	
1/2 Ht. 360K	\$ 95
TEAC	
55B Double Sided 360K	\$ 89
Quad Density	159
Drives For Apple & Franklin	
MICRO-SCI	
A-2	\$ 149
A.5C for IIC w/cable	155
A.5 1/2 height for IIE	155
Controller Add	55

PRINTER ACCESSORIES

ORANGE MICRO	
Grappler +	\$ 79
Buffered Grappler +, 16K exp. 64K	150
TOSHIBA	
Bi-Directional Trac. 1351/351	\$ 149/155
Font Disk for Down loading P1351	50
MICROTEK	
Dumpling GX (same as Grappler +)	\$ 89
Dumpling GX w/16K buffer	127
Dumpling GX w/32K buffer	137
Additional Buffering 16K	9
FOURTH DIMENSION	
Par. Card & Cable for Apple	\$ 47
OKIDATA	
Plug and Play for IBM	\$ 49
Tractor for 182 & 192	39
JUKI	
Bi-Direc. Tractor for 6100/6300	\$ 115/125
Serial Interface	65
CABLES	
IBM PC to Parallel Printer	\$ 16
Serial Cable	16
Centronics M/M or M/F	18

DISPLAY MONITORS

QUADRAM	
Amber chrome IBM compatible	\$ 169
AMDEK	
V300G	\$ 115
V300A	119
V310A for IBM PC	149
Color 300	235
Color 500 Color Composite	319
Color 600 RGB Hi-Res	429
Color 710 Super Hi-Res	545
TAXAN	
IBM Green Monochrome #121	\$ 129
IBM Amber Monochrome #122	139
RGB IBM w/Cable #420	369
RGB Super Hi-Res. #640 Best Buy	549
RGB/Comp. Med. Res. #210	245
PRINCETON GRAPHICS	
HX-12 for use with IBM PC	\$ 435
Max 12E Amber for IBM	159
SR12 Super Hi-Res	575
Scan Doubler	185
QUIMAX	
PX-4, RGB Hi-Res w/Gr. Text Mode	\$ 410
DM-14 Monochrome for IBM	150

PRE CHRISTMAS SPECIALS!!

EXECUTIVE COMPAQ

- Compaq Desktop w/640K
- Two 360K Disk Drives
- 10 meg Hard Disk
- Taxan Green Monitor
- Epson FX 185 w/Cable

\$3795

EXECUTIVE IBM

- IBM AT w/512K
- 33 meg Hard Disk
- 1.2 meg Floppy
- Monochrome Monitor Card
- Parallel & Serial Ports
- Amdek V310A

\$4295

COMPAQ STARTER

- Compaq Desk Top I
- 128K
- 1 Dbl/Dbl Disk Drive
- Taxan Amber #116

\$1799

IBM STARTER

- IBM XT w/256K
- One IBM Floppy
- Color Card w/Printer Port
- Fortis Amber

\$1999

"THE COMPANY THAT DELIVERS"

IBM PC ACCESSORIES

IBM	
IBM Dos 3.1	\$ 65
PARADISE	
Modular Graphics Card	\$ 259
Module A	75
Module B 256K w/C & C	120
5-Pak	175
64K MEMORY UPGRADE	
64K (9 chips) 200ns & 150ns	\$8.00
PERSYST BOARD	
Bob Hi-Res Display Adaptor	\$ 345
QUADRAM	
Quad Color 1 Board	\$ 179
Exp. Quadboard w/64K & Game Port	199
Quadlink 3000 Run Apple sft on IBM	329
APPLE & FRANKLIN ACCESSORIES	
ACCESSORIES	
Kensington System Saver	\$ 69
Masterpiece Control Unit	99
MICROTEK	
Serial Interface	\$ 75
MICROMAX	
Viewmax 128K extended 80 col. card	
for Apple IIE w/64K	\$ 119
80 col. card for Apple II & II+	139
ADVANCED LOGIC SYSTEMS	
Z Engine 2.2	\$ 115
APPLE	
Super Serial Card	\$ 139
ASTAR	
RF Modulator	\$ 14
MICRO-SCI	
64K, 80 Col. Card	\$ 85
VUTEK (2 yr. war.)	
Vutek - CPS Board, RGB & Composite	
w/Par. & Ser. Ports, 2 Yr. War.	\$ 189
Color Card (Herc. comp.) w/Para.	150
Monographic Card (Herc. comp.)	275
AST RESEARCH	
Six Pak + w/64K & Sidekick	\$ 225
Six Pak + w/384K & Sidekick	255
Game Port	49
KEYTRONICS	
KB5151	\$ 175
MICROTEK	
Monochrome Text Par. & Ser.	\$ 169
Color Graphics Card	165
TECHMAR	
Graphics Master	\$ 449
256K Memory Upgrade	99

PERSONAL SYSTEMS

APPLE	
Professional Sys. incl: Apple IIE w/128K & 80 col., tilt mon., duo disk w/con't kit	\$1339
Apple IIc Lightweight Portable	Call
IBM	
IBM PC 64K, 1 Drive	\$1460*
IBM PC, 2 Drives w/256K	1535*
IBM XT, 10 Meg, 360K Dr. w/256K	2399*
IBM XT Bare w/256K & IBM Floppy	1899*
Call About All "AT" Systems	
*Call for current IBM prices	
SANYO	
MBC 550-2 w/1, 320K Drive & sftwr.	\$ 750
MBC 555-2 w/2, 320K Drives & more software	977
775 Portable	1795
Serial Port for Sanyo	65
COMPAQ	
256K, w/2 - 320K Drives	\$1969
Desk Top Model 1	1699
Desk Top Model 2	1975
Desk Top Model 3	Call
Desk Top Model 4	Call
We have "286" Ports. & D.P. In stock	
WYSE	
1100-1 incl. 256K w/two 360K Drives, 1 par & 2 ser. ports	\$1399
1100-2 incl. 10 meg, 1 floppy, 256K, 1 par. & 2 ser. ports	2599
*Wyse Monitors & Exp. Chassis Available	

SOFTWARE

LOTUS DEVELOPMENT CORP.	
Lotus 1-2-3	\$ 289
Symphony	420
ASHTON TATE	
D Base II	\$ 299
D Base III	389

PRINTER SWITCH BOX

EXPONENT	
Centronics Two Switch	\$ 60
Centronics Four Switch	85
Serial Two Switch	45
Serial Four Switch (Herc. comp.)	69

MODEMS

ANCHOR	
Mark XII	\$ 199
Volksmodem XII	179
Express 1200	265
HAYES MICRO	
300 Baud Smart Modem	\$ 149
1200 Baud Smart Modem	389
1200 B for IBM PC w/SM II	375
2400 Baud Modem	645
Micro Modem IIE	149
Chronograph	189
300 For Apple IIc w/Sftwr	Call

DISKETTES

PC DISKETTES	
Sgl./Dbl. (Box of 10)	\$ 13
Dbl./Dbl. (Box of 10)	15
COMPUTER CONNECTION	
Dbl./Dbl. (Box of 10)	\$ 16
Sgl./Dbl. w/Disk Container (10)	15
Dbl./Dbl. w/Disk Container	17
Bulk 50 & Up - Dbl./Dbl.	1.35 ea.

We Stock What We Sell!!

IF YOU SEE IT ADVERTISED FOR LESS, CALL
COMPUTER CONNECTION FIRST FOR LOWEST QUOTE!

MAIL ORDER:

17121 S. Central Avenue, Unit L
 Carson, California 90746



NO SURCHARGE FOR CREDIT CARDS

We accept VISA, MasterCard, COD (w/advance), Certified Checks or Wire Transfers. Minimum Shipping Charge \$4.00. Some items subject to back order. California Res. add 6 1/2% Sales Tax. All returns are subject to a 15% restocking charge and must be authorized by store manager within 10 days. Prices subject to change without notice. This Ad supersedes all others.

ORDER LINE (800) 732-0304

(Outside California)

(213) 635-2809

(Inside California)

Mon.-Fri. 7 a.m. to 6 p.m.
 Saturday 11 a.m. to 3 p.m.

CUSTOMER SERVICE:

(213) 635-5065
 Mon.-Fri. 9 a.m. to 3 p.m.

COMPUTER CONNECTION



American Semiconductor
computers • components • hardware • software

TOLL FREE

10 mb IBM Compatible Winchester HARD DRIVE **245.**

20 mb For AT, XT, Compaq, Tandy, hi speed Corona **435.**

41256 MOS/OKI NAT. HIT **3.00**

1/2 HEIGHT Floppy Drives . 75
80287 FOR AT . 175
8087 Math Coprocessor . 99
AT TURBO KITS CALL
Winchester Controller Card 139
4164 . 796
EPSON Fx-100 . 459
COLOR CARDS . 130
Flight Simulator . 39.50
PC Tape Backup . 399
AT Tape Backup . 859

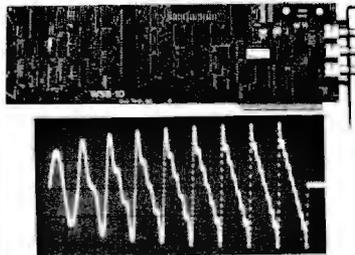
Call us for your other needs.

1-800-237-5758
SALES EXT. 505

Vendor Line 813-948-3183 Tech. Line 813-948-1890

Inquiry 21

WAVEFORM SYNTHESIZER



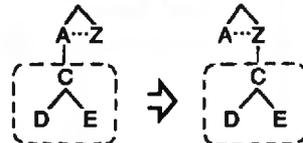
- For IBM-PC/XT/AT and compatibles
- Generates user-definable signal
- Up to 2000 points per envelope

\$795.00

QUA TECH, INC.
478 E. Exchange St. Akron OH 44304
(216) 434-3154 TLX: 5101012726

Inquiry 818

MVDIR



'mvdrr' moves a directory and all of its contents from one place to another in the DOS file system. Now you can easily maintain your file system. Other utilities are included.

\$49 for unprotected binary
\$10 for manual only

For quickest response, order with Visa/MC by calling
800-621-2283 ext 912
In TX: 800-442-5321 ext 912

Or send check/money order to address below. Add \$5 shipping for binary, \$3 for manual only; non-USA orders, add \$12 for binary, \$10 for manual only. TX orders add 6 1/8% sales tax.

Network Specialists, Inc.
Dept. B511, 13109 Chandler Drive
Dallas, TX 75243

Inquiry 294

PERSONAL COMPUTER OWNERS

EARN \$1000-\$5000 MONTHLY

Selling simple services performed by their computers

WORK AT HOME IN SPARE TIME

Get free list of 100 best services to offer

Write
C.I.L.A.
P.O. Box 60369
San Diego, CA
92106-8369

Inquiry 81

NEW Missing Half of your Monitor?



Glare and reflections from bright office lighting and windows cut the clear view of your monitor screen, making it hard to read, causing slow production. New See R.T. anti-glare spray coating eliminates these problems permanently with one quick easy application. New See R.T. has performance equal to the most expensive anti-glare screens, giving you clear, sharp images, bright colors and increased contrast on all monitor and T.V. screens. Order now and receive the large can that will treat 3 monitors. Full money-back guarantee.

Send \$14.95 to
Advanced Optics
10241 B Ridgewood
El Paso, Texas 79925



NAME _____
ADDRESS _____
CITY _____ ST _____ ZIP _____

Inquiry 12

ICs PROMPT DELIVERY!!!
SAME DAY SHIPPING (USUALLY)

OUTSIDE OKLAHOMA: NO SALES TAX

640 Kbyte MOTHERBOARD KITS: IBM PC/XT Zenith 150 & 100. Compact Portable & Plus: \$87.70

8087-2 Math Coprocessors	\$150.00
DYNAMIC RAM	
256K 64Kx4	150 ns \$8.45
256K 256Kx1	120 ns 3.50
256K 256Kx1	150 ns 2.65
128K 128Kx1	120 ns 6.50
64K 16Kx4	150 ns 2.75
64K 64Kx1	150 ns 1.10
EPROM	
27C256 32Kx8	250 ns \$9.99
27256 32Kx8	250 ns 5.75
27128 16Kx8	250 ns 3.20
27C64 8Kx8	150 ns 5.25
2764 8Kx8	250 ns 2.75
STATIC RAM	
6264LP-15 8Kx8	150 ns \$3.99

OPEN 6 1/2 DAYS: WE CAN SHIP VIA FED-EX ON SAT.

MasterCard/VISA or UPS CASH COD
Factory New, Prime Parts **uPcs**
MICROPROCESSORS UNLIMITED
24 000 S. Peoria Ave. - (918) 267-4961
BEGGS OK 74421

Prices shown above are for Oct. 14, 1985
Please call for current prices. Prices subject to change. Please expect higher or lower prices on some parts due to supply & demand and our changing costs. Shipping & insurance extra. Cash discount prices shown. Orders received by 6 PM CST can usually be delivered to you by the next morning, via Federal Express Standard Air or 36.00 or Priority One or 315.00

Inquiry 259

LIFETIME WARRANTY
ON ALL APPARAT MANUFACTURED CARDS
AT RAM ONLY CARD

Each card expands AT memory by maximum of 2 MEG when using 256K DRAM. Also uses 64K RAM. FEATURES: Starting address of any 128K boundary within 16 Meg memory range • Fills memory to 640K with starting address of 256K or 512K • Split memory option

With 512K RAM installed \$249.00
With 128K RAM installed \$199.00

Apparat, Inc.
ADD ON AND ON AND ON AND ON AND ON
4401 So. Tamarac Parkway
Denver, Colorado 80237
ORDERING AND DEALER INFORMATION
800/525-7674
Customer Service: 303/741-1778
Retail stores in Denver & Chicago

Inquiry 418

***** APPLE IBM *****

PRINTERS—PLOTTERS—MODEMS
EXTERNAL PRINTER BUFFER

- 64K RAM
- BUILT-IN MICROPROCESSOR
- WORKS WITH ANY RS232 INTERFACE
- 8 SELECTABLE BAUD RATES
- SEPARATE INPUT AND OUTPUT SPEEDS
- SELECTABLE CHARACTER ATTRIBUTES
- XON/XOFF OR HARDWARE HANDSHAKE
- BUFFER LEVEL AND STATUS DISPLAY
- STANDARD DB25 CONNECTORS
- ACCEPTS ANY DATA FORMAT

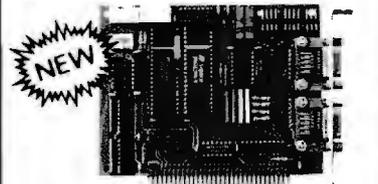
PCB, ROM & SCHEMATICS \$75
FULL KIT \$135
ASSEMBLED & TESTED \$185

5-CHANNEL 256K ALSO AVAILABLE

MICRO SYSTEMS DESIGN
PO BOX 1187
LOOMIS, CA 95650
(916) 652-5665

Inquiry 252

RS-422
Communications Board



- For IBM-PC/AT/XT and compatibles
- Dual RS-422 serial interface
- Programmable to 56k baud
- Differential drivers to 4000 ft.

\$345.00

QUA TECH, INC.
478 E. Exchange St. Akron OH 44304
(216) 434-3154 TLX: 5101012726

Inquiry 426

DoKay

COMPUTER
PRODUCTS,
Inc.

ORDER TOLL FREE

(800)
538-8800

(CALIFORNIA RESIDENTS)

(800)
848-8008

VISA

MasterCard

STATIC RAMS

2101	256 x 4	450ns	1.90
2102	1K x 1	450ns	.70
2102L-4	1K x 1	450ns	.80
2102L-2	1K x 1	250ns	1.29
2111	256 x 4	450ns	2.29
2112	256 x 4	450ns	2.29
2114	1K x 4	450ns	.90
2114-20	1K x 4	250ns	1.10
2114L-4	1K x 4	450ns	1.20
2114L-3	1K x 4	300ns	1.30
2114L-2	1K x 4	200ns	1.40
2147	4K x 1	55ns	3.95
5101	256 x 4	450ns	3.00
TM84044-4	4K x 1	450ns	2.90
TM84044-3	4K x 1	300ns	3.45
TM84044-2	4K x 1	250ns	3.90
TM84110	1K x 8	250ns	6.90
TM82010-20	2K x 0	250ns	2.40
TM82010-10	2K x 0	150ns	2.90
TM82010-10	2K x 0	100ns	4.40
HM0110-4	2K x 0	200ns	CMOS 2.40
HM0110-3	2K x 0	150ns	CMOS 2.90
HM0110-2	2K x 0	100ns	CMOS 4.40
HM0110L-4	2K x 0	200ns	CMOS 2.40
HM0110L-3	2K x 0	150ns	CMOS 2.90
HM0110L-2	2K x 0	100ns	CMOS 4.40
Z-5132	4K x 0	300ns	29.90
HM82040-15	8K x 0	150ns	CMOS 5.90
HM82040-12	8K x 0	150ns	CMOS 6.90
HM82040-15	8K x 0	120ns	CMOS 8.90

DYNAMIC RAMS

TM84027	4K x 1	250ns	1.45
UP3411	4K x 1	300ns	1.95
HM8200	4K x 1	300ns	1.95
HM4100	8K x 1	250ns	.40
HM8200	8K x 1	250ns	.40
4110-20	16K x 1	250ns	.70
4110-15	16K x 1	150ns	.90
4110-12	16K x 1	120ns	1.40
2110	16K x 1	150ns	3.90
4104-20	64K x 1	250ns	5v .80
4104-20	64K x 1	250ns	5v .80
4104-15	64K x 1	150ns	5v .70
41200-20	256 x 1	250ns	3.80
41200-15	256 x 1	150ns	3.80

EPROMS

1702	256 x 8	1 us	3.95
2700	1K x 8	450ns	2.40
2705	1K x 8	450ns	2.40
2710	2K x 8	450ns	3.95
2710-1	2K x 8	450ns	3.95
TM82510	2K x 8	450ns	3.95
TM82710	2K x 8	450ns	3.95
TM82532	4K x 8	450ns	3.95
2732	4K x 8	450ns	3.95
2732 A-4	4K x 8	450ns	21v 3.95
2732 A-35	4K x 8	350ns	21v 3.95
2732 A	4K x 8	250ns	21v 5.95
2732 A-2	4K x 8	200ns	21v 8.95
2704	8K x 8	450ns	3.95
2704-20	8K x 8	250ns	3.95
2704-20	8K x 1	250ns	5v 5.90
TM82004	8K x 8	450ns	5v 8.90
MC800704	8K x 8	450ns	5v 17.90
MC800700	8K x 8	300ns	5v 19.90
27120-45	16K x 0	450ns	5v 5.90
27120-30	16K x 0	300ns	5v 5.90
27120-25	16K x 0	250ns	5v 6.90
27200-25	32K x 8	250ns	14v 9.90

CRYSTAL CLOCK OSCILLATORS

PART NO.	FREQUENCY	PRICE
1.000	1.0000 MHz	6.90
1.843	1.8432 MHz	6.90
2.000	2.0000 MHz	6.90
4.000	4.0000 MHz	6.90
8.000	8.0000 MHz	6.90
10.000	10.0000 MHz	6.90
10.000	10.0000 MHz	6.90
10.432	10.4320 MHz	6.90
10.800	10.8000 MHz	6.90
20.000	20.0000 MHz	6.90
32.000	32.0000 MHz	6.90

CRYSTALS

1.0000 MHz	2.90	8.0000 MHz	1.95
1.8432 MHz	2.90	10.0000 MHz	1.95
2.0000 MHz	1.95	10.7386 MHz	1.95
2.0972 MHz	1.95	12.0000 MHz	1.95
2.4570 MHz	1.95	14.3182 MHz	1.95
3.2760 MHz	1.95	15.0000 MHz	1.95
3.8795 MHz	1.95	16.0000 MHz	1.95
4.0000 MHz	1.95	17.4300 MHz	1.95
4.1043 MHz	1.95	18.0000 MHz	1.95
4.9100 MHz	1.95	18.4320 MHz	1.95
5.0000 MHz	1.95	19.6600 MHz	1.95
5.0600 MHz	1.95	20.0000 MHz	1.95
5.1650 MHz	1.95	22.1184 MHz	1.95
5.2420 MHz	1.95	32.0000 MHz	1.95
5.7143 MHz	1.95	36.0000 MHz	1.95
6.0000 MHz	1.95	40.0000 MHz	1.95
6.1440 MHz	1.95	48.3580 MHz	1.95
6.4000 MHz	1.95	49.0000 MHz	1.95
6.5630 MHz	1.95	49.8000 MHz	1.95

32.768 KHz.99

VOLTAGE REGULATORS

78M05UC	.34	7824K	1.34
7805T	.74	7906K	1.44
7808T	.74	7912K	1.44
7812T	.74	7916K	1.44
7815T	.74	7924K	1.44
7824T	.74	79L05	.98
7905T	.84	79L12	.98
7908T	.84	79L15	.98
7912T	.84	79L05	.78
7915T	.84	79L12	.78
7924T	.84	79L15	.78
7905K	1.34	79N05K	9.90
7912K	1.34	79N12K	9.90
7915K	1.34	UA8240	1.90

UCT=TO-220 K=TO-3 L=TO-92

We will try to BEAT
All Competitor's Prices
CALL for Quote!

DISC CONTROLLERS

1001	6.90	2706	30.90
1771	14.90	2707	30.90
1781	22.90	8040	33.90
1793	22.90	8272	19.90
1795	22.90	M80076	22.90
1797	22.90	M80077	22.90
2143	6.90	MC3470	4.90
2701	30.90	UP0705	10.90
2703	30.90		

CRT CONTROLLERS

8045	11.90	CRT6027	10.90
8047	10.90	CRT6037	20.90
8047	23.90	DP8350	30.90
8045	10.90	H040506	11.90
7220	30.90	MC1372	8.90
8275	28.90	TM89910A	30.90

UV ERASERS

QUV-T8/1 \$49.95
ECONOMY Model



• Erases 15 EPROMS in 20 minutes
• Plastic Enclosure

6500	6500 A		
6502	4.90	6502A	5.90
6504	6.90	6520A	5.90
6505	8.90	6522A	9.90
6507	9.90	6532A	10.90
6520	4.30	6545A	12.90
6522	4.90	6551A	10.90
6532	8.90		
6545	8.90	6500 B	7.90
6551	8.90		

6800	68B00		
6800	2.90	2 MHz	
6802	7.90		
6803	17.90		
6808	12.90	68000	9.90
6809E	9.90	68002	11.90
6809	8.90	68005	11.90
6810	2.90	68010	5.90
6820	4.30	68021	9.90
6821	2.90	68040	18.90
6822	13.90	68045	18.90
6840	11.90	68050	5.90
6843	23.90		
6844	24.90	68000	34.90
6845	11.90	68047	23.90
6847	10.90	68048	19.90
6850	2.90	68052	14.90
6852	5.90	68061	8.90
6857	7.90	68064	17.90
6862	10.90	68076	19.90
6865	6.90		
6860	1.90		
6863	21.90		

8000	8200		
8031	14.90	8253	6.90
8035	8.90	8253-5	7.90
8039	5.90	8255	4.45
IR8-8080	10.90	8255-5	4.90
IR8-8073	20.90	8257	7.90
8000A	3.90	8257-5	8.90
8005	4.90	8259	5.90
8005A-2	11.90	8259-5	6.90
8006	24.90	8271	8.90
8007-3 (5 MHz)	124.90	8272	10.90
8007-2 (8 MHz)	100.90	8274	20.90
8008	10.90	8275	20.90
8009	8.90	8276	8.90
		8279-5	7.90
		8282	8.45
		8283	0.45
		8284	4.40
		8288	8.45
		8297	8.45
		8298	12.90
		8299	44.90
		8292	12.90

8100	8300		
8131	2.90	8303	2.90
8155	8.90	8304	1.90
8156-2	7.90	8307	2.90
8156	6.90	8308	2.90
8155-2	20.90	8310	3.90
		8311	3.90

8200	8700		
8202	23.90	8741	20.90
8203	30.90	8748	10.90
8205	2.90	8749	20.90
8212	1.75	8755	23.90
8214	3.75		
8216	1.75		
8224	2.29		
8225	1.75		
8228	3.45		
8237	12.90		
8237-5	14.90		
8238	4.45		
8243	4.45		
8250	6.90		
8251	2.90		
8251A	4.45		

Z-80	Z-80 B		
Z80-CPU	1.95	Z80-DMA	6.95
Z80-CTC	1.95	Z80-PIO	2.45
Z80-DART	0.95	Z80-SIO/0	0.95
Z80-DMA	7.95	Z80-SIO/1	0.95
Z80-PIO	1.95	Z80-SIO/2	0.95
Z80-SIO/0	0.95	Z80-SIO/0	0.95
Z80-SIO/1	0.95		
Z80-SIO/2	0.95		
Z80-SIO/0	0.95		

Z-80 A

Z80A-CPU	2.45	Z80B-DART	10.95
Z80A-CTC	2.45	Z80B-SIO/0	20.95
Z80A-DART	7.95	Z80B-SIO/2	20.95

5 1/4" Diskettes
NO LABEL:(ROFT SECTOR w/HUB RING)
25 per package
SS/DD... 24.75 or .99 ea.
DS/DD... 28.75 or 1.19 ea.
2-YEAR WARRANTY
ON ALL BULK DISKETTES

APPLE ACCESSORIES

Parallel Printer Card	49.95
80-Col. card for Apple II+	149.95
80-Col. card for Apple IIe	129.95
Checkmate 80-Column Card	69.95
Serial Card (communication)	69.95
Clock Calendar card	79.95
Cooling Fan	38.95
Power Supply	69.95
Joystick	29.95
Joystick Adapter Apple IIc	14.95
RF Modulator	13.95
Disk Drive Full Height	169.95
Disk Drive 1/2 Height	169.95
Controller Card	49.95
Apple Paddles	5.95
16K Card	39.95
16K Bare Board	13.95
Extend-A-Slot	34.95
Paddle Adapple	29.95
Keala Touch Pad	99.00
Magic Touch Pad w/Joystick	79.95
Keytronic Keyboard	219.00
Apple Keyboard (Taiwan)	149.95

1985 - THE IC MASTER -



Your ticket to fast and easy IC selections

\$89.95 Inquiry 136

VT100 \$150*

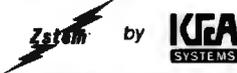
* plus your
PC, jr, XT, AT or compatible

ZSTEMpc-VT100 Smart Terminal Emulator
132-col. by windowing - no addit. hardware
Double High Double Wide Characters
Full VT100 line graphics. Smooth scrolling
2-way file transfers incl. XMODEM and KERMIT
Full keyboard softkeys/MACROS
Speeds to 38.4KB. High Throughput
Color/graphics, monochrome & EGA support
International Font Support
Single Key DOS Access
ZSTEMpc-VT100 \$150. ZSTEMpc-D200 \$125.
30 day money back guarantee. MC/VISA.

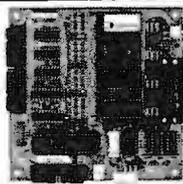
KEA SYSTEMS LTD.

#412 - 2150 W. Broadway
Vancouver, B.C. CANADA V6K 4L9
Support (604) 732-7411
TELEX 04-352848 VCR

Orders Toll Free (800) 663-8702



Inquiry 397



NOW WITH 8K RAM
FOR THE SAME PRICE

SIBEC 51

8051/52 DEVELOPMENT BOARD

8051-Based Single-Board Computer with
Monitor/Debugger

- 4 28-pin byte-wide sockets; monitor will program EEPROMS.
- Perfect for System Development and Educational Applications



\$335



Binary Technology, Inc.

MAIN ST • P.O. BOX 67
MERIDEN, NH 03770 • 603/469-3232

Inquiry 37

Z-Shell

Unix-like commands
Amazing ease of use!

Ever forget what you are doing?
Z-Shell edits and re-runs previous
DOS commands. Z-Shell's
aliases make:

```
asm p1; link p1;
erase p1.sym
```

Just "assemble"—no clumsy
batch files. Run many com-
mands on one line! Will run
with SideKick; works on clones.
Detailed 40-page manual. Only
\$79.50!

Workman & Associates

112 Marion Avenue, Pasadena, CA 91106
(818) 796-4401

Please request our new catalog

Inquiry 389



PORTABLE MEMORY EXPANSIONS

8K MEMORY MODULES \$29
For Model 100, NEC PC-8201A
& Olivetti M10

24K MEMORY MODULES \$99
For Tandy 200

128K SIDESTAR \$399
A Ram Disk Cartridge for the NEC Starlet

128K SIDECAR \$259
Ram Cartridge for the NEC PC-8201A

TTXpress 1280 \$139
Portable Thermal Printer—2.2 lbs., bat. oper.

FREE SHIPPING IN USA

(800) 732-5012 (805) 987-4788 (in Calif.)

PURPLE COMPUTING VISA/MC & AMER. EXP.
420 Constitution Ave., Camarillo, CA 93010

Inquiry 316



NEW!

SafeSkin™ KEYBOARD PROTECTOR

Remains in place during keyboard use. Prevents
damage from liquid spills, dust, ashes, etc. Fits
like a second skin, excellent feel. Available for:
IBM-PC, AT, Apple (all), Compaq, Model 100,
NEC 8201, C64, Zenith 150, DEC, Kaypro and
many others. Send \$29.95, check, M.O., Visa
& MC include exp. date. Specify computer type.
Dealer inquiries invited. Free brochure avail.

Merritt Computer Products, Inc.
2925 LBJ Fwy. #180 / Dallas, Texas 75234
(214) 942-1142

Inquiry 244



SHOOTER™ EPROM PROGRAMMER

PRICE
\$395⁰⁰

- 128K RAM
- Built-In RS 232 Port
- Programs 2716-27256
- Works with any computer or dumb terminal
- Stand alone mode

LOGICAL 1321 NW 65th Place
FT. Lauderdale, FL 33309
TEL. 1-800-EE1-PRODM
SEE OUR AD ON PAGE 284

Inquiry 225

AMBER CRTs

- Eliminates strobe, flicker, and eye fatigue
- Made with Lead/Strontium impregnated glass that stops X-ray emission
- Available in slow decay green or medium decay "European Amber" (the standard in Europe)
- High-contrast double dark face glass that also cuts U.V. radiation
- Tube face is etched to stop glare
- Ideal for word processing and programming, yet fast enough for games and graphics
- Warranted for one full year against manufacturing defects or tube failure
- Comes with a 30-day money back guarantee
- Easily installed (comes with pre-mounted hardware)

Now, you can easily upgrade your monitor to exceed European standards for persistence and color with the installation of a Langley-St. Clair Soft-View™ CRT! Available for the TRS-80™, TeleVideo™, Kaypro™, Heath™, DEC™, Zenith™, IBM PC™, Apple III™, and a wide variety of other monitors.

TO ORDER: CALL 800 221-7070
Langley-St. Clair Instrumentation Systems, Inc.
132 W. 24th St.
New York, NY 10011
In New York call 212 989-6876

Get the ProDOS™ advantage for
+
all your Aztec C65™ programs

VIX is a UNIX like operating system designed to run Manx's Aztec C65 software under ProDOS. With VIX, programs running under the SHELL will run under ProDOS including c65, cci, as65, asi, In, mklb and others. System includes:

- Standard utilities: cat, cp, date, l, mkdir, ren, rm and stty.
- An improved library written in 6502 assembly.
- A fast screen editor with undelete, auto-indent, work wrap and more.
- Source code to entire system except editor.

VIX - \$49.95 + \$3.50 shipping
Balanced binary tree data base library- \$75
b-tree with source-\$350

Eclipse Systems

223 Matthew Road
Merion Station, Pa. 19066
(215) 664-2419

Inquiry 143

FREE SOFTWARE FROM THE PUBLIC DOMAIN

User Group Software isn't copyrighted, so no fees to pay! 1000's of CP/M and IBM software programs in .COM and source code to copy yourself! Games, business, utilities! All FREE!

	Rent	Buy
IBMPC-SIG 1-370 Diskettes	400.	800.
IBMPC-BLUE 1-116 Diskettes	145.	375.
SIG/M UG 1-222 Diskettes	130.	625.
CP/M UG 1-92 Diskettes	45.	250.
PICO NET 1-34 Diskettes	25.	100.
KAYPRO UG 1-39 Diskettes	45.	90.
EPSON UG 1-39 Diskettes	45.	90.
Commodore CBM 1-28 Diskettes ..	25.	65.

Public Domain User Group Catalog Disk \$5 pp.
(payment in advance, please)
Rental is for 7 days after receipt, 3 days grace to return. Use a credit card, no disk deposit.

Shipping, handling & Insurance \$9.50 per library.
(819) 941-0925 Orders & Technical (9 to 5)
(819) 727-1015 24 Hr. 3 Min. Info Recording
Have your credit card ready!

National Public Domain Software
1533 Avohill Dr.
Vista, CA 92083

BBB AM EX

Inquiry 275

Computer Systems

VIASYN 816/286-H40 w/256K SPUZ&.5MDrv/H \$7,995
VIASYN 816/C-H20 with MI-286 CPU, 5 1/4" & 8" Floppy and TAPE \$7,695
VIASYN 816/10-H40 w/ Two 5 1/4" FLPY'S \$5,395

CALL FOR OTHER SYSTEM CONFIGURATIONS

ULTRA PC/XT COMPATIBLES:
XT-256 w/8 slots, 135W P/S, Dual Floppy, Monitor, Printer Port - Can be 100% Compatible \$995
BLUE MAX 640K, Dual FLPY, CLK-CAL, S&P Ports, 5 Slots, Monitor, 5 & 8MHz CPU Clock \$1,649

MORROW PIVOT II

MORROW PIVOT II Portable 14 Lb., w/4 HR Battery, 640X200 Luminescent Screen, 2X5 1/4" FLPY'S, S,P,RGB/COMPST. & Expansion Chassis Ports, 1200 Baud Modem, PC Compat. w/MS-DOS 2.11 & GSS-VDI for PC Graphics Devices, CLK-CAL w/Appt. Scheduler & Calc. 256K/640K \$2,439/\$2,589
MORROW MD3/MD11 with MDT70 \$1,295/\$2,039
MORROW MD11 MDT70 & HR-15-XL Printer \$2,295



data systems

ZENITH Z-158 PC-DESKTOP SYSTEM: 2 DRVS, 320K, S&P Ports, Includes MD-DOS, & 8 MHz Switch \$1,849
640K RAM OPTION / 1/2 HT 10Mb TAPE \$99/\$495
2 FLOPPY & 10Mb Drives / 20Mb Drives \$2,449/\$2,589



"JACKINTOSCH"
520 ST

COLOR SYSTEM 32/16 BIT 68000 CPU, 512K RAM, 500K DRIVE, 4 COLOR GRAPHICS 640X200 RES., MENU DU MOUSE, TOS, BASIC & LOGO SOFTWARE, MUSIC GENERATOR, PARA., SERIAL & JOYSTICK PORTS, CLOCK & TERMINAL EMULATOR \$895
JACKINTOSCH 520ST Monochrome 640X400 \$750
VIP PROFESSIONAL/520ST Same as Lotus 1-2-3 \$119
ATARI GEMWRITE/HABA WRITER Word Proc. \$75/49

S-100 Bus Boards

If you purchased before calling us, you probably paid too much! We stock ACKERMAN DIGITAL, ADVANCED DIGITAL, CCS, VIASYN, CROMEMCO, DUAL, ELECTROLOGICS, INTERCONT, MICRO, KONAN, MULLEN, PICKLES & TROUT, SYNTECH DATA, TARBELL, TECMAR, TRANSEND, VECTOR ELEC.

