

BYTE

THE SMALL SYSTEMS JOURNAL

JANUARY 1988 VOL.13, NO.1

\$3.50 IN UNITED STATES
\$4.50 IN CANADA / £1.95 IN U.K.
A MCGRAW-HILL PUBLICATION
0360-5280

PRODUCT FOCUS

Database Software

REVIEWS

Toshiba T3100/20 and T1000

PC Designs GV-386

GCC Personal Laserprinter

@Liberty vs. Baler

Microsoft's Bookshelf

MGMStation CAD

IN DEPTH

New Ideas for Managing Megabytes



ROBERT
BY LINNEY

The fast lane is *fast*

Our new Turbo Pascal® 4.0 is so fast, it's almost reckless. How fast? Better than 27,000 lines of code per minute. That's much faster than 3.0 or any other Pascal compiler and the reason why you need 4.0 today.

Pascal. The fastest and the best.

If you're just now learning a computer language, learn Pascal. If you're already programming in Pascal, you're programming with a winner because Pascal is the worldwide language of choice. Pascal is the most popular language in university computer science classes and with computer enthusiasts who appreciate Pascal's modern programming

structure. It's powerful, coherent, easy to learn and use—and with Turbo Pascal 4.0—faster than ever before.

Turbo Pascal: Technical excellence

Commitment to technical excellence and



superiority also means commitment to detail, however painstaking, and that takes time. 4.0's pre-

decessor, Turbo Pascal 3.0 is the worldwide standard, and with Turbo Pascal 4.0, we've bettered that standard. 4.0 is clearly the world's fastest development tool for the IBM® PS/2 series, PC's and compatibles—and the world's favorite Pascal compiler.

4.0 breaks the code barrier

No more swapping code in and out to beat the 64K code barrier. Designed for large programs, Turbo Pascal 4.0 lets you use all 640K memory in your computer. You paid for all that memory, now you can use it freely.

For the IBM PS/2 and the IBM and Compaq families of personal computers and all 100% compatibles.



YES!

I want to upgrade to Turbo Pascal 4.0 and the 4.0 Toolboxes

Registered owners have been notified by mail. If you are a registered Turbo Pascal user and have not been notified of Version 4.0 by mail, please call us at (800) 543-7543. To upgrade if you have not registered your product, just send the original registration form from your manual and payment with this completed coupon to:

*Pascal 4.0 Upgrade Dept.
Borland International
4585 Scotts Valley Drive
Scotts Valley, CA 95066*

Name _____

Ship Address _____

City _____ State _____

Zip _____ Telephone () _____

This offer is limited to one upgrade per valid registered product. It is good until June 30, 1988. Not good with any other offer from Borland. Outside U.S. make payments by bank draft payable in U.S. dollars drawn on a U.S. bank. CODs and purchase orders will not be accepted by Borland.

ter than ever before!



4.0 uses logical units for separate compilation

Pascal 4.0 lets you break up the code gang into "units," or "chunks." These logical modules can be worked with swiftly and separately—so that an error in one module is seeable and fixable, and you're not sent through all your code to find one error. Compiling and linking these separate units happens in a

flash because your compiling horsepower is better than 27,000 lines a minute.* And 4.0 also includes an automatic project Make.

4.0's cursor automatically lands on any trouble spot

4.0's interactive error detection and location means that the cursor automatically lands where the error is. While you're compiling or running a program, you get an error message at the top of your screen *and* the cursor flags the error's location for you.

4.0 gives you an integrated programming environment

4.0's integrated environment includes pull-down menus and a built-in editor. Your program output is

automatically saved and shown in the output window. You can Scroll, Pan, or Page through all your output and know where everything is all the time. Given 4.0's integration, you can edit, compile, find and correct errors—all from inside the integrated development environment.

You'll never lose your mind, because 4.0 never loses your place

Whenever you re-load 4.0, it remembers what you and it were doing before you left. It puts you right back in the editor with the same file and in the same place as you were working last.

*Run on an 8 MHz IBM AT

**If within 60 days of purchase this product does not perform in accordance with our claims, call our customer service department, and we will arrange a refund.

All Borland products are trademarks or registered trademarks of Borland International, Inc. Other brand and product names are trademarks or registered trademarks of their respective holders. Copyright © 1987 Borland International, Inc. BI 1159A

Circle 34 on Reader Service Card (DEALERS: 35)

Please check box(es)	Sugg. Retail	Upgrade Price [†]	Serial No.
<input type="checkbox"/> Turbo Pascal 4.0 Compiler	\$ 99.95	\$ 39.95	_____
<input type="checkbox"/> Turbo Pascal Tutor	69.95	19.95	_____
<input type="checkbox"/> Turbo Pascal Database Toolbox	99.95	29.95	_____
<input type="checkbox"/> Turbo Pascal Graphix Toolbox	99.95	29.95	_____
<input type="checkbox"/> Turbo Pascal Editor Toolbox	99.95	29.95	_____
<input type="checkbox"/> Turbo Pascal Numerical Methods Toolbox	99.95	29.95	_____
<input type="checkbox"/> Turbo Pascal Gameworks	99.95	29.95	_____
Total product amount	\$ _____		
CA and MA residents add sales tax	\$ _____		
In US please add \$5 shipping and handling for each product ordered	\$ _____		
Outside US please add \$10 shipping and handling for each product ordered	\$ _____		
Total amount enclosed	\$ _____		

Please specify diskette size: 5¼" 3½"

Payment: VISA MC Check Bank Draft

Credit card expiration date: _____/_____/_____

Card # _____



BM 1/88

[†]To qualify for the upgrade price you must give the serial number of the equivalent product you are upgrading.



```
record used by Intr and MSdos )
record
  case Integer of
    0: (AX, BX, CX, DX, BP, SI, DI, DS, ES, Flags: Word);
    1: (AL, AH, BL, BH, CL, CH, DL, DH: Byte);
  end;
and untyped-file record )
record
  Handle: Word;
  Mode: Word;
  RecSize: Word;
  Private: array[1..26] of Byte;
  UserData: array[1..16] of Byte;
  Name: array[1..79] of Char;
```

Program in the
fast lane with
Borland's new
Turbo Pascal 4.0.

Now's the time for a *fast* decision: Upgrade now to 4.0!

Compatibility with Turbo Pascal 3.0

We've created 4.0 to be highly compatible with version 3.0 and included a conversion program and compatibility units to help you convert all your 3.0 programs to 4.0.

Highlights of Borland's new Turbo Pascal 4.0

- Compiles 27,000 lines per minute
- Supports >64K programs
- Uses units for separate compilation
- Integrated development environment

- Interactive error detection/location
- Includes a command line version of the compiler

4.0 also

- Saves output screen in a window
- Supports 25, 43 and 50 lines per screen
- Generates MAP files for debugging
- Has graph units including CGA, EGA, VGA, MCGA, 3270 PC, AT & T 6300 & Hercules support
- Supports extended data types (including word, long integers)
- Does smart linking
- Comes with a free revised MicroCalc spreadsheet source code

4.0 is all yours for only \$99.95

Sieve (25 iterations)

	Turbo Pascal 4.0	Turbo Pascal 3.0
Size of Executable File	2224 bytes	11682 bytes
Execution speed	9.3 seconds	9.7 seconds

Sieve of Eratosthenes, run on an 8MHz IBM AT

Since the source file above is too small to indicate a difference in compilation speed we compiled our GOMOKU program from Turbo Gameworks to give you a true sense of how much faster 4.0 really is!

Compilation of GO.PAS (1006 lines)

	Turbo Pascal 4.0	Turbo Pascal 3.0
Compilation speed	2.2 seconds	3.6 seconds
Lines per minute	27,436	16,750

GO.PAS compiled on an 8 MHz IBM AT

60-Day Money-Back Guarantee**



For the dealer nearest
you or to order call
(800) 543-7543.

Circle 36 on Reader Service Card (DEALERS: 37)



Contents



Toshiba's New Laptop/133

65 PRODUCTS IN PERSPECTIVE

- 67 What's New
- 97 Short Takes



MultiSpeed HD
GOfer
TransImage 1000
RuggedWriter 480
Velan-2V
Book One
Surpass

Reviews

- 111 **SQL Database Management Systems**
by Richard Finkelstein and Fabian Pascal
A look at Informix-SQL, Ingres, Oracle, SQLBase, XDB II, and XQL.
- 121 **BIX Product Focus:
SQL-based Database Managers**
by Curtis Franklin Jr.
BIX users comment on the most popular packages.
- 127 **Cache in the Chips**
by Ed McNierney
The PC Designs GV-386 combines high performance with full IBM PC AT compatibility.
- 133 **The Toshiba T3100/20**
by Curtis Franklin Jr.
An AT-compatible laptop with impressive speed and portability.

- 141 **The Symmetric 375**
by Patrick Wood
A look at Symmetric's portable Berkeley Unix system.
- 151 **High-Performance Graphics Boards**
by Bill Nicholls
Two super-high-resolution PC graphics boards from Vermont Microsystems and Verticom.
- 155 **GCC's Personal Laserprinter**
by Donald Evan Crabb
Low-cost laser printing for the Macintosh.
- 163 **Allegro CommonLISP**
by Ernest R. Tello
A complete Common LISP for the Macintosh.
- 167 **Personal REXX**
by Namir Clement Shammis
A powerful batch language for the IBM PC.
- 173 **@Liberty and the Baler**
by Paul Schauble and Rick Cook
The first generation of spreadsheet compilers.
- 176 **Microsoft's Bookshelf**
by Rusel DeMaria
A powerful reference library on your PC.
- 178 **MGMStation CAD**
by Rusel DeMaria
A CAD package for precision design work on the Macintosh.

Columns

- 185 **Computing at Chaos Manor: A Writer's Tools**
by Jerry Pournelle
Editors, spelling checkers, and CD-ROMs: searching for the perfect package from Microsoft, Symantec, Oasis, and others.
- 205 **Applications Only: Real-World Answers**
by Ezra Shapiro
Reflex Plus, PhoneNET, and a TOPS network solve some practical dilemmas.



In Depth/213



Features/269

213 IN DEPTH: Managing Megabytes

214 Introduction

215 A Better Way to Compress Images

by Michael F. Barnsley and Alan D. Sloan

A new technique can achieve compression ratios in excess of 10,000 to 1.

225 Managing Immense Storage

by Theodor H. Nelson

The "xanalogical" model provides a radical new approach to mass storage.

243 Fast Data Access

by Jonathan Robie

Using query optimizers for efficient handling of large databases.

255 Achieving Mainframe Performance

by Wink Saville

Expanded memory in personal computers opens the door to programming techniques that speed performance significantly.

265 Managing Megabytes Resource Guide

269 FEATURES

271 Ciarcia's Circuit Cellar: The PCC180 Multitasking Controller Part 1: The Hardware

by Steve Ciarcia

A small controller that is both fast and powerful.

285 Focus on Algorithms: Changing Reverse Polish to Infix

by Dick Pountain

Computers perform math using reverse Polish notation.

291 Using Financial Tools for Nonfinancial Simulations

by James L. Conger

Using spreadsheets as a fast way to simulate real-world problems.

DEPARTMENTS

6 Editorial: Show Time

11 Microbytes

16 Letters and Review Feedback

33 Chaos Manor Mail

36 Ask BYTE

38 Circuit Cellar Feedback

51 Book Reviews

339 Coming Up in BYTE

READER SERVICE

338 Editorial Index by Company

341 Alphabetical Index to Advertisers

343 Index to Advertisers by Product Category

Inquiry Reply Cards: after 344

PROGRAM LISTINGS

From BIX: see 282

From BYTEnet: call (617) 861-9764

On disk or in print: see card after 32



BYTE (ISSN 0360-5280) is published monthly with additional issues in June and October by McGraw-Hill Inc. Founder James H. McGraw (1860-1948). Executive, editorial, circulation, and advertising offices: One Phoenix Mill Lane, Peterborough, NH 03458, phone (603) 924-9281. Office hours: Monday through Thursday 8:30 AM-4:30 PM, Friday 8:30 AM-1:00 PM, Eastern Time. Address subscriptions to BYTE Subscriptions, P.O. Box 6821, Piscataway, NJ 08855. Postmaster: send address changes, USPS Form 3579, undeliverable copies, and fulfillment questions to BYTE Subscriptions, P.O. Box 6821, Piscataway, NJ 08855. Second-class postage paid at Peterborough, NH 03458 and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9121. Subscriptions are \$22 for one year, \$40 for two years, and \$58 for three years in the U.S. and its possessions. In Canada and Mexico, \$25 for one year, \$45 for two years, \$65 for three years. \$69 for one year air delivery to Europe. \$1,000 yen for one year air delivery to Japan. \$5 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 U.S. and its possessions, \$4.25 in Canada and Mexico, \$4.90 in Europe, and \$5 elsewhere. Foreign subscriptions and sales should be remitted in U.S. 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.

Address editorial correspondence to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Unacceptable manuscripts will be returned if accompanied by sufficient postage. Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE.

Copyright © 1987 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 0360-5280/83, \$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 11 Bedford Row, Dept. PR, London WC1R 4EJ, England.

Subscription questions or problems should be addressed to: BYTE Subscriber Service, P.O. Box 6821, Piscataway, NJ 08855.

BYTE

THE SMALL SYSTEMS JOURNAL

EXECUTIVE EDITOR, BYTE
Frederic S. Langa

PUBLISHER/GROUP VICE PRESIDENT
J. Burt Totaro

ASSISTANT MANAGING EDITOR
Glenn Hartwig

SENIOR TECHNICAL EDITORS
Cathryn Baskin *Reviews*, G. Michael Vose *In Depth*, Gregg Williams *Features*

TECHNICAL EDITORS
Dennis Allen, Curtis Franklin Jr., Richard Grehan, Ken Sheldon, George A. Stewart, Jane Morrill Tazelaar, Tom Thompson, Eva White, Stanley Wszola

ASSOCIATE TECHNICAL EDITOR
Martha Hicks

NEWS AND TECHNOLOGY
Gene Smarte *Bureau Chief, Costa Mesa*, Jonathan Erickson *Senior Technical Editor, San Francisco*, Rich Malloy *Senior Technical Editor, New York*, Nicholas Baran *Associate Technical Editor, San Francisco*, Jeffrey Bertolucci *Editorial Assistant, San Francisco*

ASSOCIATE NEWS EDITORS
D. Barker *Microbytes*, Anne Fischer *Lent What's New, Short Takes*, Stan Miaszkowski *What's New*

CONSULTING EDITORS
Steve Clarcia, Jerry Pournelle, Ezra Shapiro

CONTRIBUTING EDITORS
Jonathan Amsterdam *Programming Projects*, Mark Dahmke *Video, Operating Systems*, Mark Haas *At Large*, Rik Jadmick *CAD, Graphics, Spreadsheets*, Robert T. Kurosaka *Mathematical Recreations*, Alastair J. W. Mayer *Software*, Alan R. Miller *Languages and Engineering*, Dick Pountain *Algorithms, Roger Powell Computers and Music*, Phillip Robinson *Semiconductors*, Jon Shielt *High-Performance Systems*, Ernest Tello *Artificial Intelligence*

COPY EDITORS
Lauren Stickler *Chief*, Susan Colwell, Judy Connors-Tenney, Jeff Edmonds, Nancy Hayes, Cathy Kingery, Margaret A. Richard, Warren Williamson

EDITORIAL ASSISTANTS
Peggy Dunham *Office Manager*, L. Ryan McCombs, June N. Sheldon

ART
Nancy Rice *Director*, Joseph A. Gallagher *Assistant Director*, Jan Muller *Assistant*, Alan Easton *Drafting*

PRODUCTION
David R. Anderson *Director*, Denise Chartrand, Michael J. Lonsky, Virginia Reardon

TYPOGRAPHY
Sherry Fiske *Systems Manager*, Selinda Chiquoine, Donna Sweeney

ADVERTISING/PRODUCTION (603) 924-6448
Lisa Wozniak *Supervisor*, Lyda Clark *Senior Account Coordinator*, Karen Cilley, Brian Higgins, Linda Fluhr, Wal Chiu Li *Quality Control Manager*, Julie Murphree *Advertising/Production Coordinator*

ADMINISTRATION
Beverly Jackson *Publisher's Assistant*

MARKETING COMMUNICATIONS
Horace T. Howland *Director*, (603) 924-3424
Wilbur S. Watson *Marketing Services Manager*, Lisa Jo Steiner *Marketing Assistant*, Stephanie Warmesky *Marketing Art Director*, Sharon Price *Associate Art Director*, Julie Perron *Market Research Analyst*

PLANNING AND RESEARCH
Michele Perron *Director*
Faith Kluntz *Copyrights Coordinator*, Cynthia Damato *Sanda Reader Service Coordinator*

FINANCIAL SERVICES
Philip L. Penny *Director of Finance and Services*, Kenneth A. King *Business Manager*, Christine Monkton *Assistant*, Marilyn Haigh, Diane Henry, JoAnn Walter, Jaime Huber

CIRCULATION
Dan McLaughlin *Director*
James Bingham *Single-Copy Sales Manager*, Vicki Weston *Assistant Manager*, Claudette Carwell *Distribution Coordinator*, Karen Desroches *Direct Accounts Coordinator*, Louise Menegus *Back Issues*

PERSONNEL
Patricia Burke *Personnel Coordinator*, Donna Healy *Receptionist*

BUILDING SERVICES
Tony Bennett *Manager*, Cliff Monkton, Mark Monkton, Agnes Perry

BIX BYTE INFORMATION EXCHANGE

EXECUTIVE EDITOR, BIX
George Bond

SENIOR EDITOR
David Betz

ASSOCIATE EDITORS
Tony Lockwood, Donna Osgood *San Francisco*

MICROBYTES DAily
D. Barker *Coordinator, Peterborough*, Gene Smarte *Bureau Chief, Costa Mesa*, Nicholas Baran *San Francisco*, Rick Cook *Phoenix*, Jonathan Erickson *San Francisco*, Martha Hicks *Peterborough*, Anne Fischer *Lent Peterborough*, Larry Loeb *Wallingford, CT*, Rich Malloy *New York*, Brock N. Meeks *La Mesa, CA*, Jeff Merron *Peterborough*, Stan Miaszkowski *Peterborough*, Wayne Rish Jr. *Washington, DC*, David Reed *Lexington, KY*

GROUP MODERATORS
David Allen *Applications*, Frank Boosman *Artificial Intelligence*, Leroy Casterline *Other*, Marc Greenfield *Programming Languages*, Jim Howard *Graphics*, Gary Kendall *Operating Systems*, Steve Krenek *Computers*, Brock N. Meeks *Telecommunications*, Barry Nance *New Technology*, Donald Osgood *Computers*, Sue Rosenberg *Other*, Jon Swanson *Chips*

BUSINESS AND MARKETING
Doug Webster *Director* (603) 924-9027, Patricia Bausum *Secretary*, Denise A. Greens *Customer Service*, Brian Warnock *Customer Service*, Tammy Burgess *Customer Credit and Billing*

TECHNOLOGY
Clayton Lisle *Director, Business Systems Technology*, MHIS, Bill Garrison *Business Systems Analyst*, Jack Reilly *Business Systems Analyst*

ADVERTISING SALES
Dennis J. Riley *Director*, (603) 924-6261
Sandra Foster *Administrative Assistant*

NEW ENGLAND
ME, NH, VT, MA, RI, ONTARIO, CANADA & EASTERN CANADA
Paul McPherson Jr. (617) 262-1160

ATLANTIC
NY, NYC, CT, NJ (NORTH)
Leah G. Rabinowitz (212) 512-2096
Dick McGurk (203) 688-7111

EAST
PA, KY, OH, NJ (SOUTH), MD, VA, W.VA, DE, D.C.
Daniel Ferro (215) 496-3833

SOUTHEAST
NC, SC, GA, FL, AL, TN
Carolyn F. Lovett (404) 282-0426

MIDWEST
IL, MO, KS, IA, ND, SD, MN, WI, NE, IN, MI, MS
Bob Denmead (312) 761-3740

SOUTHWEST, ROCKY MOUNTAIN
CO, WY, OK, TX, AR, LA
Karl Heinrich (713) 482-6757

SOUTH PACIFIC
SOUTHERN CA, AZ, NM, LAS VEGAS
Jack Anderson (714) 867-4282
Tom Harvey (213) 480-6243

NORTH PACIFIC
HI, WA, OR, ID, MT, NORTHERN CA, NV (except LAS VEGAS), UT, WESTERN CANADA
Mike Kisselberth (415) 362-4660
Bill McAfee (415) 348-4100

TELEMARKETING
L. Bradley Browne *Director*
Susan Boyd *Administrative Assistant*

BYTE BITS (2x3)
Dan Harper (603) 924-6830

THE BUYER'S MART (1x2)
Mark Stone (603) 924-3754

REGIONAL ADVERTISING SECTIONS
MIDATLANTIC, METRO NY & NEW ENGLAND, SOUTHERN CALIFORNIA, SOUTHEAST
Elisa Lister (603) 924-6830

MIDWEST, PACIFIC NORTHWEST, SOUTHWEST, METRO NY & NEW ENGLAND
Scott Gagnon (603) 924-9261

BYTE DECK MAILINGS
National
Ed Ware (603) 924-6168

A/E/C COMPUTING DECK
COMPUTING FOR ENGINEERS DECK
Mary Ann Goulding (603) 924-9261

EDITORIAL AND BUSINESS OFFICE:

One Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9281.
West Coast Branch Office: 425 Battery St., San Francisco, CA 94111, (415) 954-9718; 3001 Red Hill Ave., Building #1, Suite 222, Costa Mesa, CA 92626, (714) 657-6262.
New York Branch Editorial Office: 1221 Avenue of the Americas, New York, NY 10020, (212) 512-3175.
BYTEnet: (617) 861-9784 (sat modem at 8-1-N or 7-1-E; 300 or 1200 baud). Fax: (603) 924-7507. Telex: (603) 924-7861.
SUBSCRIPTION CUSTOMER SERVICE: Non-U.S. (201) 837-1315; inside U.S. (outside NJ) 1-800-423-8272; (inside NJ) 1-800-367-0218.

Officers of McGraw-Hill Information Systems Company: President: Richard B. Miller, Executive Vice Presidents: Frederick P. Jannott, Construction Information Group; Russell C. White, Computers and Communications Information Group; J. Thomas Ryan, Marketing and International Senior Vice Presidents-Publishers: Laurence Altman, Electronics; David J. McGrath, Engineering News-Record; Group Vice Presidents: J. Burt Totaro, BYTE; Frank A. Shinal, Dodge; Peter B. McCuen, Communications Information; Vice Presidents: Robert D. Dako, Controller; Fred O. Jensen, Planning and Development; Michael J. Koester, Human Resources; Tabet M. Sediq, Systems Planning and Technology.

Officers of McGraw-Hill Inc.: Harold W. McGraw Jr., Chairman; Joseph L. Donno, President and Chief Executive Officer; Robert N. Landes, Executive Vice President, General Counsel, and Secretary; Walter D. Sarawitha, Executive Vice President and Chief Financial Officer; Shel F. Assn, Senior Vice President, Manufacturing; Robert J. Bahash, Senior Vice President, Finance and Manufacturing; Frank D. Pangloss, Senior Vice President, Treasury Operations; Ralph R. Schutz, Senior Vice President, Editorial; George R. Elinger, Vice President, Circulation.

BYTE, BITE, and The Small Systems Journal are registered trademarks of McGraw-Hill Inc.

HiWIRE™ Starts the Job that smARTWORK® Finishes



Introducing HiWIRE™

Wintek's smARTWORK® is used by thousands of engineers to design printed-circuit boards. Now Wintek introduces HiWIRE, an electronic-schematic program that is easy to learn and use.

With a click of the mouse button, you can extract symbols from our library of over 700 common components and connect them with wires and buses. You can also easily modify the library's symbols or create your own by combining labels, lines, and arcs.

HiWIRE Advantages

- Easy-to-learn mouse/menu-driven operation
- Complete documentation and tutorial
- Extensive TTL, CMOS, micro-processor, and discrete-component libraries
- Rubberbanding

- Moving, copying, mirroring, and rotating of symbols
- Text-string searching
- Multiple display windows
- High-quality schematics from printers and plotters
- Hierarchical-design support; netlist and bill-of-materials utilities
- Schematic/layout cross checking
- 800 number for free technical support

System Requirements

- IBM Personal Computer, PC XT, or PC AT with 320K RAM, parallel printer port, 2 disk drives, and DOS V2.0 or later
- IBM Color/Graphics Adapter or EGA with RGB color monitor
- Microsoft Mouse
- IBM Graphics Printer or Epson FX/MX/RX-series dot-matrix printer, and/or:

- Houston Instrument DMP-40, 41, 42, 51, 52 or Hewlett-Packard 7470, 7475, 7550, 7580, 7585, 7586 plotter

High Performance at Low Cost

At \$895, HiWIRE delivers quality schematics quickly and easily. You don't need to guess whether or not HiWIRE is right for you. Our money-back guarantee lets you try it for 30 days at absolutely no risk. Call (800) 742-6809 toll free today and put HiWIRE to work tomorrow.

Wintek Corporation

1801 South Street
Lafayette, IN 47904-2993
Telephone: (800) 742-6809
or in Indiana (317) 742-8428
Telex: 70-9079 WINTEK CORP UD



"HiWIRE" is a trademark, and "smARTWORK", "Wintek", and the Wintek logo are registered trademarks of Wintek Corporation.

EDITORIAL

Show Time

Early winter is a great time for computer trade shows. Each year at this time, during a span of 60 days, we make our travel agency *very* happy by sending a steady stream of BYTE editors to shows ranging from COMDEX in Las Vegas to MacWorld Expo in San Francisco, with many smaller shows in between.

These shows yield a feast of new information. At one show, a major hardware manufacturer privately demonstrated for us hand-assembled prototypes of a new line of killer machines that will be announced shortly.

The high end of this line ranks among the most technologically advanced personal computers I've seen. We will be receiving sample units from the first production run, and we'll bring you full coverage, with detailed benchmarks, in an upcoming issue.

We also picked up a late-beta copy of Surpass, a powerful spreadsheet that enters the fray—along with new spreadsheets like Quattro, Win Excel, and PlanPerfect—against Lotus 1-2-3. Turn to this issue's Short Takes section for an early hands-on look at Surpass.

We've also seen a host of 80386 and 68020 hardware and software; tons of new equipment designed to work with—or outperform—IBM's Micro Channel PS/2s; new Mac enhancers; and more.

Embarrassment of Riches

Some of these items will show up in print right away, in the sections of BYTE with the latest deadlines: Microbytes, Short Takes, and What's New. Other items will appear later as First Impression articles and full-blown reviews.

But we gather much more raw information than we can possibly accommodate, even in a magazine the size of BYTE (e.g., our internal staff reports from COMDEX alone ran to almost 20,000 words). How can we best supply you with all this information?

Let's, for the moment, ignore BIX. Our show coverage there, usually as part of the microbytes conference, features detailed information on major product announcements and conference events posted within minutes or hours of occurrence. If you want the most up-to-date microcomputer information you can get, there's simply no better alternative.

But if you can't use BIX, what then? Senior Editor Rich Malloy had a suggestion: a paper transcript of our show coverage, mailed to interested readers right after a show.

To test the feasibility of this idea, we produced a trial transcript of our COMDEX coverage, and it went well: In a matter of just a few hours, Rich downloaded the BIX coverage, massaged the text, designed a print format, and laser-printed the whole package. It went so well, in fact, that we've forged ahead.

A New Publication

Starting immediately after the close of MacWorld Expo, we'll produce a paper transcript of our BIX coverage. We'll be glad to send you a copy for just the price of the paper, printing, and postage. Just drop a note to MacWorld Show Report, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458; please enclose a check or money order for \$3, and be sure to include your name and mailing address. These new Show Reports will fill a gap in our coverage of microcomputing.

Thus, we can now offer you three alternatives for show coverage: For the most timely coverage possible, there's BIX, with its essentially zero lead time and its interactive nature (via BIX, you can ask the BYTE staff questions about the show and our coverage). Slightly slower, but fast—as fast or faster than most microcomputer news weeklies, for instance—are the new BYTE Show Reports. And finally, for thoroughgoing, in-depth analysis and selective coverage of the most important new products and technologies, there's BYTE itself.

Other Changes

Does this attention to Show Reports and BIX imply that BYTE is changing? Not at all.

Except to get better. Our New Year's resolutions for BYTE include improving the quality of our writing and editing while retaining or even enhancing the depth and authority that are BYTE's hallmarks. BYTE's technical nature guarantees we'll never be a McGuffey's reader, but we can—and will—work harder to make even our most technically rigorous articles as readable as possible.