A Few Of This Month's SPECIALS Are:
ACKERMAN KLUGE CARD A&T \$175
COMPUPRO/VIASYN RAM 22, 256K STATIC \$495
COMPUPRO/VIASYN RAM 23, 128K STATIC \$285
DUAL NEW BOARD SPECIALS CALL
MACROTECH 256-ST \$695
MACROTECH VRAM 512K Static with Battery Back-Up and MDrive/H Capable \$1,195
MACROTECH ADIT-4 Intelligent I/O \$699
MACROTECH MI-286 80286/Z80H Dual Proc. \$695
MACROTECH MSR-II 1Mb Dynamic Ram \$989
VECTOR RAM17 64K Static Ram (VIASYN) \$299
VECTOR INTERFACER I Dual Serial (VIASYN) \$209
VECTOR INTERFACER II 3 Para., 1 Serial \$229

PC & AT Multifunction/Slave Bds.

We have a Good Selection of Multifunction and Memory Boards for PC, XT, AT, JR, AT & T, and PC Portables
INTEL ABOVE BOARD/AT 128K-4Mb w/Expanded Mem. SW to allow CPU to Address all Avail. Mem. \$459
LASER DISK I/O FLPY CTRL, S, P & G Ports, CLK-CAL, Ram-Disk & Print Spool/MS-DOS \$175/\$40
STB BIG BYTE 64K / RIO PLUS II 64K \$139/\$216
STB GRANDE BYTE/PC-AT 128K \$229
STB RIO GRANDE/PC-AT 128K 2 S, P & G \$319
TECMAR JR. CAPT. 128K / CAPT. UNPOPC \$289/\$157
TECMAR EXPANSION CHASSIS With 8 Slots \$675
TECMAR MAESTRO Unpopulated \$335
TECMAR WAVE 64K Fits XT Short Slot \$179
ADVANCED DIGITAL PC-SLAVE w/256K, 8 MHz 8088 CPU, 2 S Ports, RTNX S/W-For Multi-User PC \$695
ALLOY PC-SLAVE/16 256K to 768K RAM \$759

PC-Scientific/Industrial Boards

TECMAR BASE BOARD 96 Digital I/O Lines \$219
TECMAR DADIO D to A Up to 24 Devices \$249
TECMAR IEEE-488 Board \$249
TECMAR LABMASTER w/ TM40 PGL Option \$865

PC-Video/Graphics & Cad

STB GRAPHICS PLUS II & MONO PLUS II \$249/\$169
STB CHAUFFEUR RGB Port/16 Grey Shades \$279
TECMAR GRAPHICS MASTER/TENDER \$439/\$189
PFS Graph CALL
VECTRIX VX1301 13" RGB Analog Monitor \$1,195
VECTRIX VX/PCB 512 Col./Pall. of 16,800,000 \$2,395
VECTRIX VXTB 11"X11" Graphics Tablet \$385

Printers, Plotters & Buffers

BROTHER CHRISTMAS SPECIALS CALL
CITIZEN MSP-15 160/40 CPS 15" Low Profile \$409
CITIZEN MSP-25 200/50 CPS 15" ULTRA QUIET \$569
EPSON LX80, RX100+, FX80+, FX100+, LQ1500 CALL
HOUSTON INST. PLOTTERS & DIGITIZERS CALL
OBERON OMNI-READER w/PC Software \$409
OKIDATA ALL MODELS CALL
HANZON 12315 64K-256K INTELLIGENT BUFFER SER.-SER., SER.-PAR., PAR.-SER., PAR.-PAR. Computer to Printer Combinations Possible \$259
JOHNATHAN FREEMAN DESIGNS S&P In and S&P Out 64K/256K buffer \$189/\$249
PRACTICAL PERIPH. Microbuffers CALL

Networking & Switch Boxes

GILTRONIX MANUAL AND AUTOMATIC SWITCHING UNITS to Fit all of Your SHARED Printer, Terminal, Modem, and Other Peripheral Needs. From \$79
INTERCONT. MICRO LAN-PC/LANS-100 \$469/\$359
VIASYN NET II for 816/10 SYSTEM ARCNET \$425
VIASYN NET 101-96 for S-100 BUS ARCNET \$425

Mainframe & Drive Enclosures

INTEGRAND Laser Turbo 10 Slots, 2 H.D. 5 1/4" \$535
JMR POWERPLAY - Side by Side 5 1/4" H.D. with Console and 6 Surge/Noise Protected Outlets \$239
JMR 1 HS 5 1/4" H.D. PC Style Cabinet \$189
MSP 5500 5 1/4" H.D. & 1/2 HT FLPY OR TAPE \$209
MPS 10055 "SUPER STAR" 6 Slots & 1.5 H.D./Floppy Drives \$395
MICROWARE 920004 Dual Horiz. PC-Style 5 1/4" \$149
PDC 1220JR 12 Slots, 20 Amps, 5 1/4" & 8 Drives, Made for Turbodos Configurations \$939

Floppy Disk Drives

MITSUBISHI 2894 STD. / 2896 1/2 HT. 8" \$395/\$369
MITSUBISHI 4853 HALF HT. 5 1/4" 96TPI DSDD \$139
TEAC FD55B/MITSUBISHI 4851/EPSON SD-521 \$88

Hard Disk Subsystems

PC-INSIDER/PC-OUTSIDER H.D. SERIES FOR IBM 10 Mb to 116Mb Formatted with Controller & All Cables, Hardware & P/S or PC Style Cabinet CALL
TECMAR QIC 60 TAPE For PC'S \$1,449
CALL FOR DLR &/or QTY. PRICES on HARD DISKS:

MITSUBISHI Maxtor Seagate
MICROPOLIS QUANTUM Amcodyne
S-100 BUS SUBSYSTEMS Supporting Turbodos, Concur. Dos. CP/M 80 & 818 Operating Systems/CALL
III 10Mb TAPE (COMPUPRO) INT/EXT \$495/\$595

Power Solutions

PC/XT REPLACEMENT P/S 130/150 WATT \$89/\$99
SAFT SPS1000VA 1000 WATT/SINE WAVE \$1,095
SOLA MINI UPS 750 Watt Sine Wave HIGH INRUSH (4500 Watt) For Hard Disk Start-Up CALL
TRIPPLITE BC-425-FC 425 Watts 15-20 Minutes \$439
TRIPPLITE ISOBAR Line Suppressor-Filters from \$40

Monitors & Terminals

LINK 125 Wyse 50 Compat. 14" GRN or AMB w/ Higher RES., More Emul's, Selectric K.B., 8 Scroll Rates \$449
LINK 125/PC w/PC Emulating Video & Keybd CALL
PRINCETON GRAPHICS SR-12 890 X 480 RGB \$609
TATUNG CM-1322 640X200 RGB \$395
TATUNG CM-1360 LIKE 1322 with Green & Amber Switch ASK ABOUT "HOT SPARES" \$419
TATUNG CM-1370 720X480 RGB w/GRN Switch Long Persist Phos. Works w/ STB'S SUPER RES 400 \$499
TATUNG MM-1222G/A Hi-Res 12" TTL(IBM) \$119/125
TAXAN MONITORS Call for Low Prices
TECMAR 640X480 RGB. GRN Switch Long Phos \$519
ZENITH ZVM123A (Green) / 122A (Amber) \$85/\$89

Modems

HAYES SMART MODEM 1200 / 2400 \$425/\$639
PRENTICE POPCOM w/ PFS Access C150/X150 \$315
PROMETHEUS PROMODEM 1200 Hayes Compatible w/ Built-In PWR Supply-RS232 Stand Alone Unit \$289
OPTIONS FOR PROMODEM 1200 ARE:
PROCESSOR/64K MEMORY/DISPLAY \$75/\$35/\$79
PROMETHEUS 1200 APL/IBM/MAC \$295/\$265/\$329
U.S. ROBOTICS COURIER/PASSWORD \$499/\$209
U.S. ROBOTICS S-100 Board 300/1200 \$295
U.S. ROBOTICS PC MODEM w/ Telpac Software \$219
U.S. ROBOTICS PC MULTI-MODEM 256K \$439

Software • Software • Software

We have Access to all Well Known Brands - ORDER CORRECTLY - SOFTWARE IS NOT RETURNABLE!

Spreadsheets & Integrated Pkgs.

ASHTON-TATE Framework CALL
MDBS Knowledgeman \$319
SORCIM Supercalc-3 Better Than 1-2-3!!! \$209

Accounting

CORE SOFTWARE'S FASTRAK: A DATA FLEX Application for all Your Accounting Needs Supporting All Networks & Operating Systems CALL

Operating Systems & Utilities

ADVANCED DIGITAL CP/M 3.0 \$290
COMPUPRO/VIASYN CPM At Affordable Prices
CROMEMCO 68000 CROMIX \$475
DIGITAL RESEARCH Complete line up to 35% Off

Language And Tools

BD SOFTWARE "C" Compiler 8" SS SD 8 BIT \$95
COMPUTER INNOVATIONS C-86 "C" Compiler \$299
COMPUVIEW VEDIT/VEDIT-PLUS \$115/\$189
DIGITAL RESEARCH Most Products in Stock CALL
LATTICE "C" Compiler \$299
MICROSOFT Complete Line CALL

Data Base Managers

ASHTON-TATE dBASE II & III BEST PRICE
DATAFLEX FILE/RECORD Locking Multi-User CALL
PFS FILE/REPORT CALL

Communications

MYCROFT LABS MITE AND MITE PLUS CALL
MICROSTUF CROSS TALK XVI \$129
PFS Access CALL

Word Processors

MICROPRO WORDSTAR, Etc. CALL
NEWSTAR NEWWORD w/ Money Back Guar. \$129
OASIS THE WORD PLUS Spell Check, CP/M86 8" \$99
PFS WRITE/PROOF CALL/CALL

Diskettes & Cartridges

3M TAPES 300XL&600A/1000A In Stock \$29.95/19.95
DYSAN 3740/20 8" DSDD \$31
DYSAN HARD DISK CARTRIDGES 8" \$150
FUJI FILM FD20-1024 8" DSDD \$29.95

FULL DEALER SUPPORT
VISIT OUR SHOWROOM
HRS. 8:30 AM - 5:00 PM M-F

All merchandise new. Advertised prices are cash prepaid only. MC, Visa & P.O.'s from qualified firms - add 3%. Wires, COD's (\$5 min. fee) with cashiers Check/MO, & APO's accepted. Shipping: minimum \$4 first 3 lbs. Tax: AZ RES ONLY add 6% sales tax. All returns subject to 20% restocking fee or credit towards future purchases. Retail prices slightly higher. All prices subject to change without notice.



MARYMAC INDUSTRIES INC.

800-231-3680

**Radio Shack® Tandy®
Epson Printers**

People you Trust to give you the very best!



• Lowest
Discount
Prices

• Reliable
Service



• Quality
Products

"World's largest independent authorized computer dealer."

22511 Katy Fwy., Katy (Houston) Texas 77450
(713) 392-0747 Telex 774132

Inquiry 236

**3M Diskettes
Lifetime Warranty**

**TIRED OF WAITING
FOR SERVICE AND PRICE?
9 out of 10 SURVEYED
DISK BUYERS PREFERRED**

**NORTH HILLS
#1 IN SERVICE AND PRICE
1-800-328-3472**

Formatted and hard sectored disks
in stock-Dealer inquiries invited.
COD, VISA, MASTERCARD
All orders shipped within 24 hrs.



**NORTH HILLS CORP.
INTERNATIONAL**
3564 Rolling View Dr.
White Bear Lake, MN. 55110
MN. call collect - 612-770-0485

**EPROM
PROGRAMMER**



APROTEK 1000
ONLY
\$265.00

COMPLETE WITH
PERSONALITY
MODULE

117 VOLT AC POWER-RS232
-6 BAUD RATES - HANDSHAKE TO HOST
ALLOWS READ, WRITE, VERIFY & COPY
Comes complete with a CPM, IBM-PC or Apple
Driver Program on Disc.

Programs the following 5 Volt 24 or 28 pin
devices: 2716 series through 27256, 25xx series,
68764 plus others. Please Specify Personality
Module desired with order. Additional Personality
Modules only \$15.00 ea. **Full 1 year warranty.**

TO ORDER: CALL 1-800-962-5800 OR WRITE
APROTEK
1071 A AVENIDA ACASO Add
CAMARILLO, CA 93010 \$4.00 Shipping-USA
Info: (805) 987-2454 VISA or MC Add 3%

Inquiry 26

Osborne

As available only! Very limited quantity.

Important: Always call to check avail- ability before ordering.	To fix yourself, or for parts, Complete, but known not working.	Guaranteed for 30 days. May be new or refurb., depen- ding on avail. Exch/ Repair	Outright
Main Board OS-1	\$79	\$79	\$139
Main Board Exec.	\$159	\$139	\$299
Battery Pack, 40 Watt	—	—	\$49
Double Density Kit **	—	—	\$79
** Includes board, cable, documentation & disk			
5" CRT (Grn/White)	\$9.95	\$19	\$29
7" CRT (Amber)	\$19	\$49	\$99
15" CRT, no case	—	—	\$85
Drive Analog Card	\$9.95	\$29	\$59
Drive Mechanism	\$19	\$25	\$59
Power Supply	\$4.95	\$24	\$29
Keyboard (No enclos.)	\$9.95	—	\$99

Shipping charged on all orders

Computer Parts Mart 415-493-5930
3200 Park Blvd * Palo Alto * CA 94306

Inquiry 85

The Statistician

CPM IBM-PC
TRS-DOS XENIX

- * Multiple Regression
 - Stepwise
 - Ridge
 - All Subsets
 - Backward Elimination
- * Time Series Analysis
- * Descriptive Statistics
- * Transformations
- * Survey Research
 - Nonparametrics
 - XY Plots
 - ANOVA
 - Random Samples
- * Data Base
- * Search & sort
- * Hypothesis tests

Please call **TOLL FREE**
1-800-334-0854 (Ext. 814)



for more information
or write:
Quant Systems
Box 628
Charleston, SC 29402
VISA/MC Accepted

Inquiry 320

development tools

**C-DOC: a cross-reference and
documentation system, \$275.**

**The Program Tuning Kit: a sym-
bolic execution profiler, \$145.**

**The C Browser: an intelligent code
display system, \$125.**

All three \$445.

An invaluable suite of tools for C
software development under MS-
DOS/PC-DOS.

Figure Flow

☎ 1800 362 3625

Inquiry 154

WHOLESALE

AST 6-PACK + 64K \$239

ANCHOR VOLKSMODEM 12 . . . 164

AUTOCAD CALL

(DIGITIZERS, PLOTTERS) PENCEPT, HOUSTON,
HITACHI, CALCOMP, NICOLET, ENTER, GTCO

JUKI 6300 639

MAC 3.5 FLOPPY DRIVE 279

CALL FOR LATEST PRICE

APPLE	HAYES	PANASONIC
AXIOM	IBM	PARADISE
CITIZEN	JUKI	PRINCETON
C. ITOH	LEGEND	SILVER REED
COMPAC	LOTUS	TAXAN
EPSON	NEC	TOSHIBA
ENTER	NOVATION	VENTEL
GENOA	MICROPRO	ZENITH



MINORITY INDUSTRIES

5021 N. 20th St., #10261, Phoenix, AZ 85064

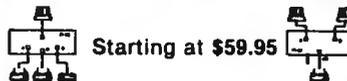
ORDERS ONLY 1-800-428-7979

OTHER INFORMATION (602) 890-0596

Prices subject to change & reflect cash discount.
Please add 2% for shipping on most items.

Inquiry 267

**SAVE TIME AND MONEY WITH
LOW COST PI-SWITCH BOXES.**



Starting at \$59.95

- Quickly shares your computer among
multiple terminals, printers, modems, etc.
with just a flick of the wrist.
- Compact black & beige aluminum
enclosure features a high quality rotary
switch with rear mounted connectors.
- Serial RS-232 Models have fem. 25-Pin Conn.
(Lines 1-7 & 20)
- PI-02-S switches 2 to 1 \$59.95
- PI-03-S switches 3 to 1 79.95
- PI-05-S switches 5 to 1 109.95
- Parallel models have fem. 36-Pin cent. conn.
- PI-02-P switches 2 to 1 94.95
- PI-04-P switches 4 to 1 154.95
- Dealers, schools & custom inquiries welcome.
- One Year Warranty, COD, VISA, M/C.
- Shipping UPS \$2.00/ea. AIR \$4.00/ea.



7301 NW 41 St.
MIAMI, FL 33166
(305) 592-6092

Inquiry 333

**M68000 SINGLE
BOARD
COMPUTER**



On board 6-10 MHz CPU, 20K RAM, 32K EPROM,
two RS-232, 16-bit port, 5-counter/timers
expandable via Memory/FDC Board.

- M68K CPU (bare board) \$ 89.95
- M68K CPU A&T (6MHz) \$495.00
- MD512K Memory/FDC (bare board) \$ 89.95
- MD512K Memory/FDC (128K) \$495.00
- FDC/Hard Disk interface option \$150.00
- M68KE Enclosure w/power supply \$249.00
- M68K Monitor EPROM's \$ 95.00
- M68K Macro Cross Assembler \$195.00
- 4XFORTH OS w/Assembler, editor \$295.00
- CP/M 68K OS w/'C' compiler \$395.00



Educational
Microcomputer
Systems

P.O. Box 16115
Irvine, CA 92713
(714) 854-8545

Inquiry 145

PRIORITY

ONE

ELECTRONICS®

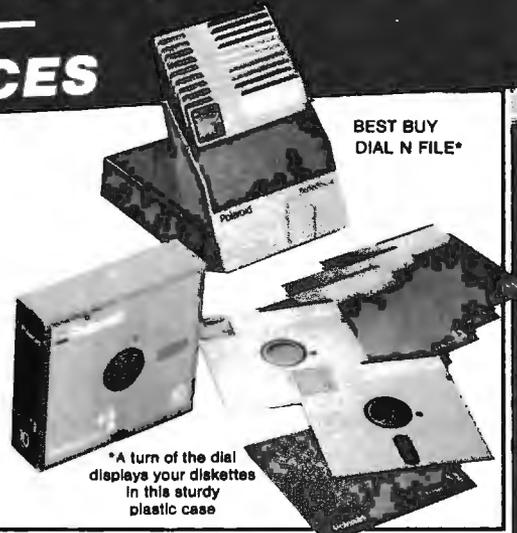
SUPERIOR QUALITY — AT "PLAIN-WRAP" PRICES

■ Polaroid/PerfectData

5¼" Double Sided Double Density

As Low As:

79¢



*A turn of the dial displays your diskettes in this sturdy plastic case

Your Benefits From Polaroid's Superior Quality:

- All disks are soft sectored in packages of 10 with reinforcing hub rings, write protect tabs, and labels
- Available in soft cardboard boxes or plastic Dial N File
- Free data recovery service
- Exceeds all industry standards
- Multi-million piece "Truck-Load" purchase for absolute lowest prices - limited quantity, so hurry
- Unconditional 20 year warranty

Today, the biggest threat to your data is you. Accidents will happen, and before Polaroid came along, they usually resulted in complete data loss.

Polaroid diskettes cannot prevent accidents, but with their free data recovery service, they will prevent loss of data. Simply return your damaged diskette to Polaroid's Data Recovery Center, and they will recover all possible data, tell you what blocks, if any, could not be recovered, and return a new disk to you.

The incredible savings offered by Priority One settles the issue of who gives the best value for your diskette dollar.

5¼" Double Density 48 TPI

Double Sided for PC's & Compatibles — Single Sided for Apple & Atari

PRICE PER BOX OF 10 DISKETTES

Part Number	Description	Retail	2-9	10-24	25-99	100 or More
BWPOL522	Double Sided	\$45.00	\$11.00	\$ 9.90	\$ 8.90	\$7.90
BWPOL522DF	Double Sided in Dial N File	\$51.00	\$13.00	\$11.40	\$10.40	\$8.90
BWPOL512	Single Sided	\$35.00	\$10.00	\$ 8.90	\$ 7.90	\$6.90
BWPOL512DF	Single Sided in Dial N File	\$41.00	\$12.00	\$10.40	\$ 9.40	\$7.90

5¼" Double Density / 96 TPI

Part Number	Description	Retail	2-9	10-24	25+
BWPOL514	Single Sided	\$50.00	\$11	\$10	\$9
BWPOL514DF	SS in Dial N File	\$56.00	\$13	\$12	\$11
BWPOL524	Double Sided	\$55.00	\$13	\$12	\$11
BWPOL524DF	DS in Dial N File	\$61.00	\$15	\$14	\$13

8" Double Density

Part Number	Description	Retail	1-9	10-24	25+
BWPOL812	Single Sided	\$45.00	\$20	\$15	\$10
BWPOL822	Double Sided	\$55.00	\$25	\$20	\$15

8" Diskettes available only in standard packaging
ALL PRICES ARE PER BOX OF 10 DISKETTES. MINIMUM ORDER IS 2 BOXES.

IRVINE



18241 Mc Durmott,
Irvine, CA 92714
(714)660-1411

PRIORITY ONE ELECTRONICS®

Inquiry 310



SAN JOSE

452 W. Trimble Rd.,
San Jose, CA 95131

Mall Your Order To:
9161 Deering Ave., Chatsworth, CA 91311
RETAIL: (818)709-5464 INDUSTRIAL: (818)709-5111

(408)946-7010

MINIMUM PREPAID ORDER 2 BOXES. Terms U.S. VISA, MC, BAC, Check, Money Order, U.S. Funds ONLY. CA residents add 8%, 6½%, or 7% Sales Tax, depending on your local rates. All prices listed are per box of 10 diskettes. Shipping charges are \$4.00 for 10 boxes (100 diskettes) or fraction thereof. Please include your phone number with your order.

Prices subject to change without notice. We will do our best to maintain prices through November 1985. We are not responsible for typographical errors. PRIORITY ONE ELECTRONICS and PRIORITY 1 ELECTRONICS are registered service marks of the Heath Group, Ltd.



ORDER TOLL FREE (800)423-5922 (NOW IN CALIF. TOO!!)

CONVERSE WITH YOUR COMPUTER

AT LAST! A FULL IMPLEMENTATION of the original ELIZA program is now available to run on your microcomputer!

Created at MIT in 1966, ELIZA has become the world's most celebrated artificial intelligence demonstration program. ELIZA is a non-directive psychotherapist who analyzes each statement as you type it in and then responds with her own comment or question—and her remarks are often amazingly appropriate!

Designed to run on a large mainframe, ELIZA has never before been available to personal computer users except in greatly stripped down versions lacking the sophistication which made the original program so fascinating.

Now our new microcomputer version possessing the FULL power and range of expression of the original is being offered at the introductory price of only \$25. And if you want to find out how she does it for tech her to do more, we will include the complete SOURCE PROGRAM for only \$20 additional!

Order your copy of ELIZA today and you'll never again wonder how to respond when you hear someone say: "Okay, let's see what this computer of yours can actually do!"

ELIZA IS AVAILABLE IN THE FOLLOWING FORMATS:

- 5 1/4 inch disk for the 48K Apple II, II Plus, IIe or IIc \$25 for Protected Version—\$45 for AppleSoft Source Version
- 5 1/4 inch disk for the 64K IBM Personal Computer \$25 for Protected Version—\$45 for IBM Disk BASIC Source Version
- 5 1/4 inch disk or tape cassette for the Commodore 64 (specify which) \$25 for Protected Version—\$45 for C-64 BASIC Source Version
- Standard 8 inch single density disk for all CP/M based computers \$25 for ELIZA.COM—\$45 with Microsoft BASIC-80 Source
- 5 1/4 inch disk for most CP/M based computers (specify computer) \$25 for ELIZA.COM—\$45 with Microsoft BASIC-80 Source

Please add \$2.00 shipping and handling to all orders (California residents please add 6% sales tax)

ARTIFICIAL INTELLIGENCE RESEARCH GROUP

921 North La Jolla Avenue, Dept B
Los Angeles, CA 90048
(213) 656-7388 (213) 854-2214
MC, VISA and checks accepted



Inquiry 29

ROMDISK

EPROM DISKETTE AND DISK DRIVE EMULATOR IBM PC* COMPATIBLES AND APPLE IIe*

- Diskless control and communications systems
- Dedicated workstations for improved productivity
- Customized, high speed, smart terminal
- Put software in silicon
- Solid state reliability and performance
- Self contained control and EPROM program circuitry
- PC and MS DOS* compatible

ROMDISK PC-1 (180K) \$495
ROMDISK PC-2 (360K) \$595
ROMDISK A FOR //e (144K) \$349



CURTIS, INC. 22 Red Fox Road
St. Paul, MN 55110 612/484-5064

*IBM PC and PC //e are registered trademarks of IBM Corp. MS-DOS is a registered trademark of Microsoft Corporation. ©Curtis, Inc. 1987. All rights reserved.

Inquiry 101

Mini-Tester Monitors 7 Most Important RS-232 Lines



Only \$34.95

2 1/4 x 2 1/4 x 3/4
Model 232MTT

2 color LED's clearly display status of TD, RD, RTS, CTS, DSR, CD and DTR. Pocket size, 1 male & 1 female connector, requires no power. May be left in permanently. Satisfaction guaranteed. ORDER NOW! New low price of \$34.95. All cash orders postpaid (IL res. add 6% sales tax) FREE: Newly revised illustrated catalog of RS-232 interface and testing equipment. Phone: 815-434-0846.

B & B electronics
MANUFACTURING COMPANY
P.O. Box 1008B, OTTAWA, IL 61350

Inquiry 33

DATAFLEX™

- Multi-user Database!
- Powerful!
- Multiple Operating System Compatibility!
- Attractive Dealer Pricing!
- Full Dealer Support!

Dataflex is a trademark of Data Access
Dealer Inquiries Invited

COGITATE

24000 Telegraph Road
Southfield, Michigan 48034 USA
(313) 352-2345

Inquiry 68

Serial ← ||| ||| ||| → Parallel



Convert What You Have To What You Want!

- RS232 Serial
- 8 Baud Rates
- Latched Outputs
- Centronics Parallel
- Handshake Signals
- Compact 3 1/2" x 4 1/2" x 1 1/2"

No longer will your peripheral choices be limited by the type of port you have available! Our new High Performance 700 Series Converters provide the missing link. Based on the latest in CMOS technology, these units feature full baud rate selection to 19.2K, with handshake signals to maximize transfer efficiency. Detailed documentation allows simplified installation. Order the Model 770 (Ser/Par) or Model 775 (Par/Ser) Today!

only \$89.95
Buffer Products Coming Soon! **ligertronics** CORPORATION
2734-C Johnson Dr.
Post Office Box 2717
Venture, California 93008
CALL (805) 658-7466 or 658-7467
For FAST Delivery

Inquiry 149

5 1/4" 3M FLEXYDISKS

	10-90	100 +
SS / DD Soft	\$1.34 ea.	\$1.29 ea.
DS / DD Soft	\$1.63 ea.	\$1.58 ea.

PLUS— A \$2.00 3M Factory Rebate Coupon with each box, along with 3M's new \$30.00 rebate for other 3M products.

In Stock — Immediate Shipment.
Mastercard, VISA, Check or Money Order.
Add \$3.00 shipping charges per each 100 or part.
Add \$2.50 additional for C.O.D. shipments.
N.J. residents add 6% sales tax.

Data Exchange
Dept. B, P.O. Box 993
178 Route 206 South
Somerville, N.J. 08878
(201) 874-5050

Inquiry 110

maxell DISKS LIFETIME WARRANTY

TIRED OF WAITING
FOR SERVICE AND PRICE?
9 out of 10 SURVEYED
DISK BUYERS PREFERRED

NORTH HILLS
#1 IN SERVICE AND PRICE
1-800-328-3472

Formatted and hard sector disks
in stock-Dealer inquiries invited.
COD, VISA, MASTERCARD
All orders shipped within 24 hrs.



NORTH HILLS CORP.
INTERNATIONAL
3564 Rolling View Dr.
White Bear Lake, MN. 55110
MN. call collect—612-770-0485

Inquiry 334

Sure it's insured?

SAFWARE® Insurance provides full replacement of hardware, media and purchased software. As little as \$39/yr. covers:

- Fire • Theft • Power Surges
- Earthquake • Water Damage • Auto Accident

For information or immediate coverage call:
1-800-848-3469

In Ohio call 1-614-262-0559



SAFWARE, The Insurance Agency Inc.

Inquiry 188

9-TRACK MAG. TAPE SUBSYSTEM FOR THE IBM PC/XT/AT



\$4757

For information interchange, backup and archival storage, IBEX offers a 9-track, IBM format-compatible 1/2" magnetic tape subsystem for the IBM PC, featuring:

- 42 M-Bytes on a single reel.
- IBM format 1800 cpl.
- Software for PC-DOS, MS-DOS.

IBEX

IBEX COMPUTER CORP
20741 Marilla St
Chatsworth, CA 91311
(818) 708-8100
TWX 910-488-2071

Write, phone or TWX for information

Inquiry 188

What the world really needs is a 69 cent Double Sided, Double Density Diskette with a LIFETIME WARRANTY!

And DISK WORLD! has it.

Introducing Super Star Diskettes: the high quality diskette with the lowest price and the best LIFETIME WARRANTY!

In the course of selling more than a million diskettes every month, we've learned something: higher prices don't necessarily mean higher quality.

In fact, we've found that a good diskette manufacturer simply manufactures a good diskette...no matter what they charge for it. (By way of example, consider that none of the brands that we carry has a return rate of greater than 1/1,000th of 1 percent!)

In other words, when people buy a more expensive diskette, they aren't necessarily buying higher quality.

The extra money might be going toward flashier advertising, snazzier packaging or simply higher profits.

But the extra money in a higher price isn't buying better quality.

All of the good manufacturers put out a good diskette. Period.

How to cut diskette prices ...without cutting quality.

Now this discovery posed a dilemma: how to cut the price of diskettes without lowering the quality.

There are about 85 companies claiming to be "diskette" manufacturers.

Trouble is, most of them aren't manufacturers.

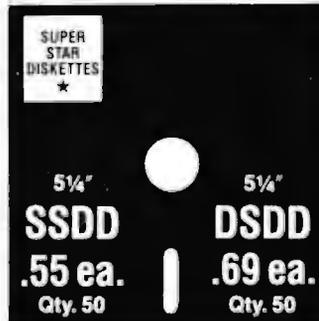
Rather they are fabricators or marketers, taking other company's components, possibly doing one or more steps of the processing themselves and pasting their labels on the finished product.

The new Eastman Kodak diskettes, for example, are one of these. So are IBM 5 1/4" diskettes. Same for DYSAN, Polaroid and many, many other familiar diskette brand names. Each of these diskettes is manufactured in whole or in part by another company!

So, we decided to act just like the big guys. That's how we would cut diskette prices...without lowering the quality.

We would go out and find smaller companies to manufacture a diskette to our specifications...specifications which are higher than most...and simply create our own "name brand" diskette.

Name brand diskettes that offered high quality at low prices.



Super Star diskettes are sold in multiples of 50 only. Diskettes are shipped with white Tyvek sleeves, reinforced hubs, user ID labels and write-protect tabs.

Boy, did we get lucky. Our Super Star Diskettes are the same ones you've been using for years...without knowing it.

In our search for the low priced, high quality diskette of our dreams, we found something even more interesting.

We found that there are several manufacturers who don't give a hoot about the consumer market for their diskettes. They don't spend millions of dollars in advertising trying to get you, the computer user, to use their diskettes.

Instead, they concentrate their efforts on turning out the highest quality diskettes they can...because they sell them to the software publishers, computer manufacturers and other folks who (in turn) put their name on them...and sell them for much higher prices to you!

After all, when a software publisher or computer manufacturer or diskette marketer puts their name on a diskette, they want it to work time after time, everytime. (Especially software publishers who have the nasty habit of copy-protecting their originals!)

Super Star Diskettes. You already know how good they are. Now you can buy them...cheap.

Well, that's the story.

Super Star diskettes don't roll off the boat from Pago-Pago or emerge from a basement plant just east of Nowhere.

Super Star diskettes have been around for years...and you've used them for years as copy-protected software originals, unprotected originals. Sometimes, depending on which computer you own, the system master may have been on a Super Star diskette. And maybe more than once, you've bought a box or two or more of Super Star diskettes without knowing it. They just had some "big" company's name on them.

Super Star Diskettes are good. So good that a lot of major software publishers, computer manufacturers and other diskette marketers buy them in the tens or hundreds of thousands.

We buy them in the millions.

And then we sell them to you.

Cheap.

When every little bit counts, it's Super Star Diskettes.

You've used them a hundred times...under different names.

Now, you can buy the real McCoy, the same diskette that major software publishers, computer manufacturers and diskette marketers buy...and call their own.

We simply charge less.

Super Special!

Order 50 Super Star Diskettes and we'll be happy to sell you an Amaray Media-Mate 50 for only \$8.75, shipping included...a lot less than the suggested retail price of \$15.95.



Regular DISK WORLD! price: \$9.69 ea.
+ \$2.00 Shpng.

DISKETTE STORAGE CASES

DISK CADDIES

The original flip-up holder for 10 5 1/4" diskettes. Beige or Grey only.

\$1.65 ea. + .20 Shpng.

DISKETTE 70 STORAGE

Dust-free storage for 70 5 1/4" diskettes. Six dividers included. An excellent value.

\$9.95 ea. + \$3.00 Shpng.



HOW TO ORDER:

ORDERS ONLY:

1-800-621-6827

(In Illinois: 1-312-256-7140)

INQUIRIES:

1-312-256-7140

FOR FASTEST SERVICE, USE NO-COST MCI MAIL: Our address is DISKORDER. It's a FREE MCI MAIL letter. No charge to you. (Situation permitting, we'll ship these orders in 24 hours or less.)

SHIPPING: 5 1/4" & 3 1/2" DISKETTES—Add \$3.00 per each 100 or fewer diskettes. **OTHER ITEMS:** Add shipping charges as shown in addition to other shipping charges. **PAYMENT:** VISA, MASTERCARD and Prepaid orders accepted. **COO ORDERS:** Add additional \$5.00 special handling charge. **APO, FPO, AK, HI & PR ORDERS:** Include shipping charges as shown and additional 5% of total order amount to cover PAL and insurance. We ship only to United States addresses, except for those listed above. **TAXES:** Illinois residents, add 7% sales tax

MINIMUM ORDER: \$35.00.

The Super Star LIFETIME WARRANTY!

Super Star Diskettes are unconditionally warranted against defects in original material and workmanship so long as owned by the original purchaser. Returns are simple: just send the defective diskettes with proof of purchase, postage-paid by you with a short explanation of the problem, and we'll send you the replacements. (Incidentally, coffee stained diskettes and diskettes with staples driven through them don't qualify as "defective".)

WE WILL MEET OR BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES SUBJECT TO THE SAME TERMS AND CONDITIONS.

DISK WORLD!, INC.

629 Green Bay Road
Wilmette, Illinois 60091

FAST DELIVERY & LOWEST PRICES YOU MAKE THE CHOICE

SPECIAL #1

CORONA

- PORTABLE
 - 256K • 2 Drives
 - Monitor • Keyboard • DOS
- \$1195**

MAIL ORDER AND SAVE

ORDER TOLL FREE (800) 621-0849 x446

SPECIAL #2

- IBM PC 256K
 - Two 360K Drives
- *\$1525**

*w/purchase of Monitor and Video Card

SYSTEMS

IBM

- PC 256K, 1 Drive\$1495
- PC 256K, 2 Drives 1575
- XT 256K, 1 Drive 1880
- XT 256K, 1 Drive 1-10 MG.. 2280

COMPAQ

- Portable (2) Drive 256K . . . \$1875
- Call on Desk Pro's

CORONA

- Portable\$1195
- Desk Top 1479

CALL ON

- Zenith\$ave
- Televideo\$ave
- AT & T\$ave
- NCR\$ave
- Tandy\$ave

MODEMS

HAYES

- Micromodem IIE\$169
- 300 159
- 1200 389
- 1200B IBM Internal 359

PROMETHEUS

- Promodem 1200\$295
- Promodem 1200A 309
- Promodem 1200B 275

ANCHOR

- Mark 12\$218
- Express 299

BIZCOMP

Call for Low Prices

PRINTERS

EPSON

Call for Best Pricing

OKIDATA

- 182, 120 CPS\$230
- 83, 120 CPS 539
- 192, 160 CPS W/Roms 350
- 193, 160 CPS 585
- 84, 200 CPS 665
- OKI-MATE 20, Color 229

TOSHIBA

- P1351 Call
- P1340 \$ave
- P351 \$1029

STARMICRONICS

- SG10/15 Call
- SD10/15 and
- SR10/15 \$ave

CITIZEN

- MSP-10\$269
- MSP-15 389
- MSP-20 419
- MSP-25 569

DISKETTES

Call for quantity discounts

PRECISION COPY

- SS 100 (Box of 10)\$17
- DS 100 (Box of 10) 19

DYSAN

- SS 100 (Box of 10)\$30
- DS 100 (Box of 10) 34

D & D DISKS

- 1.2 MG High Density\$39
- 100 Piece Discounts

IBM EXTRAS

We Carry Everything For PC,
AT or XT

Name Brands or Generic

AST RESEARCH

- SixPAK +, 64K w/Side Kick ..\$229
- Reach w/Crosstalk 375

D & D MEMORY CARD

- MF-100 + 64K same as
- SixPAK +\$129

HERCULES

- Color Card w/Printer Port ..\$139
- Mono Graphics Card 305

D & D COLOR CARD

- CC 102, w/Printer Port
- Same as Hercules\$99
- (Call on other D & D Cards)

GOODIES

- IBM Printer Cable\$19
- 64K Ram Set of Nine Chips 8
- 256K Ram Set of Nine Chips ... 40
- Power Supply 135 Watts 89
- 8087 Co Processor Call

MONITORS

PRINCETON GRAPHICS

- Max 12E\$160
- HX-9, 429
- HX-12, 445
- SR-12 w/Doubler Card 789

THOMSON

- Color Monitor New
- Monochrome Monitor Call

DRIVES

- TEAC55B\$84
- Mitsubishi 4851 84
- Tandon TM 100-2 84
- CDC 9409 84
- Seimans DT542 84
- Panasonic JU455 84
- Shugart SA455 84

In quantity's of 2 or more

IBM COMPATIBLE

TEAC

- 55A, 160K\$ 95
- 55B, 320K 89
- 55F, 720K 135

TANDON

- TM100-2, 360K\$ 94
- TM101-4, Quad Density 275

APPLE COMPATIBLE

D & D HALF HEIGHT

- 525A For IIE and II+\$109
- 525C for IIC 119

APPLE EXTRAS

MICROMAX

- Viewmax, 80 Column\$135
- Viewmax 80E, 80 Column w/64K,
IIE 119

ORANGE MICRO

- Grappler +\$ 85
- Grappler + Buffered w/64K . 155

MICRO SCI

- 80 Column Card 64K\$89

WE OFFER VOLUME DISCOUNTS! MAKE THAT CALL (800) 621-0849 x446

SPECIAL #3

PARAGON

- Accounting Software • Be Your Own Bookkeeper • No Accounting Knowledge Required

Complete **\$995**

SPECIAL #4

384K MEMORY BOARD

- Serial and Parallel Ports
- Clock/Gameport • Ram disk/Printer spool Software

w/384K only **\$189**

SPECIAL #5

10 MG HARD DISK

- Seagate or Mitsubishi w/IBM Controller

\$475

Call on 20-MG Drives

SPECIAL #6

IBM PC COMPATIBLE

- Complete System • Two 360K Drvs. • Color Monitor • 256K • Clr. Card w/Pmt. Port • DOS 2.1

\$995

**d & Discount
Computers**

SELLING TO YOU SINCE 1978

MAIL ORDER:

13324 HAWTHORNE BLVD., SUITE 201
HAWTHORNE, CA 90250

ORDER DESK:

Inside California (213) 970-0206
Outside California (800) 621-0849 x446

Hours: Monday — Saturday 8 am to 6 pm

WE CARRY TO MANY ITEMS TO LIST,
PLEASE CALL FOR A QUOTE ON ANY ITEM.



No Surcharge for Credit Cards

Terms: All merchandise new. We accept MC, Visa, Wire Transfer, C.O.D. (call), Certified Check, P.O.'s from qualified firms. Shipping: minimum 4.00 first 5 pounds. Tax: California residents only add 6½% sales tax. All returns subject to 15% restock fee. Prices Subject To Change

California Digital

17700 Figueroa Street • Carson, California 90248

LETTER QUALITY F-10 DAISY WHEEL PRINTER

\$499



The TEC F-10 Daisy Wheel printer is the perfect answer to a reasonably priced 40 character word processing printer. While this printer is "extremely" similar to C.Itoh's F-10/40 Starwriter printer. Legal counsel for the C.Itoh Company have advised us that we should refrain from referring to the TEC printer as a Starwriter. This 40 character per second printer auto installs with Wordstar and Perfect Writer. Features extensive built-in word processing functions that allow easy adaptability and reduced software complexity. Industry standard Centronics interface provides instant compatibility with

all computers equipped with a parallel printer port. The TEC F-10 accepts paper up to 11 inches in width. These printers were originally priced to sell at over \$1400. Through a special arrangement California Digital has purchase these units from a major computer manufacturer and is offering these printers at a fraction of their original cost. Options available include sheetfeeder, tractor feed, buffered memory and an assortment of printer cables for a variety of computers.



TEAC 55B 48 TPI

\$99

One Two Ten
Five Inch Double Sided Drives

TEAC FD55B half height	99	95	89
TEAC FD55F 96 TPI, half ht.	119	115	109
CONTROL DATA 9409 PC	169	159	155
SHUGART SA455 Half Height	99	95	89
SHUGART SA465 1/2 Ht. 96TPI	99	95	89
TANDON 100-2 full height	129	125	119
TANDON 101-4 96TPI full ht.	199	189	179
MITSUBISHI 4851 half height	139	135	129
MITSUBISHI 4853 96/TPI 1/2 Ht.	155	149	139
MITSUBISHI 4854 8" elec.	295	285	275
QUME 142 half height	119	105	99

Eight Inch Single Sided Drives

SHUGART 801R			
SIEMENS FDD 100-8	119	115	109
TANDON 848E-1 Half Height	369	359	349

Eight Inch Double Sided Drives

SHUGART SA851R	495	485	475
QUME 842 "QUME TRACK 8"	319	319	313
TANDON 848E-2 Half Height	459	447	435
REMEX RFD-4000	219	219	209
MITSUBISHI M2896-63 1/2 Ht.	459	449	409

FREE PROBE

California Digital is offering this \$17.95 value 1/2 Mhz. Logic Probe absolutely FREE with any purchase over \$50. The Logic Probe is a LED equipped instrument that operates from circuits under test and gives instantaneous logic level indicators. To receive your FREE Logic Probe your order must be placed by MAIL before the end of this month. Payment must accompany your order and the free Logic Probe must be requested.

DUAL SHUGART SUBSYSTEM

\$239

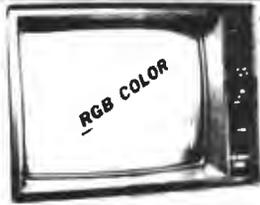
The dual Shugart subsystem features two SA465 (96 tpi) 5 1/4" double sided disk drives. Also supplied within the subsystem is 50 watt power supply and a shielded signal cable.



PLOTTER

\$219

The Corometrics Comshare 1 is the ideal solution to make short work of translating financial and numeric data into a graphic presentation. Many ready to run programs such as Lotus 1-2-3, Visi-on and Apple business graphics already support this plotter. The Comshare 1 features programmable paper sizes up to 8 1/2" by 120 inches. 5 inch per second plot speed and 0.004" step size. Easy to implement Centronics interface allows the Comshare 1 immediate use with the printer port of most personal computers. The Comshare 1 is manufactured by Corometrics, the same manufacturer of the Comshare 2 plotter. This plotter is marketed by Hewlett Kild and is sold under Emerson's name. Sweet's Label 1 is the only plotter that can plot both horizontal and vertical. \$219 normally, \$219. Also available is a hard copy plotter which has same resolution as the Comshare 1 interface cable & multi-line plotter.



NEC RGB COLOR MONITOR

\$219

The NEC JC-1401D is a 13" medium high resolution RGB monitor suitable for use with the Sanyo MBC 550 555 or the IBM PC. The monitor features a resolution of 400 dots by 240 lines. Colors available are Red Green Blue Yellow Cyan Magenta Black and White. The NEC monitor carries the Ltron-Monroe label and was originally scheduled for use in their Office of the Future equipment. A change in Monroe's marketing strategy has made these units excess inventory which were sold to California Digital. We are offering these new RGB monitors at a fraction of their original cost. Sanyo compatible NEC-1401/S, IBM PC Computer compatible NEC-1401 PC.

Shugart 604 WINCHESTER

\$99



These 6.7 Megabyte drives are new units recently released by the Shugart division of Xerox. The Shugart 604 is fully 506 industry compatible. Each drive is tested before shipment and is supplied with a 90 day warranty. SHU-604

Five Inch Winchester Hard Disk Drives

FUJITSU M2235AS 27 Meg.	899	859
RODIME R0-208 53 Meg.	1589	1493
MAXTOR XT10140 140 Meg.	3895	3785
SHUGART 712 13 Meg. 1/2 Ht	495	465
SHUGART 604 6.7 Meg.	99	89
TANDON 502 10 Meg.	419	395
TANDON 503 19 Meg.	695	675
SEAGATE 225 25 Meg.	695	625

PRINTERS

MATRIX PRINTERS

Star Gemini-SG10 120 char./sec.	STR-SG10	299.00
Star Gemini-SG15 100 char./sec. 15" paper	STR-SG15	389.00
Star Gemini-Delta 10 150 Char./sec.	STR-D10	359.00
Citizen MSP110FT 160 char./sec.	CIT-MSP10	289.00
Tooshita P1251 152 char./sec. letter quality	TOS-P1251	1495.00
Okidata 182A serial & parallel 3 1/4" paper	OKI-182A	257.00
Okidata 192A parallel interface 160 char./sec.	OKI-192A	345.00
Okidata 84P parallel 15" paper	OKI-84P	799.00
Epson LX-80 110 120 Char./sec.	EPS-LX80	239.00
Epson FX80FT 10 160 char./sec. with graphitax	EPS-FX80	369.00
Epson RX100 15 with Graphitax	EPS-RX100	369.00
Epson FX100FT 15 160 char./sec. with graphitax	EPS-FX100	459.00
Epson LQ1500 15" correspondence quality	EPS-LQ1500	895.00
Epson JX80 Color printer	EPS-JX80	519.00
Frontier 8510 parallel 9 1/4" paper	FRONT-8510P	329.00
Dataproducts B-800-3, band printer 600 LPM	DPS-B800	6995.00
Printonix P300 high speed printer 300 lines per minute	PTX-P300	3995.00
Printonix P600 ultra high speed 600 lines per minute	PTX-P600	5795.00

WORD PROCESSING PRINTERS

Siemans F10 parallel 40 char./sec.	PRO-F10P	495.00
Quintec 102 graph. display terminal	NEC-8810	1859.00
NEC8810 55 char./second serial interface	NEC-8830	1859.00
NEC8830 55 char./sec. par.1 interface	NEC-3550	1569.00
NEC3550 popular printer designed for the IBM PC	NEC-3050	889.00
NEC3050 designed for IBM PC 20 char./sec. par.1	SRD-EXP500	319.00
Silver Reed EXP500 14 char./sec. par.1 interface	SRD-EXP550	429.00
Silver Reed EXP550 17 char./sec. par.1 interface	DBL-620	1559.00
Diablo 630 40 char./sec. serial	DBL-620	759.00
Diablo 820, proportional spacing, horiz & vert tab. 20 cps	JUK-E100	399.00
Juki E100 18 char./sec	JUK-E200	699.00
Juki 6300 40 char./sec	CRX-CR2P	395.00
Correx CR2 5k buffer, proportional spacing par.1		

TERMINALS

Freedom 100 1024 screen, detachable keyboard	LIB-F100	495.00
Quintec 102 graph. display terminal	CUM-102	539.00
Ampro Dialogue 125 green screen	APX-D125G	675.00
Ampro Dialogue 175 amber screen two page, turn keys	APX-D175A	719.00
Wyse 30 14" green monochrome	WYS-30	495.00
Wyse 300 8" high color display, 400 screen	WYS-300	1159.00
Zarwin 20 terminal V152 compatible detach the keyboard	ZTH-Z29	785.00
Televideo 910 Plus 8000 mode	TVI-910P	575.00
Televideo 825 detachable keyboard 27 function keys	TVI-825	759.00
Televideo 850 graphics char. cell screen 22 line	TVI-850	850.00
Televideo 970 14" screen 132 column E video	TVI-970	1095.00

Shipping: First five pounds \$3.00, each additional pound \$.50.
Foreign orders: 10% shipping, excess will be refunded.
California residents add 6 1/2% sales tax. • COD's discouraged.
Open accounts extended to state supported educational institutions and companies with a strong "Dun & Bradstreet" rating.



California Digital

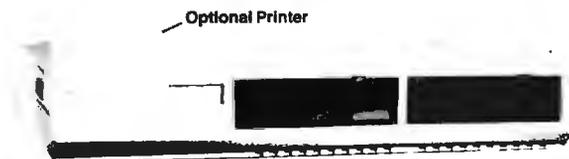
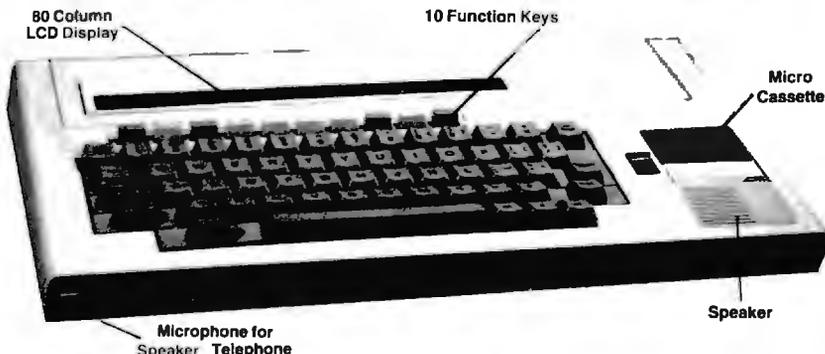
17700 Figueroa Street • Carson, California 90248

XEROX

SUNRISE COMPUTER

\$299

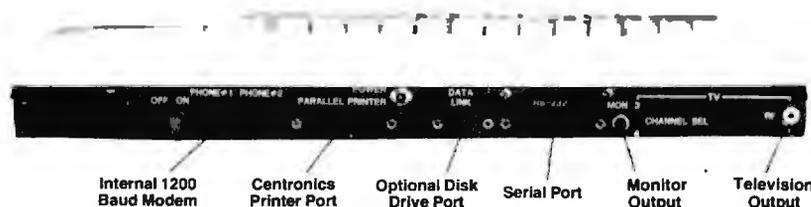
~~\$2995~~



The Xerox Sunrise 1810 is by far the best value we have ever seen in a micro computer. This is a self contained battery and AC operated portable. The Sunrise was originally priced at \$2995. Xerox has since elected to drop the computer from their product list. California Digital has purchased all the remaining inventory and is making the unit available at a fraction of its original cost.

This portable features a built in 80 column liquid crystal display, along with both RF monitor and television outputs. The internal 300/1200 baud modem includes an auto dial telephone assembly. The units has both centronics parallel and a serial port programmable to 19,200 baud. The self contained micro cassette is a recorder for dictating messages.

An optional dual floppy disk drive module, pictured above, is available for only \$219. (when purchased with the Sunrise 1810). Also available, for \$59 is an 80 column printer that mounts in the drive module. The Sunrise features a CP/M operating system which allows the operator to use any CP/M program in Xerox 5 1/4" disk format and over 5000 CP/M programs available in public domain.



1200 BAUD MODEMS

UNIVERSAL DATA

\$119



The UDS-212LP is a compact desktop modem designed to obtain all its operating power entirely from the telephone line thus eliminating the need to connect to an external AC power source. NOT Hayes compatible but the ideal 1200 baud modem to connect to any CRT terminal or computer when accessing dial up data bases. The Universal Data Div. of Motorola original suggested list price on the 212/LP was \$495. but California Digital is offering at only \$119.



\$159

The Universal Data 212A is manufactured for the minicomputer market. This modem is both 300 and 1200 baud auto answer. An industrial quality modem originally priced at \$595. NOT Hayes compatible.

SMARTTEAM 1200



\$189

The Team 212A offers all the features of the Hayes Smart Modem 1200 for a fraction of the price. Now is your opportunity to purchase a 1200 baud modem at the price of a 300 baud modem. California Digital is so confident of your complete satisfaction that we will allow the return the Team 212A and apply the full credit towards the purchase of any other modem.

UltraLink \$159
1200



The UltraLink is a Hayes compatible 300/1200 modem designed for the IBM/PC market place. The UltraLink adds a voice/data dimension to your PC. Manufacturers original suggested price on this modem is \$795. California Digital's price is only \$159.

MODEMS

Universal Data 212LP, 1200 duplex, line powered	UDS-212LP	119.00
Universal Data 212A, 300/1200 baud, industrial	UDS-212A	159.00
Universal Data 103JLP, line powered, auto answer	UDS-103LP	25.00
Hayes Smartmodem 2400 baud modem	HYS-2400	599.00
Fujitsu 2400/1200 baud auto everything	FUJ-1835D	439.00
Team 1200 Hayes Compatible, 300/1200 baud	TEM-SM1200	189.00
UltraLink 1200 data and voice on same line	UTL-1200A	159.00
CTS 212AH 1200 baud, auto dial	CTS-212AH	239.00
Terminal software for CTS 212AH	CTS-212SFT	35.00
Prometheus 1200 super features	PRM-P1200	319.00
Prometheus 1200B internal PC	PRM-P1200B	279.00
Signalman Mark 12, 1200 baud, Hayes compatible	SGL-MK12	239.00
Signalman Mark VI, 300 baud internal PC	SGL-MK6	59.00
Hayes Smart Modem 1200 baud, auto dial	HYS-12AD	389.00
Hayes 1200B for use with the IBM/PC, 1200 baud	HYS-1200B	369.00
Hayes Smartmodem, 300 baud only, auto dial	HYS-103AD	199.00
Hayes Chronograph, time & date	HYS-CHR232	199.00
Penril 300/1200 industrial quality	PEN-12AD	395.00

XEROX/XT

Fully IBM Compatible

\$1985



Includes:

- 14" Color Monitor
- Mouse & Software
- 10 Meg. Winchester
- 256K RAM Memory

This 10 Megabyte XT system was manufactured for the XEROX Corporation by Toshiba. The XEROX / XT operates all IBM software including Lotus 1-2-3 and Flight Simulator.

Built into the XEROX / XT Computer is a RS-232 serial port, Centronics parallel printer port, RGB and composite monitor output. The XEROX / XT also includes 256K/Byte of memory expandable to 640K, and a high resolution 14" RGB color monitor. The computer provides three IBM expansion slots for adding a modem or other boards. XEROX has also included a mouse along with operating software. Complete with 90 day warranty.

TOLL FREE ORDER LINE
(800) 421-5041

TECHNICAL & CALIFORNIA
(213) 217-0500

MAJOR BRAND LIQUIDATION



Retail Value \$5000

Save up to 60%

ACP PRICE
NOW ONLY!

\$1985.00

Color 14" RGB Included
10 Mb Hard Disk

ACP is proud to make this one-time special offer for a complete computer system that is 110% compatible to IBM™. This is by far the most significant bargain that we at ACP have offered in our 10 year

history. This system was successfully designed and manufactured to exceed IBM™'s PC in terms of quality, expansion modularity and capability, aesthetic appearance, and performance.

The system design utilizes the latest in state-of-the-art technology including:

- VLSI - Large Scale Integration Circuit Design
- Ergonomic CRT Design with Tilt Screen
- Professional Molded Packaging and Design
- High Quality 100 Watt Switching Supply
- Complete Integrated System
- Microsoft Compatible Mouse Function

The system is not a Taiwan or Korean knock-off. Each component is specifically designed and specified to meet the highest performance and reliability standards in the industry. It represents the best that Japanese craftsmen have to offer and you will be equally proud to own one of your own. ACP has a limited quantity of these systems in several different configurations. IBM™ PC-DOS™ v1.1/2.1, MS-DOS™ v2.11 and Concurrent v3.1 compatible. We have found no known incompatibility with any IBM™ PC application. Our technical staff has 8.5 Megabytes of various MS-DOS software packages installed including Lotus 1-2-3 and Flight Simulator. Each system comes complete with a 90 day warranty.

ACP Base System Consists of:

- (1) 360K DD/DS Floppy Disk Drive
- Mouse with Software
- 256K Memory Expandable to 640K on the Motherboard
- Deluxe Keyboard with LEDs
- Serial Port and Parallel Port
- Color or Monochrome Controller
- 4.77MHz, 8088 CPU
- 100 Watt Switching Supply w/Fan
- Three Expansion Slots
- Optional 6 Slot Expansion Chassis with Power Supply (add \$399)

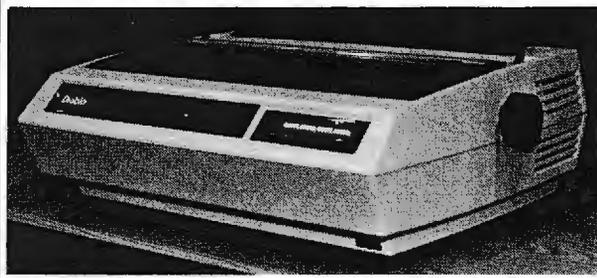
	SYSTEM CONFIGURATION	Est IBM List*	Your Price
SYSTEM A	Base System (see left) PC with 360K Floppy, Keyboard & Mouse.	\$2100.00	\$995.00
SYSTEM B	Base System (see left) plus Add'l 360K Floppy Drive	\$2295.00	\$1099.00
SYSTEM C	Base System plus 12" Green Monitor with Detachable Tilt/Swivel Base.	\$2575.00	\$1399.00
SYSTEM D	Base System plus 12" Color Monitor with Detachable Tilt/Swivel Base.	\$2995.00	\$1699.00
SYSTEM E	Base System plus Cir Monitor, 10Mb Hard Disk and Boot Diagnostics.	\$5000.00	\$1985.00
SYSTEM F	Base System plus 80 Col. x 25 Line LCD Screen	N/A	\$1299.00

Base System A (as above) **\$995.00**

*Assumes required add-in boards to provide same capacity

IBM PC is a trademark of IBM Corp.

LQP PRINTER SPECIAL



Major Manufacturer
Daisy Wheel Model 620
Letter Quality Printer
with Serial Interface.

Perfect for IBM PC and
Compatibles. Prints 25cps and
comes with 90 day warranty.

\$495.00

List \$1495.....
With purchase of
any system above **\$395.00**



10 Mb **\$449.00**
HARD DISK

w/Controller for IBM™ PC and
Compatibles.

10 Mb Standalone **\$249.00**

20 Mb Standalone **\$419.00**

PC UPGRADE SPECIAL

\$8.95 SET OF (9) 64K RAMS

\$34.95 SET OF (9) 256K RAMS

\$5.95 128K PIGGYBACKS

IBM Brand ASYNCH

INTERFACE CARD

List \$100 **ACP \$49.95**



5 Mb EXTERNAL

Sharp IBM Look-a-like w/contr. for
IBM PC. Sub-System Price: **\$429.00**
External Enclosure Add **\$195.00**

Internal w/controller
Sub-System Price: **\$299.00**

DELUXE JOYSTICK

\$11.95



Compatible w/Atari
2600, 400, 800, VIC-20/
64 and Apple. Apple re-
quires optional cable
adapter. Add **\$2.95**

APPLE DISK DRIVE

\$115.00



High quality 1/2 high
drive for Apple II, II+,
Ile or Iic. Apple Iic re-
quires optional cable
adapter. Add **\$10.00**

Parts

TOLL FREE
800-854-8230
Calif. Residents
714-558-8813

OUR POLICY Inquiry !!

- NO surcharge for VISA or Mastercard.
- NO sales tax. •All shipments Insured.
- Your card is NOT charged until we ship.
- Same day FEDEX shipment is available.
- Volume purchasing agreements available.
- Government agencies, corporate and Institutional PO's accepted.
- Orders subject to availability.
- All items have manufacturer warranty. Some warranties up to 5 years.
- Pricing subject to change w/o notice.
- Returns or cancellations may be subject to restocking fee.
- ACP Retail Store pricing may vary.
- We are not responsible for typos.

UPS POWER SUPPLY

Back Up Power for your IBM, Apple or Compatible
UPS-AT 425 Watts \$277.00
UPS-AT 1000 Watts \$485.00

A-B PRINTER SWITCH

An AB Switch allows use of two printers with your computer system. We stock over 15 different configurations!
AB Switch (Centronics) \$59.00
AB Switch (DB25) \$6.00

COLOR VIDEO CARDS

Plantronix Color Plus \$375.00
IBM Color Card 227.00
IBM Color Card w/parallel 219.00
ETG Graphics Plus 289.00
Paradise MultiDisplay Card 345.00
Evergreen Graphics Card 345.00

SPECIAL BUY

Shugart SA 4004 14" 288MB Hard Disk \$499.00

DRIVE CABINETS

IBM Style Hard Disk with power supply and fan \$185.00
Dual Hard Disk w/power sup & fan \$95.00
Dual 5 1/4" Full Height vertical mount 60.00
Dual 5 1/4" Full Height horizontal mount 60.00
Single 5 1/4" Full Height w/power sup & fan 60.00
Single 5 1/4" Full Height w/Power Dec Card 60.00

PERSYST CARDS

Persyst Color Combo - NEW! \$335.00
Persyst Color Combo - NEW! \$35.00
Persyst Bob Board Call 445.00
Persyst Shortcut Color Call
Persyst Mini Model Call
Persyst +1 Time Spectrum w/RAK 179.95
Persyst 192K Rainbow Dec Card 149.95

MODEM SPECIAL

Hayes Smartmodem Compatible 1900 Baud. External. Sold for \$29.00 \$219.00

TRANSISTORS/DIODES

P2N2222A 781.00 2N3904 1161.00
P2N2907A 51.00 2N3906 111.00
2N3906 21.00 TIP29A 21.00
2N2218A .45 TIP29A 21.00
2N2908 .45 TIP29A 21.00
2N2907 .25 1N4148 291.00
2N3055 .60 1N4148 291.00
2N3055 41.00 1N4002 121.00
2N3055 41.00 1N4004 101.00
2N3772 1.85 1MPC2222 1.49

OPTO ISOLATORS

MCT-2 \$.35 4AN33 \$.59
MCT-4 1.30 4AN33 1.23
MCT-6 .55 4AN37 1.25
MCA-255 1.69 4AN36 .98
4AN29 .68 TL117 79
4AN27 .65 5PXC3 8.29
4AN28 .60 4AN25 51.00

LED LAMPS

1-99 100
Jumbo Red \$.07 \$.09
Jumbo Green \$.17 \$.19
Jumbo Yellow \$.17 \$.19
Mini Size Red \$.10 \$.09
Mini Size Green \$.10 \$.09
Mini Size Yellow \$.10 \$.10

SPECIAL VALUES!

MCW8075 EPROM \$9.95
21182118-150ms 1019.50
D8-28S Female 1019.95
D8-28S Male 1019.50
2716C-456ms 1024.50
2716C-450ms 1029.95

CALL ACP FOR ALL YOUR VOLUME IC REQUIREMENTS

INTERSL STD-BUS BOARDS

LIST	ACP
ISB3100 250 CPU	\$200 \$99.95
ISB3101 250 Unit, CPU	200 69.95
ISB310 8088 CPU	200 79.95
ISB3218 18K CMOS RAM	810 99.95
ISB3218 18K CMOS RAM	200 99.95
ISB3220 18K CMOS RAM	750 118.56
ISB3300 250 PIO (D mating)	210 46.95
ISB3331 Unbuffered PIO	210 49.95
ISB3340 Opto Para. Input	300 118.95
ISB3400 Floppy Controller	215 79.95
ISB3410 BSI (DMA) W/Int. Inter.	250 99.95
ISB3500 Trim	200 119.95
ISB3510 Opto-iso Input	200 119.95
ISB3520 BPT Relay	150 69.95
ISB3530 DPTI Relay	150 69.95
ISB3600 Adtronic	370 79.95
ISB3610 EPROM Programmer	280 79.95
ISB3700 Remo/Async	245 69.95
ISB3711 Univ. Sync/Async	245 69.95
ISB3720 REMDACs	135 149.95
ISB3800 12 Bit AD	720 269.95

CAPACITORS

.01UF DISC BYPASS CAPACITOR 10065.50
.01UF MONOLITHIC CAPACITOR 10011.25
.1UF MONOLITHIC CAPACITOR 10014.25

CORCOM EMI FILTER

STD CORCOM 3 Conductor Filter \$4.50
Line Cord for Above - 6 foot .85
Line Cord 2 Conductor - 6 foot .35
Line Cord 3 Conductor - 8 foot .85

MUFFIN FANS

Over 10,000 In Stock
Toxin #3 7A-300 Fan NEW! \$9.95
Toxin #4 6" Muffin Fan NEW! 12.95
12VDC Fan NEW! 13.95
Finger Guards added 1.49
Power Cords Added 1.49

IC SOCKETS

SOLDERTAIL 1-99 100
8 Pin STALP \$.13 \$.10
14 Pin STALP \$.18 \$.12
18 Pin STALP \$.17 \$.12
14 Pin STALP \$.20 \$.17
20 Pin STALP \$.28 \$.20
22 Pin STALP \$.28 \$.20
24 Pin STALP \$.28 \$.20
28 Pin STALP \$.32 \$.24
36 Pin STALP \$.38 \$.28
44 Pin STALP \$.48 \$.32

WIREWRAP (GOLD)

8 Pin W/WZL \$.48 \$.40
14 Pin W/WZL \$.62 \$.49
18 Pin W/WZL \$.65 \$.55
20 Pin W/WZL \$.68 \$.57
22 Pin W/WZL \$.70 \$.59
24 Pin W/WZL \$.75 \$.63
28 Pin W/WZL \$.82 \$.69
36 Pin W/WZL \$.98 \$.82

TEXTOLUX ZERO INSERTION

16 Pin \$6.75 24 Pin \$7.85 28 Pin \$8.95
(We Stock All Types of Sockets)

EDGE CONNECTORS

S-100 ST 1-99 100
10 Pin WW \$.85 \$.85
44 Pin ST 4.75 4.10
44 Pin ST 2.75 2.50
72 Pin ST 4.75 4.25
72 Pin WW 7.25 6.95

D-SUBMINIATURE

DB25S (Female) 1.24 1.20
DB25P (Male) 2.40 2.29
Hood \$1.25 MHG W/ \$9.99
DE37P (Male) \$5.95 \$5.76
DE37P (Male) \$5.25 \$5.10
Hood \$1.75 MHG W/ \$9.99
DO30S (Female) \$5.95 \$5.65
DO30P (Male) \$6.00 \$5.70
Hood \$3.25 CAT LOG \$6.00

(OTHER STYLES IN CATALOG)

CENTRONICS

IOC 30 Pin Male \$8.95
IOC 30 Pin Female \$4.49
Solder 36 Pin Male 7.49
Solder 36 Pin Female 6.55
(CALL TOLL FREE FOR IDC'S)

IDC CONNECTORS

10 20 26 34 40 50

IDC TYPE

Solder Header IDHXSS .79 1.20 1.65 2.10 2.40 3.00
Rt Angle Solder Header IDHXSR .79 1.20 1.65 2.10 2.40 3.00
Ribbon Header Socket IDXSH .75 .95 1.35 1.60 1.85 2.10
Ribbon Header IDHMX — 5.25 5.95 6.75 7.25 8.25
Ribbon Edgecard IDEXE 1.70 2.15 2.50 2.80 3.70 3.95
Wirewrap Header IDHXW 1.80 2.90 3.75 4.25 4.95 5.50
Rt Angle WW Header IDHXWR 1.99 3.10 4.10 4.20 4.60 7.15

NOTE: To order insert number of contacts in place of xx IN ACP part number.

ORDER QUANTITY OF 50pcs (mixed) AND TAKE AN ADDITIONAL 10% OFF.