And as attractive as possible: Nancy Rice, our able art director, is already

hard at work looking at ways we can use new layouts, new line art, and new formats for tables and graphs to make the great wealth of data found in BYTE more accessible.

Other resolutions include giving more space to the print version of Microbytes in BYTE. Microbytes is already one of the finest print sources for microcomputer technology news anywhere, and as such, it has become immensely popular. As a result, we're expanding it by 33 percent, starting with the February issue.

A less welcome change: This marks the last issue with which Phil Lemmons is associated with BYTE. Phil worked here for 5 years, starting as a freelance author and ending as editorial director. In the course of his tenure, Phil enjoyed—and was largely responsible for—numerous successes, including the growth of BYTE to its current all-time-high circulation and the launching of BIX. Phil has left to pursue other career goals. We'll all miss him here, but no one more than I: Phil was, simply, the finest editor I have had the pleasure of working for. We wish him all the best.

The up side is that Phil has left BYTE marvelously positioned to continue bringing you the kind of solid, authoritative, and in-depth information you need—and that you've come to expect from BYTE. As the resolutions above indicate, we'll be building on those strengths to make BYTE even better.

We've made other resolutions—too many to talk about in this limited space—so they'll have to wait for another issue. But they all strike a similar note: Through 1988, we'll be working harder than ever to keep BYTE your premier source for expert information on personal computers. If a product or technology is at or near the cutting edge; if it's important and/or interesting; if it's aimed at sophisticated users; if it's genuinely useful or will become genuinely useful to you—folks who do the hand-holding, not those who need their hands held; then we'll cover it in BYTE. And we plan to cover it in a way that's just as authoritative, but more readable, more accessible, and more attractive than ever before.

That's our promise to you.

—Fred Langa
Executive Editor
(BIX name "flanga")



This software was developed and is marketed by Reality Technologies, Inc. in association with BusinessWeek. BusinessWeek's Business Advantage is a trademark of McGraw-Hill, Inc. Microsoft is a trademark of Microsoft Corp. © 1987 Maxell Corp. of America, 60 Oxford Drive, Moonachie, NJ 07074

Give yourself a business advantage. Free.

It's a special edition of BusinessWeek's Business Advantage™ software, a \$50 value, free on the 11th disk in specially marked 10-packs of Maxell MD2-D and MF2-DD disks. This business simulation software puts you at the helm of Microsoft in its battle with other titans of the software industry. It's fun, informative and free at your favorite Maxell dealer, while supplies last.



maxell
THE GOLD STANDARD

When you want to talk computers..

ATARI COMPUTERS

65XE 64K Computer.....	94.99
130XE 132K Computer.....	129.00
520STFM Monochrome System..	489.00
520STFM Color System.....	639.00
SF1224 Color Monitor.....	289.00
SF124 Mono Monitor.....	139.00



Atari 1040 Color System **\$839**

Includes: 1040ST, 1 mb RAM with 3 1/2" drive built-in, 192K ROM with TOS, Basic, ST language and color monitor.

COMMODORE COMPUTERS



Amiga 500 System

Includes: Amiga 500 CPU, 1 MB, 1080 RGB Monitor, Amiga DOS, Mouse, Kaleidoscope

Call

Commodore 128.....	259.00
Commodore 128D.....	529.00
Commodore 64C.....	179.00
64C, 1541C, 1802C Package....	599.00
128, 1571, 2002 Package.....	759.00
128D, 2002 Package.....	829.00

MACINTOSH HARDWARE

HARD DRIVES

CMS	
MacStack 20.....	599.00
Logic Array	
Pro App 20S.....	699.00
Lo Down	
Low Down 20.....	849.00
Mountain	
20 MB Hard with SCSI.....	899.00

FLOPPY DRIVES

Ehman Engineering	
800K External Floppy.....	199.00

MONITORS

Network Specialties	
Stretch Screen 20".....	1399.00

Radius

Full Page Display.....	1599.00
------------------------	---------

Sigma Designs

Laser View Display System....	1999.00
-------------------------------	---------

MEMORY BOARDS

Dove Computer	
Mac Snap Plus 2.....	249.00

Mac Memory, Inc.

Max Plus.....	319.00
---------------	--------

SCANNERS

AST	
Turbo Scan.....	1489.00

SOFTWARE

Ashton-Tate	
D:Base Mac.....	319.00
Microsoft	
Word 3.1.....	239.00

MS/DOS SYSTEMS

AST Premium Computer.....	Call
Compaq.....	from 1699.00
IBM-PS-2 Model 30.....	Call
IBM-AT Enhanced.....	Call
Leading Edge.....	from 999.00
PC-TOO 512K AT/Compat.....	from 999.00
NEC Multispeed Computer.....	1499.00



TOSHIBA T-1000 Lap Top Computer **\$889**

MULTIFUNCTION CARDS

AST

Six Pak Plus PC/XT.....	129.00
-------------------------	--------

Hercules

Color Card.....	159.00
-----------------	--------

Graphics Card Plus.....	199.00
-------------------------	--------

Fifth Generation

Logical Connection 256K.....	299.00
------------------------------	--------

Quadram

EGA Prosync.....	249.00
------------------	--------

Video 7

VEGA EGA Adapter.....	169.00
-----------------------	--------

Zuckerboard

Color Card w/Parallel.....	89.99
----------------------------	-------

MS/DOS SOFTWARE

Ashton-Tate

d-Base III +.....	399.00
-------------------	--------

5th Generation

Fastback Utility.....	89.99
-----------------------	-------

IMSI

Optimouse w/Dr. Halo.....	99.99
---------------------------	-------

Lotus

Lotus 1-2-3.....	329.00
------------------	--------

MicroPro

Professional 4.0 w/GL Demo....	239.00
--------------------------------	--------

Microstuf

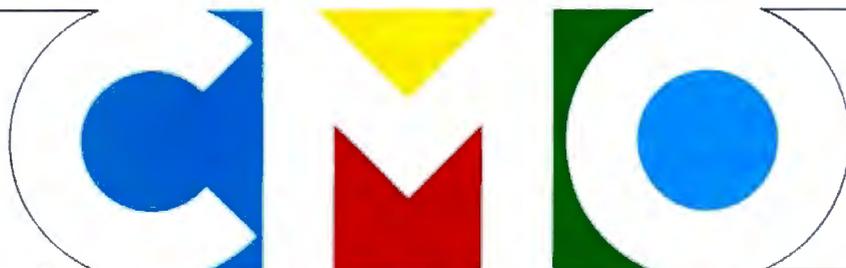
Crosstalk XVI.....	89.99
--------------------	-------

P.F.S.

First Choice (Premium).....	99.99
-----------------------------	-------

Word Perfect Corp.

Word Perfect 4.2.....	209.00
-----------------------	--------



COMPUTER MAIL ORDER

.....When you want to talk price.

DRIVES	MODEMS	PRINTERS
Atari AA314 DS/DD Disk (ST).....\$199.00 AA354 SS/DD Disk (ST)..... 119.00 SHD204 20 Mb ST Hard Drive...569.00 Commodore Amiga 1020.....189.00 Amiga 1010 3½".....219.00 1541C.....179.00 1571.....239.00 1581 3½" External.....229.00 Indus GT Disk Drive Atari XL/XE 179.00 Racore Jr. Expansion Chassis.....299.00 Seagate 20 mb ST-225 Hard Drive Kit....339.00 Supra 20 Meg Hard Drive (Amiga).....749.00 20 Meg Hard Drive (ST).....559.00 Xebec 20 mb (Amiga).....899.00	Anchor Volksmodem 1200.....\$89.99 6480 C64/128 1200 Baud.....119.00 VM520 ST520/1040 1200 Baud.129.00 Atari SX212 (ST).....89.99 Best 1200 Baud External.....119.00 Commodore Amiga 1680-1200 BPS.....169.00 CBM 1670 & C-128).....99.99 Everex Evercom 1200 Baud Internal.....99.99 Hayes Smartmodem 300.....139.99 Smartmodem 1200 External....289.00 Novation Parrot 1200.....89.99 Practical Peripherals Telecom Package.....129.00 Supra MPP-1064 AD/AA C64.....69.99 2400AT 2400 Baud Atari.....169.00	Atari 1020 XL/XE Plotter.....\$31.99 XDM121 Letter Quality.....159.00 XMM801 XL/XE Dot Matrix.....185.00 XMM804ST Dot Matrix.....179.00 Brother M-1109 100 cps, 9 pin.....199.00 M-1409 180 cps, 9 pin.....319.00 Citizen MSP-10 160 cps, 80-Column.....279.00 Premier 35 cps Daisywheel.....489.00 C.ltoh 315P 132 Column Prowriter.....549.00
MONITORS		
Amdtek Video 300 Amber Composite.....139.00 Commodore Commodore 2002.....319.00 Amiga 1080 Hi-Res Color.....299.00 Commodore 1802.....199.00		
	U.S. Robotics 1200 External \$9999 U.S. Robotics 2400 Baud Internal.....189.00	Epson EX-1000 \$499 300 cps 132 col. Epson LX-800 150 cps, 80-column..... Call FX-86E 240 cps, 80-column..... Call FX286E 240 cps, 132-column..... Call LQ-1000 24 Wire, 300 cps.....559.00 LQ-850 330 cps, 80-column..... Call LQ-1050 330 cps, 132-column..... Call Hewlett Packard Thinkjet.....379.00 NEC Pinwriter 2200 24 Wire.....379.00 Pinwriter 660 24 Wire.....459.00 Pinwriter 760 24 Wire.....679.00 Okidata Okimate 20 Color Printer.....129.00 ML-182 120 cps, 80-column.....219.00 ML-192 + 200 cps, 80-column...329.00 ML-193 + 200 cps, 132-column.479.00 Panasonic KX-1080i 144 cps, 80-column....179.00 KX-1091i 194 cps, 80-column....189.00 KX-P3131 22 cps Daisywheel....289.00 Star Micronics NX-10 120 cps, 80-column.....169.00 NX-10C 120 cps, C64 Interface.189.00 NX-15 120 cps, 132-column.....319.00 Toshiba P-321 SL 216 cps, 24-Pin.....539.00 P-351 II 300 cps, 24-Pin.....889.00
Magnavox 8502 13" Composite \$169 Magnavox 8505 RGB/Composite.....199.00 8562 RGB/Composite.....249.00 NEC JC-1402P3A Multi-Sync..... Call Princeton Graphics MAX-12 12" Amber TTL.....139.00 Taxan Model 124 12" Amber.....119.00 Thomson 4120 RGB/Composite.....249.00 Zenith ZVM 1220/1230 Composite.(ea.) 99.99	DISKETTES Maxell MD1-M SS/DD 5¼".....8.49 MD2-DM DS/DD 5¼".....9.49 MF1-DDM SS/DD 3½".....12.49 MF2-DDM DS/DD 3½".....18.49 Sony MD1D SS/DD 5¼".....6.99 MD2D DS/DD 5¼".....7.99 MFD-1DD SS/DD 3½".....11.99 MFD-2DD DS/DD 3½".....16.99 Hewlett-Packard Calculators 28C Scientific Pro.....199.99 18C Business Consultant.....139.95 12C Slim Financial.....74.99	

In the U.S.A. and in Canada

Call toll-free: 1-800-233-8950

Outside the U.S.A. call 717-327-9575, Telex 5106017898, Fax 717-327-1217

Educational, Governmental and Corporate Organizations call toll-free 1-800-221-4283

CMO. 477 East Third Street, Dept. A1, Williamsport, PA 17701

ALL MAJOR CREDIT CARDS ACCEPTED.

POLICY: Add 3% (minimum \$7.00) shipping and handling. Larger shipments may require additional charges. Personal and company checks require 3 weeks to clear. For faster delivery use your credit card or send cashier's check or bank money order. Pennsylvania residents add 6% sales tax. All prices are U.S.A. prices and are subject to change and all items are subject to availability. Defective software will be replaced with the same item only. Hardware will be replaced or repaired at our discretion within the terms and limits of the manufacturer's warranty. We cannot guarantee compatibility. All sales are final and returned shipments are subject to a restocking fee.

MICROBYTES

*Staff-written highlights of developments
in technology and the microcomputer industry.*

Price of Floppies Doesn't Guarantee Quality, Testers Say

Despite wide variations in the cost and quality of floppy disks, there's no apparent relationship between the two, according to a company that has done a comparative study of 5¼-inch floppy disks. Memory Control Technology Corp. (Omaha, NE), which manufactures disk-testing equipment and performs disk duplication services for software publishers, analyzed 18 brands of disks over the past few months. According to Jerry Korth, president of the company, the study was undertaken because of suspicions of declining quality in 5¼-inch floppies. Although many disks performed admirably, the results of the study proved those suspicions of a decline in disk quality to be true.

The company bought 10 boxes of 10 disks each at various locations throughout the country to ensure that it was using a representative sample of each brand. Prices varied tremendously, sometimes by almost 300 percent for the same brand. For example, Dysan disks were sold for both \$23.90 and \$8.40 for a box of 10 disks. The lowest price was \$4.40 for Xidex-Precision disks.

Visual quality control also varied considerably. Disks from four manufacturers (Fuji, Kodak, Memorex, and TDK) had no visual defects. The remaining companies had disks with such defects as frayed and visible liners, jacket deformities, and contamination. One company's disks had three major defects: One disk jacket enclosed two disks, and two other disk jackets enclosed hard-sectored disks. Disks in

another company's box were covered with what looked like human hair.

Memory Control Technology applied two standard ANSI recording tests to the disks. Only seven companies—BASF, JVC, Kodak, Memorex, Nashua, Sony, and 3M—had all their disks pass the "missing bit" test. Only five—BASF, Goldstar, JVC, Memorex, and TDK—had all their disks pass the "extra bit" test. No company had more than three disks fail the missing-bit test, but one company had 27 fail the extra-bit test. Other tests involved amplitude, modulation, resolution, and wear resistance. According to Korth, all disks performed outstandingly in these tests.

The final test involved formatting the disks on an IBM PC under optimal conditions. Of the 18 companies, 13 had 100 percent of their disks format without any bad sectors. Korth mentioned that this percentage is probably higher than what many people have experienced, because the PC used for the test was optimized for the lowest failure rate possible. The 13 companies whose disks passed this test were BASF, Fuji, Goldstar, JVC, Kodak, Maxell, Memorex, Nashua, Polaroid, Sentinel, Sony, Verbatim, and Xidex.

Korth said that predatory pricing policies of some disk manufacturers are having a deleterious effect on disk quality. Despite the fact that his company purchases many disks each year, Korth would prefer prices to be higher in the hope that quality would be more tightly controlled.

Optical Coprocessor Converts Raster to ASCII

While it was the hand-held optical scanner that can recognize typeset fonts that brought attention to TransImage Corp. (Sunnyvale, CA), the company's announcement that it will make its 68000-based optical-character-recognition (OCR) coprocessor board available to OEMs may have a bigger effect on image-processing applications.

At the heart of the board, which is currently an add-in card for the IBM

PC, are custom gate arrays that attend to tasks such as character processing and classification. Character processing is accomplished in a chip called the Table Processor that uses proprietary micro-coded "thinning" algorithms to essentially "peel away" the features of the character until an identifiable shape can be extracted. Two other chips take care of transforming the bit-level image data

continued

Nanobytes

Engineers at Chips & Technologies (San Jose, CA) "have become real fans" of IBM's Micro Channel Architecture, spokesperson Raj Jaswa told Microbytes Daily. "Our viewpoint is that the Micro Channel market will really take off," Jaswa said, predicting significant shipments of PS/2s and compatibles in the latter half of 1988. "With an average of three adapters per system, we see the market for adapters by 1990 as being in excess of 15 million units." . . . Lotus Development Corp. (Cambridge, MA) just says no to Windows/386.

While Microsoft's Windows/386 has been hailed as a breakthrough for users wanting multi-tasking and a graphical interface on 80386 machines, Lotus has no plans to support it with 1-2-3.

"Trying to shoehorn 1-2-3 into Windows will give sluggish performance," said Lotus spokesperson Greg Jarboe. Lotus users can get a graphical interface with the version of 1-2-3 that will run under OS/2. . . . Jim Harris, president of Hercules (Berkeley, CA), said the graphics-card maker expects to have a graphics board for the Mac II by next summer. The company recently said it would incorporate a

TOPS interface to AppleTalk networks in a new version of its Graphics Card Plus. . . . Rockwell (Newport Beach, CA) says its R9696DP 9600-bps modem board will enable modem developers to implement the full CCITT V.32 standard. The company claims the board, which is being sold to OEMs, represents a big step in full-duplex, dial-up modem technology. "We expect this product to lead to a new generation of high-speed stand-alone and PC-card modems," said Bill Baker, a Rockwell vice president. Until

continued

now, mass-market 9600-bps modems, such as those from Hayes and USRobotics, have only emulated a true 9600-bps transfer rate. . . . Tired of hitting keys or moving mice? **Very Vivid** (Toronto, Ontario) has come up with an alternative interface for Commodore's **Amiga** that consists of an Amiga 1000, a television camera, a digitizer board, and software. The camera is aimed at the user, and the system displays a two-color image of the user superimposed over a set of icons. The user chooses an icon by moving his or her image over that icon. The Midivision software is available now for \$295. . . . The next frontier for E-mail developers, according to a speaker at a recent confab on **electronic messaging**, will be in the area of directories. "Standard directories will emerge so that you will know who is out there and how to route mail to them," said Peter Westwood of **Sydney Development Corp.** (Vancouver, B.C.). Westwood also said that problems of interconnection are not so problematic anymore. "Eighty-five percent of all systems can now be connected, and the islands of communications have disappeared." . . . The souping up of microcomputers has caused a quandary for developers of **turnkey CAD systems** whose products are dependent on a particular hardware system, says Ken Ledeen, president of CAD software house **Sigma Design** (Englewood, CO). Customers want to first choose the software they need and then buy the hardware, he said. "Turnkey CAD developers are in a difficult situation because hardware is changing so rapidly and dramatically," Ledeen said. . . . Practical **computer-aided software engineering (CASE)** tools might be a few years away, but some members of the industry are warning now that companies had better start investing in those tools if they want to be competitive. "If you consider that in about 10 years we'll be conversing with our computers, think about the enormous software development that will be required," Scott McNealy, president of **Sun Microsystems**

continued

into table image data. TransImage chairman and architect Jim Faulkerson said that prototypes of these and four other custom chips required fourteen 10-by-10-inch VME boards in a VAX development system, and it took 300 seconds to identify a single character. With the custom gate arrays and algorithms, the TransImage system can recognize 40 characters per second.

When analyzing a character, the coprocessor board operates at an image-acquisition rate of 8192 pixels every 1/100th second at a resolution of 1000 lines per inch. Faulkerson minimized the effect on performance of more powerful microprocessors, like the Motorola 68020 or the Texas Instruments TMS 34010, stating that the recognition-intensive tasks are handled by the custom gate arrays. Certainly the current high costs of other chips would not justify the performance improvements. Instead, TransImage will focus

on adding new symbols to the table chips in the near future.

What may be significant to image-processing developers is that virtually any raster image stored on disk can be converted to ASCII data by "running" the image through the OCR card. Those raster images can be generated by scanning a document or by creating the images with a drawing program like MacPaint, PC Paintbrush, and others. Developers, of course, would have to write the software to the conversion, which should include operations such as character scale.

Although the initial coprocessor board is configured to work with the PC bus, a custom 8-bit bidirectional system interface chip on the board can be replaced by a chip to interface with other bus architectures—Micro Channel, SCSI, and so on. The board is currently available to OEMs at the single-quantity price of \$1200 per unit.

E-Mail Growing; Users Sending Millions of Messages Monthly

Use of electronic mail systems shows no signs of tapering off, said an industry analyst at a recent Electronic Mail Association conference. According to Walter Ulrich, a partner in Coopers & Lybrand's technology consulting firm (Houston, TX), more than 150 million electronic messages are sent every month by more than 5 million E-mail users in the U.S. alone. Ulrich said 74 percent of the major corporations in the country currently have E-mail systems in place (and another 14 percent plan on installing them within the next 12 months); 80 percent of the professional staff of those companies use E-mail on a daily basis, he said.

"E-mail usage is greater than expected," Ulrich said, "and with the network infrastructure already in place and the cost per message declining, E-mail should continue to proliferate." Ulrich claimed that E-mail is the primary application large companies plan on adopting, outdistancing voice mail, electronic

(desktop) publishing, and video conferencing. He added that installation of local area networks (LANs) has aided in the proliferation of E-mail systems. Ulrich said that the current 150,000 LAN sites (with 3 million nodes) is expected to increase to over 3 million sites by 1990 and that E-mail will be the major application used in those networks.

The predominant trend in the future, Ulrich said, will be the linking of multinational companies with their overseas affiliates. "We need to interconnect worldwide and focus on the international market," he said. Interconnection across competing public electronic systems remains one of the critical issues facing E-mail vendors, he cautioned, acknowledging that users will pay a premium for sending messages across systems. He predicted that by 1991, the total E-mail business will be worth nearly \$3 billion, and "if that isn't incentive for interconnecting, I don't know what is."

How Do You Clone a PS/2? Very Carefully

Although it has announced board-level products that can emulate the logic chips in the IBM PS/2 Models 50 and 60, Western Digital (Irvine, CA) is proceeding very cautiously in its cloning of PS/2 systems. According to Ed Marinaro, chief operating officer at the company, it is being very careful to

avoid legal entanglements with IBM over copyrights, trade secrets, or patents related to the PS/2 series.

Western Digital used three sets of engineers to design gate-array chips that emulate the IBM systems. A "forward-engineering" group was given a set of

continued



What we have here is a failure to communicate.

Until now.

Ven-Tel would like to congratulate all IBM PS/2™ users. Now let's talk. Because a complete communications system for the IBM PS/2 has arrived.

Introducing the Ven-Tel 24/2™ Internal Modem for IBM PS/2 models 50, 60 and 80. This 2400 bps modem is fully Micro Channel™ and OS/2™ compatible. It's automatically configured by the system, so no option switches are needed. And, as an option, you can buy the 24/2 bundled with CrosstalkXVI® software.



Like all Ven-Tel 2400 & 1200 bps modems, quality and reliability are guaranteed by a *free* five-year warranty.

The new Ven-Tel 24/2 Internal Modem is in stock now. For the name of your nearest Ven-Tel dealer or distributor, call 1-800-538-5121.

And start communicating.

Ven-Tel
Modems

Micro Channel, PS/2 and OS/2 are registered trademarks of IBM Corporation. Crosstalk XVI is a registered trademark of DCA.

(Mountain View, CA), told a press conference at which Sun introduced its Network Software Environment. Sun cofounder Bill Joy was a little more aggressive in his exhortations. "It's time to recapitalize software development, throw out those minicomputers, and give [programmers] reasonable computers and new development tools," Joy said. . . . Joy also took a swipe at closed architectures. "When the next good idea comes along, you won't be able to use it in a closed operating system," he said. He predicted that Unix will grab half the market for operating systems on desktop computers. Developers who scoff at Unix will regret it, he said. "It's like all those developers who ignored the Macintosh. Now that it's starting to sell well, all they can do is stand on the sidelines and watch."

specifications and asked to design a system that would meet them. The other two groups reverse-engineered the IBM systems. The results of each group were closely compared with each other. The final design, however, most closely resembles the efforts of the forward-engineering group. According to Bill Frank, a senior vice president at Western Digital, the system has a much different architecture than IBM's and uses 63 additional devices.

As for the patents that IBM reportedly has for its Micro Channel Architecture, Western Digital says it is addressing this issue by engaging in a patent exchange with IBM.

For the job of emulating IBM's BIOS chips, Western Digital is taking a slightly different approach. Here, the company has two sets of developers, one a group of analysts and specification writers and the other a group of code developers, called "virgins." Both groups are separated by a group of managers. The developer groups cannot directly communicate with each other, but

they can talk with the managers; all communications must be in writing and time-stamped.

Western Digital says it is spending \$10 million on the development of PS/2-compatible systems. Although it has announced chips that can emulate almost all the functions of the PS/2 Models 50 and 60, the company says it will not announce a compatible BIOS until sometime next year.

Western Digital's Paradise Systems division says it was able to get a head start on building a VGA-compatible chip by watching certain market events. For example, IBM's large purchase last year of 31.5-kilohertz monitors from a Japanese company gave some idea as to the features of the new graphics protocol Big Blue would use. But Western Digital's Faraday division had no such hints about the features of the PS/2s; company officials say they had to wait until they could buy a machine, which they did at 12:01 in the morning of the first day the computers became available.

C&T Chip Could Mean Cheaper Controllers

A new 3270 protocol controller chip from Chips & Technologies (San Jose, CA) could drastically lower the end-user price of 3270 emulation cards used in personal computers for micro-to-mainframe connections.

Microcomputer add-in boards that are designed around the integrated CHIPSLink 82C570 microprocessor can be built with as few as seven chips, said C&T product manager Pat Chiumiento. That's far fewer than the number of chips that are on boards like the

DCA IRMA card, which has approximately 45 components.

Chiumiento showed Microbytes Daily a seven-chip working card built by C&T as a development tool. He speculated that street prices for such a card will probably be in the range of \$200 to \$250, which is much lower than the current retail price of nearly \$1200 for IRMA cards.

The C&T chip itself could be considered a microprocessor, since it has an on-chip sequence controller and arith-

metic and logic unit enabling it to run at 4.7 million instructions per second. On one end, the 82C570 is compatible with both IRMA and IBM hardware and software environments; on the other end, it is compatible with the PC XT/AT bus. When it is used in conjunction with a companion chip, the 82C574, the 82C570 is also Micro Channel-compatible. The chip can be customized via external microcode for special applications or product differentiation.

Borland Says New Debugger Signals "A New Generation"

Borland International (Scotts Valley, CA) will soon release a debugger for its Turbo C compiler that the company says will be the first of "a new generation of debuggers." What makes the upcoming package different from current debuggers, according to spokesperson David Intersimone, is that it will combine the properties of source code and data debuggers, allowing programmers to see the actual data itself, not just pointers to the data.

"Source-level data debugging is completely different from anything else," he said. "The concept of looking at the data types is really unique." Other debugger features, said Intersimone, include record-and-playback capabilities and a "log" that records what changes were made to a listing, when those changes were made, and who made them. The debugger will also provide contact-sensitive help and overlapping, multiple-source file

windows.

"These are the sort of tools that came from our internal needs," Intersimone explained. "We analyzed what tools we need and what we do when developing products, and we built these tools into the debugger."

The initial implementations of the debugger will support Borland's Turbo C package, but Intersimone indicated that future versions will support Turbo Pascal and Turbo Basic.

TECHNOLOGY NEWS WANTED. *The news staff at BYTE is always interested in hearing about new technological and scientific developments that might have an impact on microcomputers and the people who use them. We also want to keep track of innovative uses of that technology. If you know of advances or projects that involve research relevant to microcomputing and want to share that information, please contact us. Call the Microbytes staff at (603) 924-9281, send mail on BIX to Microbytes, or write to us at One Phoenix Mill Lane, Peterborough, NH 03458.*

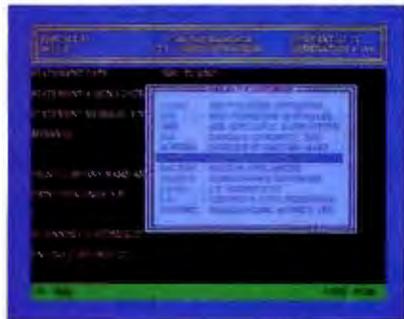
WE'VE JUST MADE THE BEST EVEN

Peachtree Complete II: The Business Accounting System

Better

New

The success story of Peachtree Complete (now with over 200,000 users) continues with the newest member of the Peachtree family, **Peachtree Complete II**. Much more than just an update, Complete II builds upon the comprehensive features that have made Peachtree the leader in small business accounting software for nearly ten years. We've added many exciting new features and designed state-of-the-art methods for using the packages. The result—all eight modules are even more powerful and easy to use, yet still priced at just **\$199**—a 96% price reduction from the original \$4,800.



Windows and Pop-Up Menus. Complete II is designed for user convenience. Use the cursor throughout the system to make easy "point-and-shoot" selections. If you can't remember a customer or account number while using a program, simply open a window and scroll through your customer list or chart of accounts. Select the information you're looking for directly from the table!

Short-Cut Keys. We speed you from one function to another without the time-consuming task of manually passing through multiple menus.