NUMBER OF CONTACTS

10 20 26 34 40 50

IDC TYPE

Solder Header IDHXSS .79 1.20 1.65 2.10 2.40 3.00
Rt Angle Solder Header IDHXSR .79 1.20 1.65 2.10 2.40 3.00
Ribbon Header Socket IDXSH .75 .95 1.35 1.60 1.85 2.10
Ribbon Header IDHMX — 5.25 5.95 6.75 7.25 8.25
Ribbon Edgecard IDEXE 1.70 2.15 2.50 2.80 3.70 3.95
Wirewrap Header IDHXW 1.80 2.90 3.75 4.25 4.95 5.50
Rt Angle WW Header IDHXWR 1.99 3.10 4.10 4.20 4.60 7.15

OKIDATA PRINTERS

Okidata 20 Color Printer \$139.00
Plug-N-Print for Okidata \$1.00
Okidata 102 (120cps, Graphics) 259.00
Okidata 102 (180cps, Graphics) 249.00
Okidata 103 (180cps, 15" Paper) 549.00
Okidata 92 (100cps, Graphics) 349.00
Okidata 93 (100cps, 15" Paper) 599.00

OKIDATA 8000 Series

Okidata 84 (200cps, Parallel) \$799.00
Okidata 84 (200cps, Serial) \$799.00
Tractor for Okidata 192 44.00
Tractor for Okidata 92 44.00
2K Serial Board for Okidata 192/193 69.00
2K Serial Board for Okidata 92/93 69.00
Extra Ribbon \$5.00

8000

65000 \$19.95 6810 \$ 2.85 9550 \$ 3.25
8000010 39.85 8261 3.75 8852 5.95
8502 5.95 8561 2.90 9000 7.90
8602 7.75 8620 14.80 8875 6.75
8803 18.85 8840 11.75 8880 2.20
8809E 9.50 8845 12.90 8907 22.95

6500

8502 \$4.50 9004 8.75 9322 \$5.25
8002A 5.90 8501 6.75 8632 5.50
9002E 6.90 9250 4.25 9351 11.50

8000

9035 \$ 3.75 9214 \$ 3.75 9258 \$ 6.75
9035 3.75 9214 3.75 9258 6.75
9035A 3.85 9228 3.40 9259 8.25
9099 24.50 9227 13.75 9283 8.25
9097-1 129.95 9257 15.36 9284 5.50
9098 17.50 9228 4.25 9286 6.45
9098 66.60 9043 5.90 9287 4.40
9155 6.75 9290 10.50 9288 11.95
9156 0.75 9261 4.25 9289 44.35
9165 28.55 9261A 5.98 9290 12.95
9232 23.95 9263 6.75 9271 27.95
9303 37.95 9265 4.25 9746 24.50
9325 3.25 9265A 5.95 9749 24.50
9212 1.95 9267 5.75 9753A 34.90

Z-80

Z-80CPU 2.25 2.75 5.95
Z-80-CTC 2.50 3.75 9.25
Z-80-DART 7.50 8.90 17.95
Z-80-DMA 7.50 8.90 17.95
Z-80-PIO 6.50 8.90 17.95
Z-80-SIO-0 8.50 9.50 22.95
Z-80-SIO-1 8.50 9.50 22.95
Z-80-SIO-2 8.50 9.50 22.95
Z-80-SIO-9 8.50 9.50 22.95

DISK CONTROLLERS

Z8003 \$34.85 Z8001 \$34.85 Z8132 \$32.95
Z8330 34.85 Z8002 34.85 Z8371 37.95

DISK CONTROLLERS

UP0785 \$24.65 1767 \$21.85 6843 \$28.95
1771 15.15 8291 32.95 8272 19.95
1781 22.75 2763 32.95 1981 6.95
1793 21.25 2763 32.95 1981 6.95
1795 21.00 2767 32.95 9216 12.95

CRT CONTROLLERS

6845 \$11.95 8273 \$28.50 TM29018 \$36.50
6845 17.95 7220 34.95 8350 39.95
8647 11.50 7227 17.95 8545 14.95
8652 14.50 7227 17.95 8602 16.95
86047 19.50 85C720 Graphics

UARTS/USARTS

16029 \$3.85 2950 \$ 6.95 1M8403 \$ 8.75
1013A 3.85 2950 6.95 1M8403 8.75
1015A 6.75 1M8402 7.75 2651 8.95

EPROMS

1702 (1M5) \$ 3.80 2732A-4 (450ns) \$ 4.50
1702 (1M5) 3.85 2732A-2 (450ns) 4.50
2756 (1V) 5.50 2732A-2 (450ns) 4.50
2716 (450ns) 3.75 2784 (450ns) 6.50
2718 (350ns) 3.75 2784 (450ns) 6.50
2719 (1V) 5.50 2784 (450ns) 6.50
2732SP 7.50 2784 (450ns) 6.50
2732SP 7.50 2784 (450ns) 6.50
2732 (450ns) 4.00 2784 (450ns) 6.50
2732 (450ns) 4.00 2784 (450ns) 6.50
2732 (450ns) 4.00 2784 (450ns) 6.50

CMOS EPROMS

27C13 89.95 27C34 39.95
27C19 89.95 27C35 12.50

STATIC RAMS

2101 (450ns) \$1.89 MK4118 54.85
2110 (450ns) .79 TM2018-2 (150ns) 3.85
2102-1 (450ns) .79 TM2018-2 (150ns) 3.85
2110-2 (250ns) 1.29 TM2018-1 (100ns) 3.00
2114-1 (450ns) 1.46 81320 4.75
2114-2 (450ns) 1.46 81320 4.75
2114-3 (200ns) 1.75 81320 4.75
2114-4 (200ns) 1.83 81320 4.75
2147 (250ns) 4.80 28112 (200ns) 32.95
4024-4 (450ns) 3.25 HM6284P-1 (150) 14.95
4044-4 (200ns) 3.75 HM6284P-1 (LP) 18.95
4044-4 (200ns) 3.75 HM6284P-1 (LP) 18.95
5101 (CMOS) 3.60 93426 (50ns) 3.95

DYNAMIC RAMS

4027 (250ns) \$1.29 TMS4006 (200ns) \$5.75
1103 (300ns) .79 TMS4018 (200ns) 27.95
4118N-2 (150ns) 1.29 81.95 4125E-10 (100ns) 8.95
4118N-3 (300ns) 1.19 81.95 4125E-20 (200ns) 7.95
4118N-4 (250ns) 80 81.95 TMS4050 (200ns) 1.85
418N-150 (150ns) 1.59 TMS4006 (300ns) 1.85
418N-200 (200ns) 1.49 81910M TMS4050 (300ns) 1.85
418N-120 (120ns) 1.25 TCH-11 (300ns) 5.95
TMS4184 (150ns) 0.95 M42526 (250ns) 1.85

DISK SPECIAL (IBM PC DSD)

\$100 EACH IBM PC DSD WOW!
PACKAGE Typex Cover QF 25 Major Mfg. Supply Limited

5 1/4" DISKETTES

VERBATIM 525-01 SSSD 1 Box 10 \$19.95
VERBATIM 525-01 DSD (IBM) 27.95 24.95
MAXELL MC-100 DSD (IBM) 19.95 19.95
MAXELL MC-100 SSSD (IBM) 24.95 22.95
MAXELL DISKS for AT (96ps) 46.95 43.95
DYBAN 10410 DSD (AT) 37.95 35.95
DYBAN 10420 DSD (IBM) 34.95 31.95
ACP SSSD (IBM) 14.95 12.95
ACP DSD (IBM) 15.95 12.95

5 1/4" DISKETTES

VERBATIM 3 1/4" SSSD (MAC) 32.00 28.00
MAXELL 3 1/4" MICRODISK (MAC) 33.00 31.00

5 1/4" DISKETTES

VERBATIM 525-01 SSSD 28.95 26.95
VERBATIM 525-01 DSD 39.95 36.95
DYBAN 81 DSD 34.95 31.95
DYBAN 81 SSSD 49.95 47.95

5 1/4" DISK

5 1/4" DISK \$14.95
HEAD CLEANING KIT \$9.95

CMOS

4000 \$ 28 4028 \$.65 4056 \$ 9.00 4505 \$.85
4001 22 4029 .75 4036 35 4050 1.10
4002 22 4031 3.25 4068 2.90 4070 1.10
4006 17 4031 3.25 4068 2.90 4070 1.10
4007 22 4032 2.16 4070 3.5 4510 1.79
4010 3.9 4034 .88 4071 1.91 4512 .79
4009 39 4035 .78 4072 2.30 4512 1.79
4011 39 4037 1.93 4073 2.8 4514 1.18
4010 34 4040 .75 4073 2.8 4514 1.18
4012 39 4041 1.91 4074 3.5 4516 1.19
4013 35 4042 .65 4077 3.5 4518 .86
4014 35 4043 .65 4078 3.5 4520 .75
4015 39 4044 .88 4081 2.9 4524 .98
4016 35 4046 .88 4082 2.9 4526 .96
4017 35 4047 .88 4085 3.95 4528 1.35
4018 39 4048 .88 4088 3.65 4535 1.33
4019 39 4049 3.85 4093 4.5 4537 .49
4020 39 4050 3.4 4094 2.95 MC14048 12.95
4021 39 4051 3.75 4095 1.90 MC14049 12.95
4022 39 4052 3.75 4096 1.85 MC1410 8.95
4023 35 4053 .75 4501 6.99 MC14411 11.95
4024 59 4055 3.98 4502 9.95 MC14412 12.95
4025 35 4056 2.96 4503 4.95 MC14418 4.98
4027 .45 CALL FOR 74HC

74C00

74C00 8.29 74C74 8.85 74C161 8.15 74C373 32.35
74C02 29 74C85 1.89 74C175 1.15 74C374 2.35
74C03 29 74C86 1.89 74C176 1.15 74C375 2.35
74C04 35 74C93 1.15 74C244 1.89 74C382 4.45
74C10 35 MORE 74C IN STOCK - ALSO IN CATALOG

LINEAR

LM100AH \$3.95 NE590 \$2.46 LM3009 .99
LM3009 .99 NE592 2.70 LM3914 \$2.95
LM3010 .35 LM709N .58 LM3915 2.95
LM3014 1.89 LM709N 1.90 LM3916 2.95
LM3015 1.89 LM710 1.90 LM3917 2.95
LM3016 1.89 LM711 .75 MC4024 1.25
LM3017 1.89 LM712 1.90 MC4025 1.25
LM3018 1.89 LM713 3.95 RC4131 3.75
LM3019 1.89 LM714 1.90 RC4132 3.75
LM3020 1.89 LM71

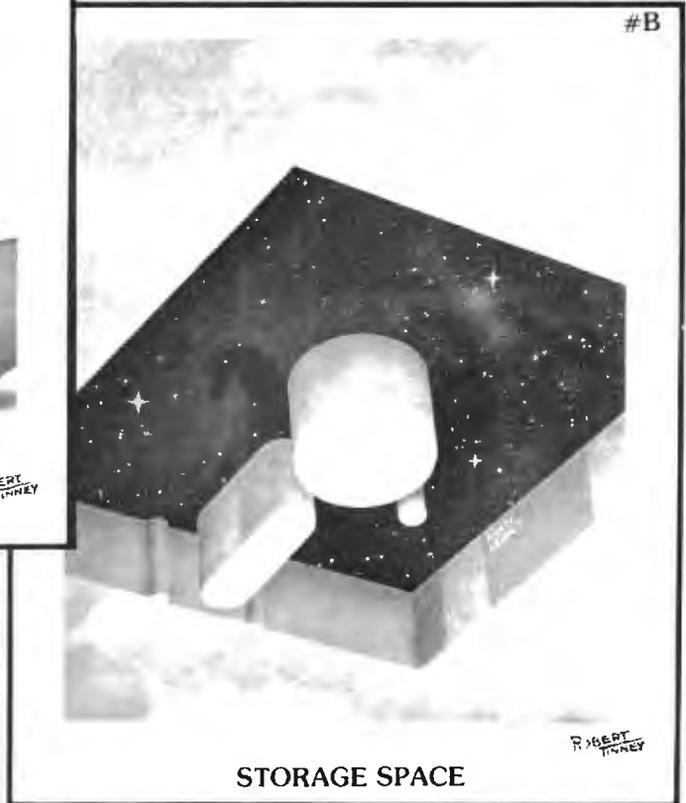
BYTE

LIMITED EDITION Classics

Beautiful 16" X 20"
Limited Edition Prints,
each signed and numbered
by the Artist.



INTELLIGENT REFLECTIONS



STORAGE SPACE

Fascinating...And Unique!

The two 1985 Byte covers shown above are now available as 16" X 20" limited edition prints. Each edition is strictly limited to 1000 prints, which are individually inspected, signed and numbered by the artist, Robert Tinney. These excellent reproductions are made from the original paintings (not from transparencies or photos) to ensure accurate color fidelity.

Byte Limited Edition Classics are printed on select 100% cotton fiber stock. This is a museum grade acid free paper, highly resistant to yellowing and cracking; you will be assured of a print which will retain its color and beauty for generations. Accompanying each print is a handsome Certificate of Authenticity, which is also personally signed and numbered by the artist, and which certifies the quality and limited number of the edition.

Price and Shipping

The price of each Byte Limited Edition Classic is \$55; if two or more prints are ordered, the price of each is only \$45.

Byte Limited Edition Classics are shipped flat, and are guaranteed to arrive undamaged or be immediately replaced. In fact, if for any reason you are not satisfied with your order, you may return it within 30 days for a no questions asked refund. Your prints will be shipped UPS Blue Label (two day delivery), and will usually be shipped within one week of receipt of order.

Ordering

To order your Byte Limited Edition Classic(s), just clip out and mail the coupon below. If you prefer, you may call in a MasterCard or Visa order to Robert Tinney Graphics, 1-(504)272-7266.

Send me the following print for \$55(\$45 each for two or more).			<input type="checkbox"/> I have enclosed check or money order to Robert Tinney Graphics <input type="checkbox"/> Please just send me your free color brochure.		Mail this coupon to: Robert Tinney Graphics 1864 N. Pamela Drive Baton Rouge, Louisiana 70815
Qty.	#	Title	Amount	Ship To:	
			\$ _____	Name: _____	Visa or MasterCard orders CALL 1-504-272-7266
			\$ _____	Address: _____	
		postage & handling \$4(\$10 overseas)	\$ _____	City: _____	
		Total \$	\$ _____	State: _____ Zip: _____	
Bill my <input type="checkbox"/> Visa or <input type="checkbox"/> Mastercharge: Exp. Date: _____					
Card No: _____					

"INSIDE IBM" SPORT-SHIRT!



INSIDE IBM

The classic November '83 Byte cover—and boy, does it look great on this 3/4 sleeve "baseball shirt"! The vivid royal blue sleeves and neckline really make the design jump out. And don't mistake this for one of those rubbery patches that cracks and peels off after a few washings. This is true four-color process: the inks are silk-screened into the fabric of the shirt, resulting in a beautiful, full-color image that lasts.

You'll also appreciate the shirt itself: a real heavy-weight made of 50% cotton, 50% polyester. You'll enjoy cotton comfort in a tough, sporty shirt that keeps its crisp, fresh look through many washings—with almost no shrinking! The price for each "Inside IBM" Sport-Shirt is only \$12.50 (\$11.50 each for 3 or more). Your order will be shipped within a week.

Please send me the following shirt(s) at \$12.50 each, or \$11.50 each for 3 or more. I have included \$2.00 for shipping and handling.

Qty.	Size	Amount
_____	Adult—Extra Large	\$ _____
_____	Adult—Large	\$ _____
_____	Adult—Medium	\$ _____
_____	Adult—Small	\$ _____
_____	Child—(sizes 10-12)	\$ _____
	Shipping and Handling	\$2.00
	(Overseas add \$3.00)	\$ _____
TOTAL		\$ _____

I have enclosed check or money order.

VISA MasterCard Free Color Brochure

Card #: _____

Exp. Date: _____

Ship my shirt(s) to:

Name: _____

(Business): _____

Address: _____

City: _____

State: _____ Zip: _____

Mail this coupon to:

Robert Tinney Graphics
1864 North Pamela Dr.
Baton Rouge, Louisiana
70815

For VISA or MasterCard Orders
or for more information
Call 1-504-272-7266

INTEL/LOTUS
4 MEGABYTE ABOVE BOARD
\$349⁹⁵ With 64K Installed for IBM PC

For Your IBM PC		For Your IBM PC-AT	
256K	\$399 ⁹⁵	128K	\$529 ⁹⁵
512K	\$449 ⁹⁵	512K	\$629 ⁹⁵
1 MB	\$549 ⁹⁵	1 MB	\$729 ⁹⁵
2 MB	\$749 ⁹⁵	2 MB	\$929 ⁹⁵
		4 MB	\$1599 ⁹⁵

TALLTREE JRAM-2/JRAM-3
2 MEGABYTE CARD
\$199⁹⁵ JRAM-2 Without Memory

1 MB JRAM-2	\$399 ⁹⁵
2 MB JRAM-2	\$599 ⁹⁵
256K JRAM-3	\$329 ⁹⁵
1 MB JRAM-3	\$499 ⁹⁵
2 MB JRAM-3	\$629 ⁹⁵

Multifunction Card
For Your IBM PC
\$149⁹⁵

Up to 384K, parallel printer port, RS-232 serial port, game port, clock/calendar, RAM disk/printer buffer software package.

	LIST	JADE
OK JADE Expando RAM	\$299	\$149. ⁹⁵
384K JADE Expando RAM	\$649	\$249. ⁹⁵

EXPAND YOUR IBM PC,
IBM PC—XT, IBM PC—AT

	LIST	JADE
AST Six Pak Plus 64K	\$395	\$249. ⁹⁵
AST Six Pak Plus 384K	\$945	\$349. ⁹⁵
AST I/O Plus	\$165	\$129. ⁹⁵
128K AST Advantage-AT	\$595	\$449. ⁹⁵
3.0 MB AST Advantage-AT	\$4145	\$1299. ⁹⁵
Quadport-AT 1S, 1P	\$154	\$139. ⁹⁵

IBM Video Boards

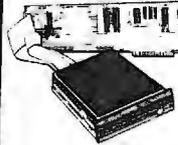
	LIST	JADE
Hercules Color Graphics	\$245	\$189. ⁹⁵
Hercules Monochrome Graphics	\$499	\$339. ⁹⁵
Tecmar Graphics Master	\$699	\$499. ⁹⁵
Paradise Graphics Card	\$395	\$319. ⁹⁵
Everex Graphics Edge	\$599	\$349. ⁹⁵
JADE RGB w/Parallel Port	\$199	\$99. ⁹⁵
JADE RGB w/Parallel & Serial	\$299	\$199. ⁹⁵
JADE TTL Monochrome 720x348	\$299	\$149. ⁹⁵

LOW PRICES!
FAST SERVICE!

135/150 WATT
 Drop-in replacement
POWER SUPPLY
 For your IBM PC

	LIST	JADE
135 Watt	\$199	\$95 ⁹⁵
150 Watt	\$249	\$115 ⁹⁵

10 MEGABYTE
Hard Disk System



FOR YOUR
IBM PC

\$469⁹⁵

Complete with controller card, data cable, and mounting hardware, totally PC/XT compatible. External model includes cabinet & power supply.

	LIST	JADE
10 MB Internal 1/2 High	\$990	\$469. ⁹⁵
20 MB Internal 1/2 High	\$1550	\$699. ⁹⁵
33 MB Internal 45 ms	\$2184	\$1229. ⁹⁵
20 MB Hi-Speed for AT	\$1250	\$699. ⁹⁵
30 MB Hi-Speed for AT	\$1550	\$899. ⁹⁵

For external cabinet & power supply add \$199⁹⁵

TEAC
55B \$99⁹⁵
360K



Disk Drive for IBM PC

	LIST	JADE
Double-sided, Double-density		
TANDON 100-2	\$299	\$119. ⁹⁵
TEAC 55B	\$249	\$99. ⁹⁵

High Resolution
Video Monitors



	LIST	JADE
Amdek 300G	\$179	\$139. ⁹⁵
Amdek 300A	\$199	\$149. ⁹⁵
Amdek 310A	\$230	\$179. ⁹⁵
Amdek Color 710	\$799	\$599. ⁹⁵
PGS MAX-12E 720 x 350	\$269	\$179. ⁹⁵
PGS HX-12 640 x 240	\$699	\$449. ⁹⁵
PGS HX-12E 690 x 350	\$785	\$549. ⁹⁵
PGS SR-12 720 x 480	\$799	\$629. ⁹⁵
PGS Scan-Doubler for SR-12	\$299	\$199. ⁹⁵
Taxan 440 Ultra Hi-Res RGB	\$799	\$599. ⁹⁵

High Speed APU Chips

8087	\$119 ⁹⁵	80287	\$199 ⁹⁵
------	---------------------	-------	---------------------

**FREE PC PAINT W/
 MICROSOFT Mouse**

	LIST	JADE
Microsoft Mouse, RS-232 Serial	\$199	\$129. ⁹⁵
Microsoft Mouse, IBM Bus	\$199	\$129. ⁹⁵
PC MOUSE with Pop-ups	\$195	\$139. ⁹⁵
PC MOUSE with Paint	\$220	\$159. ⁹⁵

KEYTRONICS



	LIST	JADE
KB5150 Improved IBM Keyboard	\$209	\$159. ⁹⁵
KB5151 Deluxe IBM Keyboard	\$299	\$199. ⁹⁵

KB5153, KB5152B & KB5152V also available

256K RAM Chip
Upgrade Kits \$399⁹⁵

High speed RAM upgrade kit with FREE parity (error detection) and one year warranty. We ship thousands of these kits to satisfied customers every week.

	LIST	JADE
64K RAM Chip Kit for PC	\$49	\$9. ⁹⁵
128K RAM Chip Kit for AT	\$395	\$99. ⁹⁵



JADE 1200
BAUD Modem \$179⁹⁵

HAYES Smartmodem 1200 Compatible at a fraction of the price. FCC approved.

	LIST	JADE
JADE 1200 BAUD External	\$349	\$179. ⁰⁰
JADE 2400 BAUD External	\$699	\$499. ⁹⁵
Software for IBM PC	\$99	\$29. ⁹⁵

HAYES
Smartmodems



Sophisticated direct-connect auto-answer/auto dial modem, touch tone or pulse dialing RS-232 interface programmable.

	LIST	JADE
HAYES Smartmodem 2400	\$899	\$629. ⁹⁵
HAYES Smartmodem 1200	\$699	\$389. ⁹⁵
HAYES 1200B w/o Smartcom II	\$539	\$339. ⁹⁵
HAYES 1200B for IBM PC	\$599	\$359. ⁹⁵
HAYES Smartmodem 300	\$289	\$169. ⁹⁵
HAYES Micromodem IIe	\$299	\$169. ⁹⁵
HAYES Smartmodem IIc	\$399	\$169. ⁹⁵
Modem Cable	\$35	\$24. ⁹⁵

PROMODEMS
As Low As \$149⁹⁵



	LIST	JADE
ProModem 300c for Apple IIc	\$199	\$149. ⁹⁵
ProModem 1200B for IBM PC	\$399	\$289. ⁹⁵
ProModem 1200 RS-232	\$495	\$299. ⁹⁵
ProModem 1200A for Apple	\$449	\$349. ⁹⁵
ProModem 1200 for Macintosh	\$495	\$349. ⁹⁵
Alpha/num Display Option	\$99	\$79. ⁹⁵
Options Processor	\$99	\$79. ⁹⁵
64K Mem Expansion for Above	\$99	\$19. ⁹⁵
Modem Cable	\$35	\$24. ⁹⁵

**HIGH RESOLUTION
640 x 260, .38 Dot Pitch
TAXAN 415
RGB COLOR
MONITOR**

LIST PRICE \$699
For cable add \$19.00 **\$295**

Printers



EPSON FX-85 & FX-185, OKIDATA 192 & 193, C. ITOH, CITIZEN, STAR

**PRICED TOO LOW
TO PUBLISH!**

Call Us Toll Free For The Best Deal In The Country!

Printer Accessories



	LIST	JADE
IBM PC Style Cable	\$54	\$19.95
Standard Parallel Cable	\$40	\$19.95
RS-232 Serial Cable	\$30	\$24.95
Ribbons	as low as	\$4.99
Apple IIC/Macintosh Cable	\$39	\$19.95

ISO-BAR



These industrial quality ISO-BARs contain surge suppression circuitry and built-in noise filters plus a 15 amp circuit breaker.

	LIST	JADE
6 Socket, 1 Filter ISO-BAR	\$69	\$44.95
4 Socket, 2 Filter ISO-BAR	\$89	\$59.95
8 Socket, 4 Filter ISO-BAR	\$99	\$69.95

UNINTERRUPTABLE POWER SUPPLY

Emergency back-up power to save your computer system. A must for every computer system.

200 Watt UPS	\$359	\$279.95
425 Watt UPS	\$539	\$459.95
1000 Watt UPS	\$1179	\$995.95

**Disk Drive
for Your
Apple IIC
\$12995**



	LIST	JADE
Disk Drive for Apple IIC	\$249	\$129.95
Parallel Printer Cable for IIC	\$99	\$59.95
Full Height Disk Drive	\$299	\$139.95
Half Height Disk Drive	\$249	\$129.95
ALS Z Engine	\$299	\$145.95
16K RAM Card	\$99	\$39.95
64K 80 Column Card for IIC	\$219	\$119.95
Best 80 Column Card II/II+	\$219	\$139.95
Printer Card & Cable	\$109	\$49.95
Fan with Surge Protection	\$99	\$59.95
Grappler Plus	\$175	\$99.95
64K Buffered Grappler+ w/16K	\$275	\$149.95

**Letter Quality Upgrade
For Your EPSON RX-80,
RX-100, FX-80, FX-100**

Near-Letter-Quality upgrade with front panel font controls for your old printer.

	LIST	JADE
LetterWriter Upgrade	\$79	\$58.95

MICROFAZER Buffers



Expandable to 64K (Parallel model expands to 512K)

	LIST	JADE
8K00 Parallel in/Parallel out	\$169	\$139.95
64K0 Parallel in/Parallel out	\$225	\$164.95
128K Parallel in/Parallel out	\$445	\$269.95

Your choice: serial in/serial out, parallel in/serial out, serial in/parallel out.

	LIST	JADE	LIST	JADE	
8K	\$199	\$169.95	64K	\$260	\$199.95

Microbuffers

Parallel or serial for printers and modems

	LIST	JADE
32K Microbuffer	\$299	\$229.95
64K Microbuffer	\$349	\$249.95
64K Add-on Board	\$179	\$149.95

CAD Software

Best schematic and mechanical drafting package we've tested! Powerful, accurate, fast, easy to learn and use for:

- Space Engineering
- Interior Decorating
- Electrical Engineering
- Logic Diagrams
- Circuit Board Layouts
- Flow Charts
- Organizational Charts
- Project Schedules
- And More!

CAD Software _____ \$1790 \$895

A-B Printer/Data Switch

Fully bi-directional switch allows your computer to run either of two printers, or allows two computers to share one printer, standard A-B switch box.

	LIST	JADE
Parallel Printer A-B Switch	\$149	\$69.95
Serial A-B Switch	\$129	\$79.95

JADE XPC IBM PC

- 640K of RAM
- 135 Watt Power Supply
- 8 Expansion Slots
- Deluxe Keyboard
- 90 Day Warranty



- 256K of RAM
- 63 Watt Power Supply
- 5 Expansion Slots
- IBM Keyboard
- 90 Day Warranty

256K of RAM, Two 360K Disk Drives & Disk Controller

\$995

OPTION #3

640K of RAM
10 Megabyte of Hard Disk
One 360K Drive
130 Watts of Power
Parallel & Serial Ports
Color Card
Taxan RGB Monitor

\$1695

OPTION #2

256K of RAM
Two 360K Drives
Color Graphics Card
Taxan RGB Monitor

OPTION #1

256K of RAM
Two 360K Drives
Monochrome Graphics Card
Amdek 310A

IBM PC _____ \$1995
JADE XPC _____ \$1295

IBM PC _____ \$2995
JADE XPC _____ \$1995

IBM PC _____ \$2395
JADE XPC _____ \$1395

JADE XPC PORTABLE

- 256K Expands to 512K
- 600 x 400 Hi-Res Video
- 110 Watt Power Supply
- Parallel and Serial Ports

- Four IBM Expansion Slots
- Deluxe Keyboard
- 90 Day Warranty

10 MEGABYTE PORTABLE

\$1395

Includes
Two 360K
Disk Drives &
Disk Controller

512K of RAM
10 MB Hard Disk
One 360K Drive

\$1995

Place Orders Toll Free!



Continental U.S.A. Inside California Los Angeles Area
(800) 421-5500 (800) 262-1710 (213) 973-7707

**JADE
Computer Products**

4901 W. Rosecrans Ave. Box 5046 Hawthorne, CA 90251-5046

HARD DISK

Complete Plug-n-Run Kits

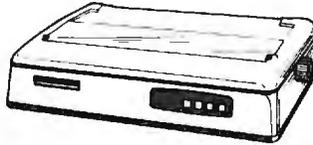
10 MB
\$439⁹⁵

20 MB
\$599⁹⁵

Why pay \$1149 for a C. Itoh STARWRITER™ F-10

When our 40 cps letter quality
daisywheel from the same
manufacturer is only

\$499⁹⁵



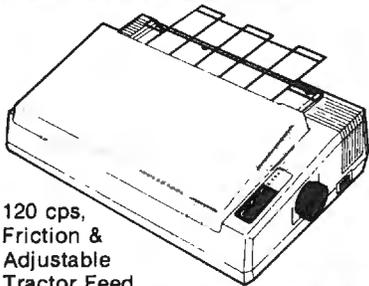
™StarWriter is a Trademark of C. Itoh
Digital Products, Inc.

STREAMING TAPE BACK-UP UNIT

½ Height Unit (Internal Mount)
File-by-File or Complete Image
Back-up and Retrieval

\$479⁹⁵

STAR GEMINI 10-X



120 cps,
Friction &
Adjustable
Tractor Feed
w/Graphics.
Limited
Quantity.

\$159⁹⁵

CANON PRINTERS

160 cps, 23 x 18 NLQ Mode, 2K
Buffer, Single Sheet & Fan Fold
Paper, Hi-Res Graphics, Bi-directional/Logic Seeking, Quiet—Less
Than 60dB

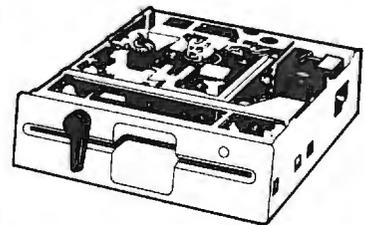
PW-1080A 10" Carriage
\$209⁹⁵ List
Price
\$499

PW-1156A 15" Carriage
\$289⁹⁵ List
Price
\$699

Hurry! Limited quantity—No rain checks!

360K DISK DRIVE

Double-Sided, Double-Density

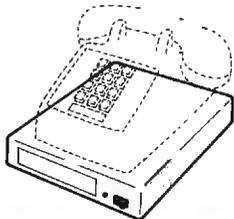


Qume for IBM
PC, XT or
Compatibles.

\$59⁹⁵

JADE 1200 BAUD MODEM

HAYES Smartmodem 1200 compatible
at a fraction of the price. FCC approved.



\$179⁹⁵

135/150 WATT

Drop-In Replacement
POWER SUPPLY

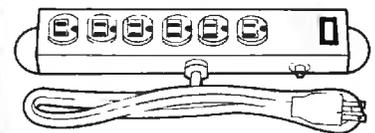
For Your IBM PC

135 Watt
\$95⁹⁵

150 Watt
\$115⁹⁵

POWER STRIP

With Surge/Spike Protection



6 Outlets, 15 AMP Circuit
Breaker, 6 Ft. Cord, UL Listed,
Made in U.S.A.

\$19⁹⁵

PLACE ORDERS TOLL FREE! 
Continental U.S.A. Inside California Los Angeles Area
(800)421-5500 (800)262-1710 (213)973-7707

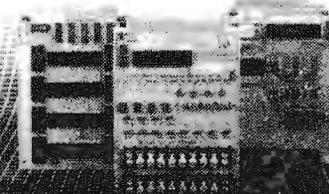
We accept cash, checks, credit cards or purchase orders from qualified firms & institutions.
Minimum prepaid order \$15.00. California residents add 6½% tax. Prices & availability sub-
ject to change without notice. Shipping & handling charges via UPS Ground 50¢/lb. UPS Air
\$1.00/lb. Minimum charge \$3.00.

JADE

Computer Products

4901 W. Rosecrans, Box 5046, Hawthorne, CA 90250-5046

6800/6809 Micro Modules



OEM 6800/6809 MICROCOMPUTER MODULES for dedicated control and monitoring. Interfaces for sensors, transducers, analog signals, solenoids, relays, lamps, pumps, motors, keyboards, displays, IEEE-488, serial I/O, floppy disks.



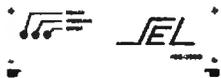
Wintek Corp.
1804 South Street
Lafayette, IN 47904
317-742-0428

Inquiry 388

ONE GPIB-488 INTERFACE

FOR ALL
IBM PC, XT, AT,
CLONES, APPLE MACINTOSH,
TANDY 2000, 1200HD, 1000

ANY LANGUAGE
EASY TO USE



MODEL 488-2000 PRICE \$675
+ SHIPPING, INSURANCE & TAX
When ordering specify computer for proper cable.

**Scientific Engineering
Laboratories**

11 Neil Drive • Old Bethpage, NY 11804
Telephone: (516) 694-3370

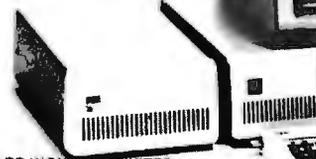
Inquiry 427

DOUBLE THE OPTION CAPACITY OF YOUR IBM PERSONAL COMPUTER

PC-XTRA

- DIRECT EXTENSION OF IBM PC BUS
- NO SOFTWARE CHANGES
- NO HARDWARE MODIFICATION
- STYLING CONSISTENT WITH IBM

Add all those special options that you've been wanting without worrying about filling your plug-in and back panel space



DEALER INQUIRIES INVITED.

\$549.00* F.O.B. SANTA ANA
CALIFORNIA RESIDENTS ADD 6% SALES TAX

P C HORIZONS, INC.

1701 E. Edinger, Ste. A6, Santa Ana, CA 92705
(714) 953-5396

Inquiry 289

uniforth™

THE PROFESSIONAL

Now UNIFORTH is better than ever!

It's been upgraded to the FORTH-83 Standard and extended with lots of new programming tools that will save you time and frustration:

- No vague error messages
- No jumping back and forth between UNIFORTH and your operating system

It's all there, in one comprehensive package

- * Prioritized Multitasking
- * Multi-file Video Editor
- * Floating-Point Arithmetic
- * Powerful String Package
- * Text File Support

Plus, the ability to copy files, search directories, compile whatever!

The Professional comes with a unique 500-page Users/Programmers Guide that will lead you painlessly from the box to the heart of FORTH. You'll find lots of examples and programming hints inside the ivory slip case.

Need more? Some of the options we offer include:

- * Telecommunications
- * Graphics
- * Cross-Compilers
- * Star Catalogs

The UNIFORTH Professional is available for most personal computers and DEC mini-computers. Prices start at only \$195!

For more information, call or write for our free 16-page catalog. We guarantee that you'll enjoy using UNIFORTH, or your money back!

UNIFIED SOFTWARE SYSTEMS

NEW ----- P.O. Box 21204, Columbus, OH 43221-0204 ----- NEW
Call (301) 552-9590 for new number

Inquiry 372

DYNAMIC RAMS

41256	120ns	\$3.15
✓41256	150ns	\$2.50
4164	120ns	\$0.75
✓4164	150ns	\$0.65
128K	150ns	\$4.25

COPROCESSORS

8087-2	\$135.00
8087-3	\$125.00
80287-3	\$195.00

E. PROMS

27C256	250ns	\$12.95
27256	250ns	\$ 7.25
27128	250ns	\$ 2.75
27C64	200ns	\$ 4.25
2784	250ns	\$ 1.75
2732A	250ns	\$ 1.80
■ 8000's iParts Available		

STATIC RAMS

6264LP-15	150ns	\$4.50
6116LP-3	150ns	\$1.75

I.C. EXPRESS

15358 Valley Blvd., City of Industry CA 91746
Phone: 818-369-2688 (Mon-Fri • 8-5/Sat 9-3)

ORDER TOLL FREE

(800) 892-8889 • (800) 882-8181

Outside California Inside California

CALL FOR CURRENT PRICES & VOLUME DISCOUNTS.

Price Shown for UPS COD Cash + MasterCard + VISA add 3%, more
Prices are subject to change. Minimum order \$10.00
California residents must add 6.5% sales tax
Shipping & Handling: UPS Ground \$5.00 UPS Air \$7.25 (under 1 lb.)
ALL MERCHANDISE IS 100% GUARANTEED

Inquiry 191

NEC PRINTERS

Pinwriter P-2	\$ 485
(w/Interface & Tractor)	
Pinwriter P-3	\$ 685
(w/Interface & Tractor)	
Pinwriter P-5	\$ 925
(w/Interface & Cut Sheet Guide)	
ELF 360, 350	\$ 380
2010/15/30/50	\$ 605
3510/15/30/50	\$ 960
8810/15/30/50	\$1365
Optional Forms Handling Devices	CALL

QUALITY PRINTERS
8415 Cement City Rd.
Brooklyn, Michigan 49230
Phone: 517-592-3749

Inquiry 319

Macintosh™



512K
Includes drive.
\$1995

Macintosh is a trademark licensed to Apple Computer, Inc.

Call for prices on other Macintosh products.

PC'S LIMITED

OUTSIDE TEXAS, ORDERS ONLY, CALL 1-800-436-5150.

7801 N. Lamar, #5-200, Austin, Texas 78752

All units for technical support and trade shows.

Call (512) 432-8322.

Also see: 11/19/83/PC/US

Ad number 407 A

Call technical support for return authorization number on all warranty repairs. Any unauthorized return subject to a 10% restocking fee. No warranty for VHS or MasterCard. 5% surcharge for American Express.

Inquiry 296

PC/TEK 4010

EM100-4010 for IBM PC, XT, AT

- Tektronix 4010 emulation
- VT102 emulation **\$249**
- Picture files
- High resolution hardcopy
- Supports IBM, IBM Enhanced, Hercules and Tecmar

EM100 for IBM PC, XT, AT

- VT102 emulation **\$149**
- File Transfer
- 132 Column modes
- Color Support

FREE VT220 UPDATE



Diversified Computer
Systems, Inc.

3775 Iris Ave., Suite 1B
Boulder, CO 80301
(303) 447-9251

Trademarks: VT100 — Digital Equipment; IBM PC, XT — IBM Corp.

Inquiry 134

Use the Power of Your Computer

... to automatically look up city, state and county information based on zip code. Table of 48,000 zips allows significant savings on data entry, error corrections and file maintenance. This set of floppy disks, including easy instructions, is just \$149. Most popular 5 1/4" and 8" formats are available. Hard disk required. Call or write for free information.

DCC Data Service

1990 M Street, N.W. Suite 610
Washington, D.C. 20036

Toll-free 1-800-431-2577

In DC & AK 202-452-1419

Inquiry 121

Micro Products International

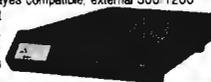
714/898-0840

Terms: We accept Visa, M/C, Pre-Play by Check or Money Order. COD's are accepted by Telephone & Mail. COD Terms are: Cashier's Check for first time orders over \$100.00.
 Fax: 714/897-3383 Tlx: 887841 XORDATA HTBH

THANKSGIVING SPECIALS

We Cater to IBM™ Dealers
*** Hardware * Software**
*** Training Tapes * Tapes**
Call for our Catalog now!

New Hayes SmartModem Compatible!
 Finally a price breakthrough on a Hayes compatible, external 300/1200 baud modem. This low price is without driver software, but if you need it add \$25.00. Call for a 26 page catalog of our special deals. Look in this spot every month for Hot, New items sure to catch your interest.



Runs the popular Hayes communications software
 FCC approved direct RJ-11 connection
 Phone Cable & power supply one low price.
 MOD-8100-00 \$199.00

IBM PC-XT SELECTRIC KEYBOARDS
 Our volume purchase of these excellent Selectric type keyboards will bring the features you have been wanting down to a price you can't resist! So many features you'll love it!
 • Single key reset
 • Separate numeric keypad
 • Separate "Arrow" keypad
 • Dimple marked "5", F, & J keys



KEY-1051-00 Selectric \$129.00
 KEY-1050-00 Standard 89.00

ADD-ON POWER SUPPLIES
 Two new, thoroughly tested IBM PC/XT power supplies for your system upgrade. Best price in Byte with ONE YEAR warranty!!
 POW-1040-00 135 watt \$99.00
 POW-1044-00 150 watt \$115.00



TURBO MOTHERBOARD
 Micro Products announces a powerful new IBM XT type motherboard. 4 layers for superior reliability & speed. Turbo mode allows 75% higher thru-put by increasing system clock to 7 MHz under software control. Designed to use new 256K RAM chips or 64K chips. 640K memory expansion does not require use of valuable card slots. Many outstanding features combined with our new 7 PAK Multifunction board make previously expensive options standard features at a LOW LOW Cost.
 BOA-6078-00 Supplied with OK \$349.00



SUPER 12 PAK MULTI-FUNCTION
This one is really loaded! Features: One Parallel Port, One RS232-C Serial Port, One Game Port, Real-Time Clock / Calendar with Battery Back-up, Expandable to 384K of Parity-checked Memory, Supplied 0K Memory, all cables, PrintSpooler and RAM Disk Software.
 BOA-6335-00 \$129.95
 Additional (9) 64K Memory Chips
 KIT-8000-00 \$ 10.00



Do it Yourself! \$1395.00 WOW! Complete System! Add-On H.D. & Tape

Three ways to begin - an Empty cabinet - a "Basic" - a Full system - all that you assemble yourself!
CABINET ONLY
 8 Slot CAB-3068-00 \$75.00
"BASIC"
 Cabinet, Keyboard, Power Supply, Motherboard w/OK SYS-8000-00 \$525.00



This is OUR Junior!
 Use this "Driveless" workstation for low-cost Networking.
Features: • 4-slot IBM™ compatible Motherboard
 • 128K Standard Memory • 8088, 8087 Math Co-processor
 • Optional Floppy Drive with Controllers.
 SYS-8100-00 \$475.00
 Full System w/Keyboard, Mono Monitor, Video Display Card, 256K 1 RAM Drive SYS-8725-00 \$895.00



NEW 17,000 in Service!
Features!
 ■ RAM Disk
 ■ Game Port
 ■ 640K cpcy
 ■ PrintSpooler
 ■ Turbo mode!
 4.77MHz to 7MHz!
 ■ Ser, Par
 ■ Clock



Add-On H.D. & Tape
 10 or 20 Megabyte on the top, your choice of Hard Disk on the bottom. Super appearance! Requires one slot in your PC for SASI interface and an extension connector on the floppy card. Everything else is supplied by us.

10 Meg	\$1095	40 Meg	\$1695
20 Meg	\$1295	105 Meg	\$4195
26 Meg	\$1395	140 Meg	\$4695



Check These Standard Features:
 • Full-Size, Feather-Touch, Capacitance Keyboard, 10 Function Keys, Calculator-Type Numeric Keypad
 • Parallel & Serial I/O • Real Time Clock • Game Port • 2-Slimline 5 1/4" DS/DD 48 TPI 360K Drives
 • 8 IBM expansion slots • RAM Disk • Print Spooler • 4 DMA & 3 Timer channels
 • Full 640K capacity on-board • 8088 16-bit CPU • Monochrome Video Card
 • Up to 32K of EPROM (full 8K supplied) • Supports PC-DOS - MS-DOS - CP/M-86
 • Power Supply Hard-Disk-Ready, no need to add-on additional power
 • High resolution 12" Monitor, Green Screen, 22 MHz bandwidth

Add-On Hard Disk
 Two ways to go. The internal system is cheaper because it does not need a P/S & Chassis. The same P/S & Chassis can be used for a 10 Meg Tape Back-up on your XT!

10 Megabyte	\$525 int/\$695 ext	40 Megabyte	\$1195 int/\$1295 ext
20 Megabyte	\$650 int/\$795 ext	105 Megabyte	\$3795 int/\$3995 ext
26 Megabyte	\$795 int/\$895 ext	140 Megabyte	\$4395 int/\$4695 ext



Not enough room here - Call for Catalog

PROM LASER
 This is the One! Our PROM Burner allows reading, storing-to-disk, recalling, and burning. Hi-speed algorithms burns 2764 in 45 seconds! Also handles 2716, 2732, 27128, 27256. Features: Zero insertion force sockets; On-board Voltage Generator; No Interference with normal computer operations.
 BOA-8640-00... \$199.00



We want your DRIVE business!

Shugart 360K	TEAC 360K	NEC 10meg	Tulin 26meg	Memtek 20
\$85.00	\$95.00	\$345.00	\$895.00	\$495.00

Now IBM-XT in a Kit!
Completely XT Compatible
\$1095.00



MISCELLANEOUS \$\$\$ SAVERS

7 PAK Multifunction Floppy, RTC, 2 Serial, 1 Parallel, Game, RAM Disk BOA-8250-00	\$188.00
64K Memory Chips (9) NEC for IBM KIT-8000-00	\$ 10.00
256K DRAM Memory Chips (9) = 256K KIT-9000-00	\$ 45.00
Add-On Memory, (up to 512K) supplied OK BOA-8350-00	\$ 99.00
Floppy Controller, Controls up to four drives, 5 1/4" 48/96 TPI BOA-8100-00	\$ 95.00
Monochrome Graphics Card, (Hercules type) (1-2-3 compatible) 720h x 348v BOA-8150-00	\$175.00
Color Graphics Card, 320 x 200 Res. Color, 640 x 200 Monochrome BOA-8200-00	\$145.00
Clock Calendar Board, fits in "short slot" w/battery Back-up BOA-8375-00	\$ 55.00
Hard Disk Controller, standard ST-506 Interface for DOS 2.1 & 3.1 BOA-8060-00	\$155.00
300 / 1200 Baud Modem Internal w/PC Talk III Communications Software BOA-8725-00	\$210.00
Monochrome Monitor, 22MHz bandwidth, composite input or TTL MON-1725-00 Green/Comp 98.00	MON-1700-00 Amber/Comp 104.00
MON-1775-00 Green/TTL... 104.00	MON-1750-00 Amber/TTL... 109.00

INTERNATIONAL ORDERS
 Micro Products is ready to serve your needs in several countries. Each Office has Sales Literature, Local Pricing, Inventory and Technical Service available to support your needs. There are no problems with U.S. Export Forms.

USA OFFICE
 15392 Assembly Lane, Unit A
 Huntington Beach, CA 92649
 Tel: 714 / 898-0840
 Tlx: 887841 XORDATA HTBH

AMSTERDAM OFFICE
 Building 70, 4th Floor
 1117 ZH Schiphol-East
 Amsterdam, The Netherlands
 Tel: (020) 45 26 50 - Tlx: 18306

AUSTRALIAN OFFICE
 8 Irwin Street, Bellevue
 W. Australia 6056
 Tel: 274-3701

MARACAIBO OFFICE
 Av. 3F Esq. Calle 81
 Centro Com. Maelga - Local #5
 Maracaibo, Venezuela 4001-A
 Tel: 061-913328 - Tlx: 62344 PEMIN

BOMBAY OFFICE
 311 Sindhi Lane
 Nanubhai Desai Rd.
 Bombay 400-004 India
 Tel: 357172 - Tlx: 011-2868

CANADA OFFICE
 264 Principale, St. Blaise,
 Quebec, Canada J0J1W0
 Tel: 541291-3116

Why didn't anybody think of it before? If you have a Phillips screwdriver and 1 - 2 hours available, SAVE yourself a bundle of MONEY! No where will you beat this deal on a complete 8 slot ready-to-assemble and run XT compatible.

- Cabinet
- 135 watt Power Supply
- Keyboard
- 8 Slot Motherboard
- 256K RAM
- 2-360K Shugart Drives
- Floppy Controller & Cable
- Mono Video Card
- TTL Amber Monitor

PRINTER RIBBONS

Lowest Prices! Highest Quality! In Stock!

Ribbon Type (Prices are per Ribbon) Qty 6+ Qty 12+

Apple Imagewriter & DMP	4.50 ea.	3.95 ea.
BMC-BX-80	6.50 ea.	5.95 ea.
C. Itoh Prowriter	4.50 ea.	3.95 ea.
Diablo Hytype II M/S	3.75 ea.	3.25 ea.
Diablo 630 M/S	3.75 ea.	3.25 ea.
Epson RX-FX-MX-80	3.85 ea.	3.30 ea.
Epson RX-FX-MX-100	5.50 ea.	4.95 ea.
Epson LQ 1500	7.75 ea.	6.95 ea.
Gemini 10-10X-15-15X	1.85 ea.	1.45 ea.
Nec 5500/7700 M/S	3.75 ea.	3.20 ea.
Nec 8023A	4.50 ea.	3.95 ea.
Okidata 80/82/83/92/93	1.85 ea.	1.45 ea.
Panasonic KXR-P1090/91/92	8.50 ea.	7.95 ea.
Radio Shack DMP-2100	6.95 ea.	6.30 ea.
Tally Spirit 80 M/S	6.00 ea.	5.95 ea.
Toshiba P1340/1350	6.95 ea.	6.30 ea.
Tritel	5.50 ea.	4.95 ea.

FREE Shipping on orders \$50 + in Continental U.S.

(add 3" under \$50 order)

Visa

M.C.

Order toll FREE 1-800-821-5339

C.R.E. Wholesale

P.O. Box 361 North Salt Lake, Utah 84054
(801) 531-7139

Inquiry 52

PROTECT YOUR COMPUTER



100% cotton
static-free
cover

I.B.M. PC Mon/KY Set	\$34.00
Apple II/III CPU/KY/Mon	\$22.00
Apple II/III CPU/KY/Duo Drive/Mon	\$24.00
Apple IIC	\$20.00
Macintosh Set	\$22.00
Printer 16X12 • 17X14 • 15X12	\$12.00
Apple Disk Drive—Single • Mac Mouse	\$ 6.00
Apple Disk Drive—Double	\$ 8.00
Video Cassette Recorder	\$15.00

Blue/Red/Grey or Beige

Check/Visa/M.O. U.S. Funds
Plus \$4.00 Ship. & Hand.
Send dimensions for custom order.

SOFT WEAR CO. LTD.

P.O. Box 974, Ganges, B.C. V0S 1E0 Canada
(604) 537-5066

SPECIAL ITEM—Tuxedo Cover for above \$48.00

Inquiry 96

PC EXPANSIONS

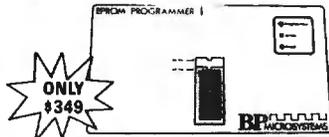
AST SixPakPlus (64k)	\$259
SixPakPlus (384k)	\$269
MegaPlus (64k)	\$269
Advantage (128k)	\$419
Advantage (1.5M)	\$639
I/O Plus	\$129
PCnet - starter kit	\$509
Quadboard (64k)	\$199
Quadboard (384k)	\$249
Quadmeg-AT (128k)	\$319
Quadmeg-AT (2M)	\$609
Quadport-AT	\$105
HERCULES graphics board	\$319
Color Card with PP	\$159
HAYES Modems: 2400	Call
Smartmodem 1200	\$409
Smartmodem 1200B	\$379
Set of 9 chips (64k)	\$10
256k chips (each)	\$4
8087 chip	\$118
Maynard Disk Controller	\$100
Sandstar Series	Call
Internal Hard Disks from	\$609
MayStream tape backup from	\$979
Qume 142A	\$108
Teac FD55B	\$109
Tandon TM100-2	\$109
CDC 9409	\$119
Verbatim Datalife disks (10)	\$25

VLN Computer Electronics

10 Park Lane • Morristown, NJ 07960

(201) 267-3268 Visa MC Check or COD

EPROM PROGRAMMER



ONLY \$349

A great value, here's why:

- Programs and reads 2716 through 27513 EPROMs, 2516 through 2564 EPROMs, 52B13 through 52B33 EEPROMs and others to manufacturers' specs
- Programs A suffix and CMOS parts
- Uses fast programming algorithm
- Requires no personality modules
- RS-232 input requires no special software
- Includes communications software for IBM PC and compatibles
- Uses Intel, Motorola, Tektronix and other formats
- Splices files for 16 bit systems
- Gold Textool ZIF socket
- Sturdy Construction
- Full 1 Year Warranty

BP MICROSYSTEMS

5325 Glenmont, Suite E, Houston, TX 77081
(713) 867-1836

Inquiry 449

PC/XT USERS!

- COGTREE Utilities by Cogitate \$129.95
- LYNC by Norton-Lamber.... \$199.95
- DATAFLEX by Data Access...Varies
- RMICOBOL by Ryan/McFarland.....Varies
- Universe by Omnitrend.... \$ 98.50
- Blue MacI by Cogitate.....\$599.00
- CadPower+ by Trilex.....\$995.00
- Softext Teaching Aids.....\$ 95.00
- PrintSet by Cogitate.....\$ 79.95
- CogiTAPE by Cogitate.....CALL!!
- Anti-Static Products.....Varies
- Uninterruptible Power Backups.....Varies
- TeleVideo Software.....CALL!!

COGITATE

"A Higher Form of Software"

24000 Telegraph Road
Southfield, MI 48034
(313) 352-2345/Telex 386581

VISA/MASTERCARD ACCEPTED
Dealer Inquiries Welcomed

Inquiry 67

JOYSTICK SPECIALIST

CS-808 Compatible with Apple II, II+, IIe, IIc and IBM pc, pcj



- 360 Degree Cursor control
- Selectable "Spring-Centering" or "Free Floating"
- Dual-Axis Trigger Adjustments
- Quick Fire Button on Stick Handle
- One Year Warranty

GRAPHIC MOUSE FOR APPLE II
ALL KINDS OF JOY STICKS FOR IBM®, APPLE®,
COMMODORE®, AND ATARI®



CENTRONIC CABLE IBM® PRINTER CABLE RS-232 TESTER

- CUSTOMER DESIGNED CABLE WELCOMED
- ALL CABLES SHIELDED, MEET U.L. SPECIFICATION

DEALER INQUIRIES WELCOMED!

CONTRIVER ENTERPRISES CO., LTD.

1038 CLARK DRIVE, VANCOUVER, B.C., CANADA V6L 3J9
TEL: (604) 251-9625, 291-9733
TELEX: 04-31112 CONTRIVER

Inquiry 97

MICROCONTROL!



THINK ABOUT A COMPLETE MICROPROCESSOR BASED ACQUISITION AND CONTROL SYSTEM THAT OPERATES JUST LIKE YOUR PERSONAL COMPUTER! ONE THAT INCLUDES EXTENSIVE REAL-WORLD INPUTS AND OUTPUTS, SO YOU WON'T NEED EXTRA BOARDS! IT'S FIELD MOUNTABLE, BATTERY OPERABLE, HAS PLENTY OF MEMORY, AND PRICES START AT ONLY \$399! NOW, THINK ABOUT APPLYING THIS STATE-OF-THE-ART CONTROL TO THAT PROJECT OF YOURS, OR MAYBE TO SOMEONE ELSE'S! OUR MANUALS SHOW YOU HOW! THE RBE SYSTEM. CALL NOW!

H.H.S. MICROCONTROLLERS

5076 OLD STATE
EDINBORO, PA 16112
(814) 734-4338

Inquiry 175

BAR CODE READER



- IBM PC/XT COMPATIBLE (AND MOST CLONES)
- CONNECTS BETWEEN KEYBOARD AND THE PC
- NO CARD SLOT REQUIRED/SIMPLE INTERCONNECT
- NO CUSTOM SOFTWARE DRIVERS REQUIRED
- HIGH FIRST READ RATE
- READS DOT MATRIX & PRINTED BAR CODE LABELS
- CODE 3 OF 9, INTERLEAVED 2 OF 5, UPC
- AUTOMATIC BAR CODE SELECTION
- AUDIO AND VISUAL INDICATORS
- READS HIGH, MED, AND LOW DENSITY LABELS
- SWITCH SELECTABLE OPTIONS
- SELF-TEST DIAGNOSTICS

\$495 ea.

PC/MS DOS BAR CODE PRINTING SOFTWARE \$79 ea.

AMERICAN MICROSYSTEMS

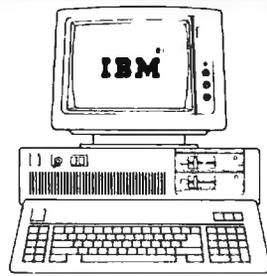
P.O. BOX 830551, RICHARDSON, TX. 75080
(817) 834-9659

MASTERCARD AND VISA ACCEPTED



Inquiry 448

IBM PC 256k, 2 floppies	IBM PC 20 + 20 256k, 1 or 2 floppies 20MB HD & 20MB Backup	IBM XT 10 + 10 256k, 1 or 2 floppies 10MB HD & 10MB Backup
IBM PC 10 MB 256k, 1 or 2 floppies	IBM XT 256k, 2 floppies	IBM XT 20 + 20 256k, 1 or 2 floppies 20MB HD & 20MB Backup
IBM PC 20 MB 256k, 1 or 2 floppies	IBM XT 10 MB 256k, 1 or 2 floppies	IBM AT 20 MB 512k, 1 or 2 floppies
IBM PC 30 MB 256k, 1 or 2 floppies	IBM XT 20 MB 256k, 1 or 2 floppies	IBM AT 30 MB 512k, 1 or 2 floppies
IBM PC 10 + 10 256k, 1 or 2 floppies 10MB HD & 10MB Backup	IBM XT 30 MB 256k, 1 or 2 floppies	IBM AT 40 MB 512k, 1 or 2 floppies



FOR EXTRA SAVINGS
Call for the latest prices for your custom configuration. All systems are configured and tested at no extra cost and come only with Compumail's 90 day warranty.

IBM AT 20 + 20 512k, 1 or 2 floppies 20MB HD & 20MB Backup	COMPAQ DESKPRO 10 MB 640k, 1 or 2 floppies	COMPAQ PORTABLE 286 Custom Configurations
IBM AT 30 + 60 512k, 1 or 2 floppies 30MB HD & 60MB Backup	COMPAQ DESKPRO 10 + 10 10MB HD & 10MB Backup	COMPAQ DESKPRO 286 Custom Configurations
IBM AT 40 + 60 512k, 1 or 2 floppies 40MB HD & 60MB Backup	COMPAQ DESKPRO 20 MB Backup Available	IBM XT COMPATIBLE Custom Configurations
COMPAQ PORTABLE 256k, 1 or 2 floppies	COMPAQ DESKPRO 30 MB Backup Available	IBM AT COMPATIBLE Custom Configurations
COMPAQ PORTABLE 10 MB 256k, 1 or 2 floppies	COMPAQ DESKPRO 40 MB Backup Available	IBM COMPATIBLES ARE YOUR LOW COST ALTERNATIVE

★ PRICE WAR ★ CALL US LAST WITH YOUR BEST QUOTES ★

PRINTERS FLOPPY/HARD DISKS MONITORS MODEMS

EPSON Daisy Wheel DX-10/DX-15 FX-85 + NLO \$339 FX-185 + NLO \$459 Sht Fdr FX-85/FX-185 \$249/\$299 NLO Upgrade Kit for FX-80/FX-100 CALL LX-80/HI-80/JX-80 \$219/\$359/\$469 Tractor LX-80/FX-80/HI-80 \$50/\$60/\$70 LQ-1500 w/Parallel Module \$889 LQ Tract/Sing/Dual Sht Fdr \$70/\$450/\$750 LX-90 w/Par Interface & Tractor \$279	OKIDATA Okimate 20 w/IBM Inter \$219 192-P/192-IBM \$329 193-P/193-IBM \$479 84 P/84 IBM \$649 192 Tractor \$70 2410 P IBM CALL TOSHIBA 1340P/341 \$499/CALL TOSHIBA 351P "REDUCED" \$999 351 Tractor/Sht Fdr \$190/\$790 JUKI 6100/6200/6300 \$349/\$549/\$679 6X00 Tractor/Sht Fdr \$150/\$250 5510P (160cps) \$369 5510 Color Kit \$150
---	--

BROTHER HR-10/HR-15XL \$239/\$339 HR-15 Trac/Kybrd/Sht Fdr \$110/\$160/\$190 HR-25P/HR-35P \$449/\$649 HR-25/35 Tractor/Sht Fdr \$120/\$200 2024L Q/Graphics-24 pin, 160/80 cps. \$799 2024L Sht Fdr-Narrow/Wide \$220/\$290 TWINRITER 5 World's First Dot Matrix & Daisy Wheel combined in ONE \$799 TWINRITER 5 Trac/Sht Fdr \$150/\$250	C. ITOH ProWriter Jr w/NLO \$219 8510BPI \$309 8510SEP + NLO \$379 8510SCEP + NLO \$449 1550-EP \$429 1550SEP + NLO \$519 1550SCEP + NLO \$619 24LP \$349 A10-30SP \$439 Y10-20P \$379 A10 Tractor \$160 F10-40P \$869 F10-55P \$1069 F10 Tractor/Sht Fdr \$190/\$290 CX-4800P 4 Pen Plotter \$429 QUME LetterPro 20P (20 cps) \$399 20P Trac/Sht Fdr \$150/\$390 SPRINT 1140 + /1155 + \$1299/\$1399 SPRINT Interface Module \$80 SPRINT Trac/Sht Fdr \$210/\$690
--	---

PANASONIC KX-P3151 LQ (22cps) \$459 KX-P1090/91/92/93 \$179/\$249/\$349/\$449	STAR Power Type/SB-10 \$329/CALL SG-10/SG-15 (120cps) \$239/\$389 SD-10/SD-15 (160cps) \$349/\$459 SR-10/SR-15 (200cps) \$499/\$599 NEC PINWRITER P-2/P-3 \$449/\$699 Sht Fdr for P-2/P-3 \$350/\$420 2050/3550/8850 \$649/\$999/\$1399 SPINWRITER Trac/Sht Fdr \$190/\$790 ELF 360 Par (16cps) \$419 DIABLO Advantage D-25 \$499 630 API \$1499 630 ECS-IBM \$1599 Trac/Mech Single Bin Sht Fdr \$230/\$470
---	---

CITIZEN: 18 months manufacturer warranty MSP-10/15 (160/40cps) \$299/\$449 MSP-20/25 (200/50cps) \$439/\$589 Sht Fdr (Specify Model) \$229 LEGEND CP-VII \$899 1200 \$259 880/1080/1380/1385 \$199/\$219/\$259/\$319 ANADEX 9620B/9625B-PLUS \$1199/\$1299 9725B COLOR \$1399 WP6000/DP6500 \$2299/\$2569	HEWLETT PACKARD PRINTERS CALL SILVER REED Daisywheel - Parallel Models 400/500/550/770 \$189/\$269/\$379/\$669 TELEVID 750 Daisywheel-50 cps CALL AB/ABC/ABCD Switch Boxes CALL KENSINGTON Universal Printer Stand \$20 With Printer \$10
--	--

CDC/MITSUBISHI/PANASONIC/TANON/TEAC Half Ht DDDD "REDUCED" \$79 Free Mounting Kit with 2 Drives CDC/TANON Full Ht DDDD \$99	HARD DISKS FOR IBM PC/XT 10 MB Int w/Controller "REDUCED" \$399 10 MB Ext w/Controller "REDUCED" \$449 20 MB Int w/Controller "REDUCED" \$529 20 MB Ext w/Controller "REDUCED" \$579 33 MB Int w/Controller "REDUCED" \$649 33 MB Ext w/Controller "REDUCED" \$699 44 MB Int w/Controller "REDUCED" \$1049
--	--

MAYNARD complete line MAYNSTREAM portable tape backup 20MB \$999 MAYNSTREAM portable tape backup 60MB \$1299	HARO DISKS/BACKUP FOR IBM PC AT CALL GENOA GALAXY TAPE BACKUPS 20 MB Int/Ext \$749/\$849 20 MB Int/Ext \$999/\$1099 32 + 60 MB Ext Disk/Backup \$2399
---	---

TALL GRASS NEW PC/T FORMAT 25/35 MB w/60 MB Backup \$2599/\$3399 50/80 MB w/60 MB Backup \$4299/\$5499 60 MB Tape Backup only \$1199 Controller \$140 Cartridge (60 MB) \$40	EVEREX 10/20 MB Int w/Cont \$579/CALL EVEREX 60MB Int/Ext Tape Backup \$899/\$999 EVEREX Expansion Chassis Half Height \$699 EVEREX Expansion Chassis Full Height \$749
---	---

INTERDYNE TAPE BACKUP 10 MB Int/Ext "REDUCED" \$369/\$549 20 MB Int/Ext "REDUCED" CALL HARD DISKS/BACKUP FOR COMPAQ CALL Bernoulli Box for Iomega 10 + 10 CALL Auto Boot also Available BERNOULLI Box for Iomega 20 + 20 CALL EMULEX JAVELIN HD & BACKUP CALL PWR SUPPLY 130/150 Watts \$89/\$109	COMPANY POLICY: Min order \$100. Prices & availability subject to change. We ship UPS only. Shipping/handling charges vary. Prices reflect cash discount on prepaid orders. Add 1% for COD orders, 3% for MC/VISA & 5% for AMEX. COD requires cashiers check. All merchandise sold is new and all sales are final. Refused shipments subject to 20% charge (Min \$50). Products shipped in factory cartons come with manufacturer warranty. For others including IBM systems, call tech support for return auth. # for warranty. Non-defective items returned as defective subject to 10% service charge (Min \$50). Not responsible for hardware or software compatibility of any product. No open add PO's or foreign orders. No showroom, demonstrators or walk-in sales. Personal or company checks take 3 weeks to clear. FOR ADVANCE PAYMENTS or PICKUP, PLEASE CALL FIRST FOR WORKORDER #.
---	--

PGS MAX-12/HX-12/HX-12E \$169/\$419/\$499 HX-9/HX-9E/SR-12 \$419/\$499/\$549 SR-12 w/Scan Doubler \$699 SR-12 w/Sigma 400 \$999	TAXAN COMPOSIT 115 Green/116 Amber \$129 MDNO 121 Gr/122 Amb \$139/\$149 COLOR 620 4 text modes 640X262 Res \$359 COLOR 630 4 text modes 640X400 Res. \$399 COLOR 640 Top of the line monitor \$489 COLOR 640 w/TAXAN 555 RGB Card \$749 COLOR 640 w/Persyst 808 Bld \$799 COLOR 640 w/Sigma 400 \$939 COLOR 640 w/Sigma 400 & PC Mouse \$1069 AMDEK 300G/300A/310A(M) \$139/\$149/\$159 COLOR 300/500/600 \$239/\$349/\$419 710 \$489 w/Teclar Graphics Master \$899 IBM Enhanced Color Monitor CALL ROLANO MB-142 14" w/Color Monitors Best Price TECMAR Color \$529 w/Graphics Master \$939 TILT/SWIVEL Monitor Pedestal \$20
---	---

HERCULES MonoGraphics \$279 Color \$149 HERCULES COMPATIBLE MonoGraphics \$199 EVEREX The Edge \$289 Graphics Edge \$289 AST Monograph Plus \$339/\$369 Preview for Mono Graphics \$249 Graphpack w/64k \$549 PERSYST Short Color/Mini Mono \$159/CALL Color Combo, Multifunction & Color from \$279 Mono Combo, Multifunction & Mono from \$279 PERSYST Bob Board \$339 PERSYST w/TAXAN 640 \$799 IBM EGA (Enhanced Graphics Adapter) CALL Gold Quadboard: Multifunction & Color CALL STB Chauffer "REDUCED" \$299 PARADISE Modular Bld from \$259 ORCHID Turbo Graphics Controller CALL TECMAR Graphics Master \$429 G Master w/TECMAR Color Monitor \$939 G Master w/AMDEK 710 Color Monitor \$899 GENOA Spectrum \$269 MYLEX Charman \$299 SIGMA COLOR 400 (Specify Monitor) \$479 COLOR 400 w/PGS SR-12 \$999 COLOR 400 w/TAXAN 640 \$939 3 Button PC Mouse w/PC Paint Add \$129

DISPLAY CARDS HERCULES COMPATIBLE MonoGraphics \$199 EVEREX The Edge \$289 Graphics Edge \$289 AST Monograph Plus \$339/\$369 Preview for Mono Graphics \$249 Graphpack w/64k \$549 PERSYST Short Color/Mini Mono \$159/CALL Color Combo, Multifunction & Color from \$279 Mono Combo, Multifunction & Mono from \$279 PERSYST Bob Board \$339 PERSYST w/TAXAN 640 \$799 IBM EGA (Enhanced Graphics Adapter) CALL Gold Quadboard: Multifunction & Color CALL STB Chauffer "REDUCED" \$299 PARADISE Modular Bld from \$259 ORCHID Turbo Graphics Controller CALL TECMAR Graphics Master \$429 G Master w/TECMAR Color Monitor \$939 G Master w/AMDEK 710 Color Monitor \$899 GENOA Spectrum \$269 MYLEX Charman \$299 SIGMA COLOR 400 (Specify Monitor) \$479 COLOR 400 w/PGS SR-12 \$999 COLOR 400 w/TAXAN 640 \$939 3 Button PC Mouse w/PC Paint Add \$129

CHIPS ETC. HIGHEST QUALITY! Major Brands 64K RAM Set \$7 10+ Sets. \$6 50+ \$5 128K RAM Set \$35 10+ Sets. \$33 50+ \$30 256K RAM Set \$30 10+ Sets. \$28 50+ \$25 8087 Maths Co-Processor. Best Price 80287-3 for IBM AT "REDUCED" \$239 ORCHID Pcturbo w/128k... \$549 640k... \$699 QUADRAM QUASprnt "REDUCED" \$499 MICROWAY'S Fastbreak/# Smasher CALL
--

EasyData 128 300/1200 Bd Int w/PCTalk III \$199 SmartTEAM 212A 1200 Bd Ext w/o sft \$209 HAYES 1200 B w/SmartCom II \$319 HAYES 1200 Ext. w/o Software \$349 Smartcom II \$89 NEW 2400 Bd Ext \$549 HAYES Translet 1000 "REDUCED" \$299 POPCOM C-150 Int w/PFS Access \$289 POPCOM X-150 Ext w/PFS Access \$299 AST RACHET 1200 Bd short card w/Crosstalk \$329 PROMETHEUS PROMODEM 1200 Ext \$269 Options Processor. \$79 w/Modem \$65 Alphanumeric Display \$79 w/Modem \$65 PROMODEM 1200 Ext + Both Options \$399 PROMODEM 1200 B Int w/MITE software \$229 QUADMODEM II shortcard w/Crosstalk XVI \$299 2400 Bd Upgrade Kit for Quadmode II CALL Ven-Tel Half Card w/Crosstalk XVI \$349 1200 Plus Ext w/o software \$349 BIZCOM IntelliModem EXT \$319 ST/XT/XT \$289/\$319/\$359 WATSON Integrated Voice Data Modem CALL EVEREX 1200B Internal w/software \$249 U.S. ROBOTICS Complete Line CALL
--

SPECIAL ITEMS BERON OMNI READER A must for any one using word processing. Works like a scanner, transferring text from paper to your computer. Reads common type faces. Will save hours of laborious typing. It is a great technological breakthrough at a very reasonable price. Comes complete with interface and software for your computer. \$599 IBM TERMINAL 3161 CALL IBM TERMINAL 3163 CALL GENERAL Parametric's VideoShow CALL CHORUS PHOTOBASE/PC-EYE CALL
--

MISC. ADD ONS CABLE Parallel, 6ft. \$20 Serial, 6 ft \$25 Keyboard Extension, 6 ft \$10 FLOPPY Drive Controller \$79 FLOPPY Controller w/P.S.G & Clock/Cal \$199 FLOPPY & HD Controller "REDUCED" \$299 HAYES Translet 1000 "REDUCED" \$299 MOUSE SYSTEMS PC Mouse w/PC Paint \$129 MICROSOFT MOUSE w/PC Paintbrush \$129/\$139 Bus/Serial \$129/\$139 KEYTRONIC KB 5151, \$165 AT Upgrade Kit, \$15 KB 5153T w/Touch Pad CALL AB/ABC/ABCD Switch Boxes CALL COMPUTER ACCESSORIES P-1-2-3 \$299 POWER DIRECTOR P2(5) \$89 P12(6) \$129 KENSINGTON Master Piece (5 outlets) \$89 KENSINGTON Universal Printer Stand \$20 KENSINGTON Master Piece Plus CALL PC Keyboard Storage Drawer. \$99 STANDBY PWR SUPPLY w/surge protection 200 Watts \$269 300 Watts \$339 800 Watts (Sine Wave) \$679 TILT/SWIVEL Monitor Pedestal \$20 PWR SUPPLY 130/150 Watts \$89/\$129 EVEREX Expansion Chassis Full Height \$699 EVEREX Expansion Chassis Full Height \$749

CALL FOR OUR WEEKLY UNADVERTISED SPECIALS   

Fantastic Price!
NASHUA
DISKETTES

FIVE YEAR WARRANTY

75¢ each
Qty. 100

5 1/4" SS/DD or DS/DD, your choice, with hub ring and Tyvek sleeve, bulk packaged, no labels. Shipping extra. For quantity 50, add 10¢ each.

Get the same low price our high-volume duplication customers get!

CALL TOLL FREE
1-800-321-4668

in Colorado, 303-234-0871

ALF Products Inc. • Denver, CO

Inquiry 13

U.S. Robotics

PASSWORD 300...\$119

PASSWORD 1200...\$195

AUTODIAL 212A...\$299

COURIER 2400...\$449

MICROLINK 1200...\$249

WITH Telpac Software.....

MICROLINK 2400...\$449

WITH Telpac Software.....

Telpac.....\$69

TOSHIBA P-351...\$1029

WITH PARALLEL INTERFACE

NO CHARGE FOR CREDIT CARDS

SAME DAY SHIPPING - FREIGHT INCLUDED

1-800-662-0034

MONDAY-FRIDAY 8:00-5:00

IN COLORADO CALL (303)779-1400

HIGHLINE SYSTEMS

P.O. BOX 9305 ENGLEWOOD, CO. 80111

Inquiry 87

TERMINAL EMULATION

Softerm PC emulates over 30 popular terminals including the:

- DEC VT102, VT220
- Data General D200, D410
- IBM 3101-20 (block mode)
- Hewlett-Packard 2622A
- Honeywell VIP7801, VIP7803

Guaranteed Compatibility

Call for free product brief

\$195 MC-VISA-COD

For the IBM PC/XT/AT, DG1, NEC, Wang PC, TI Pro, Gridcase, Tandy

SIFTRONICS

3639 New Getwell, Suite 10
Memphis, TN 38118
901-683-6850

Inquiry 452

MDS SOFTWARE UTILITIES

Keep Your Files Private with **MDS SOFTLOCK**. Protect your files using your own unique encryption key.

Need More Security? Use **MDS Super Softlock**! This powerful encryption program uses the NSA approved DES encryption algorithm.