Smart HELP. If you get stuck, the same function key will always bring HELP to your rescue with pop-up windows of information that relate to your individual trouble spot at both program and field levels.

Quick-and-Easy Error Handling. Complete II traps errors and gives a plain-English description of the problem along with suggested solutions.

Range Printing. Print all information on a report or select a specific range of information for print out. A great feature for restarting long reports or partial printing of certain sections.

Easiest Installation Ever. Enter your company's information once and it is reflected throughout the system. Complete II includes a separate Installation Guide, basic Accounting Primer, eight-volume Reference Library and extensive Tutorials on each package — all at no extra charge!

Ideal for Service Businesses. Enter information free form on service invoices or store pre-defined paragraphs of up to 160 characters. Enjoy full editing capabilities at time of invoice entry.

Eight Integrated Software Modules

- General Ledger
- Accounts Receivable
- Invoicing
- Accounts Payable
- Inventory
- Fixed Assets
- Job Cost
- Payroll

Complete II includes eight software modules that may be integrated or installed individually and may be distributed among separate computers. Install the most critical modules initially; add others later.

COMPARE FEATURE FOR FEATURE

System-Wide Features

- NEW Over 450 reports
- NEW Unlimited number of companies and consolidations
- NEW Automatic menu-driven conversion of your existing Peachtree Business Accounting data files
- NEW Increased numeric capacities to \$999,999,999.99 in key areas

General Ledger

- Chart of Accounts includes 76 suggested and 26,000 user-defined accounts
- NEW 1 to 13 user-defined fiscal periods
- Repeating journal entries
- NEW Financial statement comparisons may include current period and year-to-date with budget and/or prior period comparison
- NEW Reversing journal entries

Accounts Receivable/Invoicing

- Open item or balance forward customers
- NEW Up to 14,400 customers
- Supports partial payments
- NEW User-defined terms codes and aging periods
- NEW Automatic transactions with monthly, bi-monthly, quarterly, semi-annual, and annual frequency options

Accounts Payable

- Up to 14,400 vendors
- NEW Partial payments of invoices
- Cash requirements forecasting by due date
- NEW User-defined billing cycle on automatic invoices
- Checks printed with unlimited invoice listing on stub
- NEW Ability to void and reprint checks

Inventory

- Supports average, last purchase and standard costing methods
- Up to 19,500 inventory items (SKUs)
- NEW Automatic price change on multiple items by percent or amount

Fixed Assets

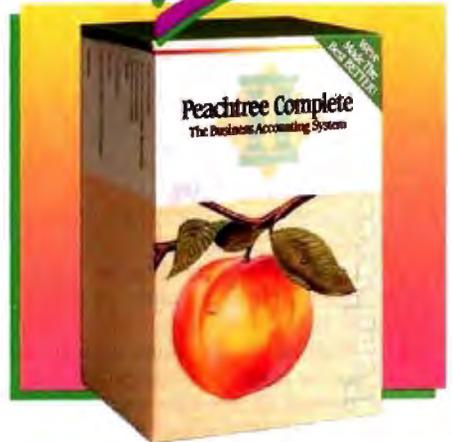
- Handles 13,000 assets and 13 methods of depreciation
- NEW Updated to handle current tax laws

Job Cost

- Tracks costs and profitability on a job-by-job basis
- Compares estimated costs with actual costs for specific tasks

Payroll

- Built-in current year federal, state, city and county tax tables for all 50 states with automatic calculation capabilities
- Automatic payroll processing supporting hourly, salaried, commission or draw-against-commission pay types
- NEW New tax laws incorporated into program
- Processes up to 3,900 employees
- NEW Supports Cafeteria Plan
- User modifiable tax tables with updates published regularly by Peachtree Software
- NEW Printed and magnetic media W-2s generated automatically



Limited Time Offer: Special Upgrade for Current Customers

For 90 days (through December 1987), Peachtree Complete registered users can purchase a Complete II upgrade with all the new features and enhancements for only \$99*. Call today with your Peachtree Complete serial number: 1-800-822-2821 or 1-800-247-3224.

Buy Forms Direct from Peachtree

Enjoy the convenience and economy of buying your forms directly from Peachtree Software with guaranteed compatibility. Call 1-800-553-6485 to order forms. In Ohio, call 1-513-973-0110.

Money-Back Guarantee

When you purchase Peachtree Complete II directly from Peachtree Software, you're protected with a 30-Day Money Back Guarantee. If you're not satisfied, simply return the product in saleable condition within 30 days and your purchase price will be promptly refunded. (A \$20 restocking fee will be charged if disk bag is opened.)

And, of course, Complete II is backed by Peachtree Software's famous technical support, labeled by *InfoWorld* as "the finest in the industry". Technical assistance is available for \$1 per minute with a 20-minute minimum via a toll-free telephone number. You only pay for what you need, without unnecessary support contracts.

Hardware Specifications

Requires PC/MS-DOS version 2.0 or higher with 384K of usable memory with a minimum 10 MB hard disk. For use with the IBM® PC, PC XT, PC AT, Personal System/2™ and compatibles. 3 1/2" media optionally available. IBM is a registered trademark and Personal System/2 is a trademark of International Business Machines. Not copy protected

* Plus \$12.50 shipping and handling. Money-back guarantee does not apply to upgrades.

To Order by Mail, Send \$199 Plus \$12.50 Shipping and Handling to:
(In Georgia, add applicable sales tax.)

Peachtree Software

A Member of the Intelligent Systems Family
4355 Shackleford Rd., Dept. BYT
Norcross, GA 30093

Call Now to Order
or for a Dealer Near You
1-800-247-3224
In Georgia, call 1-404-564-5800



Still Only **\$199**
Complete

LETTERS

and Review Feedback

On the Epson GQ-3500

In response to the review "Laser Printer Times Four" by Wayne Rash Jr. (October 1987), I would like to clarify some incorrectly stated features regarding the Epson GQ-3500 laser printer.

Mr. Rash states, "Without emulation cards, you're stuck with Epson LQ emulation, and not all software supports it." In fact, the GQ-3500 comes with built-in code sets for the Epson Page Printer and Epson LQ printers, as well as line-printer emulation.

In addition to the built-in code sets, there are optional emulation cards for the Diablo 630 and the Hewlett-Packard LaserJet Plus. The Epson GQ-3500 is supported by leading software packages, including Framework II under either the Epson Page Printer or LQ emulation.

Mr. Rash further states, "Many printer functions must be set by software. This includes normal printer operations, plus those operations unique to laser printers, such as printing multiple copies." The fact is that, through the use of the GQ-3500's SelecType control panel, the user can select paper size, number of copies, print orientation, font, international character sets, character pitch, line pitch, and weight.

Dave Thompson
Marketing Support Engineer
Epson America Inc.
Torrance, CA

Epson may well be correct in stating that the GQ-3500 is now supported by a number of widely available software packages. That was not the case when the printer was provided to me, and the company was also not able to provide the emulation modules that are now standard with the machine. Because these capabilities were not available, they could not be tested as part of the benchmarks.

—Wayne Rash Jr.

Wayne Rash Jr.'s review of the Hewlett-Packard LaserJet Series II states that "the manual fails to mention that you have to turn the printer off and back on again for the [function and font] choices to take effect." What the manual does mention is that you must reset the printer. Pages 2 through 18 of the user's manual explain the procedure completely.

You simply take the printer off-line,

then hold the Continue/Reset key down until Reset appears on the LCD panel. This also works when the printer gets confused by either software or operator problems.

John W. Sawyer
Allentown, PA

Predefined vs. Customized Formats

I read with interest Jonathan Robie's October 1987 review entitled "Three C Language Screen-Utility Packages for PCs" and must congratulate him on a job well done. But there is a point that some readers may overlook or find confusing.

Mr. Robie points out the limitations that arise from predefined formats and other vendor assumptions about the user interface. He then goes on to suggest that Vitamin C is limiting because it avoids predefined assumptions by allowing programmer-supplied routines to be inserted in key places for customized operation. He criticizes both flexibility and inflexibility, and in doing so he presents a contradiction that may leave some readers confused.

Realizing that it is virtually impossible to please all the programmers all the time, we designed Vitamin C with various standard options, behaviors, and data types. This allows typical applications to rely upon these predefined elements and be developed quickly. We also created a mechanism whereby programmer-supplied routines can be installed to customize Vitamin C for virtually any application need. This adds the flexibility to create a customized interface.

For the record, a generic version of Vitamin C is also available for Unix and Xenix environments. It will run on virtually any host machine and is not limited to XT's and AT's.

Jeff Betts
President, Creative Programming
Consultants Inc.
Carrollton, TX

It is important to let users extend or modify the data-entry procedures. Very general routines offer this flexibility but require more work from the programmer than routines designed for more specific tasks. All three packages reviewed, including Vitamin C, have a robust set of general routines and use these as the basis for more specific routines. This

makes it possible to have a large number of very specific routines without limiting the programmer who has special needs.

—Jonathan Robie

Just in Time

Thank you for the In Depth articles on workstations (November 1987). I work in purchasing for the New York state government, and the professors and students at our numerous state universities have been clamoring for a workstation contract. Your side-by-side comparisons and history of this field could not have been more timely.

Lynn Ellsworth
Albany, NY

Calculating Points

In reply to Jean-François Colonna (Letters, August 1987, page 16), I, too, wondered about the effect of truncating numbers in Peter B. Schroeder's "Plotting the Mandelbrot Set." I have written machine-code arithmetic for speed using 40-bit fixed-point numbers, which produces results comparable to those from other computers and programs.

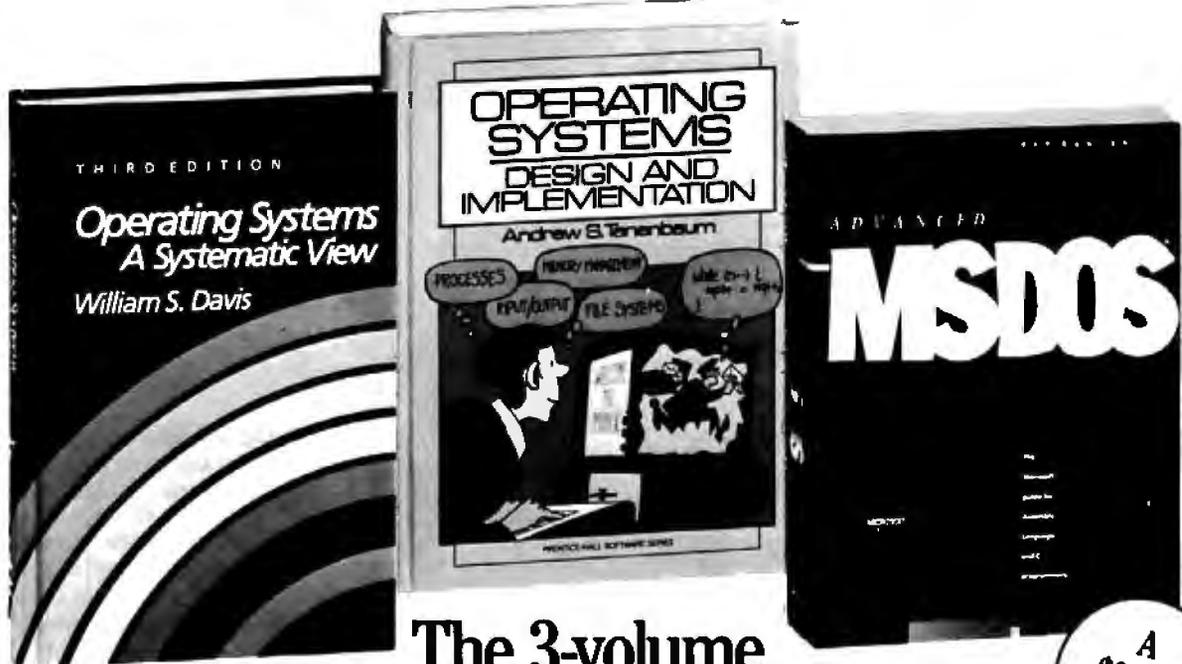
The choice of pixel spacing has a much greater effect. I find it truly remarkable that although a pixel is a square of one unit side, the calculation is performed for a point of zero area situated at one corner. It is possible to calculate a greatly magnified picture that, if suitably chosen, is full of fine detail. When the same area is calculated with a coarser pixel spacing, the general form of the picture is the same even though the points of calculation fall more or less randomly against the pattern. I believe this is due to the connected nature of the set, along with the characteristic that points adjacent to the set have

continued

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 cannot be returned to authors. Generally, it takes four months from the time BYTE receives a letter until it is published.

Together they comprise a state-of-the-art encyclopedia of operating systems techniques, ideas, and know-how ...



The 3-volume OPERATING SYSTEMS SET is yours for only \$4.95

A
\$93.85
value

as your introduction to the LIBRARY OF COMPUTER AND INFORMATION SCIENCES
You simply agree to buy three more books—at handsome discounts—within the next 12 months.

OPERATING SYSTEMS

A Systematic View
Third Edition
William S. Davis

This invaluable sourcebook gives you a complete overview of hardware interfaces and the efficient management of computer resources.

Wide-ranging, detailed, and comprehensive, it focuses on interactive processing with detailed coverage of command and job control languages, and individual chapters on the operating system internals for IBM DOS/VSE, OS/VSI and OS/VS2, UNIX, VM, and MS-DOS.

Publisher's price: \$33.95

OPERATING SYSTEMS
Design and Implementation
Andrew S. Tanenbaum

"Probably the best book on the subject ... well-written, well-organized ... The author's style is a refreshing change from what one usually finds in computer science texts."
—*Eastgate Systems*

This thorough introduction to operating system design and implementation is packed with practical descriptions of principles and techniques, including examples from such commercial operating systems as UNIX, MS-DOS, CP/M, MULTICS, and more.

800 pages long, it covers processes, input/output, memory management, and file systems, plus a complete implementation of a UNIX-like operating system and 300 pages of source code.

Publisher's price: \$36.95

ADVANCED MS-DOS
The Microsoft Guide for Assembly Language and C Programmers
Ray Duncan

"A good example of what a reference manual should be ... Duncan's strengths include a style that is at once easy to read, a thorough coverage of the subject matter heretofore unknown, and the frequent use of examples in the form of assembly language program and code fragments ... contains a great deal of valuable information I know I will frequently refer to." John D. Unger—*BYTE*

Written by a *Dr. Dobbs Journal* columnist, this definitive source of high-level MS-DOS information covers everything from directories and memory allocation to the MS-DOS EXEC function, installable device drivers, and more. It features a unique 130-page guide to each of the system interrupts.

Publisher's price: \$22.95

4 Good Reasons to Join

- 1. The Finest Books.** Of the hundreds of books submitted to us each year, only the very finest are selected and offered. Moreover, our books are always of equal quality to publishers' editions, *never* economy editions.
- 2. Big Savings.** In addition to getting the three-volume Operating Systems Set for only \$4.95 when you join, you keep saving substantially, up to 30% and occasionally even more. (For example, your total savings as a trial member—including this introductory offer—can easily be over 50%. That's like getting every other book free!)
- 3. Bonus Books.** Also, you will immediately become eligible to participate in our Bonus Book Plan, with savings of 65% off the publishers' prices.
- 4. Convenient Service.** At 3-4 week intervals (16 times per year), you will receive The Library of Computer and Information Sciences News, describing the Main Selection and Alternate Selections, together with a dated reply card. If you want the Main Selection, do nothing, and it will be sent to you automati-

cally. If you prefer another selection, or no book at all, simply indicate your choice on the card and return it by the date specified. You will have at least 10 days to decide. If, because of late mail delivery of the News, you should receive a book you do not want, we guarantee return postage.

The Library of Computer and Information Sciences is the oldest, largest book club especially designed for computer professionals. In the incredibly fast-moving world of data processing, where up-to-the-moment knowledge is essential, we make it easy to keep totally informed on all areas of the information sciences. What's more, our selections offer you discounts of up to 30% or more off publishers' prices.

If reply card is missing, please write to The Library of Computer and Information Sciences, Dept. 7-ER5-00856, Riverside, NJ, 08075, for membership information and an application.

Byte 1/88

ANTHROCART.™

Compact... a key reason why people like the AnthroCart. A lot of hardware arranged in a little space. Stacked up, not out. Sturdy enough to keep it together.

AnthroCart. High-tech furniture for high-tech equipment. Space saver. Mobile. Rugged.

The AnthroCart is designed for tight spaces. Designed so your workspace is as slick as your hardware.

Call us: 800-325-3841



Supports up to 150 lbs.
All steel frame construction
5½ square foot footprint



Anthro Corporation
Technology Furniture
3221 N.W. Yeon St.
Portland, OR 97210
503-241 7114

Anthro Corporation is a wholly owned subsidiary of Tektronix, Inc. Anthro is a registered trademark of Anthro Corporation

LETTERS

large escape times that decrease steadily as the point is moved away. A point may miss the set, but its value will reflect the proximity or other features of the set.

I also wrote a program to run on a Z80 that can be used to calculate a single point at any level of precision up to 250 decimal digits in floating-point format. At a clock frequency of 6 MHz, it does 5 divides, or 6 products per second, at maximum precision, so it's definitely not for display work.

J. Keith Wood
Liverpool, U.K.

Satisfying the Skeptic

The heuristic algorithm Peter Wayner describes in his article "Zero-Knowledge Proofs" (October 1987) is designed to satisfy a skeptic of the identity of the prover without revealing secret knowledge to the skeptic. This condition is much stronger than that required by most of the applications where Mr. Wayner suggests it might profitably be used. For example, a program verifying the identity of a user can know the password; this information must be concealed only from all witnesses to the exchange.

For this lesser purpose, it is not necessary to use a one-way function, just an interactive exchange. A simple algorithm would have the skeptical program display four random digits and invite the prover to reply with a single digit. The correct response would be the result of a simple computation: the sum, difference, product, and/or quotient of some of the digits displayed. This exchange could be repeated until the skeptic was satisfied.

Often in programming we must choose between implementing certain logic in data or in code. This technique is the code analog of a password: The password is a simple expression like "the product of the first and third digits mod 10" or "twice the fourth digit less the third." Since no witness would see the same four digits when he or she tried to sign on dishonestly, knowing the response to any single set of four digits would be of no help.

Peter Cyrus
New York, NY

I read Peter Wayner's "Zero-Knowledge Proofs" with interest. Another approach to this problem is to use encryption. Suppose the user and the computer agree upon an encryption standard and password. Then when the user tries to log in, the computer can present him or her with a random list of words, and the user can encrypt them using the agreed algorithm. So, for example, the computer says DOG and the user encrypts it and replies with

continued



CITIZEN

WE HAVE MET THE COMPETITION. AND IT IS US.

Some nine-wire dot matrix printers hide from the competition. Not the new Citizen™ MSP-50.

With the ability to handle all types of paper, top or bottom feed, and a convertible push or pull tractor, it figured it was the best. However, another printer had designs on the title.

So the MSP-50 relied on its high speed, up to 300 cps, to crush the competition. But it wasn't enough. Feature by feature these two contenders battled. Quiet mode. 240 dpi graphics. Color capability. Choice of fonts. Front panel feature controls. Even compatibility with most major software. They were equal. Finally, the MSP-50 put its 80-column print width on the line. Unfortunately, the other machine offered 136.

What was the other machine? The new Citizen MSP-55. Which just goes to prove that if you want to be considered one of the best, you have to be a Citizen in good standing.

For more information call 1-800-556-1234, Ext. 34. In California call 1-800-441-2345, Ext. 34.

©1987 Citizen America Corporation.
Citizen and the Citizen logo are trademarks of
Citizen Watch Co., Ltd.

 **CITIZEN**
Printers that run like clockwork.

OUTSTANDING SOFTWARE

For IBM PCs and Compatibles

\$3.50 PER DISK**\$3.00** PER DISK

Small Quantities

For Ten or More

SHIPPED WITHIN 24 HOURS!
 Satisfaction Guaranteed or Money Back!

- BUSINESS 1**—EZ-FORMS business form generation, completion and printing program.
- CAD 3**—The PC-Flow 1.0 computer aided flow-chart generation program. Color graphics required.
- COMM 4a,b,c,d,e**—(5 disks) Join the world of sysops with RBBS Bulletin Board System 14.1D.
- DATABASE 1a,b**—(2 disks) File Express 3.8 menu driven general purpose database manager.
- EDUCATION 1**—Interactive DOS tutorial for new PC users. Makes learning DOS painless.
- FINANCE 1a,b**—(2 disks) PC Accountant 2.0 personal bookkeeping and finance management.
- GAMES 1**—3-D Pacman, Kong, Spacewar, Janit-Joe, futuristic Flightmare and more. Color required.
- GAMES 2**—Qubert, Pango, Centipede, dungeons and dragons style Zoarre, etc. Color req.
- GAMES 3**—Blackjack with customizable rules, Armchair Quarterback (you call plays), and more.
- GAMES 4**—Star Trek, the Castle adventure game, and the original Colossal Caves Adventure.
- GAMES 5**—The Hack adventure game from the universities. Like Rogue, only much richer.
- GAMES 6**—Pinball, Othello, Dragons, Sopwith (fly a Sopwith Camel) and more. Color required.
- INFO 1a,b**—(2 disks) Cooking recipes database with keyword/ingredient retrieval. Add your own.
- MUSIC 2a,b**—(2 disks) PianoMan 3.0 polyphonic music recording and playback program.
- ORGANIZER 1**—DeskTeam, a Sidekick clone, and the Judy personal calendar program.
- PRINTER 1**—Resident print control and font utility, intelligent spooler, banner maker, and more.
- SIMULATION 1**—Maze making program, MIT's Life simulation, starfields, etc. Color graphics req.
- UTILITIES 1**—A collection of invaluable general purpose DOS utilities. An absolute must for all.
- UTILITIES 2**—More invaluable DOS utilities including screen burnout, ram disk, and more.
- UTILITIES 3**—A comprehensive set of debugging and diagnostic utilities for monitoring your computer.

NEW RELEASES UPDATES

- BUSINESS 2**—Expressgraph business graphics. Chart your data and find trends. Color graphics req.
- CAD 1a,b**—(2 disks) Fingerprint 1.2 advanced painting and Altamira object oriented design. Color.
- CAD 2a,b**—(2 disks) DanCad3d, an advanced 2D/3D drafting program w/animation. 640K, color.
- COMM 2a,b**—(2 disks) Procomm 2.42, an excellent modern program with terminal emulation.
- EDUCATION 3**—PC-Fastype 120 typing tutor. Ideal for beginners and advanced students alike.
- FINANCES 3a,b**—(2 disks) Express Calc 3.12, a powerful and user friendly spreadsheet program.
- GAMES 8**—Striker helicopter attack and Risk, the game of world domination. Color required.
- GAMES 12**—Backgammon (play the computer) and Wheel of Fortune based on the gameshow.
- GRAPHICS 1**—Record and play back screen images! Excellent for demo, etc. Color required.
- GRAPHICS 2a,b,c**—(3 disks) An excellent 3-D surface modelling and shading program. Color.
- INFO 2a,b**—(2 disks) Zip-Phone, national areacode/prefix to zip-code cross reference.
- LANGUAGE 3a,b**—(2 disks) The A86 3.09 macro assembler and debugger for 8088/86/286s.
- SHELL 4a,b**—(2 disks) Automenu and HDM II 4.04 hard disk prog. for custom full-screen menus.
- UTILITIES 5**—Hard disk utilities for verifying, formatting, parking and optimizing your disk drives.
- UTILITIES 6**—Advanced utilities including Mark/Release (remove resident progs w/o reboot)
- UTILITIES 7**—More advanced utilities including Masterkey (undeletes files from hard disks).
- WORD 1a,b**—(2 disks) PC Write 2.71, a powerful word processing system w/spell checker, laser supt.

Most software listed is shareware or user-supported.

3 5" format add \$1 disk 125 page directory add \$2

MicroCom Systems Cost of items
 3673 Enochs Street Shipping **\$3.00**
 Santa Clara, CA CA res tax _____
 95051 Total encl. _____

(408) 737-9000

Mon-Fri 7am-9pm, Sat-Sun 8am-5pm

LETTERS

XER, the computer says CAT, and the computer replies XY3, and so on. An eavesdropper will not be helped by hearing this exchange, since on the next attempt to log in, the computer may present the word WHEELBARROW for encryption.

This approach is fundamentally the same as that discussed by Mr. Wayner, but I think it helps to make some of the issues involved a bit clearer.

James Hamilton
 Dublin, Ireland

I considered the same idea for a password scheme but did not include it in my article because both parties must know the encryption process. In zero-knowledge proofs, the prover never lets the skeptic know what is being proven—in this case, that the prover knows the encryption-correct algorithm. The skeptic learns only that the prover couldn't be wrong. If public-key encryption systems were used in your system, however, you would have a zero-knowledge proof.

It is a handy idea, though, and I may implement it in the future.

—Peter Wayner

BASIC Windowing

I found "Windows for BASIC" by John W. Ross (*Inside the IBM PCs*, Fall 1987) interesting and instructive, but a few

statements about windowing in BASIC require correction. Mr. Ross does his windows for BASIC in assembly language, claiming that windows cannot be done in BASIC itself, since they are "excruciatingly slow" in the interpreted version of the language—and that compiling "doesn't help much."

To prove the opposite, I wrote a very short BASIC program (see listing 1) named WINDOW.BAS. The program opens and closes a window in the graphic mode. It also times itself: My results for a CGA were about 0.11 seconds on an IBM PC-class machine and about 0.05 seconds on a PC AT (80286) type of computer. I don't think this can be considered slow. The program was compiled using Microsoft QuickBASIC version 3.0.

Maciej Zgorzelski
 Flint, MI

In Search of True Resolution

The most misused term related to printers is "resolution." If in the data sheet of a worldwide-known company you read that its 24-pin impact dot-matrix printer has a "resolution of up to 360 by 360" (i.e., better than the LaserWriter, which has 300 by 300 dots per inch), then this is not true and can never be. In the same data sheet, you can also read that the "pin diameter is 0.2 millimeters." Try to divide 25.4 mm (1 inch) by 0.2 mm, and you will find that the result is 127.

This is not even the real resolution, because in the typographical industry the line resolution of 10 lines per mm means that in a 1-mm space you have 10 positive (black) lines and 10 negative (white) lines between them, both of the same width. The term "resolution" signifies that you must be able to distinguish between the printed (black) lines.

"Page Printers" by Rick Cook (September 1987) contains an explanatory example of this true resolution in figure B on page 193—an enlargement of a 300-dpi test pattern. In the above example of 360-dpi resolution on an impact dot-matrix printer, the authors are in reality speaking of graphic point density of 360 dots per line—their printer can pack 350 overlapping dots into one inch.

So far, I have been unable to find in any literature an exact definition of resolution in terms of dpi that is valid for dot-matrix and other printers. It is deplorable that the manufacturers do not care. Only the lack of a real standard makes such a misleading declaration as in the above-mentioned example possible and can confuse all of us if we wish to compare the real resolution.

The September BYTE contained many extremely well written and useful articles

continued

Listing 1: WINDOW.BAS.

```

DEFINT A-Z
CLS : SCREEN 2
DIM A(600), B(600)
FOR H=300 TO 600 STEP 10:
  LINE (H, 0) - (H, 199) : NEXT
FOR V=20 TO 180 STEP 10:
  LINE (300, V) - (600, V) :
  NEXT
LINE (100, 100) - (210, 112) ,, BF
LINE (100, 112) - (210, 184) ,, B
GET (100, 100) - (210, 184) , A
START:
LOCATE 1, 1:PRINT SPC(25)
LOCATE 1, 1:INPUT;"press
return... ",A$
STARTONE!=TIMER
I=320
GET (I, I/4) - (I+110, I/4+84) , B
PUT (I, I/4) , A, PSET
ENDONE!=TIMER
LOCATE 1, 1:INPUT;"press
return again... ",A$
STARTTWO!=TIMER
PUT (I, I/4) , B, PSET
ENDTWO!=TIMER
LOCATE 2, 1
PRINT "Opening window took"
ENDONE!-STARTONE!
"seconds"
PRINT "Closing window took"
ENDTWO!-STARTTWO!
"seconds"
GOTO START
  
```

Upgrade your technology

The software technology available to programmers of IBM-compatible personal computers is truly amazing. And newer, more powerful development packages appear all the time. But until now, finding out about these important products has been a difficult and time consuming task.

FREE Buyer's Guide. The New Programmer's Connection Buyers Guide contains individual descriptions of over 500 titles of programmer's development software by over 150 manufacturers. Each description covers major product features as well as any software or hardware requirements and version numbers. In the box on the right are some examples of the types of descriptions you'll find in our Buyer's Guide.

No Hidden Charges. The low discount prices in our Buyer's Guide are all you pay. We don't charge extra for domestic UPS Ground shipping, credit cards, COD orders, purchase orders, sales tax (except Ohio) or special handling (except for non-Canadian international orders).

Guarantees. We offer FREE 30-day no-risk return guarantees and 30-day evaluation periods on most of our products.

Latest Versions. The products we carry are the latest versions and come with the same manufacturer's technical support as if buying direct.

Large Inventory. We have one of the largest inventories of programmer's development products in the industry. Most orders are shipped within 24 hours.

Noncommissioned Staff. Our courteous salespeople are always ready to help you. And if you aren't sure about your needs, our knowledgeable technical people can give you sound, objective advice.

Experience. We've specialized in development software for IBM-compatible personal computers since 1984 and

are experienced at providing a full range of quality products and customer services.

How to Get Your Copy. There are three ways for you to receive your FREE copy of the Programmer's Connection Buyer's Guide: 1) Use the reader service card provided by this journal; 2) Mail us a card or letter with your name and address; or 3) Call one of our convenient toll free telephone numbers.

If you haven't yet received your Programmer's Connection Buyer's Guide, act now. Upgrading your programming technology could be one of the wisest and most profitable decisions you'll ever make.

CALL TOLL FREE
 USA: 800-336-1166
 Canada: 800-225-1166
 Ohio & Alaska
 (Collect): .. 216-494-3781

International: 216-494-3781

Telex: 9102406879
 Easylink: 62806530

Programmer's Connection
 7249 Whipple Avenue NW
 North Canton, OH 44720

Circle 216 on Reader Service Card

Limited Time Only!

**Sale Prices
 on ISAM
 File Managers**
 through 1/31/88

FairCom

c-tree in C Source Code
 List \$395 Reg \$315 Sale \$289
c-tree with r-tree
 List \$650 Reg \$519 Sale \$499

These fast and highly portable B+Tree functions provide multi-key ISAM file management for C programs. There are low level functions for directly accessing data and index files and high level functions for creating and manipulating ISAM files. The highly portable C source code can be compiled with almost any C compiler or computer for single-user, multi-user or network applications. It supports: record locking for multi-users; fixed and variable length records; fixed and variable length keys with key compression; re-use of deleted record space; duplicate and unique key fields; and more. The package includes a complete family of setup and maintenance utilities, unlimited technical support, no royalties, and free hardcopy listings of release updates. r-tree is an optional report generation utility for c-tree that permits complex, multi-line reports to be produced from single or multiple c-tree data files.

Supports all commercial grade C compilers. Requires 128K memory. Version 4.1F.

Lattice

dBC III Plus
 List \$750 Reg \$594 Sale \$499
With Library Source
 List \$1500 Reg \$1184 Sale \$998

Use the Lattice dBC III Plus library of functions to write fast C language programs to create, access and update files that are compatible with Ashton-Tate's dBASE III PLUS database management system. dBC III Plus is network ready with functions that solve complicated network database problems. These functions let you lock files or records automatically or manually, prevent you from accidentally

locking files or records that are already locked, and allow you to test whether files or records are locked or free. You can share your ISAM files with as many stations as are possible on your network.

Specify compiler (current version): Borland Turbo C, Lattice C, or Microsoft C. Requires 128K memory. Version 1.0.

SoftCraft

Btrieve
 List \$245 Reg \$184 Sale \$169

Xtrieve
 List \$245 Reg \$184 Sale \$169

Report Option
 List \$145 Reg \$99 Sale \$89

Btrieve/N
 List \$595 Reg \$454 Sale \$429

Xtrieve/N
 List \$595 Reg \$454 Sale \$429

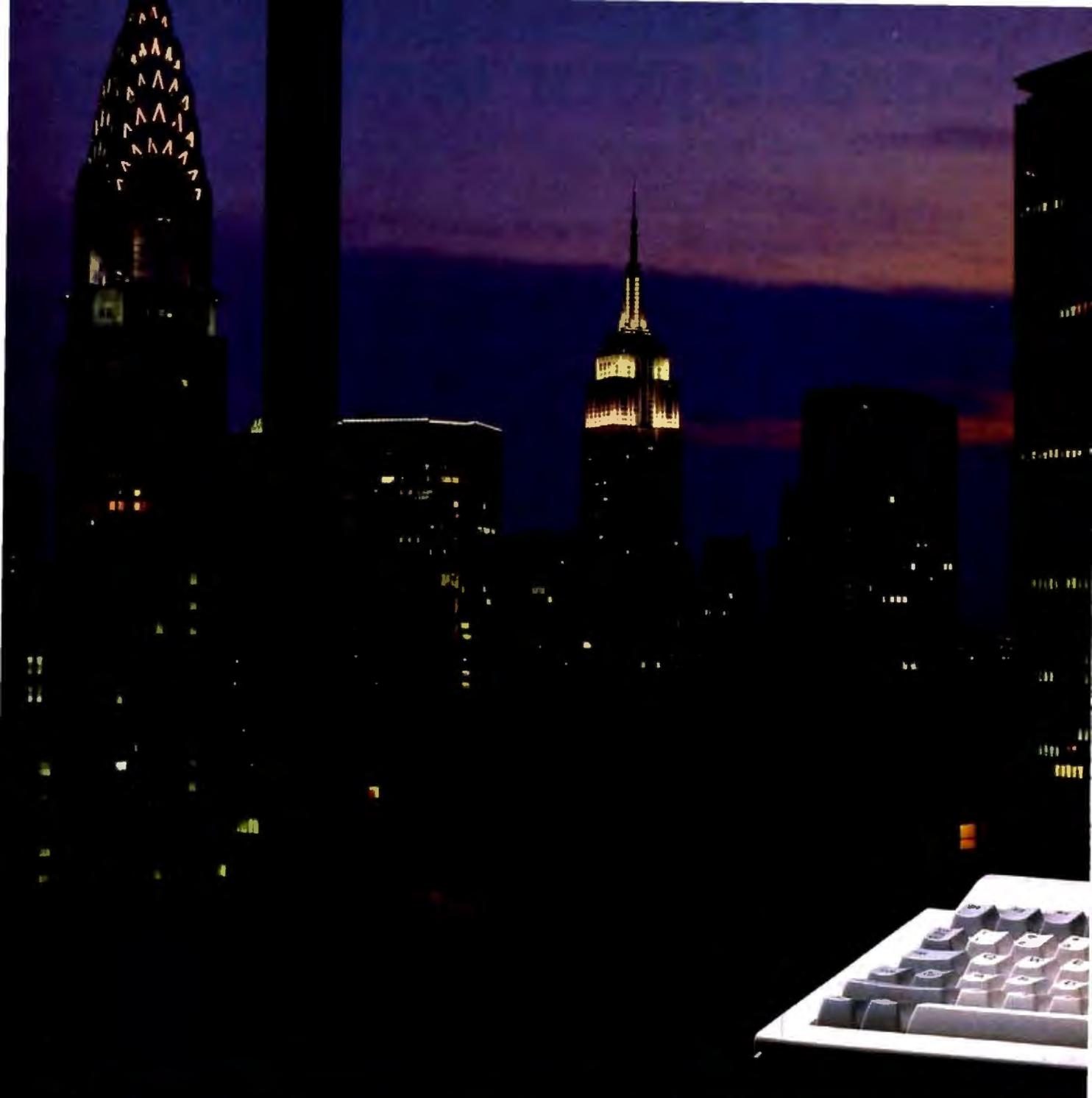
Report Option/N
 List \$345 Reg \$269 Sale \$249

Btrieve is a keyed, indexed file management system for use with most programming languages. Btrieve allows a file structure with: record length up to 4K bytes (64K in some environments); up to 24 different keys per file; maximum key size of 255 bytes; a maximum file size of over 4 billion bytes; and file size limited only by physical storage capacity and operating system limitations. Duplicate, modifiable, null and segmented keys are allowed and there is no limit to the number of files open at one time. Written in 8088 assembly language for maximum efficiency, Btrieve uses extensive cache buffering to optimize performance and pre-imaging to automatically recover damaged files. Transaction bracketing and automatic record locking allow you to guarantee the integrity of your data files despite the concurrency problems that arise in a network. The optional Xtrieve is a menu-driven query system that enables Btrieve users to access Btrieve files without writing a program. The Report Option for Xtrieve allows you to easily generate reports.

Specify single-user or multi-user/network version. For multi-user/network version, specify environment: 3Com3plus; IBM TopView; Microsoft Windows; MultiLink Advanced; MPOS; Novell Advanced NetWare; XENIX System V/AT; or satellite or server-based IBM PC Network. Btrieve supports most language compilers and interpreters. Requires hard disk and 128K memory (Btrieve routines use 32K). Version 4.10.

**The Free
 Programmer's Connection
 Buyer's Guide.**





The New TeleVideo 965. An Incredible Display Of Power And Versatility.

For just \$599, the new 965 gives you ASCII, ANSI and IBM® PC compatibility in a single terminal.

The 965's versatility is unparalleled. It supports 23 terminal emulations, more than any other model in its class. You

even get your choice of ASCII, ANSI or IBM Enhanced PC keyboard styles to fit any job.

There's a 14" flat display in green or page-white with crisp, clear characters in a high-resolution 10x16 character matrix. A 2-position keyboard with a true accounting keypad, 20 user-programmable editing keys, and 128 programmable function keys.



The 965 can display up to 49 data lines, enough to show large spreadsheets or two normal display pages of text at the same time. No other terminal this affordable can do that. There's also an interactive calculator mode and dedicated memory for even more custom features.

The 965's state-of-the-art

single board design uses a 16-bit CPU and sophisticated gate array to give you a high-performance, very reliable terminal that's very easy to service. There's also a full one-year end-user warranty.

All in a sleek terminal that takes up very little space.

The 965 terminal, a whole new look from TeleVideo. Call

us toll-free or write today for more information.

TeleVideo Systems, Inc.,
1170 Morse Avenue, Sunnyvale,
CA 94088-3568.

 **TeleVideo**[®]
THE VISION YOU NEED TO SUCCEED

Call 1-800-835-3228

Circle 270 on Reader Service Card

dedicated to printer technologies. However, "resolution" was not always correctly explained.

For example, Lars Jansson's article entitled "Print Quality" states, "We find this in laser printers with a resolution of 300 by 300 dots per inch and a dot size of about 0.1 mm." Here a wrong word is used. This is not a true resolution in typographic industry terms. If we wish to compare a resolution of a photo printer (for example, Linotronic) and a laser printer, we have to use the terms "line" and "dot" in the same sense.

If this statement regarding diameter of dots is right, then such a laser printer has only about a 127-dpi resolution. For a real 300-dpi resolution, the dot diameter has to be 0.00166 inch (0.042 mm) at most.

Compare this with the proper wording in Julio Guardado's article "Color Thermal-Transfer Printing": "The Color-Master design places up to 200 dots per linear inch, each dot with a 0.005-inch diameter." This is exactly right, because the author uses the word "places." Here the resolution would be 100 dpi.

As for impact dot-matrix printers, the best ones with a wire (pin) diameter of 0.2 mm have a true resolution (theoretically) of 63.5 dpi, and the more common 0.3-mm wire ones have a resolution of only 42.3 dpi.

Jaromir Smejch
Prague, Czechoslovakia

Calling All Macros

The members of our group are avid users of macros to aid our word-processing tasks. We define macros as prerecorded keystrokes that are fed into a program one at a time when a signal is given.

While books are available on the use of macros in spreadsheets, less attention has been paid to their best use in word processing. Accordingly, we have started a Macrobank, an exchange service for word-processing macros so that good ideas can be disseminated to others. If readers send us a 3½- or 5¼-inch MS-DOS floppy disk (any density) containing macros they use, we will incorporate those into our collection of macros and send contributors a complete set.

The macros don't have to be especially complex. We are interested in all the macros readers use, particularly the simple ones they use every day. Readers should consider anything they send us to be in the public domain, as we will make the macros available to other macro users without charge.

Rollie Cole
Paul Sommers
Macrobank
14022 23rd Ave. NE
Seattle, WA 98125

Ada's Not Complete

I have read many extreme statements about Ada, both pro and con, but never have I read a claim as far out as Mark Fowler's (Letters, October 1987, page 22): "Ada is complete; substitutions are not needed."

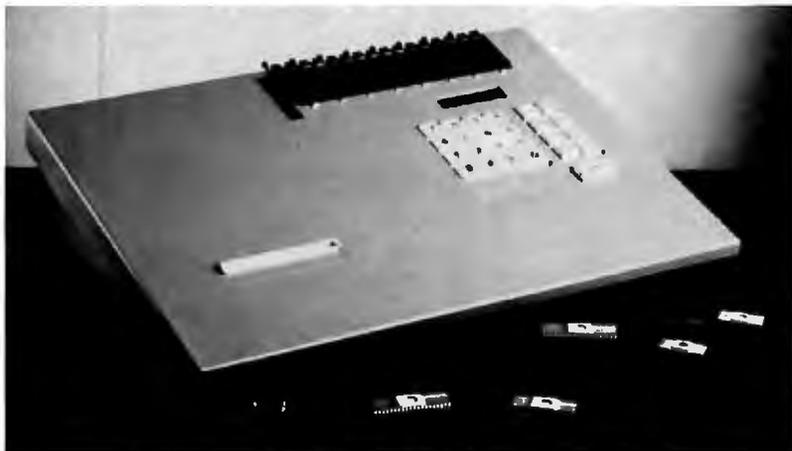
Ada is seriously deficient in character handling. It lacks variable-length strings, not to mention string scanning facilities. Compare Ada's string handling to PL/I, and it looks seriously incomplete; compare Ada's string handling to SNOBOL 4, SL/5, or ICON, and it looks ludicrous.

Ada is missing several important control structures. It has no mechanism for backtracking, no coroutines, and no decision tables.

Ada does not allow the programmer to define new operators, only to overload existing ones. Again, not only is something missing from Ada, but something is missing that another language (ALGOL 68) has.

Ada is not only incomplete, it is not
continued

BYTEK's NEW 135 MULTIPROGRAMMER™ OFFERS 18/12 PROTECTION PLAN



THREE PROGRAMMERS IN ONE. With the addition of the 135 MultiProgrammer™ BYTEK has provided a true Universal Programming Site. The 135 is a SET EPROM Programmer, a GANG EPROM Duplicator, and a UNIVERSAL DEVICE Programmer, designed for Engineering Development, Production and Field Service Environments.

BYTEK's new 135 MultiProgrammer™ is a High Performance Instrument setting new standards for Universal Device Support and Flexibility at affordable prices.

VERSATILE: With standard 256K BYTE of RAM, expandable to 2 MegaByte, the 135 supports more devices than any other production programmer on the market today. The 135 provides EPROM programming capabilities of virtually any 24-, 28-, and 32-Pin EPROM and EEPROM from 16K to MegaBit Devices. The 135 can Program SETS of Devices, 16- and 32-Bit Wide. As a GANG EPROM Duplicator, it copies up to eight (8) devices from RAM, with options for 16 Devices.

COMPATIBLE: The 135 offers Terminal and Computer Remote control, Data I/O* compatible+.

FLEXIBLE: The 135 can easily be expanded to program 40-Pin EPROMS, Bipolar PROMs, Logic Array Devices, EPROM Emulation, and 40 Pin Micro Devices.

18/12 PROTECTION PLAN: BYTEK offers High Performance, unsurpassed quality, and product reliability. BYTEK is the first to offer a full EIGHTEEN MONTH WARRANTY, and TWELVE MONTH FREE Device Support Updates.

BYTEK

Call us today at:
1-800-523-1565
Mastercard or Visa is accepted
In Florida call 1-305-994-3520

BYTEK Corporation
Instrument Systems Division
1021 S. Rogers Cir., Boca Raton, FL 33487
Tel: (305) 994-3520 FAX: (305) 994-3615

BYTEK International
511 11th Ave., So. Minneapolis, MN 55415
Tel: (612) 375-9517 FAX: (612) 375-9480
Telex: 4998369 BYTEK

* Data I/O is a Registered Trademark of Data I/O Corporation.
+Some limitations may apply.

First Again in the PS/2 Galaxy



Everex Delivers 2400B Modem.

Let the Evercom Family of modems open your doors of communications. Talk to an old friend in the Far East or send information to Europe. Evercom does it fast...up to 2400 bps. And whether you have IBM® PC/XT/AT® compatible or the newer PS/2 machine, Everex offers internal and external modems to suit your needs. Why Wait! Go on line and make the world a smaller place today.

The Everex Way... Quality, Features, Price, and Performance.



Evercom 12/24

- 300/1200/2400 bps speed
- Hayes® AT compatible
- S/W Vol. control
- Adaptive dialing
- Auto data to voice switching
- Phone off-hook detect
- Auto Dial / answer
- On-line help
- Free BitCom software



Evercom 24E

- Stylish package
- Goes International
- push-button speakerphone
- 2400 bps max. speed
- Status and activity indicator
- Mute button
- ON/OFF switch
- Includes features of Evercom 24
- Free BitCom software



Evercom II 24

- Internal modem for PS/2 machines
- Goes International
- 300/1200/2400 bps speed
- Uses Machine's speaker
- Auto data to voice switching
- Phone off-hook detect
- Easy installation
- Free Bitcom software

List Price
\$399.

For competitive pricing or the name of the nearest EVEREX dealer, call us toll free at:

1-800-821-0806

(in USA)

1-800-821-0807

(in Calif.)

Ever for Excellence

EVEREX

48431 Milmont Drive, Fremont, CA 94538

EVEREX, EVER for Excellence, and Evercom are trademarks of Everex Systems, INC. Hayes, IBM, PC/XT/AT, PS/2 are trademarks and registered trademarks of their respective companies

Circle 91 on Reader Service Card (DEALERS: 92)

If you don't buy you'll miss

If you're looking for a good way to judge personal computers, a simple question will do: "What's in it for me?"

In the case of the IBM Personal System/2 family the simple answer is, "a great deal."

For openers, each model offers higher performance levels thanks to a "balanced system" approach for making things work together. Components were designed not just to coexist but to bring out the best in each other. So, for example, many of the programs you're using now and a wide range of other DOS applications will run up to 150% faster on the IBM Personal System/2 than on previous IBM PCs, depending on the model, of course.

Things that are optional on other PCs are standard on the Personal System/2—like advanced graphics, parallel and serial ports and more. And advanced IBM technology brings new levels of reliability and data protection.

It'll do what you're doing now. Only better.

At the heart of many of these advances is a unique design shared by the Models 50, 60 and

80 of the Personal System/2 family. Technically it's called parallel bus architecture. We call it Micro Channel. But you can think of it simply as a super-highway with lots of fast lanes and bypasses. It allows data to flow faster and more efficiently, reducing the chance of information bottlenecks in the system.

What's more, the Micro Channel architecture not only makes it easier to speed information throughout the system, it also makes it easier to install peripherals and expansion cards in the system. There are no more DIP switches to set. It's all done electronically and automatically and, therefore, a great deal more reliably and easily.

Feature cards in your system can even transfer data directly to memory, via Micro Channel, leaving the microprocessor free to do other things.

The design of the Micro Channel also provides a faster, more efficient way to connect your



an IBM PS/2, the bus.

system to other IBM Personal Systems, local area networks, minicomputers and mainframes.

**It'll do what you want to do tomorrow.
Only better.**

Micro Channel architecture also gives the IBM Personal System/2 something else that's surprisingly rare in personal computing: the ability to improve with age.

One of the main reasons the architecture was created, after all, was to get the most out of IBM's new operating system, OS/2. And together they'll unleash the power of the 286 chip in the Personal System/2 Models 50 and 60 and the 386 chip in the Model 80.

With IBM Operating System/2 you don't have to be a "power user" to run several programs at once. You can prepare a presentation while your system recalculates a spreadsheet and gets data from a main-

frame. And with a future edition of OS/2, you'll be able to share all this information with others on a local network or over mega-distances. Vast memory and host processor resources will be more accessible. And software will do more things more easily.

So catch the Micro Channel bus and you're on the fast track to higher performance, exceptional expandability and greater reliability tomorrow, as well as today.

For more data about the IBM Personal System/2, call your IBM Marketing Representative or visit an IBM Authorized Advanced Products Dealer. For the dealer nearest you call 1-800-447-4700.



IBM is a registered trademark and Personal System/2, PS/2, Operating System/2, OS/2 and Micro Channel are trademarks of IBM Corporation © IBM 1987.



step is just that this process makes "soft" dots, and printed pixels may be in 1-to-1 correspondence with color video monitor/storage systems. Companies with prototypes or products already on the market include Hitachi, Sony, Fuji, and Kodak, and we can probably expect full-page (8½- by 11-inch) printers about a year from now. Smaller-format (4- by 6-inch) printers are available now. You haven't appreciated a high-resolution screen dump in color until you have seen it in this media.

L. M. Marks
Mississauga, Ontario, Canada

False Claim

Roman A. Dyba (Letters, October 1987, page 12) says that a claim in my and Brian Wichmann's article "Building a Random-Number Generator" (March 1987) is untrue. Specifically, Mr. Dyba says that if x_1 and x_2 are independent and uniformly distributed over the range (0,1), then the combination of x_1 and x_2 will also be uniformly distributed over (0,1). He is wrong.

We are well aware that the sum of x_1 and x_2 is not uniformly distributed, but we had defined "the combination" to mean the *fractional part* of the sum, not

the sum itself. Of this, the statement is true.

David Hill
Harrow, Middlesex, U.K.

AI Limits

I read with interest George Beinhorn's book review of *Intelligence: The Eye, the Brain, and the Computer* by Martin A. Fischler and Oscar Firschein (August 1987). One question Mr. Beinhorn posed interests me: "What are the inherent limitations of artificial intelligence?" Obviously, we should not waste our efforts attempting to do the impossible. It is unfortunate that the field of AI seems so unaware of the fact that this question has been given thorough treatment in the past by writers from other disciplines.

The subject of human intelligence and how it relates to nonhuman entities is treated thoroughly in a book called *The Difference of Man and the Difference It Makes* by Mortimer J. Adler. Written in 1967, the book clearly explains intelligence and how it is qualitatively different between humans and animals. Adler also addresses the subject of machine intelligence, and he issues specific challenges to the field of AI. People working with AI should read this book to understand the

problems they are confronting and learn about what a machine can and cannot do.

Marin David Condic
Parsippany, NJ

Thanks for the Accelerators

Thank you for "80286 Accelerators" by Raymond GA Cote (November 1987). I have tried, without success, to talk with accelerator manufacturers about their products—do they work, how do they work, when do they not work, and with what are they compatible or incompatible? All I could get out of them was the promise that if it didn't work, I would get my money back.

Now I'm glad I didn't do anything at all. The secret was to hold out for a faster system, not to junk up my existing one. If I really do need more speed, I ought to be able to justify it. If I cannot, then I should not try to justify a chancy second-best.

Sid Phillips
LaGrange, GA

Acer vs. Compaq DOS

I am writing in response to Ed McNierney's review of the Acer 1100 80386 clone ("Acer 1100 and Micro 1386+," November 1987). I have an 1100 at work.

continued

TO: All persons interested in the future of the volume telecommunications market over the next decade.

Subject: GUIs

- Data: 1. Company specialises in Fax products
2. New products due for release soon —
Model 321 scanner specially designed for fax applications. Very easy to program, and OEM enquiries welcomed
Complete PCFax System (Scanner and Fax Card) to retail at under US\$1.5K
3. Products already available—
TellerFax 207—stand-alone Fax which can link with a PC for maximum flexibility
4. Distributorship applications invited for all of these.

Suggested Action: Contact GUIs below.

GUIs

A Little Giant in Telecommunications

Glorious Union Information Systems Inc.

14th Floor, 207 Tun-Hwa North Rd., Taipei, Taiwan, R.O.C

TEL: 2-7153356 2-7168035

TLX: 22651 GUIs FAX: 2-7134572

THE COMPLETE NETWORK SOLUTION IS NETWORK BOARD FREE.



Making the right connections. The decision is yours. Now that most companies have multiple levels of computing power, you need more than just a short-term answer to your networking demands.

You know what you need...DOS program compatibility, multi-tasking, expandability, file/record locking with password-protected security, remote access, and ease of use. In short, you need LANLink™...the complete networking solution.

Network Board Free...Network Operating System Complete. In 1985, LANLink™ was the first network to be free of network boards. All of the network logic was on Server and Satellite diskettes. To this day, all it takes to set up a LANLink™ network is inexpensive cable, network software, and the very same communications ports most PCs & PS/2s already have.

And now, LANLink™ comes with its own network operating system...PC-MOS/386™. So you're no longer dependent on a system designed for single users and stand-alone computers.

The First Network You Buy...The Last Network You'll Need. Designed to take full advantage of the newest 80386 machines, LANLink™ provides a true multi-user system which supports the complete line of PCs, PS/2s, and PC-compatibles.

It lets you expand as your office networking needs grow. Each user gets multi-tasking capabilities, and you can network different types of computers. If desired, you can have multiple servers. And with the terminal support upgrade, you're able to use terminals, or PCs, as satellites in multi-user "work groups."

DOS Program Compatibility...Complete Connectivity. dBASE III, WordPerfect, Lotus 1-2-3, and Symphony, are among the thousands of DOS-programs that are LANLink™ compatible. The network enables security-cleared users to access and share everything from programs and databases to high-speed laser printers and large-capacity hard disks. R-LAN™ or Remote-LAN, gives you the ability to access the LANLink™ system, via modem, whether you're across the street or across the country.

A Platform for YOUR Future. The choice is clear. You can pay more than you want, for a stack of network boards. You can get less than you need with a CheapLAN—that's file transfer software which masquerades as a network. Or, you can get LANLink™. And install a SOLUTION that will take you far into the future. Its price of \$495 includes a server and a satellite module plus the network operating system. For complete details and the authorized dealer nearest you, call The Software Link TODAY at the toll-free number listed below.

CALL: 800/451-LINK

In Georgia: 404/441-2580	International/OEM Sales: 404/263-1006	Resellers/VARs: 404/448-5465	Canada: 800/387-0453
-----------------------------	--	---------------------------------	-------------------------

3577 Parkway Lane, Atlanta, GA 30092 Telex 4996147 SWLINK FAX 404/263-6474

LANLink™

THE SOFTWARE LINK



Dealer Inquiries Invited

Circle 249 on Reader Service Card (DEALERS: 250)

LANLink, PC-MOS/386™ and R-LAN™ are trademarks of The Software Link, Inc. PS/2, dBASE III, WordPerfect, Lotus 1-2-3 and Symphony are trademarks of IBM Corp., Ashton-Tate, WordPerfect Corp., and Lotus Development Corp., respectively. Prices and technical specifications subject to change. Copyright ©1987. All Rights Reserved.