Looking For A Sophisticated, Multi-Tasking Operating System? Stop looking—**You found MDS-OPS**. This versatile operating system can be adapted to commercial micro's, mini's, or special processors with equal ease. Fast, powerful, limited only by your skill and imagination.

Convert your Wordstar files to pure ASCII with **Un-Wordstar**. Now you can print directly, send your files via modems and comm lines, and develop programs using Wordstar's full editing capability.

(Wordstar is a tm of MicroPro Intl. Corp.)

FREE SPECIAL. Un-Wordstar sent **FREE** when you request information on any MDS software utility program.

(please send \$2.00 for materials & postage)

MDS MEGA DATA SYSTEMS, INC.
44 Netto Ln., Plainview
NY 11803 (516) 933-2130

Inquiry 242

FREE OFFER COMPUTER
PRODUCTS SUPPLY

Datalife®
Mini-Floppy Disks
for your home and
office computer.



Datalife®
Get a free head cleaning disc inside each box of Datalife 5 1/4" or 5 1/8" mini discs while supply lasts.

Verbatim Products are the best products for your customer. All discs are individually full surface tested and certified 100% error free. They are also backed by a lifetime warranty. Also, to insure that your computer gets the best care, Videotape Products, Inc. is offering a free Head Cleaning disc. Regular cleaning guards against data loss, errors and poor performance caused by debris and contamination. Be sure and get your free head cleaning disc with your Verbatim Mini-disc order while supplies last, as well as all your computer products from Computer Products Supply for the best prices and prompt delivery.

COMPUTER
PRODUCTS SUPPLY

CALL TOLL FREE FOR PRICING
(800) 621-0840 ext. 285
OR CALL COLLECT
(213) 684-1144

Verbatim.

320 North Madison Avenue
Los Angeles, CA 90004

Inquiry 86

Payroll & Checkwriting Systems

All payroll systems include tax deposit and unemployment liability calculations. All necessary quarterly and annual reports are generated (941's, W-2's, etc.)

Restaurant/Tipped Employees

Accurately calculates tips deemed wages, excess tips, allocated tips, and overtime rates. Complete summary of all wages by job description and department. One employee may have several different job descriptions.

Job Costing & Analysis

Each employee can have multiple selections from 75 different job sites and 48 different job costing categories during any pay period.

General Payroll

Each employee can have several different job descriptions within a department.

Available for MS-DOS®, IBM® Compatibles, Norstar®, & Other Selected Computers
Demo w/Manual Available
Dealer Inquiries Welcome

Business & Accounting Software Systems Inc.
508 East Lionshead Circle, Suite 2
Vail, Colorado 81657 303-476-2104

Inquiry 46

CORONA PORTABLE PC

Includes MS-DOS™ ver 2.11, PC TUTOR & PC PAL
FULLY IBM®PC COMPATIBLE

W/ 1 Floppy 356 - 640 x 400 graphics \$1295.00

W/ 2 Floppies 256 - 640 x 400 graphics 1595.00

DISK DRIVES

Internal PC Harddisk systems (Includes Hard disk, Base plate, controller card & cable, complete & ready to install)

10Mb-FAST \$399.00

20Mb-FAST 095.00

Shugart SA455 1/2 hd 48kpi floppy drive 85.00

160ns 64k DRAMS-each 1.00

PRINTERS

Panasonic KX-1091 120cps(120x1) \$99.00

Panasonic KX-1093 180cps(180x1) \$45.00

Panasonic KX-1093 180cps(180x1) \$45.00

Toshiba P-351 Parallel (Serial add \$50) 1899.00

Toshiba P-1540 Sprint & Graphics \$499.00

CORONA Laser Printer - 8 Pages/Minute 2995.00

CANON Laser Beam Printer (Dialo Compatible) 2495.00

Immediate delivery - Satisfaction Guaranteed - Full Support and Maintenance Thru CompuMaid™.

MICRO SPEC

1-800-245-2667 - 1-713-358-6954 (Texas)

1803 Crockett Houston, TX 77007

Mastercard - Visa - C.O.D.

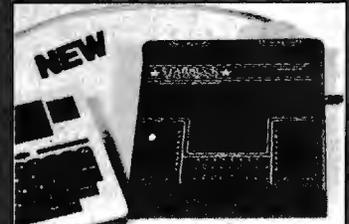
2% Discount for Pre-Paid Orders.

Watch this space for our monthly special!

This ad was typeset on a CORONA Laser Printer using the PC/TX System.

Inquiry 253

DATA ACQUISITION
and control for ANY computer



The Model 1232 communicates via RS-232, and has 8 analog inputs (± 4 VDC; 12 bits), 8 digital inputs and outputs, and a 2000 point buffer. Suitable for field data logging or lab use, the 1232 costs only \$690. The 8-bit system (0-5 VDC) is \$490. Detailed manual, \$6. Phone our applications engineer at 617-237-5514 or write:

STARBUCK DATA COMPANY

2 Mica Lane, Wellesley, MA 02181

Inquiry 351

CROSS-8
MAYBE THE ONLY DEVELOPMENT SOFTWARE YOU'LL EVER NEED

- Table based 8 bit cross-assembler
- Tables/Source files included for:

1802	6502	8048	COP400
3870	6801	8051	Z8
	6805	8085	Z80
- Modify/Create tables for most 8 bit micros
Create your own instruction sets
- INTEL, MOTOROLA, TEKTRONIX output formats
- Use with any EPROM programmer
- 36 page manual, full instructions
- Available in the following disk formats:
 - 5 IBM PC PC MS DOS 2.0 or greater, compatibles
 - 5 APPLE II - Iig CP M-80 (Softcard), compatibles
 - 8 SSSD CP M 80 (Z80 only)

\$99.95 US \$129.95 CDN

Credit card orders include card no., name on card, expiry date signature Nova Scotia residents add 10% sales tax

UNIVERSAL CROSS-ASSEMBLERS
P.O. BOX 384 BEDFORD NOVA SCOTIA
8AA 2X3 CANADA

Inquiry 374

4164 49¢ ea. 41256 \$2.95 ea.

STATIC RAMS

2101	256x4	(450ns)	1.95
5101	256x4	(450ns)(CMOS)	3.95
2102L-4	1024x1	(450ns)(LP)	2.99
2102L-2	1024x1	(250ns)(LP)	1.45
2112	256x4	(450ns)	2.99
2114	1024x4	(450ns)	.99
2114L-4	1024x4	(450ns)(LP)	1.09
2114L-2	1024x4	(200ns)(LP)	1.49
2114L-15	1024x4	(150ns)(LP)	1.95
TMS4044-4	4096x1	(450ns)	1.95
TMM2016-150	2048x8	(150ns)	1.89
TMM2016-100	2048x8	(100ns)	2.49
HM6116-4	2048x8	(200ns)(CMOS)	1.79
HM6116-3	2048x8	(150ns)(CMOS)	1.89
HM6116LP-4	2048x8	(200ns)(CMOS)(LP)	1.89
HM6116LP-3	2048x8	(150ns)(CMOS)(LP)	1.99
HM6116LP-2	2048x8	(120ns)(CMOS)(LP)	2.95
HM6264LP-15	8192x8	(150ns)(CMOS)	4.75
HM6264LP-15	8192x8	(150ns)(CMOS)(LP)	4.95
HM6264LP-12	8192x8	(120ns)(CMOS)(LP)	5.95

LP=Low power

DYNAMIC RAMS

4116-250	16384x1	(250ns)	.49
4116-200	16384x1	(200ns)	.69
4116-150	16384x1	(150ns)	.89
4116-120	16384x1	(120ns)	1.49
MK4332	32768x1	(200ns)	6.95
4164-200	65536x1	(200ns)(5V)	.49
4164-150	65536x1	(150ns)(5V)	.89
4164-120	65536x1	(120ns)(5V)	1.95
TMM6665	65536x1	(200ns)(CMOS)	2.95
TMS4164	65536x1	(150ns)(5V)	1.95
4164-REFRESH	65536x1	(150ns)(5V)(REFRESH)	2.95
TMS4416	16384x4	(150ns)(5V)	4.95
41128-150	131072x1	(150ns)(5V)	5.95
41258-200	262144x1	(200ns)(5V)	2.95
41256-150	262144x1	(150ns)(5V)	2.95

5V=Single 5 Volt Supply REFRESH=Pin 1 Refresh

★★★★HIGH-TECH★★★★

NEC V20 μ PD70108 \$20⁹⁵

REPLACES 8088 TO SPEED UP IBM PC 10-40%

- * HIGH-SPEED ADDRESS CALCULATION IN HARDWARE
- * PIN COMPATIBLE WITH 8088
- * SUPERSET OF 8086/8088 INSTRUCTION SET
- * LOW POWER CMOS

★★★★SPOTLIGHT★★★★

EPROMS

2708	1024x8	(850ns)	3.95
2716-6	2048x8	(850ns)	2.49
2716	2048x8	(450ns)(5V)	2.29
2716-1	2048x8	(350ns)(5V)	3.95
TMS2532	4096x8	(450ns)(5V)	3.95
2732	4096x8	(450ns)(5V)	2.49
2732A	4096x8	(250ns)(5V)(21V PGM)	2.89
2732A-2	4096x8	(200ns)(5V)(21V PGM)	4.95
27C64	8192x8	(250ns)(5V)(PGM)	9.95
2764	8192x8	(450ns)(5V)	2.29
2764-250	8192x8	(250ns)(5V)	2.49
2764-200	8192x8	(200ns)(5V)	4.95
TMS2664	8192x8	(450ns)(5V)	8.95
MCM68766	8192x8	(350ns)(5V)(24 PIN)	17.95
27128	16384x8	(250ns)(5V)	3.49
27C256	32768x8	(250ns)(5V)(CMOS)	15.95
27256	32768x8	(250ns)(5V)	9.95

5V=Single 5 Volt Supply 21V PGM=Program at 21 Volts

ORDER TOLL FREE
800-538-5000
800-662-6279 (CA)



SPECTRONICS CORPORATION EPROM ERASERS



Model	Timer	Capacity Chip	Intensity (uW/cm ²)	Unit Price
PE-14	NO	9	8,000	\$83.00
PE-14T	YES	9	8,000	\$119.00
PE-24T	YES	12	9,600	\$175.00

8000

8035	1.95
8039	2.95
8080	2.95
8085	2.95
8087-2	139.95
8087	109.00
8088	7.95
8088-2	9.95
8155	2.95
8155-2	3.95
8748	9.95
8755	19.95
80286	129.95
80287	185.00

6500

6502	2.79
65C02 (CMOS)	12.95
8507	9.95
6520	1.95
8522	4.95
8526	26.95
6532	6.95
6545	6.95
6551	5.95
6561	19.95
6581	34.95

2.0 MHz

6502A	2.95
6520A	2.95
5522A	5.95
6532A	11.95
6545A	7.95
6551A	6.95

3.0 MHz

6502B	6.95
-------	------

6800

6800	1.95
6802	4.95
6803	9.95
6809	5.95
6809E	5.95
6810	1.95
6820	2.95
6821	1.95
6840	6.95
6843	19.95
6844	12.95
6845	4.95
6847	11.95
6850	1.95
6883	22.95

2.0 MHz

68B00	4.95
68B02	5.95
68B09E	7.95
68B09	7.95
68B21	4.95
68B46	8.95
68B50	3.95
68B54	7.95

CLOCK CIRCUITS

MMS369	1.95
MMS369-EST	1.95
MMS5817	12.95
MMS58174	11.95
MSM5832	2.95

CRT CONTROLLERS

6845	4.95
68B45	8.95
6847	11.95
HD46605SP	6.95
MC1372	2.95
8275	26.95
8276	19.95
8278	12.95
CRT5027	9.95
CRT5037	9.95
TMS9918A	19.95

DISK CONTROLLERS

1771	4.95
1791	9.95
1793	9.95
1795	12.95
1797	12.95
2781	19.95
2793	19.95
2797	29.95
6843	19.95
8272	4.95
UPD765	4.95
MB8876	12.95
MB8877	12.95
1691	6.95
2143	8.95

BIT RATE GENERATORS

MC14411	9.95
BR1941	4.95
4702	8.00
COM8116	8.95
MM5307	4.95

UARTS

AY5-1013	3.95
AY3-1015	4.95
TR1602	3.95
2651	4.95
IM6402	6.95
IM6403	9.95
INS8250	6.95

SOUND CHIPS

76477	3.95
76489	8.95
SSI-263	39.95
AY3-8910	12.95
AY3-8912	12.95
SP1000	39.00

CRYSTALS

32.768 KHz	.95
1.0 MHz	2.95
1.8432	2.95
2.0	1.95
2.097152	1.95
2.4576	1.95
3.2768	1.95
3.579545	1.95
4.0	1.95
4.032	1.95
5.0	1.95
5.0888	1.95
6.0	1.95
8.144	1.95
8.5536	1.95
8.0	1.95
10.0	1.95
10.738635	1.95
12.0	1.95
14.31818	1.95
15.0	1.95
16.0	1.95
17.430	1.95
18.0	1.95
18.432	1.95
20.0	1.95
22.1184	1.95
24.0	1.95
32.0	1.95

CRYSTAL OSCILLATORS

1.0MHz	5.95
1.8432	5.95
2.0	5.95
2.4576	5.95
2.5	4.95
4.0	4.95
5.0888	4.95
6.0	4.95
6.144	4.95
8.0	4.95
10.0	4.95
12.0	4.95
12.480	4.95
15.0	4.95
16.0	4.95
18.432	4.95
20.0	4.95
24.0	4.95

MISC.

TMS99531	9.95
TMS99532	19.95
ULN2003	7.95
3242	4.95
3341	4.95
MC3470	1.95
MC3480	8.95
MC3487	2.95
11C90	13.95
2513-001 UP	6.95
AY5-2376	11.95
AY5-3600 PRO	11.95

74LS00

74LS00	.16
74LS01	.18
74LS02	.17
74LS03	.18
74LS04	.16
74LS05	.18
74LS08	.18
74LS09	.18
74LS10	.16
74LS11	.22
74LS12	.22
74LS13	.26
74LS14	.39
74LS15	.26
74LS16	.17
74LS17	.22
74LS18	.22
74LS19	.23
74LS20	.26
74LS21	.17
74LS22	.18
74LS23	.26
74LS24	.18
74LS25	.18
74LS26	.18
74LS27	.26
74LS28	.26
74LS29	.26
74LS30	.26
74LS31	.26
74LS32	.18
74LS33	.26
74LS34	.26
74LS35	.26
74LS36	.26
74LS37	.26
74LS38	.26
74LS39	.26
74LS40	.26
74LS41	.26
74LS42	.26
74LS43	.26
74LS44	.26
74LS45	.26
74LS46	.26
74LS47	.26
74LS48	.26
74LS49	.26
74LS50	.26
74LS51	.26
74LS52	.26
74LS53	.26
74LS54	.26
74LS55	.26
74LS56	.26
74LS57	.26
74LS58	.26
74LS59	.26
74LS60	.26
74LS61	.26
74LS62	.26
74LS63	.26
74LS64	.26
74LS65	.26
74LS66	.26
74LS67	.26
74LS68	.26
74LS69	.26
74LS70	.26
74LS71	.26
74LS72	.26
74LS73	.26
74LS74	.26
74LS75	.26
74LS76	.26
74LS77	.26
74LS78	.26
74LS79	.26
74LS80	.26
74LS81	.26
74LS82	.26
74LS83	.26
74LS84	.26
74LS85	.26
74LS86	.26
74LS87	.26
74LS88	.26
74LS89	.26
74LS90	.26
74LS91	.26
74LS92	.26
74LS93	.26
74LS94	.26
74LS95	.26
74LS96	.26
74LS97	.26
74LS98	.26
74LS99	.26

HIGH SPEED CMOS

A new family of high speed CMOS logic featuring the speed of low power Schottky (Bns typical gate propagation delay), combined with the advantages of CMOS: very low power consumption, superior noise immunity, and improved output drive.

74HC00

74HC: Operate at CMOS logic levels and are ideal for new, all-CMOS designs.

74HC00	.59	74HC148	1.19
74HC02	.59	74HC151	.89
74HC04	.59	74HC154	2.49
74HC08	.59	74HC157	.89
74HC10	.59	74HC158	.95
74HC14	.79	74HC161	1.15
74HC20	.59	74HC175	.95
74HC27	.59	74HC244	1.89
74HC30	.59	74HC245	1.89
74HC32	.69	74HC257	.85
74HC51	.59	74HC259	1.39
74HC74	.75	74HC273	1.89
74HC85	1.35	74HC293	4.99
74HC86	.89	74HC300	1.39
74HC93	1.19	74HC303	1.39
74HC107	.79	74HC328	2.29
74HC109	.79	74HC374	2.29
74HC112	.79	74HC390	1.39
74HC125	1.19	74HC393	1.39
74HC132	1.19	74HC401	1.59
74HC133	.89	74HC402	1.39

PARTIAL LISTING ONLY — CALL FOR A FREE CATALOG

CMOS

4001	.19	14419	4.95
4011	.19	14433	14.95
4012	.25	4503	.49
4013	.35	4511	.69
4015	.29	4516	.79
4016	.29	4518	.85
4017	.49	4522	.79
4018	.69	4526	.79
4020	.59	4527	1.95
4021	.69	4528	.79
4024	.49	4529	.79
4026	.25	4532	1.95
4027	.39	4538	.95
4028	.65	4541	1.29
4035	.69	4553	5.79
4040	.69	4558	.79
4041	.75	4702	12.95
4042	.59	74C00	.29
4043	.85	74C14	.59
4044	.69	74C74	.59
4045	1.98	74C83	1.95
4046	.69	74C85	1.49
4047	.69	74C95	.99
4049	.29	74C150	5.75
4050	.29	74C151	2.25
4051	.69	74C161	.99
4052	.69	74C163	.99
4053	.69	74C164	1.39
4056	2.19	74C192	1.49
4060	.59	74C193	1.49
4066	.29	74C221	1.75
4069	.19	74C240	1.89
4076	.69	74C264	1.89
4077	.29	74C374	.99
4081	.22	74C905	10.95
4085	.79	74C911	4.95
4086	.89	74C917	8.95
4093	.49	74C922	4.49
4094	2.49	74C923	4.95
14411	9.95	74C926	7.95
14412	6.95	80C97	.95

7400/9000

7400	.19	74147	2.49
7402	.19	74148	1.20
7404	.19	74151	1.35
7406	.29	74151	.55
7407	.29	74153	.55
7408	.24	74154	1.49
7410	.19	74155	.75
7411	.26	74157	.55
7414	.49	74159	1.65
7416	.25	74161	.69
7417	.25	74161	.69
7420	.19	74164	.85
7423	.29	74165	.85
7430	.19	74166	1.00
7432	.29	74175	.89
7438	.29	74177	.75
7442	.49	74178	1.15
7445	.69	74181	2.25
7447	.89	74182	.75
7470	.35	74184	2.00
7473	.34	74191	1.15
7474	.33	74192	.79
7475	.45	74194	.85
7476	.35	74196	.79
7483	.50	74197	.75
7485	.89	74199	1.35
7486	.35	74221	1.35
7489	2.15	74246	1.35
7490	.39	74247	1.25
7492	.50	74248	1.85
7493	.35	74249	1.95
7495	.55	74251	.75
7497	2.75	74255	1.35
74100	2.29	74273	.75
74121	.29	74278	3.11
74123	.49	74367	.65
74125	.45	74368	.65
74141	.65	9368	3.95
74143	5.95	9602	1.50
74144	2.95	9637	2.95
74145	.60	96502	1.95

74500

74500	.29	745183	1.29
74502	.29	745188	3.95
74503	.29	745174	.79
74504	.29	745175	.79
74505	.29	745188	1.95
74508	.35	745189	1.95
74510	.29	745195	1.49
74515	.35	745196	1.49
74530	.29	745197	1.49
74532	.35	745226	3.99
74537	.69	745240	1.49
74538	.69	745241	1.49
74574	.49	745244	1.49
74585	.95	745257	.79
74586	.35	745253	.79
745112	.50	745258	.95
745124	2.75	745280	1.95
745138	.79	745287	1.69
745140	.55	745288	1.69
745151	.79	745298	2.89
745153	.79	745373	1.65
745157	.79	745374	1.69
745158	.95	745371	4.95
745161	1.29	745371	2.95

VOLTAGE REGULATORS

TO-220 CASE

7805T	.49	7905T	.59
7808T	.49	7908T	.59
7812T	.49	7912T	.59
7815T	.49	7915T	.59

TO-3 CASE

7805K	1.39	7905K	1.49
7812K	1.39	7912K	1.49

TO-92 CASE

78L05	.49	79L05	.69
78L12	.49	79L12	.69

OTHER VOLTAGE REGS

LM323K	5V 3A	TO-3	4.75
LM338K	A4 5A	TO-3	3.95
78M05K	5V 5A	TO-3	7.95
78M12K	12V 5A	TO-3	8.95
78P05K	5V 10A	TO-3	14.95

LINEAR

TL066	.69	LM733	.98
TL071	.69	LM741	.29
TL072	1.09	LM747	.69
TL074	1.49	LM748	.69
TL081	.59	MC1330	1.69
TL082	.99	MC1350	1.19
TL084	1.49	MC1372	6.95
LM301	.34	LM1414	1.59
LM309K	1.25	LM1458	.49
LM311	.89	LM1488	.49
LM312	.89	LM1489	.49
LM317K	3.49	LM1496	.85
LM317T	.95	LM1812	8.25
LM318	1.49	LM1889	1.95
LM319	1.25	ULN2003	.79
LM320	***7900	KR2206	3.75
LM322	1.65	KR2211	2.95
LM323K	4.79	KR2240	1.95
LM324	.49	MPQ2907	1.95
LM331	3.95	LM2917	1.95
LM334	1.19	CA3046	.89
LM335	1.40	CA3081	.99
LM336	1.75	CA3082	.99
LM337K	3.95	CA3088	.80
LM338K	3.95	CA3089	1.95
LM339	1.49	LM1310E	1.95
LM340	***7900	CA3146	1.29
LM350T	4.60	CA3160	1.19
LF353	.69	MC3470	1.95
LF356	.99	MC3480	8.95
LF357	.98	MC3487	2.95
LM358	.59	LM3500	4.99
LM380	.49	LM3805	1.95
LM382	1.95	LM3911	2.25
LM386	.89	LM3914	2.39
LM393	.45	MC4024	3.49
LM394H	4.60	MC4044	3.99
TL494	4.20	RC4136	1.25
TL497	3.26	RC4558	.69
NE555	.29	LM1380A	1.95
NE556	.49	107	.49
NE558	1.29	75110	1.95
NE564	1.95	75150	1.95
LM565	.95	75154	1.95
LM566	1.49	75188	1.25
LM567	.79	75189	1.25
NE570	2.95	75451	.39
NE571	2.95	75452	.39
NE592	.98	75453	.39
LM710	.75	75477	1.29
LM723	.49	75492	.79

H-TO-5 CAN, K-TO-3, T-TO-220

IC SOCKETS

8 PIN ST	1.99	100
14 PIN ST	.15	.11
16 PIN ST	.17	.13
18 PIN ST	.20	.18
20 PIN ST	.29	.27
22 PIN ST	.30	.27
24 PIN ST	.40	.32
40 PIN ST	1.09	.98
64 PIN ST	4.25	CALL

ST-SOLDERTAIL

8 PIN WW	.59	.49
14 PIN WW	.69	.52
16 PIN WW	.69	.58
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	4.95	CALL
24 PIN ZIF	5.95	CALL
28 PIN ZIF	6.95	CALL
40 PIN ZIF	9.95	CALL

ZIF-TEXT TOOL
(ZERO INSERTION FORCE)

EDGE CARD CONNECTORS

100 PIN ST	S-100	.125	3.95
100 PIN WW	S-100	.125	3.95
62 PIN ST	IBM PC	.100	1.95
50 PIN ST	APPLE	.100	2.95
44 PIN ST	STD	.156	1.95
44 PIN WW	STD	.156	4.95

36 PIN CENTRONICS

ICDN36	RIBBON CABLE	6.95
CEN36	SOLDER CUP	4.95
CEN36PC	RT ANGLE PC MDUNT	4.95
ICDN36/F	RIBBON CABLE	7.95

INTER SIL

ICL7106	9.95
ICL7107	12.95
ICL7660	2.95
ICL8038	4.95
ICM7207A	6.95
ICM7208	15.95

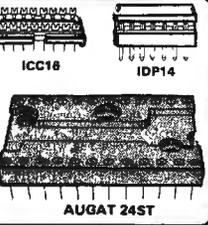
DATA ACQ INTERFACE

ADC0800	15.55	8T26	1.29
ADC0804	3.49	8T28	1.29
ADC0809	4.49	8T95	.89
ADC0812	14.95	8T96	.89
ADC0817	9.95	8T97	.59
ADC0831	8.95	8T98	.89
DAC0800	4.4C	DM8131	2.95
DAC0806	1.95	DP8304	2.25
DAC0808	2.95	D58833	2.25
DAC1020	8.25	D58835	1.59
DAC1022	14.95	D58836	.99
MC1408L8	2.95	D58837	1.65

DIP CONNECTORS

DESCRIPTION	ORDER BY	CONTACTS								
		8	14	16	18	20	22	24	28	40
HIGH RELIABILITY TOOLED ST IC SOCKETS	AUGATxxST	.62	.79	.89	1.09	1.29	1.39	1.49	1.69	2.49
HIGH RELIABILITY TOOLED WW IC SOCKETS	AUGATxxWW	1.30	1.80	2.10	2.40	2.50	2.90	3.15	3.70	5.40
COMPONENT CARRIES (DIP HEADERS)	ICCxx	.49	.59	.69	.99	.99	.99	.99	1.09	1.49
RIBBON CABLE DIP PLUGS (IDC)	IDPxx	---	.95	.95	---	---	---	1.75	---	2.95

FOR ORDERING INSTRUCTIONS SEE D-SUBMINIATURE BELOW



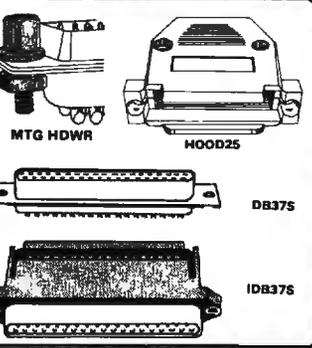
DIODES/OPTO/TRANSISTORS

1N751	.25	4N26	.69
1N759	.25	4N27	.69
1N4148	.19	4N28	.69
1N4004	25/1.00	4N33	.69
1N4002	.25	4N37	1.49
KBPD4	.55	MCT-2	.59
KBUBA	.95	MCT-6	1.29
MDA990-2	.35	TIL-111	.99
N2222	.25	2N3906	.10
N2222	.10	2N4401	.25
2N2905	.50	2N4402	.25
2N2907	.25	2N4403	.25
2N3055	.79	2N4445	1.75
2N3904	.10	TIF31	.49

D-SUBMINIATURE

DESCRIPTION	ORDER BY	CONTACTS						
		9	15	19	25	37	50	
SOLDER CUP	MALE	DBxxP	.82	.90	1.25	1.80	3.48	
	FEMALE	DBxxS	.95	1.15	1.50	1.50	2.35	4.32
RIGHT ANGLE PC SOLDER	MALE	DBxxPR	1.20	1.49	---	1.95	2.65	---
	FEMALE	DBxxSR	1.25	1.55	---	2.00	2.79	---
WIRE WRAP	MALE	DBxxPWW	1.69	2.56	---	3.89	5.60	---
	FEMALE	DBxxSWW	2.78	4.27	---	6.84	9.95	---
IDC RIBBON CABLE	MALE	IDBxxP	2.70	2.95	---	3.98	5.70	---
	FEMALE	IDBxxS	2.92	3.20	---	4.33	6.76	---
HOODS	METAL	MHOODxx	1.25	1.25	1.30	1.30	---	---
	GREY	HOODxx	.65	.65	---	.85	.75	.95

ORDERING INSTRUCTIONS: INSERT THE NUMBER OF CONTACTS IN THE POSITION MARKED "xx" OF THE "ORDER BY" PART NUMBER LISTED.
EXAMPLE: A 15 PIN RIGHT ANGLE MALE PC SOLDER WOULD BE DB15PR.



LED DISPLAYS

FND-357(359)	COM CATHODE	.382"	1.25
FND-500(503)	COM CATHODE	.5"	1.49
FND-507(510)	COM CATHODE	.5"	1.49
MAN-72	COM ANODE	.3"	.99
MAN-74	COM CATHODE	.3"	.89
MAN-8940	COM CATHODE	.8"	1.99
TIL-313	COM CATHODE	.3"	1.25
HP5082-7760	COM CATHODE	.43"	2.95
TIL-311	4x7 HEX W/LOGIC	.270"	9.95
HP5082-7340	4x7 HEX W/LOGIC	.290"	7.95

DIFFUSED LEDS

JUMBO RED	T14	.10	.09
JUMBO GREEN	T14	.14	.12
JUMBO YELLOW	T14	.14	.12
MOUNTING HDW	T14	.10	.09
MINI RED	T1	.10	.09

IDC CONNECTORS

DESCRIPTION	ORDER BY	CONTACTS					
		10	20	26	34	40	50
SOLDER HEADER	IDHxxS	.82	1.29	1.68	2.20	2.58	3.24

BARGAIN HUNTERS CORNER

IBM COMPATIBLE MONOCHROME DISPLAY ADAPTOR

- * 720 x 350 PIXEL SCREEN (80 CHARACTERS x 25 LINES)
- * CHARACTER ATTRIBUTES:
BLINK, UNDERLINE, REVERSE, VIDEO & INTENSIFIED
- * STANDARD TTL OUTPUT
- * MADE IN USA BY INTERSIL SYSTEMS
- * 90 DAY WARRANTY
- * INCLUDES 5 PAGE MANUAL

\$4995

NOTE: THE ABOVE CARD DOES NOT INCLUDE A PARALLEL PRINTER PORT. DON'T LET THIS PRICE SCARE YOU. IF YOU PURCHASED THESE FROM AN EXCESS INVENTORY LOT, WE CAN SELL THEM AT AN UNHEARD OF PRICE.

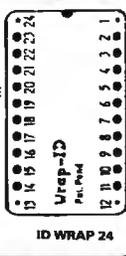
PURCHASE THE ABOVE MONOCHROME DISPLAY ADAPTOR AND THE SAMWOO MONOCHROME MONITOR

FOR ONLY \$13995

SPECIALS END 12/31/85

SOCKET-WRAP I.D.™

- * SLIPS OVER WIRE WRAP PINS
 - * IDENTIFIES PIN NUMBERS ON WRAP SIDE OF BOARD
 - * CAN WRITE ON PLASTIC, SUCH AS IC #
- | PINS | PART# | PCK. OF | PRICE |
|------|-----------|---------|-------|
| 8 | IDWRAP 08 | 10 | 1.95 |
| 14 | IDWRAP 14 | 10 | 1.95 |
| 16 | IDWRAP 16 | 10 | 1.95 |
| 18 | IDWRAP 18 | 5 | 1.95 |
| 20 | IDWRAP 20 | 5 | 1.95 |
| 22 | IDWRAP 22 | 5 | 1.95 |
| 24 | IDWRAP 24 | 5 | 1.95 |
| 28 | IDWRAP 28 | 5 | 1.95 |
| 40 | IDWRAP 40 | 5 | 1.95 |
- PLEASE ORDER BY NUMBER OF PACKAGES (PCK. OF)



PAGE WIRE WRAP WIRE PRECUT ASSORTMENT IN ASSORTED COLORS \$27.50

100ea: 5.5", 6.0", 6.5", 7.0"
250ea: 2.5", 4.5", 5.0"
500ea: 3.0", 3.5", 4.0"

SPOOLS

100 feet \$4.30 250 feet \$7.25
500 feet \$13.25 1000 feet \$21.95

Please specify color:
Blue, Black, Yellow or Red

EMI FILTER

- * MANUFACTURED BY CORCOM
- * LOW COST
- * FITS LC-HP BELOW
- * 6 AMP 120/240 VOLT



\$4.95

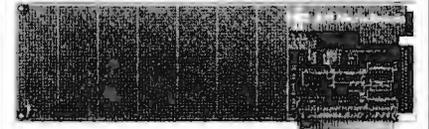
6 FOOT LINE CORDS

LC-2 2 CONDUCTOR .39
LC-3 2 CONDUCTOR .99
LC-HP 3 CONDUCTOR W STD FEMALE SOCKET 1.49

MUFFIN FANS

3.15" SQ ROTRON 14.95
3.63" SQ ETRI 14.95
3.18" SQ MASUSHITA 16.95

WIRE WRAP PROTOTYPE CARDS FR-4 EPOXY GLASS LAMINATE WITH GOLD-PLATED EDGE-CARD FINGERS



IBM-PR2

IBM

BOTH CARDS HAVE SILK SCREENED LEGENDS AND INCLUDES MOUNTING BRACKET

IBM-PR1 WITH -5V AND GROUND PLANE . . . \$27.95
IBM-PR2 AS ABOVE WITH DECODING LAYOUT \$29.95

S-100

P100-1 BARE - NO FOIL PADS \$15.15
P100-2 HORIZONTAL BUS \$21.80
P100-3 VERTICAL BUS \$21.80
P100-4 SINGLE FOIL PADS PER HOLE \$22.75

APPLE

P500-1 BARE - NO FOIL PADS \$15.15
P500-3 HORIZONTAL BUS \$22.75
P500-4 SINGLE FOIL PADS PER HOLE \$21.80
7060-45 FOR APPLE IIe AUX SLOT \$30.00

FRAME STYLE TRANSFORMERS

12.6V AC CT	2 AMP	5.95
12.6V AC CT	4 AMP	7.95
12.6V AC CT	8 AMP	10.95
25.2V AC CT	2 AMP	7.95

25 PIN D-SUB GENDER CHANGERS

\$7.95



SWITCHING POWER SUPPLIES

PS-IBM \$99.95

- * FOR IBM PC-XT COMPATIBLE
- * 130 WATTS
- * -5V @ 15A, -12V @ 4.2A
- * -5V @ .5A, -12V @ .5A
- * ONE YEAR WARRANTY



PS-130 \$99.95

- * 130 WATTS
- * SWITCH ON REAR
- * FOR USE IN OTHER IBM TYPE MACHINES
- * 90 DAY WARRANTY



PS-A \$49.95

- * USE TO POWER APPLE TYPE SYSTEMS
- * +5V @ 4A, +12V @ 2.5A
- * -5V @ .5A, -12V @ .5A
- * APPLE POWER CONNECTOR



PS-3 \$39.95

- * AS USED IN APPLE III
- * +5V @ 4A, +12V @ 2.5A
- * -5V @ .25A, -12V @ .30A,
- * 15.5" x 4.5" x 2.0", .884 LBS.



PS-ASTEC \$19.95

- * CAN POWER TWO 5W FDDS
- * +5V @ 2.5A, -12V @ 2A
- * -12V @ .1A
- * +5V @ 5A IF +12V IS NOT USED
- * 6.3" x 4.0" x 1.9", 1 LB.



PS-TDK \$29.95

- * +5V @ 4A, +12V @ 2A
- * +12V @ 2.8A, -12V @ .30A
- * 6.2" x 7.4" x 1.7", 1.6 LBS.