HARMONY COMPUTERS

2357 CONEY ISLAND AVE. (BET. AVES. T & U) BKLYN. NY 11223
ORDER DEPT. ONLY 800-441-1144 OR 718-627-1000 — INFORMATION 718-627-8888



**NO ADDITIONAL CHARGE
FOR CREDIT CARDS**

**IBM PS II MODEL 30 (20 Meg) \$1699.00
EPSON LX 800 \$184.00**

**PANASONIC 1091 II \$174.00
COMMODORE 128D \$449.00**

Apple Image Writer II	454
Brother HR 40	550
Brother HR 20	329
Brother 1509	358
Citizen 1200	144
Citizen 1800	167
Citizen MSP 10	254
Citizen MSP 15	319
Citizen MSP 40	289
Citizen MSP 45	405
Citizen Premier 35	438
Dynas Ink Jet	289
Epson LX800	184
LX 80 and 86 Cutsheet Feed	24
Epson LQ500	167
Epson LQ 1000	529
Epson LQ 1000 Tractor	39

IBM	
IBM PS 25 Monochrome	1019
IBM PS 25 Color	1269
IBM PS 2 Model 30 (2 Drives)	1249
IBM PS 2 Model 30 (20 Meg)	1699
IBM PS 2 Model 50 (20 Meg)	2849
IBM PS 2 Model 60 (40 Meg)	3899
IBM P S 2 Mono Monitor	199
IBM P S 2 Color (8512) Monitor	469
IBM P S 2 Color (8513) Monitor	529
Hertz AT (10 MB) 2.5" 540 K. w Drive	499
Hertz AT 286 w 1.2 Meg Drive	974

MONITORS	
Amdah 300 A	99
Amdah 410A	144
Amdah Co in 8005	379
Amdah Co in 727	419
Princeton H112 P 3	394
Princeton H112E	127
Princeton M114 VE	479
Scan Display 1150 E and	159
NEC MultiSync	514
NEC MultiSync Plus	659
Gold Star 111 Amber	99
Gold Star RGB Color	789
Color Composite	176

ATARI	
130 XE	134
XT 517 (new Atari Disk Drive)	160
Atari Video 1	31
Atari 407	109
Atari Model 201	49
Atari 520 Keyboard	348
Atari 100 Disk Drive	179

AT&T	
ATT 6300 Drive AMH w Keyboard	849
ATT Monitor	189
ATT 301 Keyboard	119
ATT 302 Keyboard	169
AMH K 725 Color Monitor	399

"PRINTER SPECIALS"			
Epson LQ 850	489	NEC P6	427
Epson LQ 1050	679	NEC P7	599
Epson FX 88E	299	NEC Color P6	529
Epson FX 209E	449	NEC Color P7	629
Epson LQ200	359	Okidata 182 Plus	214
Epson EX 1000	469	Okidata 192 Plus	288
Epson LQ2500	899	Okidata 193 Plus	424
IBM Proprietary II	359	Okidata 292 w INTFC	424
IBM Proprietary XL	429	Okidata 293 w Intfc	549
IBM Proprietary 24	539	Panasonic KXP 1080 i Model 2	159
IBM Proprietary XL24	699	Panasonic KXP 1091 i Model 2	174
IBM Quietwriter III	1149	Panasonic KXP 1092 i	279
NEC 8850	719	Panasonic KXP 3131	263
NEC 2200	1039	Hewlett Packard Laserjet II	1500

PC BOARDS, DRIVES, CHIPS	
Toshiba 5 1/4 Disk Dr	99
Toshiba 3 1/2 Disk Dr	129
AST Six Pack 384K	159
AST Six Pack Premium 256 K	189
AST Rampage (286)	294
Hercules Color Card	139
Hercules Monographic Plus	169
NEC EGA GB1	239
Quad Prosync (with mouse)	219
Quadram Ultra VGA (with mouse)	319
Video 7 Deluxe	199
Video 7 VGA	289
Genoa Hi Res Card	239
ATI Wonder EGA	189
ATI VGA Wonder	349
Paradise Auto Switch (480)	169
Paradise VGA	129
Everex Auto Sync (480)	149
Everex EGA Deluxe (640x480)	139
Everex Edge	189
Intel 8027-5	109
Intel 8027-2	168
Intel 80287-6	169
Intel 80287-8	269
Intel 80287-10	299

SEAGATE HARD DRIVES	
20 Meg w Controller	289
20 Meg No Controller	259
30 Meg w Controller	319
30 Meg No Controller	289
30 Meg AT #4036	499
40 Meg AT #2936	469
Intell 20 Meg Hard Card	309
Memorize 30 Meg Hard Card	374
London 40 Meg Hard Card	469
Memorize MAC 20 Meg External	559

MODEMS	
Hayes 1200	274
Hayes 1200B w Smartcom 2	274
Hayes 300	139
Hayes 5400	409
Hayes 2400B w Smartcom 2	409
Microcom 2E	139
Everex 1200 Internal	89
Everex 2400 External	229
Everex Mac 2400 External	269
Capitron 1200 External	109

APPLE	
FGS with 256K	779
Apple Drive (5 1/4)	249
Apple Drive (3 1/2)	309
MAC Plus	1819
MACSE (2 Drives)	2599
MACSE Keyboard	99
MAC SE Extended Keyboard	199
Imagewriter II	399
Apple Color Monitor (RGB)	299
Apple Black & White Monitor	118
Master Drive (E, H, MAC) 5 1/4	99
Miniscribe MAC 20 Meg Ext. Drive	869
Everex Mac Modem 1200 Ext	269

COMMODORE	
Commodore 178D (Built-in Drive)	449
Commodore 178	234
1517 Drive (5 1/4)	232
1680 Modem	119
Commodore 64C	176
1541C Disk Drive	119
1581 Disk Drive (5 1/2)	219
2002 Monitor	244
1315 Monitor	184
Star 1X10C	174
Star 1X1000C	174
Amiga 500 with 1080 Monitor	849
Amiga 1080 Color Monitor	289
Amiga 500 Computer	449
Amiga 512 RAM Upgrade (for Amiga 500)	159

Panasonic KXP 3151	409
Panasonic KXP 1582	389
Panasonic KXP 1595	439
Panasonic 1524	559
Seikosha 1200	165
Star NX 1000	174
Star NX 10	149
Star NX 10C	164
Star NX15	299
Star ND 10	259
Star ND 15	399
Star NB 2410	419
Star NB 2415	569
Toshiba 341 SL	644
Toshiba 351 Model 2	789
Toshiba 351 Model 2 Color	1024
Toshiba 321 SL	474
Toshiba 351 SX	999

SOFTWARE	
Lotus 123 Ver 2	309
Q Base 3.1	375
Framework 2	119
Symphony 1.2	419
Microsoft Word 4.0	209
Microsoft Excel (Mac)	228
Microsoft Excel (IBM)	296
Microsoft Windows 1.04	59
Word Perfect 4.2	184
Word Perfect Library	49
Q & A 2.0	184
PFS First Choice	99
PFS Professional Write	109
Norton Utilities 4.0	49
Norton Utilities Advanced	79
Microsoft Mouse (IBM PC and P 51)	99
Wordstar Professional Part 1	229
Mathematic Advantage Part 2	224
Bankstreet Writer Plus	69
DAC Easy Accounting	49
Websters Desk Top Publishing	429
Managing Your Money	109
Font Writer II (Data Transfer Software and cables)	79
3 1/2 Inch Software	Call

PORTABLES	
Sharp PC 4502 (2 Drives)	1195
NEC MultiSync Et	1269
NEC MultiSync Et	1699
Toshiba T 1000	766
Toshiba T 1000 (120 Meg)	3099
Toshiba T 1000 3000 and 1100 Plus	649
Dynas Ink Jet Font Printer	289
Framework II (Data Transfer Software)	79

NEC	
Power Mate II w NEC 78 Meg Hard Drive	1299
Powermate II w NEC 40 Meg Hard Drive	2099
Powermate 388 w NEC 40 Meg Hard Drive	3349
NEC MultiSync	649
NEC MultiSync Et	1189
NEC MultiSync (Hard drive)	Ca

Master Card and Visa welcome. For your protection we check for stolen credit cards. Shipping & handling extra. Defective merchandise will be replaced or repaired at our discretion within the terms of our warranty. All sales final. Price and availability subject to change without notice. We cannot guarantee compatibility.

LETTERS

The hardware seems solid, but the version of DOS provided with it (3.20) has some serious bugs. Most notably, certain programs that redirect LPT1 to COM1 fail miserably unless you slow the machine down to 4.77 MHz. These problems don't occur if you boot the machine with Compaq DOS version 3.1.

Additionally, Microsoft Windows/386 will not run whatsoever under Acer's DOS. The machine blurs out Error: Unsupported Intel 80386 CPU version or Error: Incorrect DOS version. Yet, again, if you boot off a Compaq DOS (version 3.1) floppy disk, Windows/386 comes up and runs just fine (on the machine that gave the Incorrect DOS version error—the machine that gave the Unsupported Intel 80386 CPU version error still would not run Windows/386).

John Roberts
Portland, OR

Reader Request

I normally work in a Unix environment, but I use an IBM PC under MS-DOS 2.x frequently enough to warrant pursuing the following task: Is it possible to have the shell (via a batch file) read an ASCII file and return the contents on one line of that file in the context of \$1, \$2, \$3, and

so on, so that I can branch to different parts of the .BAT file depending on the state of some routine?

One application could be to determine if the communications port is configured for printer x or printer y. The only way I can think of to automate this feature in a .BAT file is to be able to pass the information from an ASCII file to the shell in some way. Can that be done without coding in assembly language? Perhaps through Turbo C? Do readers have any suggestions?

Jacques Cazier
Houston, TX

FIXES

Pricing Error

In the Items Discussed box for Computing at Chaos Manor for September 1987, we incorrectly reported the price of Definion's 68020 boards for the IBM PC. Prices for the boards begin at \$1094 for a 12.5-MHz board with 1 megabyte of RAM (not upgradable). Models with faster CPUs and more RAM are also available, such as the DSI-785/4, which costs \$6610 and includes a 25-MHz CPU

and 4 megabytes of RAM (upgradable to 16 megabytes).

How Much Is That Pup?

SK Data alerted us to a pricing error in the announcement of its Golden Retriever Pup on page 18 of our Fall 1987 *Inside the IBM PCs* issue. The Pup sells for \$5, and Golden Retriever sells for \$99.

VCR Technology Tape Backup

On page 70 in the November 1987 What's New section, we incorrectly stated the name of the company that makes the VAST device. It should be Emerald Systems Corp. The item also states that the VAST device will back up data from a CD-ROM. It will not.

HYPERchannel Fix

We would like to clarify a statement in "A Look at Apple's Cray Simulation Engine" (Microbytes, September 1987). HYPERchannel is not the I/O channel on the Cray supercomputer but is a separate piece of hardware sold by Network Systems Corp. for networking computers of various manufacturers. HYPERchannel is the registered trademark of Network Systems Corp. for use with Network Systems' network adapters. ■

CHAOS MANOR MAIL

Jerry Pournelle answers questions about his column and related computer topics.

Still Speedy After All These Years

Dear Jerry,

I was very interested in your August column about benchmarking two BASIC compilers—so interested, in fact, that I dug out my dusty old Sinclair QL and fished around for my copy of the Super-BASIC compiler SuperCharge.

After entering the benchmark test and compiling, I was rather pleased with the results. Remember, this is the very slowest configuration of the 68008 QL (some RAM expansions increase speed by more than 50 percent), using a very old version of a now much-enhanced compiler, compiling a very powerful version of BASIC (more so than QuickBASIC, at least, and I have used both extensively). The times I—or rather the computer, since I used its clock for accuracy—got were:

	Time	Code size	Data size
Slow	3:58	8006 bytes	51,200 bytes
Fast	2:52	9796 bytes	51,200 bytes

The fast version of the benchmark used the compiler in-line code option—hence the larger code size. These results raise some questions. What would the results have been with the latest compiler and a fast RAM expansion? We could easily expect times in the 1-minute range for the Fast benchmark—and not an 80286, 80287, 80386, or 80387 in sight! What rubs in the point even more is that the benchmarks were, of course, running under QDOS and were therefore multitasking with BASIC (which is more than MS-DOS can do).

Perhaps more people should pay attention to this long-forgotten machine. And its price in England? The QL is £99, the compiler £80 (for the new, faster, more powerful program called Turbo).

Danny Ross
Basingstoke, Hampshire, U.K.

Fascinating. I knew the 68000 chip was good, but that's little short of amazing.

The Sinclair was one of the most frustrating machines ever constructed. The basic computer engineering was excellent, but the user interface and video were just plain horrible. Sir Clive Sinclair took the trouble to show me his new "notebook" machine a few months before it came out, and it seemed to me to have the same pattern: really excellent

design and concept, but little appreciation for the small things that help market a system. I wish him well; he's done a lot for the computer revolution.—Jerry

How to Publish?

Dear Jerry,

This letter is a request for advice. If you are not in an advisory mood, please feel free to use file 13. My ego won't survive, but that's all right.

Back in the dark ages, as a graduate student, I developed a set of FORTRAN II multivariate statistical programs for use on my research project. In the ensuing years, every time I used one of the programs, I promised myself that I really would get busy and develop them as a coherent system. Twenty years ago they actually did get translated to the new, superpowerful FORTRAN IV.

Two years ago, several things happened nearly simultaneously. First, I involuntarily became a former geologist. Second, Albert the Compaq home-steaded my dining room. And third, I fell in love with C.

To while away the time between non-existent interviews, I began work on my system, which consists of factor analysis, stepwise multiple regression, distance-based cluster analysis with dendrogram, multigroup discriminant analysis, multigroup canonical analysis, and a standard data-file construction program—all with dynamic dimensioning.

Much to my surprise and the relief of my friends, the Thélème system is now complete. During my thrashing about with translation and development, I discovered that there is no publication on number crunching in C; if mentioned at all, it is discussed as an afterthought. Also, source code for multivariate statistics, in any language, does not exist at a price below absurd.

Now for my request. I believe there is a market for my system as a book. Numerical procedures in C would be illustrated by the source code statistical system. This

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. He can be reached c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Create Powerful Programs with Blaise TOOLS

Whether you're an expert or a novice, you can benefit from using special tools to enhance your programs, make them reliable, and give them a professional look. With windows, menus, pop-up memory resident programs, and communications support, Blaise Computing offers you a wide range of programming tools to let you take full advantage of the Microsoft and Borland programming environments. All language support packages include fully commented source code, complete comprehensive manuals and sample programs.

C TOOLS PLUS/5.0 \$129.00

Full spectrum of general service utility functions including: windows; menus; memory resident applications; interrupt service routines; intervention code; and direct video access for fast screen handling. Specifically designed for Microsoft C 5.0 and QuickC.

Turbo C TOOLS \$129.00

Windows and menus; ISRs; intervention code; screen handling including EGA 43-line text mode support; direct screen access; and memory resident applications. Carefully crafted specifically to complement Turbo C.

Turbo POWER SCREEN

COMING SOON! General screen management; paint screens; block mode data entry or field-by-field control with instant screen access. For Turbo Pascal.

Turbo POWER TOOLS PLUS \$129.00

NEW VERSION! Now supports Turbo Pascal 4.0. Screen, window, and menu management including EGA support; DOS memory control; ISRs; scheduled intervention code; and much more.

Turbo ASYNCH PLUS \$129.00

NEW VERSION! Now supports Turbo Pascal 4.0. Interrupt driven support for the COM ports. I/O buffers up to 64K; XON/XOFF; up to 9600 baud; modem and XMODEM control.

ASYNCH MANAGER \$175.00

Full featured interrupt driven support for the COM ports. I/O buffers up to 64K; XON/XOFF; up to 9600 baud; modem control and XMODEM. For Microsoft C, Turbo C or MS Pascal.

KeyPlayer \$49.95

"Super-batch" program. Create batch files which can invoke programs and provide input to them; run any program unattended; create demonstration programs; analyze keyboard usage.

PASCAL TOOLS/TOOLS 2 \$175.00

Expanded string and screen handling; graphics routines; memory management; general program control; DOS file support and more. For MS-Pascal.

EXEC \$95.00

NEW VERSION! Program chaining executive. Chain one program from another in different languages; specify common data areas; less than 2K of overhead.

RUNOFF \$49.95

Text formatter for all programmers. Written in Turbo Pascal: flexible printer control; user-defined variables; index generation; and a general macro facility.

**TO ORDER CALL TOLL FREE
800-333-8087!**

BLAISE COMPUTING INC.

2560 Ninth Street, Suite 316 Berkeley, CA 94710 (415) 540-5441

It copies 5¼ and 3½ inch diskettes all by itself.

Just load your diskettes, press one button, and walk away. The Victory Auto-loader automatically copies diskettes operating stand-alone or attached to an IBM/PC* or Mountain* compatible system. Bulk canisters allow fast, easy loading and unloading. Switching drives takes less than five minutes.



Copy Different Formats, Flawlessly. Our Auto-Format-Analysis™ feature lets you copy different formats, including PS/2*. The system tests for quality and accuracy, sorting disks into one of two output canisters.

No User-Required Adjustments. The Autoloader's self-calibration and simple diagnostics for checking drive alignment allow you to maintain the system without outside service.

Call 1-800-421-0103. And ask about the Victory family of affordable duplication systems—with serialization, copy protection and custom label printing.



VICTORY ENTERPRISES
Technology, Inc.

8910 Research Blvd., B2
Austin, Texas 78758
512-450-0801

In Europe call BFI: Paris (33-1) 45330137,
Frankfurt (49-6074) 27051, London (44-1)
941-4066, Milan (39-2) 316716.

*IBM PC and PS/2 are trademarks of International Business Machines Corporation. Mountain is a registered trademark of Mountain Computer, Inc.

CHAOS MANOR MAIL

will, I hope, be possible at a price even poor starving students can afford. I am electing the book route because practitioners of any art balk at invariable canned products. In addition, a book would be more useful as a reference than a disk would be.

My experience in publishing is limited to company reports, where the manuscript is handed to the secretary and the author heads for the field until the furor abates. I also have some experience with journal publication, where the manuscript is mailed off and the author cowers in a corner under the slings and arrows of outraged referees. I have no idea how publication is accomplished in the "real world."

Any advice you may care to offer will be gratefully received.

P.S. Thanks for *Footfall*. Because most of my recreational reading is pure escape, I thoroughly enjoy a good blood-and-thunder space opera unencumbered with an intrusive moral or philosophy. By the way, what relationship does the biker in *Footfall* bear to a similar character in *Lucifer's Hammer*? They read like the same character with different names.

Fred E. Fisher
Katy, TX

SYSTEM SOLUTIONS.... ARE MADE POSSIBLE WITH QUA TECH

DATA ACQUISITION
Analog I/O: 8, 12, 14 bit A/D,
D/A, 72 Digital I/O

COMMUNICATION
Synchronous/Asynchronous
RS422, RS232,
RS485, Current Loop



Digital I/O, Power Control

GPIO (IEEE-488) CONTROLLER

WAVEFORM SYNTHESIZER
Arbitrary Waveform Generation



QUA TECH
INCORPORATED

478 E. Exchange St., Akron, Ohio 44304
(216) 434-3454 TLX: 5101012726
1-800-553-1170 FAX: (216) 434-1409

The best advice I can give you is to join the writers conference on BIX; a number of professional writers give advice to newcomers.

The long answer is, you haunt bookstores until you find a company that publishes books like yours—Addison-Wesley, Que, John Wiley and Sons, and Osborne/McGraw-Hill come to mind. Decide which of those appeals to you, and write a good letter of inquiry. If you have the manuscript completed, send it; if not, send in at least one good sample chapter and an outline of what the book will contain.

The cover letter shouldn't try to tell the publisher its business, which is marketing books. But it won't hurt at all to include your thoughts on the target market. A cover letter isn't strictly required, but it can help a lot. It can also hurt; if it is arrogant, ignorant, or both, your manuscript is not likely to be read, or at least it won't be read soon. A good cover letter (and your letter to me indicates that you can write one) can get the editor eager to look at what it covers. If you find a publisher, have someone send me a review copy.

As to Footfall: A writer I much admire told me that you can put all the morals and philosophy you like in a book as long as the characters don't know it. Harry Reddington, a.k.a. Mark Czescu, never knew what he illustrated. —Jerry ■

10 Important Reasons C Programmers Use Our File Manager

1. It's written in C.

Clearly the growing language of choice for applications that are fast, portable and efficient. All of db_VISTA's source code is written in C.

2. It's fast – almost 3 times faster than a leading competitor.

Fast access that comes from the unique combination of the B-tree indexing method and the "network" or direct "set" relationships between records. A winning combination for fast performance.

3. It's flexible.

Because of db_VISTA's combination of access methods, you can program to your application needs with ultimate design flexibility. Use db_VISTA as an ISAM file manager or to design database applications. You decide how to optimize run-time performance. No other tool gives you this flexibility without sacrificing performance. db_VISTA is also well behaved to work with most any other C libraries!

4. It's portable.

db_VISTA operates on most popular computers and operating systems like UNIX, MS-DOS and VMS. You can write applications for micros, minis, or even mainframes.

5. Complete Source Code available.

We make our entire C Source Code available so you can optimize performance or port to new environments yourself.

6. It uses space efficiently.

db_VISTA lets you precisely define relationships to minimize redundant data. It is non-RAM resident; only those functions necessary for operation become part of the run-time program.

7. Royalty free run-time.

Whether you're developing applications for yourself or for thousands, you pay for db_VISTA or db_QUERY only once. If you currently pay royalties to someone else for your hard work, isn't it time you switched to royalty-free db_VISTA?

db_VISTA™

Features

- ◆ **Multi-user** support allows flexibility to run on local area networks
- ◆ **File structure** is based on the B-tree indexing method
- ◆ **Transaction processing** assures multi-user consistency
- ◆ **File locking** support provides read and write locks
- ◆ **SQL-based db_QUERY** is linkable
- ◆ **File transfer** utilities included for ASCII, dBASE optional
- ◆ **Royalty-free** run-time distribution
- ◆ **Source Code** available
- ◆ **Data Definition Language** for specifying the content and organization of your files
- ◆ **Interactive database access** utility
- ◆ **Database consistency check** utility

File Management Record and File Sizes

- ◆ Maximum record length limited only by accessible RAM
- ◆ Maximum records per file is 16,777,215
- ◆ Maximum file size limited only by available disk storage
- ◆ Maximum of 256 index and data files
- ◆ Key length maximum 246 bytes
- ◆ No limit on number of key fields per record
- ◆ No limit on maximum number of fields per record

Operating System & Compiler Support

- ◆ **Operating systems:** MS-DOS, UNIX, XENIX, ULTRIX, Microport, VMS, Macintosh
- ◆ **C compilers:** Lattice, Microsoft, IBM, Aztec, Turbo C, XENIX, UNIX and LightspeedC

8. db_QUERY & db_REVERSE.

Add the SQL-based, ad hoc query and report writer for a relational view of db_VISTA databases. Use db_REVERSE to re-design your database easily and quickly! Both royalty free!

9. Free tech support.

60 days of free technical and application development support for every Raima product. Of course, extended support and training classes are also available at your place or ours.

10. Upward database compatibility

Start out with file management in a single-user PC environment—then move up to a multi-user LAN or a VAX database application with millions of records. You'll still be using db_VISTA. That's why so many C programmers are choosing db_VISTA.

John, You forgot one...
11. db_Vista training class
All you need to know to get the most from db_Vista! 2-5 days...Basics, Advanced, and Internals. Call Now! Will cut development costs a lot!
January 11-15

30-day Money Back Guarantee!

Try db_VISTA in your environment for 30 days and prove it to yourself. If not completely satisfied, return it for a

Price Schedule	db_VISTA	db_QUERY
<input type="checkbox"/> Single user	\$ 195	\$ 195
<input type="checkbox"/> Single user w/Source	\$ 495	\$ 495
<input type="checkbox"/> Multi-user	\$ 495	\$ 495
<input type="checkbox"/> Multi-user w/Source	\$ 990	\$ 990
NEW:		
<input type="checkbox"/> VAX Multi-user	\$ 990	\$ 990
<input type="checkbox"/> VAX Multi-user w/Source	\$1980	\$1980

Order Now.

Put db_VISTA to work in your application program. Ordering is easy—simply call toll-free. We'll answer your technical questions and get you started. Call today.

Call Toll-Free Today!

1 (800) db-RAIMA
(800/327-2462) or
206/828-4636



RAIMA™
CORPORATION

3055 - 112th NE, Bellevue, WA 98004 USA
(206) 828-4636 Telex: 6503018237 MCIUW

ASK BYTE

Steve Ciarcia answers your questions on microcomputing.

A Simple Problem

Dear Steve,

All three expansion slots in my Tandy 1000 are full. I have seen expansion chassis for additional slots and a power supply that cost from about \$500 to \$1200. These prices seem too high for what appears to be a simple add-on. Is there an easy way to build an expansion chassis with, say, four to six slots?

I would like to add a hard disk drive, a memory board (above 640K bytes), and a speedup board (if one exists for the Tandy 1000). Since I have three slots filled, I would need four more slots, assuming the expansion unit requires a slot in the main unit.

Am I wishing for the impossible? After all, for between \$500 and \$1200, I could buy a faster IBM PC AT clone or equivalent unit. (My wife wouldn't balk at "add-ons," but I think I'd have a problem buying an entire computer.)

Chris Bonney
St. Louis, MO

The prices for expansion boxes do seem a little extravagant, but they also show no sign of coming down (which is a bad sign). It turns out that those boxes have some interesting design problems, and there are no simple answers.

When you sit down to design a bus, you need to know how many circuits will connect to each line. That gives you the maximum steady-state current the bus drivers will have to supply. Next, you figure out the capacitance on the bus, which determines the transient current. The more loads or the greater the capacitance, the bigger the drivers you need to do the job. Remember that those drivers are on each card, not just the system board.

You can add an expansion box in one of two ways: by direct wiring or adding buffers. The former is simply a set of wires that runs between the original system board and the expansion board, so the bus drivers have to handle the added loads and capacitance. If you add buffers to drive the expansion board, the original drivers don't have to contend with an additional load (the buffers are located on a card that plugs into the original bus, just as you expected).

In fact, buffered designs have bus drivers at each end, so neither bus is connected directly to the cable. Each bus has

a card connected to the cable, so you lose one slot in each. In some designs the circuitry is on the expansion chassis board. Such designs don't need a separate card in that box, but they still use a card slot in the computer.

Obviously, a double-buffered expansion bus is a better way to do things. But here's the catch: There's no way to tell in which direction those new drivers must send the signals. For example, suppose you have a video card in the expansion box and a hard disk controller in the original system. When the processor reads data from the disk, the buffers in the expansion box should be inactive to avoid conflicts with the disk card. A read from the video card requires that the buffers drive data from the expansion box onto the original bus. But you can't tell which is which by any logic based on the bus signals alone.

A similar problem comes up with I/O ports and control lines. It turns out that the true-blue IBM expansion box, which was recently discontinued, used a bizarre scheme: It waited to see which bus was active, then turned on the drivers to send data in the other direction. Perforce, it also added a wait state or two to all data transfers to cover the indecision. Ugly, but it worked fairly well.

Another problem is radio-frequency interference (RFI). The cable between the two units contains a large number of lines all switching at the same time, and it is just about the right length to serve as an antenna. You wind up with a very nice TV and radio jammer.

What to do? If you're up for a little soldering, you might want to try the brute-force approach. Get a PC system board (from the back pages of BYTE) without any components at all. Use some ribbon cable to connect it directly to your Tandy 1000 and see if it works. I'd suggest wiring the cable with ground lines alternating with signals to keep the RFI down and making it a foot or so long to keep the capacitance down.

You'll need to add a power supply for the expansion board, but do not connect the power supply lines between the two systems (only the ground lines—two supplies connected together don't work at all). Fitting the thing into a case should be straightforward, but you'll wind up with a rather funny-looking 1000.

I can assure you that a speedup card won't work, simply because the longer bus won't tolerate any higher speeds.

Given the rather low prices for AT clones, it may be worth your while to invest in a bigger, better, faster, more expensive system that will almost certainly work when you take it out of the box. One problem with trying to exceed the designer's specs is that you're likely to wind up with a pile of hardware that doesn't quite work anymore.—Steve

Get in Touch

Dear Steve,

I am trying to locate a place to purchase some conductive, transmissive Mylar that is used to make touch-screen input systems. It is similar to the indium-/tin-/oxide-coated glass used in capacitive touch-oven controllers. I have called some of the thin-film deposition companies, but I haven't received any of the promised literature. Do you know a source for this product?

Also, what is the preferred method to connect to this material? Several years ago I had a sheet of this material, and I used zebra strips and edge connectors.

Mike Kerr
Johnson City, TN

I don't know about any conductive Mylar, but I have tinkered with some Kynar film. It has some amazing properties: It's piezoelectric, pyroelectric, transparent (with the right electrodes), and durable. It's made by Kynar Piezo

continued

IN ASK BYTE, Steve Ciarcia, a computer consultant and electronics engineer, answers questions on any area of microcomputing. The most representative questions will be answered and published. Send your inquiry to Ask BYTE

c/o Steve Ciarcia
P.O. Box 582
Glastonbury, CT 06033

Due to the high volume of inquiries, we cannot guarantee a personal reply. All letters and photographs become the property of Steve Ciarcia and cannot be returned.

The Ask BYTE staff includes manager Harv Weiner and researchers Eric Albert, Tom Cantrell, Bill Curlew, Ken Davidson, Jeannette Dojan, Jon Elson, Frank Kuechmann, Tim McDonough, Edward Nisley, Dick Sawyer, Robert Stek, and Mark Voorhees.

Quality champ captures low price title with \$745 data acquisition board.

By: Joe Zimmerman, Sports Staff
Marlboro, MA

Faster than you could say "what hit me?" the fight was over.

With speed (20 kHz), multiple I/O combinations (16 A/D, 2 D/A, 16 DIO), and a below-the-belt price, Data Translation brawled its way to the low price data acquisition championship.

Asked after the fight about the loser's slow speed and high price, Fred Molinari said, "Was he fightin' in slow motion, or what? I can't believe anyone would pay him more."

Indeed, this reporter can't believe it either. The DT2811 is a great value—even without the FREE DT/Gallery Software that Data Translation ships with it. And optional industry standard software packages are available at incredibly low prices.

For more information, call Data Translation today. You'd have to be punch drunk to buy anything else.



Fred Molinari, President



Call (617) 481-3700.

To learn more, see us in Gold Book 1987, or call to receive our first-ever 1987 3-Book Set, including 1987 Catalog, Product Summary Price List, and Applications Handbook.

Model	Analog Inputs			Analog Outputs			Digital Functions				Price
	Input Channels	Resolution (bits)	Throughput	Output Channels	Resolution (bits)	Throughput	I/O lines	Programmable Clock	Screw Terminal Panels	Software	
DT2811	16SE/8DI	12	20 kHz	2	12	50 kHz	8 In, 8 Out	Yes	Yes	DT/Gallery (free) LPCLAB LABTECH ACQUIRE DT/Notebook	\$745

DATA TRANSLATION®

World Headquarters: Data Translation, Inc., 100 Locke Drive, Marlboro, MA 01752-1192, (617) 481-3700 Tlx 951646

European Headquarters: Data Translation Ltd., The Mulberry Business Park, Wokingham Berkshire, RG11 2QJ, England, 734-793838 Tlx 851849862

International Sales Offices: Australia (2) 662-4255; Belgium (2) 735-2135; Canada (416) 625-1907; Chile (2) 25-3689; China (408) 727-8222, (8) 721-4017; Denmark (2) 274511;

England 734-793838; Finland (90) 372-144; France (1) 69280173, (1) 69077802; Greece 951-4944, (03) 152-7039, (1) 361-4300; Hong Kong (3) 7718585; India (22) 23-1040; Israel (3) 32-4298;

Italy (2) 81-821; Japan (3) 502-5550, (3) 375-1551, (3) 355-1111; Korea 778-0721/5; Morocco (9) 30-4181; Netherlands (70) 99-6360; New Zealand (9) 504-759; Norway (02) 55 90 50;

Peru (14) 31-8060; Portugal (1) 545313; Singapore 7797621; South Africa (12) 46-9221; Philippines 818-0103; Spain (1) 455-8112; Sweden (8) 761-7820; Switzerland (1) 723-1410;

Taiwan (2) 709-1394; West Germany (89) 80-9020.

Data Translation is a registered trademark of Data Translation, Inc.

Circle 77 on Reader Service Card

CD-ROM/WORM

ALL PRODUCTS, LOWEST PRICES,
EXPERT ADVICE

INTRODUCTORY OFFER

- Hitachi CDR-1503S CD-ROM drive \$895 and your choice.
- Grollier Electronic Encyclopedia (+\$80 after 1/88) or
- Microsoft Bookshelf with MS-DOS Extension or
- McGraw-Hill Science and Technical Reference Set or
- PC-SIG 817 PC Software Programs

Hitachi CDR-1503S CD-ROM DRIVE \$729
with Digital Audio Input/Output \$929

Full height - standalone - front auto load - Hi-Fi CD audio capabilities (with CD-PLAY described below) - daisy chain capabilities - for IBM PC/XT/AT and full compatibles.

Hitachi CDR-3500 CD-ROM DRIVE \$829
with Digital Audio Input/Output \$979

Half height - Internal mount - same features as Hitachi CDR-1503S.

WORM DRIVES—400 MB \$2799
—800 MB \$3799

Full height - standalone - for IBM PC/XT/AT and full compatibles.

Call for pricing on all Hitachi, Phillips, Denon, Sony and Panasonic drives.

SOFTWARE FOR HITACHI AND COMPATIBLE CD-ROM DRIVES*



CD-PLAY \$95
Permits user to play CD audio disks. RAM resident "Pop-up" accessory - compatible with all major software - recognizes CD and displays track title information - outputs to headphones or stereo amplifier.

CD-PLAY + SAMPLER \$195
Same features as CD-PLAY plus CD sampling functions for electronic musicians.

CD-TEST \$195
Tests accuracy of data storage on CD audio disks - for audiophiles, CD-Professionals (available soon).

CD-UTILITIES \$195
Quick Basic routines permit software developers to access CD-ROM/Audio drive capabilities.
* Drive must have audio output capabilities.

CDP sells all software including the International Dictionary of Medicine and Biology - Med Line - Library References and Indexes - Encyclopedia of Chemical Technology - Corporate Databases.

Call for Prices/Catalogues. Special prices for first time customers, computer dealers, corporate/government accounts, libraries, educational institutions. International shipments a specialty.

TO ORDER CALL 800-MEGABYTE (634-2298) INQUIRES CALL 212-996-6999

Policy: Shipping and handling extra. Personal and company checks require 3 weeks to clear. For faster delivery use your credit card (add 3% for MC and Visa, add 5% for AMEX) or send a cashier's check or bank money order. New York residents add 8.25% sales tax. All prices are U.S.A. prices and are subject to change and all items are subject to availability. Defective software will be replaced with the same item only. Hardware will be replaced or repaired within the terms and limits of the manufacturer's warranty. We cannot guarantee compatibility. All sales are final and returned shipments are subject to a restocking fee.

CDP
Compact Disc Products, Inc.
217 East 85th Street (Suite 216)
New York, NY 10028

Parallel port

Signal	Pin #
strobe	1
data 0	2
data 1	3
data 2	4
data 3	5
data 4	6
data 5	7
data 6	8
data 7	9
BUSY	11

Speech chip

Pin #	Signal
20	ALD
18	A1
17	A2
16	A3
15	A4
14	A5
13	A6
	No connection
	No connection
9	LRO

Figure 1: Diagram for connecting an Atari 1040ST's parallel port to an SP0256 speech-synthesis chip. You should also wire the parallel port's ground (pins 18 to 25) to the ground of whatever circuit board the SP0256 is on.

Film Group, Pennwalt Corp., 900 First Ave., King of Prussia, PA 19406, (215) 337-6710. The company was selling a \$45 experimenter's kit a while ago. The film had aluminum electrodes, so it wasn't transparent. Pennwalt makes it with transparent electrodes, but that costs more.

The nice thing about Kynar is that it generates a voltage when you touch it. A few suggested circuits let you pin down where the touch occurred. You can either zebra or pattern the connections right in the film.

If you're buying the stuff by the acre, the company will do anything you want. In sample sizes, you're stuck with whatever they've got. Depending on your application, Pennwalt may have some standard film that will be close enough. —Steve

Little Orphan Softcard

Dear Steve,
After recently purchasing an Apple IIGS computer, I was disappointed to learn from Microsoft that my Softcard (which I used previously on my Apple II Plus) is incompatible with the IIGS. I have heard conflicting reasons for this incompatibility. Some say all I need is a software upgrade, while others—including Microsoft—say the situation is hopeless. Can you tell me the cause for this incompatibility and how I can go about solving this problem?

Steven Park
Baltimore, MD

One of the unfortunate happenings in the microcomputer industry is the occasional creation of an orphan interface that is unable to follow along when a major equipment upgrade is performed. If your Z80 board is the original Microsoft Softcard, it has indeed been orphaned because of uncorrectable (sans hardware changes) timing problems. If you have the newer Softcard II (with 64K bytes of on-board

RAM), a software update is available from Microsoft that accommodates the differences between the II Plus and the IIGS.

If you have the older card, it looks like your only option is to get a newer Z80 card with appropriate software for the new computer. —Steve

Parallel Talk

Dear Steve,
I am building a speech synthesizer for my Atari 1040ST. The circuit is based on a diagram I found for Commodore 64 and Radio Shack computers, and it uses an SP0256-AL2 chip. How do I connect the chip to my Atari's serial or parallel port?
Kairi Yousif
El Cajon, CA

The SP0256 speech-synthesis chip you are trying to interface was designed to be driven easily from a Centronics-compatible parallel printer port. The Atari 1040ST parallel port meets that requirement.

Look at the pin connection diagram in figure 1. You'll also need a low-pass filter and audio amplifier stage, but I assume those are shown on the schematic from which you are working. —Steve

CIRCUIT CELLAR FEEDBACK

More Talk

Dear Steve,
Recently, I came across your article on ADPCM (adaptive differential pulse-code modulation) for speech synthesis (June 1983 Circuit Cellar).

I am starting a small project on the statistical analysis of speech at the allophone level. Do you know of any source that could supply a set of the allophones in a digitized form? It would be of great help

continued

"We need a powerful relational database"



"But we need a high performance spreadsheet"



It's a Win-Win with Open Access II The Most Powerful Database and Spreadsheet Available in An Integrated Package

The arguments for integrated software used to be convenience, ease of use, and shortened learning curve. The argument against it was no power. The argument is over. According to our users, the primary reason for their purchase of Open Access II is the power of the relational database and the spreadsheet with 3-D graphics, followed by convenience and ease of use. And, by the way, this database and spreadsheet are integrated with a word processor, communications and desk accessories.

Nose-to-Nose Comparison Chart

	Database	Form Query	Report Generator	Query Processor	Relational Database	Graphics	3-D Graphics	Spreadsheet	Goal Seeking	Work Processor	Communications	Time Management
Open Access II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Symphony	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Framework	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

What's New in Open Access II

Meeting the challenge of advanced hardware technology, Open Access II update version 2.05 includes graphics drivers for the IBM Personal Systems/2, extended memory support, math co-processor support (8087/80287) and 37 other additions and alterations.

Developers Delight

The power and flexibility available in this package makes it an ideal software choice for developers of complex vertical applications, developers in need of large databases with sophisticated programming capabilities. With the addition to our product line of Runtime System and our upcoming compiler, Open Access II has

Software Products International

10240 Sorrento Valley Road · San Diego, California 92121

strengthened its position as a software developer's power tool.

Accounting Access is now available for customized bookkeeping with Open Access II.

Also, Filling Your Network Needs

Local Area Network users around the world are singing the praises of Open Access II Network. So is the press, Infoworld calls it "an excellent value... may be one of the software bargains of the year." LAN Magazine says "... a sharp product... a unique and interesting spreadsheet locking scheme."

Test Drive - \$19.95

We invite you to experience the power, flexibility, and performance available in this integrated package by test driving Open Access II with our Demo Tutorial. For only \$19.95 you can experience this software, limited only by file size restrictions.

Call **800-521-3511**

(if you're in California call **800-621-7490**).

Order your Demo Tutorial today, it's a powerful experience.

"I always get what I want"



"Me too!"

Open Access II users call for update trade-in information.

"WITH dBASE, MY PROGRAMMING LANG



To develop useful applications with most database management software, you're forced to learn a programming language.

But with every rule, there's an exception.

In this case, it's R:BASE® System V.

As Ike Botnick will attest.

Botnick, who owns a company that develops and sells software to monitor stock market fluctuations, needed to keep track of his customers, orders, inventory and billings.

What he didn't need was dBASE®

"THE ONLY GOOD THING I GOT FROM dBASE WAS MY MONEY BACK"

Botnick saw an ad for dBASE III PLUS™, believed its claim that you can develop applications without having to program, and bought it.

As soon as he attempted to develop applications with it, like custom reports, he ran into trouble.

When he called Ashton-Tate with questions, he was politely told that he would have to learn the dBASE programming language.

To which Botnick politely replied, "I'm damned if I'm going to spend three months learning a programming language just so I can develop a few simple business databases."

That's when he turned to R:BASE System V.

"R:BASE SYSTEM V IS THE PRODUCT dBASE PROMISES IN ITS ADVERTISING"

Because our EXPRESS System generates programming code, three days after Botnick opened the box, he had finished two-thirds of his application. Two days more, and his order entry, invoicing and

MOST FREQUENT USAGE WAS !%? \$ # & * !"

—Ike Botnick, R:BASE System V user.



customer tracking application was complete.

When he finished, he had a system with three tables, special order entry rules, custom invoice forms that matched his old invoices, a multi-level set of menus, and a whole list of customized reports and summaries.

"If I'd worked straight through," he says, "it would have taken maybe a day and a half. And not only did I get the application I needed, it was automatically debugged. System V is exactly what a business needs. It's great for people who don't know how to program."

**FOR YOUR LOCAL MICRORIM DEALER,
CALL 1-800-624-0810, DEPT. BY0188:**

The best way to get started with R:BASE System V is to call our toll-free number and ask for the name of your nearest Microrim dealer. Or, order a Trial Pack.

Circle 168 on Reader Service Card

They're just \$19.95 plus shipping for the 5.25-inch Trial Pack. Or \$24.95 plus shipping for the 3.5-inch Trial Pack.

R:BASE System V. It's one decision you'll swear by.

**R:BASE
SYSTEM V
MICRORIM**



InfoWorld's Overall MS-DOS Software Product of the Year.

*From Alaska and Canada call 1-206-607-1800 Dept. BY0188. The 5.25-inch format runs on IBM PC, XT, AT and 100% compatibles, and on all major LANs with no additional cost for extra users attached to the server. The 3.5-inch format runs on IBM PS/2 and other 100% MS-DOS compatibles. Trademarks/Owners: Microrim, R:BASE/Microrim, Inc.; IBM, PS/2/International Business Machines, Inc.; dBASE, dBASE III PLUS/Ashion-Tate Corporation; InfoWorld/CW Communications, Inc. © Microrim 1987.

LABELING SOFTWARE



For DOT MATRIX and Laser Printers

(Epson/IBM/Okidata/LaserJet)

- Labels for shelves, bins, inventory
- Text readable up to 50 ft
- Bar Codes 1 2 of 5, UPC/ EAN MIL-STD. AIAG. Code 39
- Any size label • Flexible format
- Color options • Reversals • Fast
- File input • Menu driven • \$279
- Other bar code programs from \$49
- Not Copy Protected!

30 Day Money Back Guarantee!

WORTHINGTON
DATA SOLUTIONS

417-A Ingalls Street
Santa Cruz, California 95060
408/458-9938

Bar Code Readers for PC, XT, AT, PS/2



RS-232 and PS/2 model \$399
PC/XT/AT Internal/External ... \$385

- Rugged Metal Pen
- Reads 1 2 of 5, UPC/EAN Codabar, Code 39, etc.
- Attaches as 2nd Keyboard
- No software needed to add bar code reading to your system

30 Day Money Back Guarantee!

WORTHINGTON
DATA SOLUTIONS

417-A Ingalls Street,
Santa Cruz, California 95060
408/458-9938

in getting my project started. A PCM-coded set readable on an IBM PC would be easiest to use.

Lawrence M. Politzer
Engineering Technology Dept.
Youngstown State University, OH

One of the problems facing anybody building speech-recognition hardware or software is that there's no standard speech against which to measure the results. This allows anyone to define a test set that makes the answers come out very well for whatever's just been developed, but it tends to breed suspicion in the users, who find that it doesn't work well in real life.

Since you're not developing a commercial system, you might be able to pry some samples out of manufacturers who build such hardware. There might be some strings attached, but they'd surely be less onerous than having to do the sampling yourself.

The IEEE Acoustics, Speech, and Signal Processing Society may also have contacts that can help. I recall that there were some tapes available with digitized speech samples, but my memory fails after that point. Get in touch with the IEEE, perhaps through your campus chapter, and see what they've got.
—Steve

Home Control

Dear Steve,
I would like to put a system for controlling a hi-fi and perhaps other things from any of several locations (upstairs and downstairs) in my two-story home. I'm not ready to design and build the system, but because of some remodeling projects, it is an ideal time to string cables through the walls. Hence, my question: What kind of cables? If they have lots of wires, they will be expensive but will permit relatively cheap and dumb terminals. On the other hand, if I am willing to build several smarter terminals, then perhaps very simple cables will suffice. What do you recommend?

Benjamin G. Cooper
Minneapolis, MN

You're fortunate to have the opportunity to lay your own wire. Most people have no option but to resort to AC power carriers like the X-10 system.

As for the type of wire you should use, the best trade-off between cost, flexibility, and performance is probably shielded dual twisted pair, which is just a more expensive variant of phone wire. As apparent from the name, it combines four wires with a shield connection that you can use for ground.

Four wires give you lots of options:

full-duplex RS-232C plus RTS and CTS handshaking; RS-422, single-ended or differential; and so on. RS-232C is the best bet for keeping costs down; nearly every gadget you might want to hook up will adapt to an RS-232C.

Wiring topology is another issue. Bus, star, and ring networks have their own advantages and disadvantages. A bus topology is probably best, but it needs fancy software and chips. A ring is good, but it requires active nodes (i.e., everything on-line for any communication to take place) unless you bypass unused nodes with a switch. A star is simple, but it needs lots of wire and a central controller. Check out a book on local-area networks (LANs) and see which one is best for you.

The shielding really helps protect your data from noise spikes. Though it might be convenient, I wouldn't route the data cable next to the AC power lines and outlets—better be safe than sorry. Of course, it goes without saying that you have to make sure your setup meets all building codes. Safety first.—Steve

Just the Facts

Dear Steve,
I have a few questions for you. First, what is a real-time operating system? Second, is MS-DOS a real-time operating system? Finally, how are Unix and Xenix related?

Hugh Roth
New York, NY

MS-DOS was originally designed to handle just one task at a time. When a program is loaded, DOS gives it all available memory with no restrictions on its accessing that memory. DOS was also written with nonreentrant code, which means that trying to run two or more programs concurrently is more difficult than it has to be.

You usually find real-time operating systems in scientific and process-control environments. For example, a computer may be controlling an industrial process where, for the most part, very little raw computing power is needed. The computer monitors temperatures, pressures, valve openings and closings, and so on. However, in an emergency, it may be vital that the computer shut down processes quickly.

The computer must assess certain information—say, that a critical temperature or pressure has been reached. It may be that if a high pressure isn't relieved immediately, some damage may occur. Suppose also that as a result of this high pressure, a critically high temperature has been created elsewhere. The computer must analyze this information and

continued

FUTURE COMPATIBLE.

Advanced technology ready to work for you today.

At Tandon we feel that our personal computers should not only be exactly compatible with your present needs, but able to meet all your future standards as well.

Our Targa 20, for example, is a powerful 80286-based system with many features not yet available elsewhere.

It comes with a full 1MB of memory and the ability to use it all with our ingenious Memory Management System.

And when Microsoft's Windows 2 operating environment is available, you

can expect it to run even faster than the equivalent PS/2 system.

Large storage capacity, faster processing speed, innovative technology, a small footprint, and the reliability and quality assurance of an industry leader like Tandon.

So whether you need a powerful computer to help you manage your present business, or use a high-

performance state-of-the-art system to keep you compatible with the future, call today.

National 1-800-556-1234 Ext. 171. In California 1-800-441-2345, Ext. 171.

FEATURES	
Processor	80286
Supports OS/2	Yes
1MB Memory	Standard
Memory Management	Yes
Storage	20MB
Small Footprint	Yes



Tandon

Price. Selection. Quality.

Please send me your Tandon Fact Pac, a comprehensive set of literature and product reviews:

Name _____
 Company _____
 Address _____
 City/State/Zip _____
 Telephone _____

Tandon Computer Corporation
 405 Science Drive
 Moorpark, CA 93021

BYTE 188

PS/2 is a registered trademark of International Business Machines Corp. Microsoft Windows is a registered trademark of Microsoft Corporation.

Now use WordPerfect® with PerfectPal™ and forget those function keys

Sure, WordPerfect is the world's best word-processing software, but most of us never master more than a third of its power.

But now there's a way you can use all the WordPerfect you need. It's called PerfectPal. It will help you become a WordPerfect power-user immediately.

PerfectPal is a handy add-on system of 246 pre-coded macros that simplify every WordPerfect command to a key stroke or two. Including commands most give



up on such as sort, math, merge, columns, table of contents, and hundreds more. PerfectPal lets you use easy to remember key strokes like ALT-P to print a document instead of menus and manuals.

And, PerfectPal even includes commands that WordPerfect doesn't—such as full foreign language and math symbols.

PerfectPal is for the novice and expert alike. So order now and make your perfect better yet.

Only \$79
plus \$3 S/H
30-Day-Money-Back
Guarantee

1-800-451-6086

PerfectPal

PC [TEMPLATE] P.O. Box 9273, Glendale, CA 91206

246 pre-coded macros that simplify WordPerfect productivity.

CIARCIA FEEDBACK

enable equipment to relieve the critical temperatures and pressures. This scenario demands a real-time operating system, one that can respond to independent and possibly simultaneous events and do so without the computer's losing track of what it is working on at the time.

DOS is not the operating system for handling environments as described above. Some attempts at providing multitasking for DOS are available: Digital Research's Concurrent PC DOS, DESQview by Quarterdeck Systems, Windows by Microsoft, and The Software Link's PC-MOS are a few examples. These solutions use some form of time-slicing algorithm. They intercept the system-clock interrupt, suspend the currently executing program and store its operating status, and pass control to another process. Usually, the operating system gives each program equal slices of execution time, assigned in round-robin fashion. In our process-control example, this task-assignment technique may be unacceptable, since it could be a relatively long time before a critical task is given its execution time slice.

Real-time operating systems can give variable amounts of execution time to processes. They can also assign priorities to processes, thus enabling the computer to recognize emergencies and devote more time to an important program. (I have used a process-control application as an example, but the control of scientific experiments can be similar.) While Unix is a multiuser, multitasking operating system, its design is such that, like MS-DOS, it is not suitable for real-time operations.

Unix is a trademark of AT&T. Other vendors, such as Microsoft, license Unix from AT&T but are prohibited from advertising it as Unix. They adapt it to various machines and market it under their own names (Xenix is Microsoft's Unix offering). Thus, anyone who is familiar with Unix on a minicomputer will find it almost identical to Xenix on an IBM PC.
—Steve

I Miss the Megabytes

Dear Steve,
I recently acquired an NEC MultiSpeed laptop computer; I've owned a Compaq "luggable" for several years. I got the NEC because I needed a lightweight computer that I could carry from office to office. Now, although I enjoy the speed of my laptop, its two 720K-byte floppy disk drives still seem small after my Compaq's 30-megabyte hard disk drive.

I know that at least one manufacturer makes hard disk drives for the NEC (I saw an NEC with a hard disk drive at

continued

POWER TOOL.

Introducing 4x488™

You get intelligent IEEE-488 and RS232 ports to make instrument programming fast and easy.

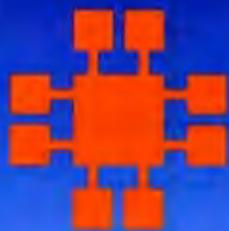
You can have up to 4 Mbytes of memory on the same board for your largest programs, RAM disks, and data acquisition tasks.

Compatibility is built-in so you can run your favorite programs or create new ones with our advanced programming tools.

To get your FREE demo disk—call 617-273-1818.

cec Capital Equipment Corp.
Burlington, MA 01803

The bottom line—IEEE-488, RS232, par. port, 4MB EEM LIM, runs DOS and OS/2.



JDR INSTRUMENTS™

Complete customer satisfaction... superior service... friendly, knowledgeable personnel... quality merchandise... providing the best values in leading edge technology.



Our DMM-300 A remarkable value! 7995

This full function 3.5 digit DMM offers highly accurate performance and a host of added features to help you do the job—fast. Capacitance, transistor, temperature, conductance and audible continuity in addition to the ranges you'd expect from a DMM of this quality. Temperature probe, test leads and battery included. Input impedance: 10M ohm. Basic DC accuracy: plus/minus 0.25%. Approx. 7" x 3 1/2" x 1 3/4" Wt. 13 1/2 ozs.

FULLY OVERLOAD PROTECTED

TRANSISTOR TESTER

9 FUNCTIONS 34 RANGES

CONDUCTANCE TESTER ADDS VERSATILITY

TEMPERATURE TESTER TO 2000° F

DC VOLTAGE TO 1000 VOLTS

AC/DC CURRENT 200µA TO 10A

CAPACITANCE TESTER 2000pF TO 20µF

DPM-1000 \$54.95

3.5 DIGIT PROBE TYPE DMM

Custom 80 pin LSI chip provides accuracy and reliability in such a compact size. Autoranging, audible continuity and data hold feature help you pinpoint the problem quickly. Case and batteries included.

- Basic DC accuracy: plus/minus 1%
- DC voltage: 2v-500v, autoranging
- AC voltage: 2v-500v, autoranging
- Resistance: 2k ohms-2M ohms, autoranging
- Fully over-load protected
- Input impedance: 11M ohm
- Approx. 6 1/2" x 1" x 3/4" Under 3 ozs.



- ★ **2 YEAR REPLACEMENT WARRANTY**
- ★ **30 DAY MONEY BACK GUARANTEE**
- ★ **TOLL FREE TECHNICAL SUPPORT**
- ★ **NEXT DAY AIR SHIP AVAILABLE**

MODEL 2000 \$349.95

20 MHz DUAL TRACE OSCILLOSCOPE

Model 2000 makes frequency calculation and phase measurement quick and easy. The component tester aids in fast troubleshooting. Service technicians appreciate the TV Sync circuits for viewing TV-V and TV-H and accurate synchronization of the video signal. Blanking, VITS, and V/H sync pulses.

- Exceptionally bright 5" CRT
- Built-in component tester
- TV Sync filter
- X-Y operation • 110/220 volts



MODEL 3500 \$499.95

35 MHz DUAL TRACE OSCILLOSCOPE

Wide bandwidth and exceptional 1mV/DIV sensitivity make the Model 3500 a powerful diagnostic tool for engineers or technicians at a remarkable price. Delayed triggering allows any portion of a waveform to be isolated and expanded for closer inspection. Variable Holdoff allows stable viewing of complex waveforms.

- Exceptionally bright 5" CRT
- Delayed and single sweep modes
- Z axis intensity modulation
- X-Y operation • TV sync filter
- Fast 10ns rise time



DMM-200 \$49.95

3.5 DIGIT FULL FUNCTION DMM

Get highly accurate performance at a very affordable price. Rugged construction, 20 amp current capability and 22 ranges make it a perfect choice for serious field or bench work. Lo battery indicator and tilt-stand. Probes and 2000 hour battery included.

- Basic DC accuracy: plus or minus 0.25%
- DC voltage: 200mv-1000V, 5 ranges
- AC voltage: 200mv-750V, 5 ranges
- Resistance: 200 ohms-20M ohms, 6 ranges
- AC/DC current: 200µA-20A, 6 ranges
- Input impedance: 10M ohm
- Fully overload protected
- Approx. 7" x 3 1/2" x 1 1/2" Wt. 11 ozs.



DMM-100 \$29.95

3.5 DIGIT POCKET SIZE DMM

Perfect for the field service technician. Shirt pocket size without compromising features or accuracy. Large, easy to read 1/2" LCD display. Fully overload protected for safety. 2000 hour battery life with standard 9v cell. Probes and battery included.

- Basic DC accuracy: plus/minus 0.5%
- DC voltage: 2v-1000v, 4 ranges
- AC voltage: 200v-750v, 2 ranges
- Resistance: 2k ohms-2M ohms, 4 ranges
- DC current: 2mA-2A, 4 ranges
- Input impedance: 10M ohm
- Fully overload protected
- Approx. 5" x 3" x 1". Under 7 ozs.

Circle 130 on Reader Service Card

JDR INSTRUMENTS, 110 KNOWLES DRIVE, LOS GATOS, CA 95030
RETAIL STORE: 1256 SOUTH BASCOM AVE, SAN JOSE, CA (408) 947-8881

COPYRIGHT 1987 JDR MICRODEVICES



ORDER TOLL FREE 800-538-5000

Tandy Computer Accessories: Because there is no better value.TM

Take Control with the Tandy® Power Switching System



Get total control plus power protection for only \$79⁹⁵.

The Tandy Power Switching System consolidates all of your power needs into one convenient unit. This six-outlet power controller places your entire system at your fingertips. In addition, you get full power-line noise filtration, plus full common and differential mode spike protection. For more protection, the system includes a circuit breaker. The Power Switching System acts as a monitor base and even swivels to provide the best viewing angle. Take control—get the Tandy Power Switching System today! (26-203)

Radio Shack®
The Technology Store™
A DIVISION OF TANDY CORPORATION

Price applies at Radio Shack Computer Centers and participating stores and dealers. Computer system not included.

spring COMDEX), but I have lost information on the company.

Also, I have been thinking about building a battery-backed RAM disk with storage capabilities on the order of 10 megabytes. I would like it to be able to plug into the slot vacated by one of the disk drives and include a connector for an external power supply for when I change its battery. Can you give me any pointers about its construction?

Finally, I am considering changing some boards in my Compaq and replacing them with some of the newer multi-function cards. I am pretty sure that all of the slots in my Compaq are IBM-compatible, but I would like to be assured of this. I recently replaced the machine's keyboard (through my local dealer) and ended up paying considerably for the replacement, since the Compaq's keyboard requires 12 volts instead of the 5 V that most other keyboards require. I've sent Compaq a letter concerning slot compatibility, but the company has not answered so far.