CAPACITORS

TANTALUM			
1.0µf	15V .35	.47µf	35V .45
6.8	15V .70	1.0	35V .45
10	15V .80	2.2	35V .65
22	15V 1.35	4.7	35V .85
40	35V .40	10	35V 1.00

DISC			
10µf	50V .05	500	50V .05
22	50V .05	.001µf	50V .05
27	50V .05	.0022	50V .05
33	50V .05	.005	50V .05
47	50V .05	.01	50V .07
68	50V .05	.02	50V .07
100	50V .05	.05	50V .07
220	50V .05	.1	12V .10
560	50V .05	.1	50V .12

MONOLITHIC			
.01µf	50V .14	.1µf	50V .18
.047µf	50V .15	.47µf	50V .25

ELECTROLYTIC			
RADIAL		AXIAL	
1µf	25V .14	1µf	50V .14
2.2	35V .15	10	50V .16
4.7	50V .15	22	16V .14
10	50V .15	47	50V .20
47	35V .18	100	35V .25
100	16V .18	220	25V .30
220	35V .20	470	50V .50
470	25V .30	1000	16V .60
2200	16V .70	2200	16V .70
4700	25V 1.45	4700	18V 1.25
COMPUTER GRADE	44,000µf	30V	3.95

DATARASE EPROM ERASER \$34.95

- * ERASES TWO EPROMS IN 10 MINUTES
- * COMPACT-NO DRAWER
- * THIN METAL SHUTTER PREVENTS UV LIGHT FROM ESCAPING



1/4 WATT RESISTORS

5% CARBON FILM ALL STANDARD VALUES FROM 1 OHM TO 10 MEG. OHM

10 PCS	same value	.05	100 PCS	same value	.02
50 PCS	same value	.025	1000 PCS	same value	.015

RESISTOR NETWORKS

SIP	10 PIN	9 RESISTOR	.69
SIP	8 PIN	7 RESISTOR	.59
DIP	16 PIN	8 RESISTOR	1.09
DIP	16 PIN	15 RESISTOR	1.09
DIP	14 PIN	7 RESISTOR	.99
DIP	14 PIN	13 RESISTOR	.99

SPECIALS ON BYPASS CAPACITORS

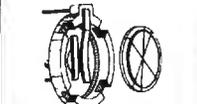
.01 µf CERAMIC DISC	100/\$5.00
.01 µf MONOLITHIC	100/\$10.00
.1 µf CERAMIC DISC	100/\$6.50
.1 µf MONOLITHIC	100/\$12.50

WISH SOLDERLESS BREADBOARDS

PART NUMBER	DIMENSIONS	DISTRIBUTION STRIP(S)	TIE POINTS	TERMINAL STRIP(S)	TIE POINTS	BINDING POSTS	PRICE
WBU-D	.38 x 6.50"	1	100	---	---	---	2.95
WBU-T	1.38 x 6.50"	---	---	1	630	---	6.95
WBU-204-3	3.94 x 8.45"	1	100	2	1260	2	17.95
WBU-204	5.13 x 8.45"	4	400	2	1260	3	24.95
WBU-206	6.88 x 9.06"	5	500	3	1890	4	29.95
WBU-208	8.25 x 9.45"	7	700	4	2520	4	39.95

LITHIUM BATTERY

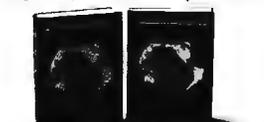
AS USED IN CLOCK CIRCUITS



3 VOLT BATTERY \$3.95
BATTERY HOLDER \$1.49

IC MASTER

\$79.95



THE INDUSTRY STANDARD

VISIT OUR RETAIL STORE LOCATED AT 1256 SOUTH BASCOM AVENUE IN SAN JOSE

JDR Microdevices

1224 S. Bascom Avenue, San Jose, CA 95128
800-538-5000 • 800-662-6279 (CA) • (408) 995-5430
FAX (408) 275-8415 • Telex 171-110

ALL MERCHANDISE 100% GUARANTEED

HOURS: M-W-F, 9-5 TU-TH, 9-9 SAT, 10-3
PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING

TERMS: Minimum order \$10.00. For shipping and handling include \$2.50 for UPS Ground and \$3.50 for UPS Air. Orders over 1 lb. and foreign orders may require additional shipping charges - please contact our sales department for the amount. CA residents must include applicable sales tax. All merchandise is warranted for 90 days unless otherwise stated. Prices are subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sale.

PARTIAL LISTING ONLY — CALL FOR A FREE CATALOG

PRINTER BUFFERS

- FREES COMPUTER FOR OTHER TASKS WHILE PRINTING LONG DOCUMENTS.
- STANDALONE DESIGN - WORKS WITH ANY COMPUTER OR PRINTER.
- ALL MODELS FEATURE PRINT PAUSE, MEMORY CHECK AND GRAPHICS CAPABILITY.

SP120P PARALLEL \$139.95
 • 64K UPGRADABLE TO 256K
 • LED INDICATOR SHOWS VOLUME OF DATA IN BUFFER

SP120S RS232 SERIAL \$159.95
 • 64K UPGRADABLE TO 256K
 • SIX SELECTABLE BAUD RATES FROM 600B - 19,200B

SP110 PARALLEL \$249.95
 • 64K UPGRADABLE TO 512K
 • SPOOLS OUTPUT OF UP TO THREE COMPUTERS
 • LED BARGRAPH DISPLAYS AMOUNT OF DATA IN BUFFER
 • RESET FUNCTION CLEARS DATA IN BUFFER
 • REPEAT FUNCTION CAN PRODUCE MULTIPLE COPIES OF A DOCUMENT



SP120



SP110

3-WAY SWITCH BOXES

- SERIAL OR PARALLEL
- CONNECTS 3 PRINTERS TO 1 COMPUTER OR 3 COMPUTERS TO 1 PRINTER
- ALL LINES SWITCHED
- HIGH QUALITY ROTARY SWITCH MOUNTED ON PCB
- GOLD CONTACTS
- STURDY METAL ENCLOSURE



SWITCH-3P CENTRONICS PARALLEL \$99.95
SWITCH-3S RS232 SERIAL \$99.95

IBM PRINTER CABLE

- DB25 TO CENTRONICS
- SHIELDED CABLE

\$9.95

JOYSTICKS



\$7.95

\$4.95

NASHUA DISKETTE SPECIALS

5 1/4" SOFT SECTOR DS/DD WITH HUB RINGS

\$9.90
BOX OF 10

89¢ea
BULK QTY 50

79¢ea
BULK QTY 250

NASHUA DISKETTES WERE JUDGED TO HAVE THE HIGHEST POLISH AND RECORDED AMPLITUDE OF ANY DISKETTES TESTED. SEE "COMPARING FLOPPY DISKS" BYTE 9-84

DISKETTE FILE

\$8.95



HOLDS 70 5 1/4" DISKETTES

DISKETTES

NASHUA 5 1/4"

N-MD2D DS/DD SOFT SECTOR \$9.90
N-MD2F DS/QUAD SOFT SECTOR \$34.95
N-MD2H DS/HIGH DENSITY FOR AT \$49.95

NASHUA 8"

N-FD1 SS/DD SOFT SECTOR \$27.95
N-FD2D DS/DD SOFT SECTOR \$34.95

NASHUA 3.5"

N-3.5SS 3.5" SS/DD FOR MACINTOSH \$32.95

VERBATIM 5 1/4"

V-MD1D DS/DD SOFT SECTOR \$23.95
V-MD2D DS/DD SOFT SECTOR \$29.95
V-MD110D SS/DD 10 SECTOR HARD \$23.95

IBM STYLE COMPUTER CASE

ATTRACTIVE STEEL CASE, WITH HINGED LID, FITS POPULAR PC/XT COMPATIBLE MOTHER-BOARDS.

- SWITCH CUT-OUT ON SIDE FOR PC/XT STYLE POWER SUPPLY
- CUT-OUT FOR 8 EXPANSION SLOTS
- ALL HARDWARE INCLUDED

ONLY \$59.95



FLOPPY DISK DRIVES

TEAC
FD-55B 1/2 HEIGHT DS/DD \$89.95
FD-55F 1/2 HEIGHT DS/QUAD \$99.95

SHUGART
SA460 5 1/4" (80 TRACK) DS/QUAD \$199.95

TANDON
TM100-2 5 1/4" (FOR IBM) DS/DD \$99.95

MPI
MPI-B52 5 1/4" (FOR IBM) DS/DD \$89.95

SIEMENS 8" DISK DRIVES

FD100-8 SS/DD SA801R EQUIV \$119.00
FD200-8 DS/DD SA851R EQUIV. \$159.00
JFORMAT-2 SOFTWARE \$49.95
 SUPPORT FOR QUAD DENSITY DRIVES FROM TALL TREE SYSTEMS



TEAC FD-55B



TANDON TM100-2

DISK DRIVE CABINETS

5 1/4" DRIVE ENCLOSURES

CAB-APPLE APPLE TYPE DRIVE CABINET WITHOUT POWER SUPPLY \$24.95
CAB-1FH5 FULL HEIGHT 5 1/4" BEIGE DRIVE CABINET WITH POWER SUPPLY \$69.95
CAB-2SV5 DUAL SLIMLINE 5 1/4" CABINET WITH POWER SUPPLY - VERTICAL MOUNT \$49.95

8 INCH DRIVE ENCLOSURES BY JMR

CAB-2SV8 DUAL SLIMLINE 8" DRIVE CABINET WITH POWER SUPPLY - VERTICAL MOUNT \$209.95
CAB-2FH8 DUAL FULL HEIGHT 8" DRIVE CABINET WITH POWER SUPPLY - HORIZONTAL \$219.95



CAB-1FH5



CAB-2SV5



CAB-2FH8

EXTENDER CARDS

IBM
 IBM-PC \$45.00
 IBM-AT \$68.00
 APPLE II \$45.00
 APPLE IIe \$45.00
 MULTIBUS \$86.00

POWER STRIPS

• UL APPROVED
 • 15A CIRCUIT BREAKER
\$12.95



KEYBOARD-AP

- REPLACEMENT FOR APPLE II KEYBOARD
- CAPS LOCK KEY
- AUTO-REPEAT
- ONE KEY ENTRY OF BASIC OR CP/M COMMANDS

\$49.95



CASE WITH KEYBOARD

FOR APPLE MOTHER-BOARD MODEL KB-1000

- USER DEFINED FUNCTION KEYS
- NUMERIC KEYPAD WITH CURSOR CONTROL
- CAPS LOCK
- AUTO-REPEAT

ONLY \$79.95

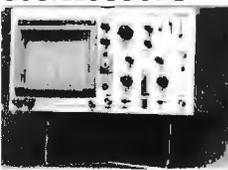


HIGH QUALITY TEST EQUIPMENT FROM JDR INSTRUMENTS

20 MHz DUAL TRACE OSCILLOSCOPE

MODEL 2000

\$389



- BAND WIDTH - DC: TO 20 MHz (-3db) AC: 10 Hz TO 20MHz (-3db)
- SWEEP TIME - .2 μSEC TO .5 SEC/DIV ON 20 RANGES
- COMPLETE MANUAL AND HIGH QUALITY HOOK-ON PROBES INCLUDED
- INPUT IMPEDANCE: 1 MEG OHM
- TV VIDEO SYNC FILTER
- X-Y AND Z AXIS OPERATION
- 110/220 VOLT OPERATION
- COMPONENT TESTER
- LP CONSUMPTION - 19 WATTS
- BUILT-IN CALIBRATOR
- AUTOMATIC OR TRIGGERED TIMEBASE

35 MHz DUAL TRACE OSCILLOSCOPE

MODEL 3500

\$549



- BAND WIDTH - DC: TO 35MHz (-3db) AC: 10 Hz TO 35MHz (-3db)
- SWEEP TIME - .1 μSEC TO .5 SEC/DIV ON 21 RANGES
- DELAYED TRIGGER - 100 mSEC TO 1 μSEC WITH INTENSIFIED AND DELAYED MODES
- COMPLETE MANUAL AND 1X-10X COMPENSATED HOOK-ON PROBES INCLUDED
- VARIABLE HOLD OFF FOR VIEWING COMPLEX WAVES
- TV VIDEO SYNC FILTER
- TRIGGERING OF CH-A, CH-B, ALTERNATING, LINE OR EXTERNAL
- X-Y AND Z AXIS OPERATION

DIGITAL MULTIMETER PEN MODEL DPM-1000

\$49.95



AUTO RANGING, POLARITY AND DECIMAL!

- LARGE 3.5" DISPLAY
- DATA HOLD SWITCH FREEZES READING
- FAST, AUDIBLE CONTINUITY TEST
- LOW BATTERY INDICATOR
- OVERLOAD PROTECTION
- ONLY 1 1/2" x 6" x 3/4"
- DC VOLTS 1mV-500V
- AC VOLTS 1mV-500V
- .1 OHM - 2 MEG OHM
- WEIGHS ONLY 2.3 OUNCES
- LOW PARTS COUNT-CUSTOM 80 PIN LSI INSURES RELIABILITY
- INCLUDES MANUAL, BATTERIES, HARD CASE, AND ALLIGATOR CLIP

CALL FOR VOLUME QUOTES

© COPYRIGHT 1985 JDR MICRODEVICES

IBM COMPATIBLE INTERFACE CARDS ALL WITH A ONE YEAR WARRANTY

MULTIFUNCTION CARD \$129.95
ALL THE FEATURES OF AST'S 6 PACK PLUS AT HALF THE PRICE



- CLOCK/CALENDAR
- 0-384K RAM
- SERIAL PORT
- PARALLEL PORT
- GAME PORT
- SOFTWARE INCLUDED

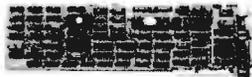
PRINTER CABLE \$9.95 64K RAM UPGRADE 9/\$7.11

COLOR GRAPHICS ADAPTOR \$99.95
FULLY COMPATIBLE WITH IBM COLOR CARD



- 4 VIDEO INTERFACES: RGB, COMPOSITE COLOR, HI-RES COMPOSITE MONOCHROME, CONNECTOR FOR RF MODULATOR
- COLOR GRAPHICS MODE: 320 x 200
- MONO GRAPHICS MODE: 640 x 200
- LIGHT PEN INTERFACE

MONOCHROME GRAPHICS CARD \$129.95
FULLY COMPATIBLE WITH IBM MONOCHROME ADAPTOR AND HERCULES GRAPHICS CARD



- LOTUS COMPATIBLE
- TEXT MODE: 80 x 25
- GRAPHICS MODE: 720 x 348
- PARALLEL PRINTER INTERFACE
- OPTIONAL SERIAL PORT

FLOPPY DISK DRIVE ADAPTOR \$59.95



- INTERFACES UP TO FOUR STANDARD FDDs TO IBM PC OR COMPATIBLES
- INCLUDES CABLE FOR TWO INTERNAL DRIVES

1200 BAUD INTERNAL MODEM FOR IBM
INCLUDES PC TALK III COMMUNICATIONS SOFTWARE



- HAYES COMPATIBLE
- AUTO DIAL/AUTO ANSWER
- AUTO RE-DIAL ON BUSY
- INCLUDES SERIAL PORT!
- ONE YEAR WARRANTY

EASYDATA-12B \$195

300 BAUD MODEM FOR APPLE OR IBM
CLOSE-OUT SPECIAL NOW ONLY



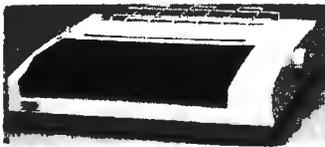
\$49.95

INCLUDES ASCII PRO-EZ SOFTWARE (A \$100 VALUE IN ITSELF)

- FCC APPROVED
- BELL SYSTEMS 103 COMPATIBLE
- INCLUDES AC ADAPTOR
- AUTO DIAL/AUTO ANSWER
- DIRECT CONNECT

CABLE FOR APPLE IIc \$14.95

100 CPS ESPRIT PRINTER



\$149.95

- 9 x 9 DOT MATRIX
- 100 CPS - BIDIRECTIONAL
- FRICTION AND TRACTOR FEED
- PROPORTIONAL SPACING
- 80 COLUMN
- PARALLEL AND SERIAL INTERFACES
- 8 CHARACTER SETS AND GRAPHICS

CABLE TO IBM PC \$9.95
REPLACEMENT RIBBON CARTRIDGE SZ-44 \$11.95

PS-IBM 130 WATTS \$88.85



TEAC DISK DRIVES FOR IBM PCs



FD-55B DS/DD \$89.95
FD-55F DS/QUAD \$89.95

UNBELIEVABLE MONITOR DEALS



TAXAN RGB VISION III
MODEL 415

- 18 MHz BAND WIDTH
- 640 x 282 PIXEL RESOLUTION
- 16 COLORS WITH INTENSITY CONTROL
- 12" BLACK MATRIX
- IBM AND LOTUS COMPATIBLE

CABLE FOR IBM \$15.95

\$289.95



SAKATA COMPOSITE COLOR
MODEL SC-100

- TOP RATED FOR APPLE
- 13" COMPOSITE VIDEO
- RESOLUTION: 280H x 300V
- INTERNAL AUDIO AMPLIFIER
- ONE YEAR WARRANTY

\$169.95

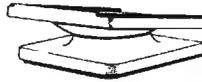


SAMWOO MONOCHROME
MODEL DM-216B

- PERFECT COSMETIC MATCH FOR IBM PC
- IBM COMPATIBLE TTL INPUT
- 12" NON-GLARE SCREEN
- P39 GREEN PHOSPHOR
- HI-RES 22 MHz BAND WIDTH

\$99.95

MONITOR STAND TILTS AND SWIVELS



\$12.85

APPLE COMPATIBLE INTERFACE CARDS

EPROM PROGRAMMER \$79.95



MODEL RP525

- DUPLICATE OR BURN ANY STANDARD 27xx SERIES EPROM
- EASY TO USE MENU-DRIVEN SOFTWARE INCLUDED
- MENU SELECTION FOR 2716, 2732, 2732A, 2764 & 27128
- HIGH SPEED WRITE ALGORITHM
- LED INDICATORS FOR ACTIVITY
- NO EXTERNAL POWER SUPPLY REQUIRED
- ONE YEAR WARRANTY

18K RAMCARD \$39.95

- FULL TWO YEAR WARRANTY
- EXPAND YOUR 48K APPLE TO 64K
- USE IN PLACE OF APPLE LANGUAGE CARD

BARE PC CARD W/ INSTRUCTIONS \$9.95



IC TEST CARD \$99.95

- QUICKLY TESTS MANY COMMON ICs
- DISPLAYS PASS OR FAIL
- ONE YEAR WARRANTY
- TESTS: 4000 SERIES CMOS 74HC SERIES CMOS 7400; 74LS, 74L, 74H, 74S, SOME PROMS AND RAMS

DISK DRIVES

FOR APPLE COMPUTERS



BAL-525 \$99.95

- 1/2 HEIGHT-ALPS MECHANISM
- 100% APPLE COMPATIBLE
- FULL 1 YEAR WARRANTY



BAL-500 \$129.95

- TEAC MECHANISM - DIRECT DRIVE
- 100% APPLE COMPATIBLE
- FULL 1 YEAR WARRANTY



AP-135 \$129.95

- FULL HT. SHUGART MECHANISM
- DIRECT REPLACEMENT FOR APPLE DISK II
- SIX MONTH WARRANTY



FOR APPLE IIc
AD-3C \$139.95

- 100% APPLE IIc COMPATIBLE, READY TO PLUG IN W/ SHIELDED CABLE & MOLDED 19 PIN CONNECTOR
- FAST, RELIABLE SLIMLINE DIRECT DRIVE
- SIX MONTH WARRANTY



FOR MACINTOSH
MAC535 \$299.95

- 3.5" ADD-ON DISK DRIVE
- 100% MACINTOSH COMPATIBLE
- SINGLE SIDED 400K BYTE STORAGE
- HIGH RELIABILITY DRIVE FEATURES
- AUTO-EJECT MECHANISM
- FULL ONE YEAR WARRANTY

DISK DRIVE ACCESSORIES

- DISK CONTROLLER CARD \$49.95
- APPLE IIc ADAPTOR CABLE \$19.95
- ADAPTS STANDARD APPLE DRIVES FOR USE WITH APPLE IIc

COMREX CR-1000 DUAL SLIMLINE DISK DRIVE \$199.95
FOR APPLE COMPUTERS

- SPACE SAVING DESIGN; STACK BETWEEN COMPUTER AND MONITOR
- QUIET, RELIABLE 1/2 HEIGHT DRIVES
- TOTAL STORAGE CAPACITY: 286K BYTES
- AUTO-EJECT MECHANISM
- SHIELDED CABLE INCLUDED



INCLUDES CONTROLLER AND DOS 3.3 WITH DISK UTILITIES

ALL MERCHANDISE 100% GUARANTEED

© COPYRIGHT 1985 JDR MICRODEVICES

U·N·C·L·A·S·S·I·F·I·E·D A·D·S

NEEDED: Inner-city school serving area with unemployment rate higher than national average needs tax-deductible donation of electric typewriters; IBM, Apple, or compatible computers; and peripherals. Mildred Louise Business College, 3116 Bond Ave., East St. Louis, IL 62207.

WANTED: Sheenway School & Cultural Center seeks donations of PCs and printers to develop a computer learning center for inner-city youth. Will pay shipping and provide tax information. Sheenway School, 10101 South Broadway, Los Angeles, CA 90003. (213) 757-8359.

WANTED: Nonprofit community agency seeks tax-deductible donation of IBM PC (or compatible), terminal, and printer to organize and record volunteer placements in schools, nursing homes, and other nonprofit service agencies in and near large retirement area. Mary Glenn, Volunteer Bureau of the Sun City Area, Peoria, AZ 85345. (602) 972-6809.

WANTED: Reb Zalman Schachter-Shalomi's nonprofit national Jewish renewal organization seeks tax-deductible donation of Kaypro 2 or 4 (or similar machine). Will pay shipping and provide receipt. Moshe ben Asher, B'nai Or Religious Fellowship, 6723 Emlen St., Philadelphia, PA 19119. (215) 849-5385.

WANTED: Nonprofit religious organization seeks tax-deductible donation of computer or system (preferably CPM or MS-DOS) for financial uses. Receipt available; will pay shipping. Church of Jesus Christ of Latter Day Saints, Carrollton Branch, c/o John Johnson, 1816 Oak Grove Church Rd., Carrollton, GA 30117. (404) 834-0904.

FOR SALE: CAD system, Tektronix 4051 computer with 8-inch disk drives, 36- by 45-inch Logic Systems plotter, and more. Make offer. Willing to donate to veritable nonprofit organization Warren, Process Control Consultants, 5707 Lacey Blvd. #103, Lacey, WA 98503. (206) 459-9163.

NEEDED: Nonprofit foundation needs donations of computers and office equipment for software development. Prefer 68000-type virtual-memory machines. Tax-deductible. Free Software Foundation, 1000 Massachusetts Ave., Cambridge, MA 02138. (617) 876-3296.

WANTED: Any kind of technical manuals of printers, disk drives, and computers. Also, I would like to correspond with other computerists. Jose Carlos Valle, Rua Luiz Goes, 1894 Sao Paulo, Brazil, CEP: 04043.

WANTED: End user needs help from Z80 programmer to modify old CPM word processor (Apple CPM, North Star format). Need printer driver, bells, and whistles. Will pay expenses. Robert Greenwood, POB 401, Wheatley Heights, NY 11798.

WANTED: NRI course in microcomputers and microprocessors. Also, NRI master course in TV, video servicing, and other courses. CIE, Heathkit, etc. Incomplete or older courses acceptable. Reasonable. Joseph Wegner Jr., POB 262, Glendale, CA 91209.

FOR SALE: Back issues of *Creative Computing* (June 1979 to September 1985) and *Computers and Electronics* (formerly *Popular Electronics*, October 1977 to September 1985). Some issues missing. \$1 per issue or make offer. David Ellsworth, 2732 Durant Ave., Berkeley, CA 94704. (415) 540-9315.

FOR SALE: Heath H-11 with numeric coprocessor, two 8-inch disk drives, H-19 terminal, dot-matrix printer, and more. Very good condition. \$1500 or best offer. Curt Franklin, 20 Maple St., Needham, MA 02192. (617) 449-1337.

FOR SALE: H-89/90 with 64K, H-17 and H-37 controllers plus three-port serial card. Two SS/HS H-17 drives, four DS/SS 96-tpi drives. Dustcovers, spare memory chips, documentation, and more. \$1200. H-14 printer available; best offer. R. F. Rumpf, 6036 Legion Rd., Stevensville, MI 49127. (616) 429-5628.

WANTED: Documentation, schematic drawings, and public-domain programmed cassette tapes for Interact Model One 16K computer (manufactured by Interact Electronics, Ann Arbor, Michigan). John Griffin, POB 481, Fedhaven, FL 33854.

FOR SALE: HDE Omni-65 microcomputer system: KIM-based, 56K RAM, dual 8-inch drives, 15-slot backplane, EPROM card, Centronics 737-II printer, Hazeltine 1500 VDT, and more. 4 years old. \$2500.

Bill Hliwa, 603 Charlesgate Circle, East Amherst, NY 14051. (716) 689-7344.

FOR SALE: RB5X robot: \$1000 plus UPS costs. Larry Bean, 2873 Grosvenor Dr., Cincinnati, OH 45239.

WANTED: Documentation on the IMSAI MIO board, IMSAI 64K RAM board, and PERSCI 277 drives. Also can DIO controller be switched out to gain access to the 4K it normally occupies? Have CP/M 2.2 BIOS and experience interfacing 8-inch Shugarts to the DIO. Grant Hargrave, 1559 LaFontaine #2, Montreal, Quebec H2L 1V1, Canada.

FOR SALE: TRS-80 computer with 16K RAM, monitor, keyboard, CTR-80 cassette recorder for storing programs, cables, books, and more. \$190 or best offer. Dan or Nancy O'Connell, 63 Maple St., Wenham, MA 01984. (617) 774-5047.

FOR SALE: S-100 Ittaca Intersystems DPS-1 CPM machine with front panel, 64K, two Shugart DS/DD 1.2-megabyte 8-inch drives, and Soroc IQ 140 terminal. Mint condition. Watson Klineciewicz, 1020 Ethel Ave., Fairview Village, PA 19403. (215) 539-3775.

FOR SALE: Z80-based MP/M system with 128K RAM, two 8-inch SS/SD drives, two serial ports, one parallel port, and TeleVideo 950 and 910. Best offer. Molly McClure, 3 Ashford Court, Boston, MA 02134. (617) 254-6266.

FOR SALE: CompuPro 816/C with 20-megabyte 8-inch hard disk and terminal. Nearly new, excellent condition. \$5000. Robert Mitchell, Solar Systems Design Inc., RD 3, Box 239, Selkirk, NY 12158.

FOR SALE: NEC 3500R letter-quality printer (serial interface, can be used with IBM or Fortune-type micro). Excellent condition. M. B. Motwani, 2741 Binbrooke, Troy, MI 48084.

FOR SALE: Tandy 2000 with 256K, 640 by 400 color graphics, color monitor, and more: \$4000. A. Hsia, Unicom Inc., POB 3228, Kent, OH 44240. (216) 678-4147.

WANTED: RGB monitor for IBM. For sale: Acoustic modem: \$80. Atari 1200XL computer: \$80. Speech synthesizer for Atari computers: \$60. Zenith 12-inch amber monitor: \$75. Al P. Casper, 3632 CTH 1, Saukville, WI 53080. (414) 675-6946.

WANTED: Exchange of information with anyone owning a Netronics Explorer 88 in IBM-compatible version (737 ROM), or am I all alone? Lawrence Wallcave, 6578 Birch Dr., Santa Rosa, CA 95404.

WANTED: BMC i800 users to form group. Jim Stone, 1921 MacArthur St., Rancho Palos Verdes, CA 90732. (213) 643-9900.

FOR SALE: Trump Card, Z8001 CPM card for IBM PC. (See Circuit Cellar, May 1984 BYTE.) \$500. Bob Brumlag, 3512 Crown Blvd., La Crosse, WI 54601. (608) 788-9562.

FOR SALE: MPX-16 single-board computer system (factory-assembled) with keyboard interface adapter, Key Tronic keyboard, power supply, IBM monochrome adapter, documentation, and more. Perfect working condition. \$900 or best offer. Tom Lobenstein, 2053 Glencoe Way #2, Hollywood, CA 90068. (213) 874-5703.

FOR SALE: HP 7580 plotter. 24 by 36 inches. Good condition. \$9750. Ted Schaefer, (918) 835-1771.

FOR SALE: Thirty 8748s. All unused and purchased directly from Intel. 1K EPROM, 64 bytes of RAM, and 27 I/O lines. \$15 each or all for \$375. Ken Hoffmann, 2112 110th Lane NW, Coon Rapids, MN 55433. (612) 757-3404.

UNCLASSIFIED ADS MUST BE *noncommercial*, from readers who have computer equipment to buy, sell, or trade on a onetime basis. All requests for donated computer equipment must be from nonprofit organizations. Programs to be exchanged must be written by the individual or be in the public domain. Ads must be typed double-spaced, contain 50 words or less, and include full name and address. This is a free service; ads are printed as space permits. BYTE reserves the right to reject any unclassified ad that does not meet these criteria. When you submit your ad (BYTE, *Unclassified Ads*, POB 372, Hancock, NH 03449), allow at least four months for it to appear.

WANTED: Apple computer Time II clock card. Needed for research project; willing to buy, rent, or borrow for one week. For sale: Cipher Data 9-track NRZ computer: \$30. Meter movements, rectifiers, and motors: \$50 for lot. Apple II drive: \$150. Other equipment available. Donald G. Hayes Jr., Apt. 3, 8515 Greenwood Ave., Takoma Park, MD 20912. (301) 589-4190.

FOR SALE: 256K card and Apple 80-column card for Apple IIe. \$300 buys both cards. James E. Schwob, 140 Riverview 6W, Great Falls, MT 59404. (406) 761-0092.

WANTED: Micromint Z8 computer system controllers BCC11 and/or peripherals and accessories. Reply with condition and price. Alan, POB 501, Planetarium Station, New York, NY 10024.

FOR SALE: Two TEAC SS/DD 5¼-inch disk drives, perfect condition. \$100 each or \$150 for both. Boris H. Traven, D.O., 109 Country Club Place, Cherry Hill, NJ 08003. (215) 750-3113 or (609) 428-8624.

FOR SALE: VT-100 terminal upgrade kit. Turns VT-100 into VT-125 with bit-mapped graphics and RGB color outputs for external monitors. Includes hardware, installation instructions, and VT-125 user guide. \$600. Todd Hawk, 159 North Oller Ave., Waynesboro, PA 17268. (717) 762-8406.

FOR SALE: Data System Design 480 dual DS/DD floppy-disk drives for DEC equipment. Good condition, hardly used; interface card and cable included. Make offer. Scott Russell, POB 1125, Metairie, LA 70004. (504) 834-3341.

FOR SALE: Heathkit ET-6800 Microprocessor Trainer with hexadecimal keypad, LED, 6808, power supply, expansion capabilities, and programming manuals, plus *Using the 6800 Microprocessor*. \$50 or best offer. Gary M. McComas, Route #1, Box 454, West Hamlin, WV 25571. (304) 825-5664.

FOR SALE: Letter-quality printers. NEC 7515 (RS-232 and Diablo-compatible), 55 cps. Almost new. \$1475. Datamarc 2000 envelope feeder: \$950. Marc 3000 sheet/envelope feeder: \$650. Greg Kelley, 203 South Summit, Arkansas City, KS 67005. (316) 442-6344.

FOR SALE: Back issues of *onComputing* (complete set), *Popular Computing* (vol. 1, no. 1 to vol. 2, no. 12), *Interface Age* (vol. 1, no. 1 to vol. 9, no. 4), *Creative Computing* (vol. 1, no. 1 to vol. 9, no. 1) and vol. 9, no. 7), *Dr. Dobbs' Journal* (vol. 1, no. 1 to no. 12), and *Compuite!* (vol. 1, no. 1 to vol. 6, no. 12). Make offer. Walter Quattannens, Melkwezerstraat 39, B-3350 Linter, Belgium, West Europe.

FOR SALE: Sinclair ZX-81, 16K RAM, Mindware plain-paper printer, cables, and books: \$95. Timex Sinclair 1000, 16K RAM, cables, and books. A. Fred Anderson, Box 112, RFD #2, Antrim, NH 03440. (603) 588-2276.

FOR SALE: Atari 800, disk drive, printer, tape drive, books, documentation, and more. Like new. \$699. Ted Larson, RFD #2, Box 210, Milo, ME 04463. (207) 965-8092.

WANTED: German students wish to correspond about computers with American students. Michael Stal, Avenstr. 34, 800 München 5, West Germany.

FOR SALE: HP 67: \$175. HP 82162A HP-IL thermal printer: \$450. Also, two 82106A single memory modules: \$15 each. M. Dorian Gregory, RR #1, North Rd., Gibsons, British Columbia V0N 1V0, Canada.

WANTED: High school student seeks correspondence and information on computer simulation of immiscible fluid systems. Stephen Mercer, 2019 Clinton St., Rockford, IL 61103. (815) 963-4493.

FOR SALE: Apple II+ computer and drive, 64K, parallel and serial ports, and more. \$995 or best offer. Walt Heenan, Route 5, Box 309X, Vernon, NY 13476.

FOR SALE: Two HP 85 tape-drive computers. Very good condition. \$2000 for both. James Wells, Route 3, Box 335, Petersburg, VA 23803. (804) 733-4472.

WANTED: Radio amateurs with Sinclair or Timex computers to exchange public-domain programs through OZX. Send SASE for sample newsletter. Alex F. Burr, K5XY, 2025 O'Donnell Dr., Las Cruces, NM 88001.

FOR SALE: Toshiba P1340 dot-matrix letter-quality printer. Excellent condition. \$800. Viktoria Stockmal, 424 Long Hill Ave., Shelton, CT 06484. (203) 735-4851.

B.O.M.B

BYTE'S ONGOING MONITOR BOX

ARTICLE#	PAGE	ARTICLE	AUTHOR(S)	ARTICLE#	PAGE	ARTICLE	AUTHOR(S)
1	9	Microbytes	staff	14	219	High-Resolution Printer Graphics	Bridger, Goresky
2	37, 452	What's New	staff	15	237	The μ PD7281 Processor	Jeffery
3	44	Ask BYTE	Ciarcia	16	254	The Data General/One	Rash
4	57	Book Reviews	Walker, Lowans, Finger, Hopper	17	266	Sanyo MBC-775	Roberts
5	89	Ciarcia's Circuit Cellar: The World's Smallest 1200-bps Modem	Ciarcia	18	275	Five C Compilers for the Macintosh	Field
6	112	Programming Project: An Assembler for VM2	Amsterdam	19	337	MagiC/L	Gilbert, Woodhull
7	123	Programming Project: Extending Turbo Pascal	Webster	20	355	IBM's Professional Graphics System	Jadrnicek
8	137	CD-ROMs and Their Kin	Shuford	21	361	Juki's 6300 Daisy-Wheel Printer	Rash
9	151	Highs and Lows of Parameter Passing	Kilian	22	373	Computing at Chaos Manor: Old Favorites and New Ones	Pournelle
10	161	Game-Paddle Control Linearity Test	De Jong	23	401	According to Webster: Memories	Webster
11	169	The Amiga's Custom Graphics Chips	Robinson	24	419	BYTE U.K.: Living C-Personal	Pountain
12	187	Raster Operations	Bennett	25	433	Mathematical Recreations: Repeating Decimals	Kurosaka
13	207	Moving Pictures	Demetrescu	26	445	BYTE Japan: Comparing Fujitsus	Raika

BOMB Results

A COOPERATIVE EFFORT

The tally from the August BOMB shows five coauthors will divvy up the \$100 bonus: Trevor G. Marshall, George Scolaro, David L. Rand, Tom King, and Vincent P. Williams. Their article "The DSI-32 Coprocessor Board, Part 1: The Hardware" placed first after "The Amiga Personal Computer" by staffers Gregg Williams, Jon Edwards, and Phillip Robinson.

But it is Susan Eisenbach and Chris Sadler, authors of "Declarative Languages: An Overview," who each win \$25 of the \$50 allotted for second place. The columns by Steve Ciarcia and Jerry Pournelle continue to receive their usual high rating in the BOMB.