David Ferguson
Winter Haven, FL

Premier Technologies (1890 McGaw Ave., Irvine, CA 92714, (714) 261-1184) and Axonix Corp. (417 Wakara Way, Salt Lake City, UT 84108, (801) 365-9521) both offer a 10-megabyte hard disk drive for the NEC MultiSpeed.

It may be technically possible to build a 10-megabyte RAM disk drive for your NEC, but it may not make sense when you take everything into consideration. For example, if you were to use 1-megabit chips, you would need 90 of them for a 10-megabyte RAM disk.

Ninety chips take up a fair amount of space and produce a fair amount of heat. Even at bargain prices of \$25 each, that would be \$2250 for the chips alone. Power requirements would probably mean either a permanent AC adapter (limiting portability) or an additional battery pack to lug around. All in all, one of the above hard disk drives would be a better choice.

Compaq makes some nice computers, but it has fallen short in technical support for the end user, refusing to answer even simple questions. The company requires that the end user be serviced by a dealer and does not make its technical manuals available. Since I have not had much access to Compaq's computers, I can't comment on the keyboard question.

As far as replacing some boards, they should be compatible, but you should either try out the board before you buy it or make a prior arrangement with the vendor for a refund if it doesn't work.

—Steve ■

Great Deal.

Greater Deal.



How do you make a great deal even better?
By adding a full 20 megabytes more storage
to our Quantus X/T— and pricing it at only
\$100 more.

The new \$895 Quantus X/T 40. Leave it to
Quantus to give you more bytes for your buck.

Specifications and prices subject to change.

Circle 306 on Reader Service Card

QUANTUS

Quantus Microsystems
One Butterfield Park
Spofford, NH 03462

(800) 255-0125
(800) 356-9001

(603) 363-8301
(603) 886-3220

Just What The Doctor Ordered. And The Lawyer. And The Architect...

The Quantus Turbo AT

- Monochrome monitor
- Half-height 40Mb hard drive
- 80286 running at 6-10MHz
- 1Mb RAM
- 8 expansion slots
- Text/graphics card
- Speaker
- 1.2Mb floppy drive
- 101-key enhanced keyboard
- 200 watt power supply
- 3 year limited warranty

\$1495
COMPLETE

The Quantus MT386

- Monochrome monitor
- Full-height 80Mb hard drive
- 80386 running at 4.77/6/8/10/16MHz
- 2Mb RAM
- 8 expansion slots
- Text/graphics card
- Speaker
- 1.2Mb floppy drive
- 101-key enhanced keyboard
- 200 watt power supply
- 3 year limited warranty

\$2995
COMPLETE

The Quantus Turbo XT

- Monochrome monitor
- Half-height 20Mb hard drive
- 8088 running at 4.77-8MHz
- 640K RAM
- 8 expansion slots
- Text/graphics card
- Speaker
- 360K floppy drive
- 84-key keyboard
- 150 watt power supply
- 2 year limited warranty

\$795
COMPLETE



QUANTUS

Quantus Microsystems
One Butterfield Park
Spofford, NH 03462

(800) 255-0125 (603) 363-4564
(800) 356-9001 (603) 886-3220

How To Buy A Network Without Blowing Your Net Worth.

Introducing Q-LAN. The complete, powerful local area network priced so low, it could only be from Quantus.

Like all Quantus systems, Q-LAN comes completely configured and ready to run — with hardware and software, cabling and connectors. Plus, Q-LAN gives you the option of custom-configuring your own network.

And, as you'd expect, our networks also come with a very small price tag — under \$5000 for a complete 2-user system.

Call Quantus today. At prices this low, you can't afford not to.

5-User Q-LAN

1 A/T File Server with 70Mb hard drive, monochrome monitor, 101-key keyboard, EGA graphics card

5 X/T Workstations with 640K, floppy, monochrome monitor, 101-key keyboard, EGA graphics card, 150 watt power supply

6 network cards, network software, complete network cabling, MS-DOS

\$9900

The Quantus logo is displayed in white, bold, sans-serif capital letters on a red rectangular background. The letter 'S' at the end of the word has a stylized arrow pointing upwards and to the right.

Quantus Microsystems
One Butterfield Park
Spofford, NH 03462

(800) 255-0125 (603) 363-8301
(800) 356-9001 (603) 886-3220

Specifications and prices subject to change.

Circle 308 on Reader Service Card



Actual unretouched screen image.

Mitsubishi Has A Great Picture In-Store For You.

A High-Quality Line of PC Monitors Priced Below The Competition.

Introducing the Mitsubishi *brand name* family of PC Monitors. Select from five different IBM® compatible models, along with the new IBM PS/2™ compatible XC-1429C. Each has a 13V" diagonal viewing area and proprietary high contrast glass for the sharpest image possible.

Affordably Priced PC Monitors

The XC Series incorporates proven Mitsubishi quality and reliability at an extremely affordable price. In fact, we've included a wide variety of features for which you'd expect to pay considerably more. Like advanced video and deflection circuits to reduce distortion and optional tilt and swivel base for improved ergonomics. Also in-line self-convergence for low power consumption and extra reliability.

The XC Series is available in quantity, ready to support a wide range of application needs—from standard word processing and business graphics to windowing and high resolution solids modeling and CAD.

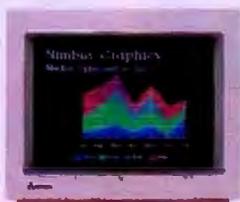
Complete Customer Satisfaction

Mitsubishi stands behind its brand name XC Series monitors with knowledgeable applications and service personnel and backs each product with a comprehensive one-year warranty. It all adds up to a worldwide reputation for state-of-the-art electronics and unparalleled customer satisfaction.

Compare the picture quality and see for yourself why Mitsubishi monitor displays look so good.

For product literature and your nearest distributor, call Mitsubishi today at 1-800-556-1234 Ext. 54. In California call 1-800-441-2345 Ext. 54. Mitsubishi Electronics America, Inc., Computer Peripherals Division, 991 Knox Street, Torrance, CA 90502.

Circle 183 on Reader Service Card
(DEALERS: 184)



XC-1409C

\$519.00 Sug. Retail
IBM-CGA Compatible
Medium Resolution Monitor:
13V" • 2,000 characters,
640 x 200 graphics resolution
• TTL video input
15.75KHz • 16 colors
0.4mm pitch stripe mask

XC-1410C

\$659.00 Sug. Retail
IBM-EGA Compatible
High Resolution Monitor:
13V" • 2,000 characters,
640 x 350 graphics resolution
• Dual-Mode/TTL
video input 15.75/
22.4KHz • 16/64 colors
0.4mm pitch stripe mask

XC-1430C

\$739.00 Sug. Retail
IBM-EGA Compatible
High Resolution Monitor:
13V" • 2,000 characters,
640 x 350 graphics resolution
• Dual-Mode/TTL
video input 15.75/
22.4KHz • 16/64 colors
0.31mm fine dot pitch

XC-1412C

\$799.00 Sug. Retail
IBM-PGC Compatible
High Resolution Monitor:
13V" • 4,800 characters,
640 x 480 graphics resolution
• Analog video input
30.49KHz • Infinite colors
0.31mm fine dot pitch

XC-1429C

\$685.00 Sug. Retail
IBM-VGA Compatible
High Resolution Monitor:
13V" • 4,800 characters,
640 x 480 graphics resolution
• Analog video input
31.5KHz • Infinite colors
0.28mm fine dot pitch

NEW!

Expansion Chassis/Tape Back-up



Specification

Model No.	No. of Slot	Space for Height Drive	Power Supply (Watts)	Dimension DxWxH(cm)	Price
M-1*	0	1	50	30x15x6.5	\$139
M-2	3	3	100	42x25x16	\$299
M-3	5	3	100	39x30x15	\$239
M-4	12	2	100	40x49x14	\$299
M-5	0	2	45	39x18x15	\$149
M-6	0	1	50	26.5x18x13.5	\$169
M-7	5	2	100	38.5x30x13.5	\$299
M-8	0	2	45	39.5x18x13.5	\$149
M-9	0	2	60	38.5x49x9	\$249
M-10	8	4	135	43x49x14	\$239

* Extra space for a stand alone controller

EXT and RCV Adapters (Interfacing Computer & Chassis With Slots)...\$149

Tape Back-up (With Controller & Cable)...\$499

ORDER TOLL FREE: (800) 826-0267
In California Call (408) 434-0877
SOURCE ELECTRONICS CORP.

2380 Qume Drive, Suite A
 San Jose, CA 95131

Telex: 279366 Fax: (408) 434-0539

line and extracts option flags and arguments (Microsoft C apparently has no facility to do this). He puts the function to good use in a sample program called Timer, which performs a number of timing and sound functions inside the IBM PC. Starting with the Timer program, Hansen puts his programming methodology into practice by providing both pseudocode descriptions and manual pages for his programs.

File-oriented Utilities

Many concepts and much of the code developed in the first two sections find application in Section III, which is devoted to a set of file-oriented programs, including several Unix-like file and directory utilities. Although some of the programs duplicate functions provided by DOS, they generally exhibit some added features. The LS utility, for example, is a general-purpose directory lister that outperforms the DIR command by affording a number of output options. The subsequent chapter extends the programming technique developed thus far to the methodical development of PR, a Unix-like program designed to display or print the contents of text files either with or without formatting options. Between the author's clear explanations and the program's intrinsic usefulness, this chapter is pure gold.

Display Functions

In Section IV, the author turns his attention to screen-oriented programs, starting with brief discussions about determining the display system type and methods of updating displays. He develops a synchronized block-copy routine to address the latter problem and extends it in the following chapter into a set of functions that interact with a screen buffer.

Hansen begins a separate chapter on the ANSI.SYS device driver with the basics of what it is, how it's used, and the pros and cons of using it in the IBM PC environment. Having laid the groundwork, he then presents the source code for an ANSI interface package and uses it to implement a program that controls screen attributes.

In what is effectively the final chapter in the book, the author presents a file-viewing utility and discusses its construction. The appendixes in Section V cover, among other things, overviews of various C implementations and a summary of the routines presented in the book.

One gauge of the usefulness of a technical book, especially one that presents a series of working examples to the reader, is the value of the examples in relation to the cover price. For example, I have bought books that were hardly worth the trouble to read, despite a plethora of natively formatted source code. Others have provided one or two gems that made buying the book a break-even proposition. On rare occasions, I run across a book from which you get your money's worth and more; *Profluent C* is such a book.

Alex Lane (1873 Bartram Rd., Jacksonville, FL 32207) is a registered professional engineer with a strong interest in artificial intelligence. The moderator of the prolog conference on BIX, he can be contacted there as "a.lane."

THE COMPLETE GUIDE TO MIDI SOFTWARE

Reviewed by Donald Swearingen

Any book that claims to be the complete guide to any subject even loosely related to computer software must inevitably fall short of that claim. In a field where programmers are often hard at work on a program's next revision even as the current release is being shipped, it is practically impossible to provide a truly up-to-date compendium of available software.

continued

SOFTERM PC
 SEAMLESS REMOTE VIRTUAL-DISK
 KEYBOARD TRANSLATE FILE TRANSFER SCRIPT FILES
 TERMINAL EMULATION GENERAL COMMUNICATIONS
 EXACT EMULATION MODEM SUPPORT DOS INTERFACE
 BACKGROUND MAIL MONITOR LOCAL FILE TRANSFER
 UTILITIES DISK UTILITIES
 HOST SYSTEMS: DEC, Data General, IBM, Hewlett-Packard, and others
 PC APPLICATIONS: WordPerfect, Lotus 1-2-3, dBASE, and others

"50 Exact Emulations, 7 File Transfer Protocols, and Multi-port Background Communications"

- Seamless Remote Virtual-Disk integrates file transfers between remote systems and your favorite PC application using local disk syntax
- Supports IBM® PS/2, PC, XT, AT compatibles
- Operates over any NetBIOS LAN, and the DEC LAT, Banyan, Bridge, Novell, and Allen Bradley Asynchronous Servers

SOFTERM PC
 With All Features and
 • 50 Exact Emulations
 Block and Conversational
 \$195.00

SOFTERM PC
 With All Features and
 • 50 Exact Emulations
 Block and Conversational
 • DEC VT 240 VT 241
 \$345.00

For Information Call
800/225-8590

SCITECH
 303/593-9540 Telex 450236

AW... WHAT THE HECK!

More than two years ago, we introduced the leading low-cost (under \$1000) CAD system, ProDesign II. It was priced at \$299. Since that time, more than 1000 enhancements have been added to the software, making ProDesign II the price performance leader in CAD.

Now, ProDesign II has been renamed DesignCAD and packaged with more than \$400 worth of supplementary software, including symbol libraries, file transfer utilities, and materials list programs. We added more than 100 enhancements to the software, making DesignCAD an extremely powerful CAD system at any price.

We were at a loss, however, when it came time to set the price. We considered pricing DesignCAD at \$999. We thought about reducing the price to a low \$599. We talked to industry experts. We met with marketing consultants. We performed calculations on the finest spreadsheets money can buy. Then, in the great American tradition, we said "Aw... What the Heck!" DesignCAD is priced at \$299!

New Name: ProDesign II is now DesignCAD

New Features:

- Compatibility with most other CAD systems large and small (DXF and IGES, Input and Output included at no extra charge).
- Compatibility with virtually all desktop publishing systems is included at no extra charge.
- Expanded Memory Support is now provided to utilize the full power of your PC/AT.
- Several new character fonts are now provided at no extra charge.
- More than 100 new drawing features are now provided at no extra charge.
- Symbol libraries with more than 500 symbols are included at no extra charge.
- A Bill of Materials utility is provided at no extra charge.
- DesignCAD provides complete support for the IBM System/2.

Same Quality:

- DesignCAD has all the features and capabilities of ProDesign II - normally found only in CAD systems costing thousands of dollars.
- DesignCAD, like ProDesign II, has unparalleled ease of use.
- DesignCAD, like ProDesign II, has unprecedented dot matrix print quality.
- DesignCAD supports more than 200 printers, 80 plotters, and virtually any mouse, digitizer, and display compatible with the IBM PC.

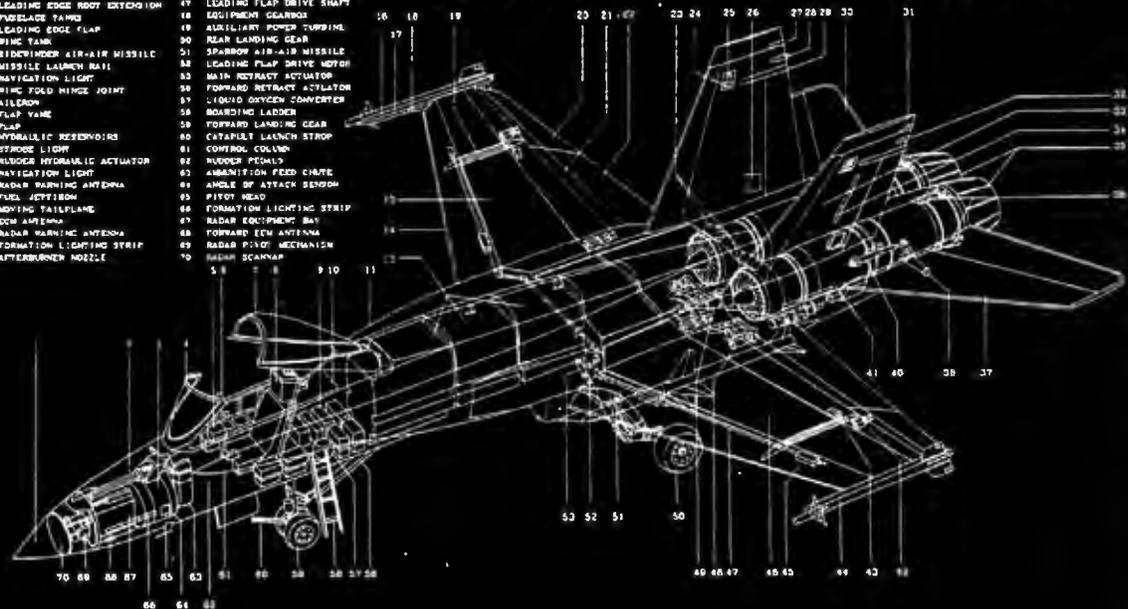
Call or write for a FREE DEMO DISK:
American Small Business Computers
 118 South Mill • Pryor, OK 74361 • 918/825-4844

ProDesign II is now **DesignCAD** Still Only **\$299!** *Circle 15 on Reader Service Card*

- | | |
|--------------------------------|---------------------------------|
| 1 RADOME | 59 AFTERBURNER NOZZLE ACTUATOR |
| 2 DOWN ROTARY CLIMBER | 60 MOVING TAILPLANE |
| 3 AMBITIONION MEGALINE | 61 TAILPLANE PIVOT MOUNTING |
| 4 WINGSCREEN | 62 TAILPLANE HYDRAULIC ACTUATOR |
| 5 INSTRUMENT PANEL | 63 TURBOPROP ENGINE |
| 6 HEAD-UP DISPLAY | 64 WING HYDRAULIC ACTUATOR |
| 7 CANOPY | 65 WING FOLD ACTUATOR |
| 8 EJECTION SEAT | 66 SIDEWINDER AIR-AIR MISSILE |
| 9 AVIONICS EQUIPMENT | 67 LEADING FLAP ACTUATOR |
| 10 SECOND SEAT SPACE | 68 WING PANEL |
| 11 LEADING EDGE ROOT EXTENSION | 69 LEADING FLAP DRIVE SHAFT |
| 12 FUELPLANE TANK | 70 EQUIPMENT GEARBOX |
| 13 LEADING EDGE FLAP | 71 AUXILIARY POWER TAPPING |
| 14 WING TANK | 72 REAR LANDING GEAR |
| 15 SIDEWINDER AIR-AIR MISSILE | 73 SPARROW AIR-AIR MISSILE |
| 16 MISSILE LAUNCH RAIL | 74 LEADING FLAP DRIVE MOTOR |
| 17 NAVIGATION LIGHT | 75 MAIN RETRACT ACTUATOR |
| 18 WING FOLD HINGE JOINT | 76 FORWARD RETRACT ACTUATOR |
| 19 WING | 77 LIQUID DIVIDER CONVERTER |
| 20 AILERON | 78 BOARDING LADDER |
| 21 FLAP VANE | 79 FORWARD LANDING GEAR |
| 22 FLAP | 80 CATAPULT EJECTOR STRAP |
| 23 HYDRAULIC RESERVOIR | 81 CONTROL COLUMN |
| 24 STROBE LIGHT | 82 WHEEL PEDALS |
| 25 WING HYDRAULIC ACTUATOR | 83 AMBITIONION FEED CHUTE |
| 26 NAVIGATION LIGHT | 84 ANGLE OF ATTACK SENSOR |
| 27 RADAR SEARCHING ANTENNA | 85 PILOT HEAD |
| 28 FUEL SYSTEM | 86 FORMATION LIGHTING STRIP |
| 29 MOVING TAILPLANE | 87 RADAR EQUIPMENT BAY |
| 30 DOW ANTENNA | 88 FORWARD ICM ANTENNA |
| 31 RADAR SEARCHING ANTENNA | 89 RADAR PITCH MECHANISM |
| 32 FORMATION LIGHTING STRIP | 90 RADAR SCANNER |
| 33 AFTERBURNER NOZZLE | |

F18 HORNET

DRAWN USING DESIGNCAD



Introducing

Quaid Analyzer

the tool that created CopyWrite

Now you can debug your own programs with a professional quality debugger - the one that unraveled every form of copy-protection used on the PC.

With the Quaid Analyzer, you can:

- See occurrences of any interrupt, with its meaning shown on the screen.
- View memory as text or instructions, scrolling as easily as you do with an editor.
- Run until a memory location or I/O port is changed.
- Protect your hard disk from accidental destruction.
- Analyze software without the source, even when it uses countermeasures to thwart tracing.
- See all stages of the boot load.

We kept the Quaid Analyzer off the market to avoid helping publishers with copy-protection. Now that copy-protection is gone, we can sell it to you.

The Quaid Analyzer is a software tool occupying 100K bytes. It runs on any IBM PC and most MS-DOS systems without hardware modification.



Call (416) 961-8243

Quaid Analyzer \$99 U.S.

All orders shipped at our expense within a day. All major credit cards accepted.

or return coupon to:
45 Charles St. East
Third Floor, Dept. 605
Toronto, Ontario. M4Y 1S2

Payment method MC-Visa-Amex-Diners-Check

Card No. _____

Expiry Date _____

Name _____

Address _____

City/State _____

Phone No. _____

Signature _____



Quaid Software Limited

Ask about Disk Explorer the program that takes over where Quaid Analyzer leaves off.

BOOK REVIEWS

Not unpredictably, *The Complete Guide to MIDI Software*, written by Howard Massey and the staff of New York's Public Access Synthesizer Studio (PASS), provides something less than a complete overview of this new and rapidly expanding area of software development. What it does provide, according to its authors, is an unbiased survey of some 60 musical instrument digital interface (MIDI) software packages available at the time of the book's publication. As you shall see, even this more circumscribed objective proves difficult to fulfill.

Real-World Perspective

PASS, which has been reorganized as the Center for Electronic Music, is a nonprofit organization devoted to making available state-of-the-art facilities for audio production and synthesis, along with various related services, including workshops, seminars, and individual instruction. As such, the members of PASS are in the position of having had hands-on experience with all the software described. This reservoir of expertise gives the book its strongest voice; the comments and observations reflect a real-world perspective rather than the detached or tendentious attitudes that are often present in critical reviews.

However, while a great deal of specific and quite useful information is communicated within its pages, the book fails to define any general criteria by which readers might objectively compare one program with others of its class.

Only 8 of the book's 250 pages are devoted to introductory and background material. The remaining pages consist of actual reviews of individual MIDI software packages. The authors skimp on more general information that might have been most useful to a reader attempting to get his or her bearings in an often confusing world of hype and promotion.

The authors suggest that you "buy the hardware to run the software." While this may represent a good basic strategy, it fails to address a broader context where functional overlap, the relative price-to-performance ratio, life expectancy (will the manufacturer even be in business in 2 years?), and usability for other tasks often cloud the picture, making choices far less clear-cut than such a simple approach might suggest.

The allocation of a short descriptive paragraph to each of the computers for which MIDI software is reviewed simply does not provide sufficient enlightenment for making informed choices. Also missing is a discussion of available MIDI interfaces and their prices for each computer, an important factor in the decision of which computer to buy.

The MIDI software reviews constitute the bulk of the book. They are organized into seven sections, each covering MIDI software for a particular computer. Included are the IBM PC and compatibles, the Apple Macintosh, the Apple II, the Atari ST, the Commodore 64, and, with a single entry for each, the Commodore 128 and the Texas Instruments 99/4A. Amiga owners will be disappointed to find no entries for their computer, even though a number of MIDI applications are now available for the Amiga. Even for the computers covered, there are a number of puzzling omissions. For example, the Steinberg Pro-24 sequencer for the Atari ST has been available since the fall of 1986, but it somehow failed to make the book, despite its 1987 publication date. Once again, however, any software book calling itself "complete" must have an omniscient viewpoint and almost no lead time.

Review Format

A standard format is applied to the review of each MIDI program surveyed. Each review begins with a "box score" describing the program name, function, author, MIDI interface requirements, price, and a list of the program's special features and limitations. This is followed by a "guided tour" discussion

continued

Order Status,
Technical & Other
Info. (602) 246-2222
FAX # (602) 246-7805

Call for programs
not listed



SPECIAL
MICROSOFT WORD 4.0
\$195

No Charge for
MasterCard or Visa



TOLL-FREE ORDER LINE 1-800-421-3135

FREE SOFTWARE! FREE SOFTWARE! FREE SOFTWARE!

Purchase over \$100 and receive one of these disks absolutely FREE! Purchases over \$250 get two free disks, over \$400 get three, or get all four disks when your purchase is over \$500! **1) MIXED BAG** — A great assortment of utilities and games all packed on one disk. **2) PC-WRITE** — Try this famous feature packed word processor. It's a winner! **3) FONT-SET** — Lets you set popular fonts like bold, underline, etc. on most late model printers from Citizen, Epsc, NEC, Okidata, Panasonic, Star, Toshiba, etc. You can even use your printer like a typewriter! **4) ABC-LIST** — Great mailing list program! Sort on any field, do qualified searches, print reports and mailing labels, and more!

— SOFTWARE —

ACCOUNTING

Cyma Call
Dac Easy Acct. \$54
Dac Easy Payroll 39
Dollars & Sense 94
In House Accl. 39
Managing Your Money 3.0 117

COMMUNICATION PROGRAMS

Carbon Copy Plus 115
Crosstalk XVI 89
Crosstalk MK4 110
Remote 89
Smartcom II 79

DATA BASE MANAGERS

Clipper 379
Condor 3 325
DBase III Plus Call
DB-XL 82
Fox Base Plus 195
Genifer 194
Paradox 2.0 398
PFS: Pro File Call
Powerbase 169
Q&A 190
Quicksilver 295
Revelation 464
R Base System V Call
Reflex 81
Relate & Report 112
VP Info 48

DESKTOP PUBLISHING

Pagemaker 479
PFS: First Publisher 59
Ventura Publisher 455

GRAPHICS

Chartmaster Call
Diagram Master Call
Easy Cad 109
Energraphics 2.01 294
Generic Cad 59
In-A-Vision 275
Microsoft Chart 3.0 229
Newsroom Pro 65
Printshop 33
Prodesign 2 148

INTEGRATED

Ability 56
Ability Plus Call
Enable Call
Framework II Call
Smart System 429
Symphony Call

LANGUAGES

Lattice C Compiler 242
Microsoft C Compiler 249
Microsoft Fortran 255

Microsoft Macro Assembler ... \$84
Microsoft Pascal 166
Microsoft Quick Basic ... 55
Microsoft Quick C 55
Ryan McFarlan Fortran 342
Ryan McFarlan Cobol 549
Turbo Basic 55
Turbo C 55
Turbo Pascal 55
Turbo Prolog 55

MULTI-USER SOFTWARE

Fox Base 299
Word Perfect 310
Word Perfect Modules ea 75
Microsoft Word Call

PROJECT MANAGER

Microsoft Project 219
Super Project Plus Call
Timeline 2.0 270
Total Havard Man. 2 Call

SPREADSHEET

Hal 115
Lotus 1-2-3 Call
Silk 149
Spreadsheet Auditor 82
Supercalc 4 Call
VP Planner 48

UTILITIES

Copy II PC 19
Copywrite 39
Cubit 30
Deskview 2.0 72
Direct Access 49
Eureka 85
Fastback 85
Formtools 56
Graph in the Box 2 55
Mace 55
Microsoft Windows 55
Norton Advanced 75
Norton Utilities 48
PC Tools 19
Prokey 4.0 70
Q DOS 49
Rightwriter 75
Sidekick 55
Sideways 39
Sqz Call
Superkey 55
Turbo Lightning 55
XTree 35

WORD PROCESSING

Microsoft Word 4.0 195
Multimate Advantage II Call
Volkswriter 3 139
Webster Spellcheck 37
Word Perfect 185

Word Perfect Executive \$109
Word Perfect Library 59
Wordstar Pro 233
Wordstar 2000+ 206

— HARDWARE —

ACCESSORIES

Brooklyn Bridge 72
Copy II PC Bd. 75
Curtis Ruby 59
Mach III Joystick 36
Masterpiece 88
Masterpiece + 99
150 Watt Power Supply 69

BOARDS

AST Advantage Premium 422
Sixpac Premium Call
Sixpac 145

HERCULES

Color Card 145
In Color Card 302
Graphics Plus 182

INTEL

Above PC 64K 225
Above 286 319
Orchid Tiny Turbo 389

SUNTEK

IO XT 65
IO AT 65

TALLTREE

J Ram 3 ATP Call

COMPUTERS

AZ 386

80386-16 Micro Processor, 1 MB of Ram, Teac 1.2 MB disk drive, 220 watt power supply, 6 layer mother board, RT keyboard \$2995

AZ TURBO AT

512K, 6 & 10 MHZ, keyboard, 200 watt power supply, one 1.2 teac drive, Phoenix Bios. \$975

AZ TURBO XT

135 watt power supply, One 360K drive, 640K, keyboard \$519

AZ 10

150 watt power supply, dual 360K drive, 10 MHZ mother board, 640K, keyboard \$670

AST 286 PREMIUM COMPUTER

512K, expandable to 2MB on the system board, RT enhanced style keyboard, parallel, serial and clock, 1.2 MB floppy disk drive, 7 expansion slots, two 32 bit fastram slots, DOS 3.1 & Basic 1 year warranty Call

EGA BOARDS

ATI Ega Wonders 195
Nec GBI Call
Paradise Auto480 155
Quad EGA Plus 295
Vega Deluxe 236

EGA MONITORS

AMDEK 722 455
Casper 410
Mitsubishi Diamond Scan 509
NEC Multisync 559
Multisync Plus Call

HARD CARDS

AZ 20 MB 425
AZ 30 MB 499
AZ 40 MB 625
Plus 20 MB Call
Plus 40 MB Call

HARD DRIVES

Seagate 20 MB 269
Seagate 30 MB 299
Seagate 30 MB AT Call

MODEMS

AZ 300/1200 75
Everex 300/1200 89
Hayes 1200 Call
Hayes 1200B Call
Hayes 2400 Call
U.S. Robotics 2400 335

MICE

Genius 59
Logitech Call
Microsoft Bus W/Paintbrush 92
Microsoft Serial 119
Optimouse w/Dr Halo 89
Optimouse w/DPE 185

MONITORS

AMDEK 410 Amber \$145
Magnovox RGB Call
PRINCETON
Max 12 138
HX 12E 460
SAMSUNG
TTL Amber w/tilt 75
Color w/tilt 249

PRINTERS

CITIZEN
MSP 10 249
MSP 15 315
MSP 20 285
120 D 142
Premiere 35 471
Tribute 224 639
EPSON - Call on all models
NEC
P5XLP 840
P7 Parallel 619
8850 1059
P6 Parallel 439
P960XL 1035
OKIDATA - Call on all models
PANASONIC
1080-1/M2 189
1090-1/M2 199
1092-1 306
1524 572
1592 392
1595 439
3131 259
3151 407
STAR MICRONICS
NB24-10 458
NB24-15 610
ND10 275
NP10 139
NX10 180
NX15 306
TOSHIBA
321 SL 510
341 SL Call
351 Model II 910

RAM

64K 150NS 16.50
256K 150NS 33

TERMS: Shipping on most software is \$5.00. AZ orders +6.7% sales tax. Personal check/company check - allow fourteen (14) days to clear. We accept purchase orders from authorized institutions for 35% more than cash price. All returns are subject to our approval. There will be a 20% restock fee. Minimum phone order \$50. All prices are subject to change. Due to copyright laws we cannot take back any open software.