BYTE ADVERTISING SALES STAFF:

Dennis J. Riley, Advertising Sales Manager, 70 Main Street, Peterborough, NH 03458, tel. (603) 924-9281

NEW ENGLAND

ME, NH, VT, MA, RI.
EASTERN CANADA
Paul McPherson Jr. (617) 262-1160
McGraw-Hill Publications
575 Boylston Street
Boston, MA 02116

ATLANTIC

NY, NYC, CT, NJ (NORTH)
Leah Rabinowitz (212) 512-2096
McGraw-Hill Publications
1221 Avenue of the Americas—
39th Floor
New York, NY 10020

Dick McGurk (203) 968-7111
McGraw-Hill Publications
Building A—3rd Floor
777 Long Ridge Road
Stamford, CT 06902

EAST

PA (EAST), NJ (SOUTH),
MD, VA, W.VA, DE, D.C.
Daniel Ferro (215) 496-3833
McGraw-Hill Publications
Three Parkway
Philadelphia, PA 19102

SOUTHEAST

NC, SC, GA, FL, AL, TN
Maggie M. Dorvee (404) 252-0626
McGraw-Hill Publications
4170 Ashford-Dunwoody Road—
Suite 420
Atlanta, GA 30319

MIDWEST

IL, MO, KS, IA, ND, SD, MN, WI, NB, IN
Bob Denmead (312) 751-3740
McGraw-Hill Publications
Blair Building
645 North Michigan Ave.
Chicago, IL 60611

GREAT LAKES, OHIO REGION

MI, OH, PA (ALLEGHENY), KY,
ONTARIO, CANADA
Mike Kisseberth (313) 352-9760
McGraw-Hill Publications
4000 Town Center—Suite 770
Southfield, MI 48075

SOUTH PACIFIC

SOUTHERN CA, AZ, NM, LAS VEGAS
Jack Anderson (714) 557-6292
McGraw-Hill Publications
3001 Red Hill Ave.
Building #1—Suite 222
Costa Mesa, CA 92626

Karen Niles (213) 480-5243, 487-1160
McGraw-Hill Publications
3333 Wilshire Boulevard #407
Los Angeles, CA 90010

NORTH PACIFIC

HI, WA, OR, ID, MT, NORTHERN CA,
NV (except LAS VEGAS), W. CANADA
David Jern (415) 362-4600
McGraw-Hill Publications
425 Battery Street
San Francisco, CA 94111

Bill McAfee (415) 964-0624
McGraw-Hill Publications
1000 Elwell Court—Suite 225
Palo Alto, CA 94303

SOUTHWEST, ROCKY MOUNTAIN

UT, CO, WY, OK, TX, AR, MS, LA
(214) 458-2400
McGraw-Hill Publications
Prestonwood Tower—Suite 907
5151 Beltline
Dallas, TX 75240

WEST COAST SURPLUS

AND RETAIL ACCOUNTS
Tom Harvey (805) 964-8577
3463 State Street—Suite 256
Santa Barbara, CA 93105

The Buyer's Mart

Karen Burgess (603) 924-9281
BYTE Publications
70 Main Street
Peterborough, NH 03458

Post Card Mailings

National
Bradley Browne (603) 924-6166
BYTE Publications
70 Main Street
Peterborough, NH 03458

International Advertising Sales Representatives:

Mr. Hans Csokor
Publimedia
Reisnerstrasse 61
A-1037 Vienna, Austria
222 75 76 84

Mrs. Gurit Gepner
McGraw-Hill Publishing Co.
PO Box 2156
Bat Yam, 59121 Israel
3 866 561 321 39

Mr. Fritz Krusebecker
McGraw-Hill Publishing Co.
Liebigstrasse 19
D-6000 Frankfurt/Main 1
West Germany
69 72 01 81

Mrs. Maria Sarmiento
Pedro Teixeira 8, Off. 320
Iberia Mart 1
Madrid 4, Spain
1 45 52 891

Mr. Andrew Karnig
Andrew Karnig & Associates
Finnbodavagen
S-131 31 Nacka, Sweden
8-44 0005

Mr. Jean Christian Acis
McGraw-Hill Publishing Co.
17 rue Georges Bizet
F 75116 Paris
France
(1) 47-20-33-42

Mr. Arthur Scheffer
McGraw-Hill Publishing Co.
34 Dover St.
London W1X 3RA
England 01 493 1451

Mr. Savio Pesavento
McGraw-Hill Publishing Co.
Via Flavio Baracchini 1
20129 Milan, Italy
02 86 90 617

Seavex Ltd.
400 Orchard Road, #10-01
Singapore 0923
Republic of Singapore
Tel: 734-9790
Telex: RS35539 SEAVEX

Seavex Ltd.
503 Wilson House
19-27 Wyndham St.
Central, Hong Kong
Tel: 5-260149
Telex: 60904 SEVEX HX

Hiro Morita
McGraw-Hill Publishing Co.
Overseas Corp.
Room 1528
Kasumigaseki Bldg.
3-2-5 Kasumigaseki,
Chiyoda-Ku
Tokyo 100, Japan
3 581 9811

R.E.A.D.E.R S.E.R.V.I.C.E

Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.
398 1ST PLACE COMP. SYSTEMS.....	108	79 COMPUTER AFFAIRS INC.....	330	158 FORTRON, INC.....	471	434 LUCKY GOLDSTAR.....	109
2 A-D ELECTRONICS.....	388	80 COMPUTER CONNECTION.....	480	159 FORTRON, INC.....	471	* LYBEN COMP. SYS.....	426
3 AST RESEARCH.....	19	314 COMPUTER DIRECT.....	334, 335	160 FOX AND GELLER, INC.....	322	228 LYCO COMPUTER.....	181
4 AST RESEARCH.....	19	82 COMPUTER INNOVATIONS.....	382	161 FOX SOFTWARE, INC.....	359	229 MAIN STREET COMPUTER.....	307
5 AB COMPUTERS.....	206	83 COMPUTER MAIL ORDER.....	308, 309	402 FUTURE COMPUTING/MCGRAWHILL	435	231 MANX SOFTWARE SYS.....	71
450 ABOHM CORP.....	346	84 COMPUTER PARTS.....	439	* GENERAL ELECTRIC INFO. SYS.....	437	232 MARC SOFTWARE.....	282, 283
6 ACCO INTERNATIONAL.....	23	85 COMPUTER PARTS MART.....	485	164 GENERAL TECHNOLOGY.....	51	233 MARC SOFTWARE.....	282, 283
401 ACS INT'L INC.....	127	86 COMPUTER PROD. SUPPLY.....	503	417 GENICOM.....	25	234 MARK WILLIAMS CO.....	59
7 ADDMASTER CORP.....	364	88 COMPUTER WAREHOUSE.....	339	167 GOLD HILL COMPUTERS.....	168	235 MARK WILLIAMS CO.....	61
8 ADTEK.....	223	89 COMPUTER WAREHOUSE.....	339	168 GOLDEN BOW SYSTEMS.....	438	451 MARTIN MARIETTA.....	409
9 ADV. DIGITAL CORP.....	36	90 COMPUTERBANC.....	70	169 GOLDEN BOW SYSTEMS.....	324	236 MARYMAC INDUSTRIES INC.....	485
10 ADV. DIGITAL CORP.....	36	91 COMPUTRADE.....	415	431 GRAFPOINT.....	74	237 MASTERBYTE COMP. OF N.Y.....	410
11 ADVANCED COMP. PROD.....	492, 493	92 CONCORD TECHNOLOGY CO.....	60	171 GTCO CORP.....	180	238 MAXELL DATA PRODUCTS.....	7
12 ADVANCED OPTICS.....	481	93 CONROY-LAPOINTE.....	80, 81	172 GTE-TELENET.....	389	239 MARYNARD ELECTRONICS.....	15
13 ALF PRODUCTS, INC.....	503	94 CONROY-LAPOINTE.....	80, 81	435 GTEK INC.....	414	162 MCGRAW-HILL, INC.....	375
* AMBER SYSTEMS.....	49	95 CONROY-LAPOINTE.....	80, 81	436 GTEK INC.....	414	240 MCGRAW-HILL BOOK CO.....	405
18 AMER. DESIGN COMPONENTS.....	474	97 CONTRIVER ENTERPRISES.....	501	174 H&E COMPUTRONICS.....	43	* MCGRAW-HILL BOOK CO.....	459
19 AMERICAN COMPUTER.....	391	98 COSMOS.....	296, 297	175 H.S. MICROCONTROLLERS.....	501	242 MEGA DATA SYS. INC.....	503
20 AMERICAN COMPUTER.....	391	99 CPU INC.....	478	176 HAMMER COMPUTER SYSTEMS.....	76	448 MEGASOFT.....	501
* AMERICAN MICROSYSTEMS.....	501	399 CUESTA SYSTEMS.....	18	177 HANZON DATA INC.....	332	243 MEGATEL COMPUTER TECH.....	406
21 AMERICAN SEMICONDUCTOR.....	481	101 CURTIS INC.....	487	178 HARMONY VIDEO & COMP.....	408	244 MERRITT COMP. PRODUCTS.....	483
22 AMPERE INC.....	311	102 CUSTOM COMP. TECH.....	468	179 HAYES EMPLOYMENT.....	441	245 MFI ENTERPRISES INC.....	342
24 AMPRO COMPUTERS INC.....	379	103 CUSTOM COMP. TECH.....	469	180 HERCULES COMPUTER TECH.....	136	246 MICRAY ELECTRONICS.....	374
439 ANSA SOFTWARE.....	134, 135	445 CYMA CORPORATION.....	293	181 HERCULES COMPUTER TECH.....	336	247 MICRO DATA BASE SYS.....	327
440 ANSA SOFTWARE.....	134, 135	446 CYMA CORPORATION.....	293	182 HEWLETT-PACKARD.....	175	248 MICRO DESIGN INT'L.....	305
* ANTHRO CORP.....	398	104 CYMA CORPORATION.....	417	183 HEWLETT-PACKARD.....	345	249 MICRO MART, INC.....	64, 65
418 APPARAT, INC.....	481	105 CYMA CORPORATION.....	417	184 HEWLETT-PACKARD INFO. SYS. 20, 21	21	250 MICRO PRODUCTS.....	500
27 APROTEK.....	261	106 C AND D DISCOUNT.....	489	87 HIGHLINE SYSTEMS.....	503	251 MICRO SOLUTIONS.....	298
28 APROTEK.....	261	107 DAC SOFTWARE INC.....	55	187 HOUSTON INSTR/BAUSCH&LOMB	349	252 MICRO SYSTEMS DESIGN.....	481
26 APROTEK.....	485	108 DATA ACCESS CORP.....	315	188 IBEX COMP. CORP.....	48	253 MICRO-SPEC.....	503
29 ARTIFICIAL INT'L RESRCH.GRP.....	487	109 DATA EXCHANGE.....	436	189 IBS CORP.....	24	254 MICROCOMPUTER ACCESSORIES.....	365
* AT&T INFORMATION SYS.....	84, 85	110 DATA EXCHANGE.....	487	190 IBS CORP.....	24	255 MICROCOMPUTER ACCESSORIES.....	365
* AT&T INFORMATION SYS.....	424, 425	111 DATA SPEC.....	325	429 IBM.....	72, 73	256 MICROGRAFX.....	17
* AT&T INTERNATIONAL.....	400	112 DATA SPEC.....	325	416 IBM (ISG) SERVICES.....	245	* MICROMINT INC.....	432
30 ATRON CORP.....	302	118 DATACOPY CORP.....	380	191 I.C. EXPRESS.....	499	257 MICROPRO INT'L.....	301
31 ATRONICS INT'L INC.....	314	119 DATASOUTH COMP. CORP.....	145	* INFORMATION APPLIANCE.....	427	258 MICROPRO INT'L.....	303
32 AVOCET.....	231	120 DAYNA COMMUNICATIONS.....	352, 353	194 INTEGRAND.....	430	259 MICROPROCESSORS UNLTD.....	481
* AWESOME TECHNOLOGY, INC.....	67	121 DCC DATA SERVICE.....	499	195 INTERCONTN. MICRO SYS.....	46	* MICRORIM INC.....	204, 205
449 BP MICROSYSTEMS.....	501	122 DELUXE COMP. FORMS.....	66	196 INTERCONTN. MICRO SYS.....	46	406 MICROSHOP.....	473
33 B&B ELECTRONICS.....	487	123 DIGITAL DISK.....	236	197 INTERFACE INC.....	11	407 MICROSHOP.....	473
* B&C MICROSYSTEMS.....	410	124 DIGITAL MEDIA, INC.....	324	198 INTERFACE INC.....	11	* MICROSOFT CORP.....	120, 121
35 BASF SYSTEMS.....	154, 155	125 DIGITAL PRODUCTS INC.....	146	* INTERFACE TECH CORP.....	221	* MICROSOFT CORP.....	139
428 BASIC TIME.....	442, 443	126 DIGITAL RESEARCH COMP.....	78	199 IOMEGA.....	34, 35	* MICROSOFT CORP.....	141
37 BINARY TECHNOLOGY INC.....	483	127 DIGITAL TALK.....	48	200 ITT INFORMATION SYSTEMS.....	131	* MICROSOFT CORP.....	363
38 BITTNER ELECTRONICS.....	436	128 DIRECT AID DATA INC.....	440	201 ITT INFORMATION SYSTEMS.....	131	261 MICROSTUE, INC.....	160
39 BLAISE COMPUTING INC.....	290	129 DISKETTE CONNECTION.....	415	202 IADE COMP PROD.....	496, 497, 498	263 MICROWARE SYSTEMS CORP.....	366
42 BORLAND INT'L.....	CII, 1	432 DISKS PLUS.....	74	203 JAMECO ELECTRONICS.....	52, 53	264 MICROWAY.....	252
43 BORLAND INT'L.....	CII, 1	130 DISKWORLD! INC.....	470	204 IDR INSTRUMENTS.....	191	265 MICROWAY.....	451
44 BORLAND INT'L.....	39	131 DISKWORLD! INC.....	479	205 IDR MICRODEVICES.....	504, 505	266 MIMIC SYSTEMS INC.....	115
45 BORLAND INT'L.....	39	132 DISKWORLD! INC.....	488	206 IDR MICRODEVICES.....	506, 507	267 MINORITY INDUSTRIES.....	485
46 BUSINESS & ACCOUNTING SFTW.....	503	133 DISPLAY TELECOMMNTNS.....	477	207 IDR MICRODEVICES.....	508	230 MIS.....	272
47 BUSINESS TOOLS INC.....	197	134 DIVERSIFIED COMPUTER SYS.....	499	420 IMC RESEARCH.....	146	* MIX SOFTWARE.....	125
* BYTE BACK ISSUES.....	304	136 DOKAY COMP PROD. INC.....	482	421 IMC RESEARCH.....	146	66 MODTRAC SYSTEMS.....	406
* BYTE SUBSCRIBER MESSAGE.....	416	137 DOW JONES NEWS/RETRIEVAL.....	331	209 JOHN WILEY & SONS.....	69	444 MODULA SYSTEMS.....	416
* BYTE SUBSCRIPTION SERVICE.....	344, 467	139 DYNATECH.....	173	* IS&A GROUP INC.....	247	268 MOUNTAIN VIEW PRESS.....	271
48 BYTE CONNECTION, THE.....	310	140 DYNATECH.....	173	* IS&A GROUP INC.....	333	269 MULTITECH SYSTEMS.....	150
49 BYTEK COMP SYS. CORP.....	32	141 EARTH COMPUTERS.....	292	211 KADAK PRODUCTS LTD.....	324	270 MULTITECH SYSTEMS.....	150
* C WARE/DESMET C.....	62	170 EAST DIGITAL.....	402	397 KEA SYSTEMS LTD.....	483	273 NANTUCKET.....	45
81 C.I.L.A.....	481	* EASTMAN KODAK CO.....	183	212 KIMTRON CORP.....	393	274 NANTUCKET.....	45
30 C.J. COMPUTERS.....	340	143 ECLIPSE SYSTEMS.....	483	213 KRUEGER TECHNOLOGY INC.....	472	275 NAT'L. PUBLIC DOMAIN SFTW.....	483
51 C.J. COMPUTERS.....	340	144 ECOSOFT.....	444	214 KRUEGER TECHNOLOGY INC.....	472	276 NATIONAL INSTRUMENTS.....	156
52 C.R.E. WHOLESALE.....	501	145 EDUCATIONAL MICROCOMP. SYS.....	485	215 KYOCERA.....	12, 13	277 NATIONAL MEMORY SYSTEMS.....	312
* CALIF. DIGITAL.....	490, 491	146 ELEK-TEK INC.....	190	216 L-COM INC.....	294	272 NBS INC.....	408
53 CALIF. MICRO HOUSE.....	54	147 ELEXOR INC.....	438	217 LABORATORY MICROSYS.....	68	278 NCR.....	41
54 CAPITAL EQUIPMENT CORP.....	18	422 ELLIS COMPUTING INC.....	195	* LANGLEYST. CLAIR.....	483	279 NEC HOME ELECTRUSA.....	354
55 CARINT LTD.....	60	148 ENERTRONICS.....	378	218 LARK SOFTWARE.....	390	280 NEC INFORMATION SYS.....	CIII
58 CHALCEDONY SOFTWARE.....	392	* EPSON AMERICA.....	83	219 LATTICE, INC.....	428	294 NETWORK SPECIALISTS, INC.....	481
59 CHALCEDONY SOFTWARE.....	392	150 EVEREX SYSTEMS.....	56	221 LINTEK INC.....	62	* NEWSNET INC.....	16
60 CHORUS DATA SYSTEMS.....	313	151 EXPRESS BUSINESS SOFTWARE.....	192	222 LIONHEART PRESS.....	438	* NORTH HILLS CORP.....	485
61 CITIBANK N.A.....	189	152 EXPRESS MICRO SUPPLIES.....	381	224 LOGICAL DEVICES.....	284	* NORTH HILLS CORP.....	487
447 CLARITY SOFTWARE.....	447	153 EXPRESS SYSTEMS INC.....	328, 329	225 LOGICAL DEVICES.....	483	* NRI SCHOOLS ELECTR. DIV.....	273
62 CLEVELAND CODONICS INC.....	132, 133	154 FIGURE FLOW LTD.....	485	223 LOGICSOFT.....	288	283 OKIDATA.....	129
63 CLEVELAND CODONICS INC.....	132, 133	155 FIRST CLASS PERIPHERALS.....	227	226 LOGITECH INC.....	384	284 ORANGE MICRO.....	4
64 CMA MICRO COMP. DIV.....	412	156 FLAGSTAFF ENGINEERING.....	147	227 LOMAS DATA PRODUCTS.....	403	285 ORCHID TECHNOLOGY.....	157
65 CMS.....	475	157 FLAGSTAFF ENGINEERING.....	147	* LOTUS DEVELOPMENT.....	387	286 ORION INSTRUMENTS.....	306
* COALITION FOR LITERACY.....	280					441 ORYX SYSTEMS.....	429
* CODEX CORPORATION.....	385					442 ORYX SYSTEMS.....	429
68 COGITATE.....	487					443 ORYX SYSTEMS.....	429
67 COGITATE.....	501					288 OSBORNE/MCGRAW-HILL.....	431
74 COMMUNICATIONS ELECTR.....	476					289 P.C. HORIZONS.....	499
* COMPAQ COMPUTER CORP.....	110, 111					297 P.D.O. CABLES.....	324
75 COMPETITIVE EDGE.....	412					290 PACIFIC EXCHANGES.....	324
* COMPUMAIL.....	502					292 PANASONIC COMPUTER DIV.....	79
378 COMPUPROVIASYN.....	241					293 PC NETWORK.....	243
77 COMPUSAVE.....	440					295 PC'S LIMITED.....	396, 397
78 COMPUSERVE.....	153					296 PC'S LIMITED.....	499

TO GET FURTHER information on the products advertised in BYTE, either pick up your touch-tone telephone and use TIPS (if you are a subscriber), or fill out the reader service card. Either way full instructions are provided following this reader service index which is provided as an additional service by the publisher, who assumes no liability for errors or omissions. *Correspond directly with company.

BYTE READER SERVICE



Fill out this coupon carefully. PLEASE PRINT. Requests cannot be honored unless the zip code is included. This card is valid for 6 months from cover date.

Name _____ NOVEMBER 1985

4EB5

(Title) _____ (Company) _____

Address _____ Telephone _____

City _____ State _____ Zip _____

I purchased this copy by Subscription Newsstand computer store or bookstore

23 45 67 89	11 33 155 177 199	221 243 265 287 309	331 353 375 397 419	441 463 485 507 529	551 573 595 617 639	661 683 705 727 749	771 793
2 24 46 68 90	112 134 156 178 200	222 244 266 288 310	332 354 376 398 420	442 464 486 508 530	552 574 596 618 640	662 684 706 728 750	772 794
3 25 47 69 91	113 135 157 179 201	223 245 267 289 311	333 355 377 399 421	443 465 487 509 531	553 575 597 619 641	663 685 707 729 751	773 795
4 26 48 70 92	114 136 158 180 202	224 246 268 290 312	334 356 378 400 422	444 466 488 510 532	554 576 598 620 642	664 686 708 730 752	774 796
5 27 49 71 93	115 137 159 181 203	225 247 269 291 313	335 357 379 401 423	445 467 489 511 533	555 577 599 621 643	665 687 709 731 753	775 797
6 28 50 72 94	116 138 160 182 204	226 248 270 292 314	336 358 380 402 424	446 468 490 512 534	556 578 600 622 644	666 688 710 732 754	776 798
7 29 51 73 95	117 139 161 183 205	227 249 271 293 315	337 359 381 403 425	447 469 491 513 535	557 579 601 623 645	667 689 711 733 755	777 799
8 30 52 74 96	118 140 162 184 206	228 250 272 294 316	338 360 382 404 426	448 470 492 514 536	558 580 602 624 646	668 690 712 734 756	778 800
9 31 53 75 97	119 141 163 185 207	229 251 273 295 317	339 361 383 405 427	449 471 493 515 537	559 581 603 625 647	669 691 713 735 757	779 801
10 32 54 76 98	120 142 164 186 208	230 252 274 296 318	340 362 384 406 428	450 472 494 516 538	560 582 604 626 648	670 692 714 736 758	780 802
11 33 55 77 99	121 143 165 187 209	231 253 275 297 319	341 363 385 407 429	451 473 495 517 539	561 583 605 627 649	671 693 715 737 759	781 803
12 34 56 78 100	122 144 166 188 210	232 254 276 298 320	342 364 386 408 430	452 474 496 518 540	562 584 606 628 650	672 694 716 738 760	782 804
13 35 57 79 101	123 145 167 189 211	233 255 277 299 321	343 365 387 409 431	453 475 497 519 541	563 585 607 629 651	673 695 717 739 761	783 805
14 36 58 80 102	124 146 168 190 212	234 256 278 300 322	344 366 388 410 432	454 476 498 520 542	564 586 608 630 652	674 696 718 740 762	784 806
15 37 59 81 103	125 147 169 191 213	235 257 279 301 323	345 367 389 411 433	455 477 499 521 543	565 587 609 631 653	675 697 719 741 763	785 807
16 38 60 82 104	126 148 170 192 214	236 258 280 302 324	346 368 390 412 434	456 478 500 522 544	566 588 610 632 654	676 698 720 742 764	786 808
17 39 61 83 105	127 149 171 193 215	237 259 281 303 325	347 369 391 413 435	457 479 501 523 545	567 589 611 633 655	677 699 721 743 765	787 809
18 40 62 84 106	128 150 172 194 216	238 260 282 304 326	348 370 392 414 436	458 480 502 524 546	568 590 612 634 656	678 700 722 744 766	788 810
19 41 63 85 107	129 151 173 195 217	239 261 283 305 327	349 371 393 415 437	459 481 503 525 547	569 591 613 635 657	679 701 723 745 767	789 811
20 42 64 86 108	130 152 174 196 218	240 262 284 306 328	350 372 394 416 438	460 482 504 526 548	570 592 614 636 658	680 702 724 746 768	790 812
21 43 65 87 109	131 153 175 197 219	241 263 285 307 329	351 373 395 417 439	461 483 505 527 549	571 593 615 637 659	681 703 725 747 769	791 813
22 44 66 88 110	132 154 176 198 220	242 264 286 308 330	352 374 396 418 440	462 484 506 528 550	572 594 616 638 660	682 704 726 748 770	792 814

BYTE'S BOMB is your direct line to the editor's desk. Each month the two top-rated authors receive bonuses based on your evaluation. First look at the list of this month's articles and corresponding article numbers (located on the page preceding the Reader Service list), then rate each article you've read as Excellent, Good, Fair, or Poor based on your overall impression of the article, by circling the appropriate number in each column below. Your feedback helps us produce the best possible magazine each month.

Article No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Excellent	1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69	73	77	81	85	89	93	97
Good	2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70	74	78	82	86	90	94	98
Fair	3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71	75	79	83	87	91	95	99
Poor	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100

Article No.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Excellent	101	105	109	113	117	121	125	129	133	137	141	145	149	153	157	161	165	169	173	177	181	185	189	193	197
Good	102	106	110	114	118	122	126	130	134	138	142	146	150	154	158	162	166	170	174	178	182	186	190	194	198
Fair	103	107	111	115	119	123	127	131	135	139	143	147	151	155	159	163	167	171	175	179	183	187	191	195	199
Poor	104	108	112	116	120	124	128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188	192	196	200

BYTE READER SERVICE



Fill out this coupon carefully. PLEASE PRINT. Requests cannot be honored unless the zip code is included. This card is valid for 6 months from cover date.

Name _____ NOVEMBER 1985

4EB5

(Title) _____ (Company) _____

Address _____ Telephone _____

City _____ State _____ Zip _____

I purchased this copy by Subscription Newsstand computer store or bookstore

1 23 45 67 89	111 133 155 177 199	221 243 265 287 309	331 353 375 397 419	441 463 485 507 529	551 573 595 617 639	661 683 705 727 749	771 793
2 24 46 68 90	112 134 156 178 200	222 244 266 288 310	332 354 376 398 420	442 464 486 508 530	552 574 596 618 640	662 684 706 728 750	772 794
3 25 47 69 91	113 135 157 179 201	223 245 267 289 311	333 355 377 399 421	443 465 487 509 531	553 575 597 619 641	663 685 707 729 751	773 795
4 26 48 70 92	114 136 158 180 202	224 246 268 290 312	334 356 378 400 422	444 466 488 510 532	554 576 598 620 642	664 686 708 730 752	774 796
5 27 49 71 93	115 137 159 181 203	225 247 269 291 313	335 357 379 401 423	445 467 489 511 533	555 577 599 621 643	665 687 709 731 753	775 797
6 28 50 72 94	116 138 160 182 204	226 248 270 292 314	336 358 380 402 424	446 468 490 512 534	556 578 600 622 644	666 688 710 732 754	776 798
7 29 51 73 95	117 139 161 183 205	227 249 271 293 315	337 359 381 403 425	447 469 491 513 535	557 579 601 623 645	667 689 711 733 755	777 799
8 30 52 74 96	118 140 162 184 206	228 250 272 294 316	338 360 382 404 426	448 470 492 514 536	558 580 602 624 646	668 690 712 734 756	778 800
9 31 53 75 97	119 141 163 185 207	229 251 273 295 317	339 361 383 405 427	449 471 493 515 537	559 581 603 625 647	669 691 713 735 757	779 801
10 32 54 76 98	120 142 164 186 208	230 252 274 296 318	340 362 384 406 428	450 472 494 516 538	560 582 604 626 648	670 692 714 736 758	780 802
11 33 55 77 99	121 143 165 187 209	231 253 275 297 319	341 363 385 407 429	451 473 495 517 539	561 583 605 627 649	671 693 715 737 759	781 803
12 34 56 78 100	122 144 166 188 210	232 254 276 298 320	342 364 386 408 430	452 474 496 518 540	562 584 606 628 650	672 694 716 738 760	782 804
13 35 57 79 101	123 145 167 189 211	233 255 277 299 321	343 365 387 409 431	453 475 497 519 541	563 585 607 629 651	673 695 717 739 761	783 805
14 36 58 80 102	124 146 168 190 212	234 256 278 300 322	344 366 388 410 432	454 476 498 520 542	564 586 608 630 652	674 696 718 740 762	784 806
15 37 59 81 103	125 147 169 191 213	235 257 279 301 323	345 367 389 411 433	455 477 499 521 543	565 587 609 631 653	675 697 719 741 763	785 807
16 38 60 82 104	126 148 170 192 214	236 258 280 302 324	346 368 390 412 434	456 478 500 522 544	566 588 610 632 654	676 698 720 742 764	786 808
17 39 61 83 105	127 149 171 193 215	237 259 281 303 325	347 369 391 413 435	457 479 501 523 545	567 589 611 633 655	677 699 721 743 765	787 809
18 40 62 84 106	128 150 172 194 216	238 260 282 304 326	348 370 392 414 436	458 480 502 524 546	568 590 612 634 656	678 700 722 744 766	788 810
19 41 63 85 107	129 151 173 195 217	239 261 283 305 327	349 371 393 415 437	459 481 503 525 547	569 591 613 635 657	679 701 723 745 767	789 811
20 42 64 86 108	130 152 174 196 218	240 262 284 306 328	350 372 394 416 438	460 482 504 526 548	570 592 614 636 658	680 702 724 746 768	790 812
21 43 65 87 109	131 153 175 197 219	241 263 285 307 329	351 373 395 417 439	461 483 505 527 549	571 593 615 637 659	681 703 725 747 769	791 813
22 44 66 88 110	132 154 176 198 220	242 264 286 308 330	352 374 396 418 440	462 484 506 528 550	572 594 616 638 660	682 704 726 748 770	792 814

To get further information on the products advertised in BYTE, fill out the reader service card with your name and address. Then circle the appropriate numbers for the advertisers you select from the list. Add a first-class stamp to the card, then drop it in the mail. Not only do you gain information, but our advertisers are encouraged to use the marketplace provided by BYTE. This helps us bring you a bigger BYTE. The index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

PLACE
POSTAGE
HERE

BYTE

READER SERVICE
PO BOX 298
DALTON, MA 01227-0298
USA

PLACE
POSTAGE
HERE

BYTE

READER SERVICE
PO BOX 298
DALTON, MA 01227-0298
USA

BYTE

SUBSCRIPTIONS

4EB5

For a subscription to BYTE, please complete this card.

Name _____

Address _____

City _____

State _____ Zip _____ Country _____

Card No. _____

Expiration date _____

Four digits above name—Master Charge only _____

Signature _____ Date _____

Please allow eight weeks for processing. Thank you

USA

Canada
Mexico

- | | | |
|----------------------------------|-------------------------------|-------------------------------|
| <input type="checkbox"/> 1 year | <input type="checkbox"/> \$21 | <input type="checkbox"/> \$23 |
| <input type="checkbox"/> 2 years | <input type="checkbox"/> \$38 | <input type="checkbox"/> \$42 |
| <input type="checkbox"/> 3 years | <input type="checkbox"/> \$55 | <input type="checkbox"/> \$61 |

- \$69. Europe (air delivery) payment enclosed
 \$37 Worldwide (surface mail) payment enclosed

(Air mail rates available upon request)

Please remit in US funds drawn on a US bank. Thank you.

- Check enclosed (Bonus: [North American only] one EXTRA issue—receive 13 issues for the price of 12)



- Bill me (North America only)

BYTE

SUBSCRIPTIONS

4EB5

For a subscription to BYTE, please complete this card.

Name _____

Address _____

City _____

State _____ Zip _____ Country _____

Card No. _____

Expiration date _____

Four digits above name—Master Charge only _____

Signature _____ Date _____

Please allow eight weeks for processing. Thank you

USA

Canada
Mexico

- | | | |
|----------------------------------|-------------------------------|-------------------------------|
| <input type="checkbox"/> 1 year | <input type="checkbox"/> \$21 | <input type="checkbox"/> \$23 |
| <input type="checkbox"/> 2 years | <input type="checkbox"/> \$38 | <input type="checkbox"/> \$42 |
| <input type="checkbox"/> 3 years | <input type="checkbox"/> \$55 | <input type="checkbox"/> \$61 |

- \$69. Europe (air delivery) payment enclosed
 \$37 Worldwide (surface mail) payment enclosed

(Air mail rates available upon request)

Please remit in US funds drawn on a US bank. Thank you.

- Check enclosed (Bonus: [North American only] one EXTRA issue—receive 13 issues for the price of 12)



- Bill me (North America only)

*Note our special offer!
Send cash with your order
and receive 13 issues
for the price of 12 for
each year you subscribe.
(North America only, please.)*

Don't Miss An Issue!

Have BYTE delivered to your door.

Each month BYTE will bring you the latest in microcomputer technology.

DISCOVER and IMPLEMENT new ideas. Don't miss the original information presented in the pages of BYTE.

With BYTE you'll always be among the first to know about the important breakthroughs, worthwhile new equipment, and innovative projects in the world of computing.

CHALLENGE US to deliver the very best idea in microcomputers and advanced technology to you. Return the attached card today!

Subscribe to BYTE—the world's leading computer magazine.

PLACE
POSTAGE
HERE

BYTE SUBSCRIPTIONS

PO Box 597
Martinsville, NJ 08836-0597
USA

PLACE
POSTAGE
HERE

BYTE SUBSCRIPTIONS

PO Box 597
Martinsville, NJ 08836-0597
USA

⋮
⋮
⋮

TO HEAR HOW QUIET OUR NEWEST PINWRITER DOT MATRIX PRINTER IS, JUST CALL 1-800-543-8000.



Pinwriter P5 dot matrix printer

We won't waste words trying to describe how quiet our new Pinwriter™ P5 printer is. Besides we've come up with an easy way to for you to actually hear it. Without even getting up. Just call the toll-free number above and you can listen to a recorded demonstration.

You'll hear the actual sound of the Pinwriter. And how it compares to other leading dot matrix printers. You'll also see, that unlike most other dot matrix printers, you can talk on the phone or carry on a conversation, while the P5 is running.

The Pinwriter P5 not only sounds great, it looks great. It has superior graphics resolution. And more built-in true fonts than any other dot maxtrix printer. Plus it can use a variety of font cartridges.

It's also the fastest 24-pin dot matrix printer going. It clocks at 290 CPS in draft mode and 100 CPS in letter-quality. And you can select either speed at the touch of a button.

NEC printers are also incredibly reliable. With normal use they can run an average of 5 years without a repair.

The new Pinwriter P5 dot matrix printer. The first printer that offers less bang for the buck.

To hear one in action, call the above toll-free number. Or see your nearest NEC dealer. For more information, call 1-800-343-4418 (in MA 617-264-8635).

Or write: NEC Information Systems, Dept. 1610, 1414 Massachusetts Ave., Boxborough, MA 01719.

NEC PRINTERS. THEY ONLY STOP WHEN YOU WANT THEM TO.

NEC

NEC Information Systems, Inc.

THE NEW TANDY TRS-80[®] MODEL 4D. ONLY \$1199 WITH DESKMATE[™] SOFTWARE

Features Two Built-In Double-Sided Drives for 736K of Disk Storage

Introducing our all-in-one computer that's ready to use the minute you put it on your desk. The Model 4D (26-1070) is perfect for busy professionals, educators, and home users. Many programs are available, but the only one you may ever

need is included.

DeskMate 6-in-1 disk software lets you get down to business fast! Prepare reports, memos, and letters. Make quick and easy spreadsheet calculations. Create a name-and-address file or inventory. Built-in calendar/alarm alerts you to appointments. Communicate with information services

and send messages to other DeskMate users (requires optional modem).

Model 4D features a 12" 80 x 24 display, 64K memory, built-in RS-232C serial and parallel printer interfaces. Easily expandable, too. See it today at any Radio Shack Computer Center and participating stores and dealers.

Inquiry 324



Monthly Calendar with
Current Date Highlighted

Appointment Calendar
and Event Reminder

Menu of Files in
Six Different
Applications

Quick Reference
of Commands

Radio Shack
The Technology Store[™]
A DIVISION OF TANDY CORPORATION