TOLL-FREE ORDER LINE 1-800-421-3135

WAREHOUSE DATA PRODUCTS

2701 West Glendale Ave. • Phoenix, AZ 85051

We do not guarantee compability

— STORE HOURS —

Monday, Wednesday & Thursday	9am-11pm EST	7am-9pm MST	6am-9pm PST
Tuesday & Friday	9am-7pm EST	7am-5pm MST	6am-4pm PST
Saturday	11am-7pm EST	9am-5pm MST	8am-4pm PST

WHAT'S OPTIONAL ON THEIRS IS
STANDARD ON OURS!!



NEW
LOWER
PRICES!

10MHz

Complete System
with (2) 360K Drives
& Monographic Monitor
Assembled & Tested
With MSDOS 3.3
Add \$69.95

TM
Swan **XT10**

\$629

Standard Features

- 10/4.77 MHz 8088-1CPU
- 640K RAM
- 150W Power Supply
- (1) Serial Port
- (1) Parallel Port
- Hercules Compatible Video Card (720 x 348)
- Quality Hi-Resolution Amber Monitor w/Tilt & Swivel
- (1) Game Port
- Clock Calendar w/Battery Backup
- 101 Key Enhanced "AT" Touch & Click Style Keyboard

Mono System w/20MB Seagate HD ... **\$849.00***

Mono System w/30MB Miniscribe HD. **\$879.00***

Base Unit w/o Monitor or Video Card .. **\$459.00***

*Single 360K Floppy Drive

Option Upgrades for XT10 & AT12:

Hercules to CGA with CGA Card and RGB Monitor Add **\$170.00**

Hercules to EGA with EGA Card (operates in CGA, MDA, or

HGA modes)and Packard Bell EGA Monitor Add **\$399.00**



30 DAY SATISFACTION GUARANTEE

Your complete satisfaction is our top priority. Any Swan system may be returned within 30 days from the date of shipment for a full refund. *



FOR YOUR PROTECTION WE GO THE

EXTRA YEAR A full 1 year warranty is included, with a 2nd year SEW (Swan Extended Warranty) available. Call or write for details.



FAST DELIVERY ... We ship within 24 hours.

TECHNICAL SUPPORT Our support staff is on call 9-5 Mon-Fri to answer all of your questions and make sure that you get the most from your systems.

YOUR COMPUTER INVESTMENT IS HASSLE FREE!!!



12MHz

Complete System
with 1.2MB Drive
& Monographic Monitor
Assembled & Tested
With MSDOS 3.3
Add \$69.95

TM
Swan **AT12**

\$999

Standard Features

- 80286 12/10 MHz (Keyboard Switchable) 13.3 Norton S.I.Rating
- 640K of RAM on 1MB Motherboard
- 200W Power Supply
- Ports: (1) Serial, (1) Parallel, (1) Game
- Dual Floppy/Dual Hard Drive Controller
- 8 Expansion Slot
- 101 Enhanced "AT" Touch & Click Style Keyboard
- Clock Calendar w/Battery Backup
- Hercules Compatible Video Card (720 x 348) w/Parallel Port (2nd)
- Quality Hi-Resolution Amber Monitor w/Tilt & Swivel

Mono System w/40MB

Miniscribe HD #3650 **\$1395.00***

Mono System w/40MB

Seagate HD #251 **\$1495.00***

Base Unit w/o Monitor

or Video Card **\$899.00***

SWAN VIDEO & I/O CARDS

- Monographics half card (720 x 348)
- Hercules Compatible w/parallel port **\$69.95**
- Color half card (640 x 200)
- CGA Compatible **\$69.95**
- Monographics, Hercules Compatible,
- 2 Floppy Controller, Parallel, Serial, Gameport,
- Clock & Calendar w/Battery Backup **\$119.95**
- Same board as above, except with CGA
- output instead **\$109.95**

* Items returned must be as-new, without modification or damage. All warranty cards, manuals and packaging must be included. Return shipping must be prepaid and insured, bearing a RAC (Return Authorization Code) on the shipping label.

DON'T

AMERICAN	
Design CAD 3.0.....	\$189.00
ANSA	
Paradox (1.1).....	\$349.00
Paradox (2.0).....	\$409.00
ASHTON-TATE	
D Base III.....	\$389.00
FrameWork II.....	\$399.00
Multimate Advantage II.....	\$CALL
Rapidfile.....	\$244.00
BOEING	
Boeing Calc.....	\$239.00
Boeing Graph.....	\$189.00



Quatro.....	\$119.00
Eureka.....	\$104.95
Reflex.....	\$89.95
Reflex Workshop.....	\$44.95
Sidekick(unprotected).....	\$54.95
Travelling Sidekick Bundle.....	\$79.95
Superkey.....	\$59.95
Sprrt.....	\$CALL
Travelling Sidekick.....	\$44.95
Turbo C.....	\$75.95
Turbo Database Toolbox.....	\$44.95
Turbo Gameworks.....	\$44.95
Turbo Graphix Toolbox.....	\$31.00
Turbo Jumbo Pack.....	\$184.95
Turbo Lightning.....	\$59.95
Turbo Pascal.....	\$62.95
Turbo Pascal N. Methods.....	\$62.95
Turbo Prolog.....	\$64.95
Turbo Prolog Toolbox.....	\$62.95
Turbo Tutor.....	\$26.95



WE CARRY QUALITY
PRODUCTS FROM THESE
FINE MANUFACTURERS

PRINTERS



120D.....	\$174.00
MSP-10.....	\$279.00
MSP-15.....	\$379.00
Premier 35.....	\$459.00
Tribute 224.....	\$CALL

Panasonic

1080III.....	\$159.00
1091III.....	\$189.00
1092III.....	\$299.00
1592.....	\$389.00
1595.....	\$439.00
3131.....	\$259.00
3151.....	\$399.00
Laser Printer.....	\$CALL



NP-10.....	\$134.95
NX-10.....	\$157.95
NX-15.....	\$349.00
ND-10.....	\$289.00
ND-15.....	\$429.00
NR-15.....	\$499.00
NB24-10.....	\$499.00
NB24-15.....	\$639.00

OPEN: 8:00AM-9:00PM Mon-Fri; 10:00AM-6:00PM Sat, 12:00PM-8:00PM Sun EAST COAST TIME



TUSSEY COMPUTER PRODUCTS

P.O. BOX 1006
STATE COLLEGE, PA 16804

SETTLE FOR LESS...tcp SHIPS IT

SOFTWARE

BRODERBUND
 Graphics Library Disks\$24.95
 Newsroom Pro\$69.95
 Print Shop\$39.95
 Print Shop Companion\$32.00
 Toy Shop\$42.95

Central Point Software

COPY II PC\$27.00
 Option Board\$79.95
 PC Tools\$27.00

CHANG LABS
 Rags To Riches\$289.00
DAC SOFTWARE
 Dac Easy Accounting\$69.95
 Dac Easy Acct. Tutor\$19.95
 Dac Easy Payroll\$39.95
 Dac Easy Payroll Tutor\$24.95

DAYBREAK
 Silk\$89.95

FIFTH GENERATION
 Fastback\$89.00

FUNK
 Sideways\$37.95

GENERIC SOFTWARE
 Generic CADD 3.0\$69.95
 Generic CADD w/Dot Plot\$89.95

LIFETREE
 Volks Writer\$157.00
 Words & Figure\$137.00

LIVING VIDEOTEXT
 Ready!\$52.95
 Think Tank\$97.95

LOTUS
 123\$307.00
 HAL\$119.00
 Symphony\$439.00

MECA
 Managing Your Money\$119.95

MERIDIAN TECHNOLOGY
 Carbon Copy\$109.00

MICROPRO
 Wordstar 2000+\$219.00
 Wordstar Prof Rel 4\$249.00

MICRORIM
 DB Graphics\$169.00
 R Base System 5\$427.00

Microsoft

PC Excel\$319.00
 Access\$159.00
 Bookshelf\$CALL
 C Compiler\$249.00
 Chart 3.0\$249.00
 Flight Simulator\$32.95
 Fortran\$267.00
 Macro Assembler\$87.00
 MS-DOS & GW Basic\$CALL
 Mouse\$109.00
 Pascal\$167.00
 PC Works\$CALL
 Project\$329.00
 Quick Basic\$57.00
 Windows 2.02\$79.00
 Windows/386\$149.00
 Word Version 4.0\$299.00

MICROSTUFF
 Crosstalk XVI\$94.00

NORTON PRODUCTS
 Norton Commander\$39.95
 Norton Utilities\$49.95
 Norton Advanced Utilities\$84.00

PAPERBACK SOFTWARE

Executive File\$29.95
 Executive Writer\$39.95
 VP Graphics\$79.95
 VP Expert\$79.95
 VP-Info\$59.00
 VP Planner\$CALL
 VP Planner Plus\$99.95

PERSONICS CORP
 Smart Notes\$47.95
SIMON & SCHUSTER
 Typing Tutor III\$39.95

SOFTWARE PUBLISHING
 First Publisher\$64.95
 Harvard Total PM II\$349.00
 Harvard Graphics\$229.00
 PFS First Choice\$94.00
 Professional File\$139.00
 Professional Plan\$CALL
 Professional Write\$109.00

SPRINGBOARD
 Newsroom Pro\$69.95
 Clip Art\$CALL

SYMANTEC
 Q&A\$219.00

TURNER HALL
 Note Plus\$57.00
 SQZ\$57.00

UNISON WORLD
 Newsmaster\$69.95

WORD PERFECT
 Wordperfect\$207.00
 Executive\$127.00
 Library\$79.00
 Math Plan\$CALL

XEROX
 Ventura Publisher\$549.00



Software orders over \$50.00 & Accessories/Peripherals under 8 pounds will be shipped **FEDERAL EXPRESS** (Yes even at these prices) You only pay TCP's standard shipping charge of \$4.00 per order. Orders arriving before 1:00 PM our time will be shipped out same day. If part of your order is back-ordered the remainder will be shipped UPS Ground for FREE!



SECURITY
 ■ Your Credit Card is not charged until your order is shipped.
 ■ We insure your order at no extra cost to you.
 ■ Tussey is a financially strong and well established company.

CUSTOMER SUPPORT
 ■ After sales support.
 ■ Knowledgeable staff, all graduates of Tussey's "Computer Boot Camp".
 ■ Our advanced warehouse/materials handling system assures your order is shipped out accurately & on time.
 ■ Our IBM 5360 allows instant order and inventory status.



To order by mail: We accept money order, certified check, personal check. Allow 2 weeks for personal & company checks to clear. Shipping: \$4.00 for software and accessories/ \$10.00 for printers and color monitors/ \$6.00 for disk drives and other monitors/ Add \$3.00 per box shipped COD. Call for other shipping charges. Additional shipping required on APO, FPO, AK, HI. Terms: ALL PRICES REFLECT CASH DISCOUNT, ADD 1.9% FOR MASTERCARD OR VISA. All products include factory warranty. ALL SALES ARE FINAL Defective items replaced or repaired at our discretion. Pennsylvania residents add 6% sales tax. Prices and terms subject to change without notice.



HARDWARE

PC HARD DRIVES

MiniScribe
 30MB XT Drive w/controller ...\$339.00
 30MB Hard Card\$429.00
 30MB AT Hard Card\$479.00
 40MB AT Drive\$379.00

Seagate
 ST-225 20MB w/controller\$289.00
 ST-238 30MB w/controller\$359.00
 AT Hard Drives: ST-4038\$549.00
 ST-251\$469.00

PC LAPTOP COMPUTERS

ZENITH
 181\$1,595.00
 183\$2,395.00

NEC
 Multispeed\$CALL

MAGNAVOX

7613 TTL (Green)\$89.00
 7623 TTL (Amber)\$89.00
 8515 RGB\$249.00
 8083 EGA\$319.00
 8873 Multimode\$479.00

WESTERN DIGITAL
 File Card 20\$429.00
 File Card 30\$479.00
 AT FD/HD Controller\$159.00

Swan Technologies
 40MB Tape Backup\$339.00

PC ADD ON BOARDS

AST
 Advantage (128k)\$319.00
 Rampage AT\$419.00
 Rampage PC
 6 Pak+(64k)\$CALL
 I/O Mini II\$159.00

ATI
 Graphic Solution\$169.00
 EGA Wonder\$274.00

BOCA RESEARCH
 EGA/CGA/MDA/MCA\$149.00
 BOCARAM XT w/OK\$139.00
 BOCARAM AT w/OK\$169.00
 Bocarams are Intel Above Board compatible

BOCA I/O AT\$79.95
 BOCA I/O XT\$79.95
 Gameport Adapter for I/O\$19.95

HERCULES
 Graphics Plus\$179.00
 In-Color Card\$299.00
 Other Hercules boards in stock. Call for price

INTEL
 AboveBoard PC\$227.00
 AboveBoard PS/XT\$267.00
 AboveBoard AT\$329.00

SWAN TECHNOLOGIES
 Add on Cards
 -Compatibility guaranteed
 -1 year replacement warranty
 CGA card w/printer port\$69.95
 Hercules Compatible Mono card w/printer Port\$69.95
 Multi I/O\$CALL

PARADISE NEW LOW PRICES
 Autoswitch 360\$149.00
 Autoswitch 480\$169.00

ZUCKER
 OGA\$89.95
 Monochrome Graphics\$94.95
 Memory Expansion\$CALL

MOUSE IMSI
 PC mouse w/Dr. Halo II \$89.00

MONITORS

TTL Monochrome
 Amdk 410A Amber, Green, or White\$149.00
 Packard Bell Amber w/std. \$97.00
 Micro Display Systems
 Genius VHR w/video card. \$CALL
 Samsung TTL\$89.00

RGB
 Magnavox 8562\$269.00
 Magnavox 8515\$289.00
 Thomson ... All Models\$CALL
 Zenith 1330\$407.00

EGA
 NEC Multisync II\$CALL
 Packard Bell
 EGA/CGA/TTL Auto\$419.00
 Goldstar EGA\$CALL
 Amdk 722\$477.00
 Thomson Ultrascan\$499.00
 Zenith 1470 EGA\$219.00

CURTIS CALL FOR BEST PRICE ON ALL CURTIS PRODUCTS

EDUCATIONAL & CORP ACCOUNTS
 Purchase orders accepted from qualified corporations and institutions
CALL 1-800-533-1131
 Inside PA 814-234-2236

MODEMS

Hayes Smart Modem
 1200B\$259.00
 2400B\$CALL

Swan Technologies 1/2 Card
 Internal 300/1200, Includes PC Talk III software\$69.00
 2400 baud Internal\$119.00

Packard Bell External
 300/1200 baud\$149.00
 2400 baud External\$279.00

US Robotics Sportster
 300/1200 baud\$139.00

Ventel Modems
 Call for best prices on all models
 Zucker
 300/1200 Half Cd Modem with software\$87.00

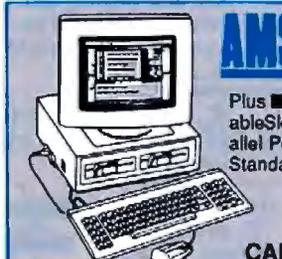
DISKS

per box of 10 3.5" 5.25"
BONUS DS/DD\$6.95
MAXELL DS/DD\$17.95 \$9.95
VERBATIM DS/DD\$19.95 \$9.95
SONY DS/DD\$17.95 \$8.95

CHIPS

Numeric Coprocessors
 8087\$104.00
 8087-2\$147.00
 80287\$179.00
 80287-2\$CALL

Call for Pricing on Memory Chips. Prices are too volatile to list!!!



AMSTRAD PC-1512
 Full PC Compatibility

Plus ■ 8MHz Processor ■ 3 Available Slots ■ 512K Memory ■ Parallel Port, Serial Port, Game Port Standard ■ Microsoft Compatible Mouse ■ MOS-DOS 3.2, GEM Desktop, GEM Basic 2 ■ CGA Video Card

CALL FOR BEST PRICE

TELEX: 910 250 4239

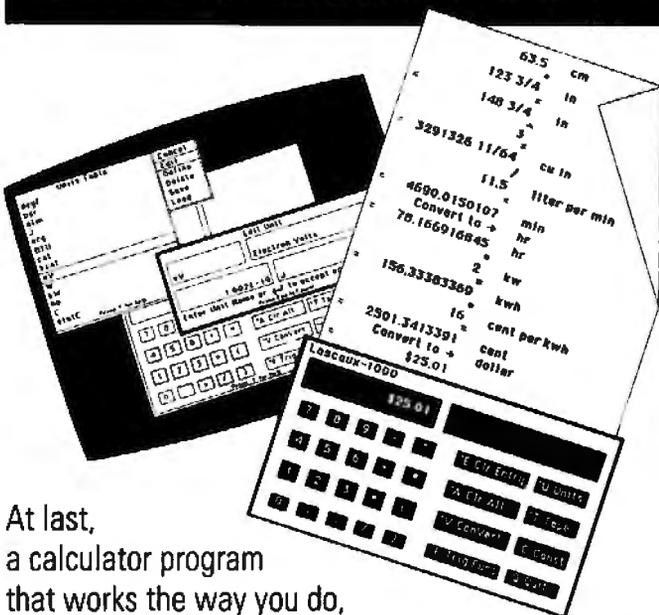
Circle 277 on Reader Service Card

CALL TOLL FREE **1-800-468-9044**

Inside PA
 Call 814-234-2236



Lascaux1000



At last,
a calculator program
that works the way you do,
with physical quantities,
not just numbers.

Introductory price \$59.95

**make it
the calculator
on your PC.**

Lascaux Graphics 3220 Steuben Ave. Bronx, NY 10467 (212) 654-7429

**720K & 1.44MB
Drivers Available
For DOS 2.1 & Up!**

**NOW!
2MB Model
Available**

THE 3.5" CONNECTION!

This internal 720K 3.5" disk drive is a "drop-in" replacement for 5.25" drives! It's the ideal solution for exchanging data between your PC/XT/AT and the new generation of laptops. Disk format is compatible with IBM, Toshiba and Zenith portables. The Model 853W drive kit contains everything you need, including interface adapters, premium SONY drive, and complete documentation. Uses your existing disk controller (no additional slots required). Requires DOS 3.2 for maximum performance. Ask about our Model 873W (1.44MB).

**\$\$ SAVE \$\$
SONY DISKS**

Tigertronics™
INCORPORATED

**\$159.95
+ FRT. & TAX**

400 Daily Lane
P.O. Box 5210
Grants Pass, OR 97527

**WE'VE
MOVED!! IMMEDIATE DELIVERY!**
Call 503-474-6700 or 503-474-6701

BOOK REVIEWS

of the program's use from start-up to shutdown, usually encompassing several pages and providing a good feel for the program's basic operations. The book makes extensive use of screen images, reproduced poorly but legibly, to illustrate each program's layout and use. Each review ends with a short "final word" section that summarizes the program's general characteristics.

Based as they are on the personal experiences of the PASS staff, the guided tours represent by far the most extensive and useful material in the book. But the format also reveals the subtle personal biases and presumptions each of the reviewers inevitably brings to the task at hand. Also, the "forms" are not filled in consistently. One review for an IBM PC program states that the program requires an expansion slot for the MIDI interface. But this is not listed as a requirement for the other PC programs, even though all of them will require a MIDI interface and an associated slot.

In a review of a MIDI sequencer program, the ability to record real-time MIDI notes and events is listed as a special feature when this is what a sequencer is supposed to do in the first place, a fact readers would have been aware of with better introductory material. One of the "limitations" listed for a MIDI voice librarian on the Macintosh is that "Mac Plus users must have a separately powered MIDI interface." This is, of course, a limitation of the Macintosh and the MIDI interface rather than of the MIDI software. It seems that the review standards, whatever they may be, are not applied evenly and that the reviewers don't want to say anything too negative about any of the programs.

Take Your Chances

This is not the "complete" guide to MIDI software that it claims to be. Can you still gain something from this treatise, incomplete as it is? I think so, though it will cost you \$20 to find out if you agree. Even with all its shortcomings, you just may find within its pages that one tidbit of information that will galvanize your decision as to which MIDI software package is best for you. And if you make the right decision, the book will have been worth its price.

Donald Swearingen (2261 Market St., Box 289, San Francisco, CA 94114) is a freelance programmer, musician, and author.

A LITTLE SMALLTALK

Reviewed by Joel West

Three years ago, Timothy Budd was faced with the challenge of teaching object-oriented programming to students at the University of Arizona. Budd took the resources available—a group of 12 graduate students and a Unix-based time-sharing system—to develop a version of Smalltalk for his teaching. The result was Little Smalltalk.

A Little Smalltalk is geared to two types of readers: the introductory student learning the language, and the more advanced student modifying the system. The book is a readable teaching text for a one-semester introductory course and a concise companion to hands-on exercises using the Little Smalltalk system.

The System

Little Smalltalk is written in C and runs under Unix systems. The author, now at Oregon State University, distributes the public domain source code for the system as a nine-track Unix tape image.

Little Smalltalk is a dialect of Smalltalk and nearly a proper subset of Smalltalk-80, which was developed at the Xerox Palo Alto Research Center (PARC) and documented by the original Smalltalk books. Although the dialects are different—Smalltalk-80 is the original and seminal dialect—Little Smalltalk is

continued

If you think you can buy a better C compiler, don't. We'll buy it for you!

Buy Let's C[®] with *csd*[™] for just \$75. If you're not satisfied, get Turbo C or QuickC. Free*.

Why are we making this incredible offer? Because we're absolutely certain Let's C and *csd* are the best C programming tools you can own.

Is there a chance you might not jump to take advantage of our proposition? Maybe. So here are a few reasons you should.

Rest assured that, like its competition, Let's C features incredibly fast in-memory compilation and produces extremely tight, high quality code. But these days everybody compiles fast. The differences lie in how much faster you can perform other programming chores.

Take debugging, for example. How important is the C Source Debugger, *csd*? When you see it cut development time in half, you'll forget about mere compile time very quickly:

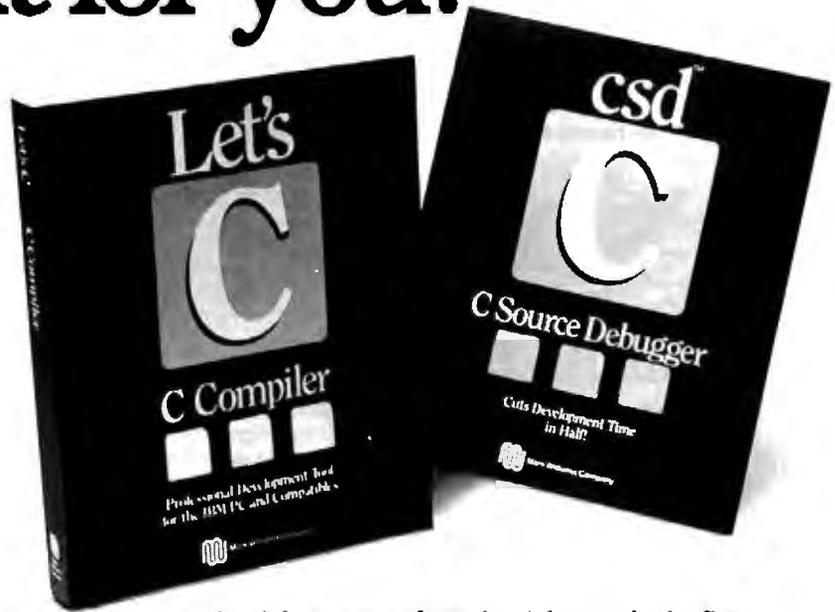
"csd is close to the ideal debugging environment... a definite aid to learning C and an indispensable tool for program development."—William G. Wong, BYTE

And comparatively speaking: *"No debugger is included in the Turbo C package... a serious short-coming."*—Michael Abrash, Programmer's Journal

Let's C also comes with its own full-featured assembler. Which will save you the time and money of purchasing one separately. Again unlike our competitors.

As for documentation, the Let's C manual is full of complete, not partial, examples. With information in a revolutionary lexicon format for instant access.

Instant access is what we strive to offer when it comes to technical support, too. See how different it is



to get the right answers from the right people the first time you call.

And finally, there's the issue of reliability. We've been satisfying users for over ten years. Our competitors are still working out bugs and initial delivery dates.

LET'S C AND *csd* FEATURES

LET'S C:

- Now compiles twice as fast
- Integrated edit-compile cycle: editor automatically points to errors
- Includes both small and large memory model
- Integrated environment or command line interface
- 8087 sensing and support
- MS-DOS object compatible
- Full K & R plus ANSI extensions
- Full UNIX compatibility and complete libraries
- Many powerful utilities including make, assembler, archiver
- MicroEMACS full screen editor with source code included
- Supported by dozens of third party libraries

csd:

- Large and small memory model
- Debug in C source code, not assembler
- Provides separate source, evaluation, program and history windows
- On-line help screens
- Ability to set trace points and monitor variables
- Can interactively evaluate any C expression
- Can execute any C function in your program
- Trace back function

So if you're thinking about buying any other C compiler, maybe you should think again. But you only have until January 31st to order and take advantage of this special offer. So think fast. And call 1-800-MWC-1700 soon. (1-312-472-6659 in Illinois.)



1430 West Wrightwood, Chicago, Illinois 60614

Mark Williams Let's C and *csd*.

*Offer available on telephone orders only. To exchange Let's C and *csd* for Turbo C or QuickC, return registration card within 15 days of purchase date, notify Mark Williams Company that you are returning products and receive a return authorization number. Products must be returned within 30 days from shipping date. QuickC will be shipped only if available.

dB Fast™ -VS- Clipper™

**LAN
compatible!**

New dBase III Plus™ Compiler

- Smaller EXE's
- Faster compilation
- Faster execution
- Lower price!

OPERATION	dBFast	Clipper
Minimum .EXE file size	1kb	120kb
Compiling/Linking	2 Seconds	4 Minutes
Execution time	6 Seconds	17 Seconds
PRICE	\$149	\$695

d-Smallest! With Clipper™, the smallest program you can create is 120k. And it goes up from there! dBFast™ creates programs as small as 1k with typical program sizes from 5 to 10k. Just think, now it's possible to fit all your programs on one floppy disk. And if you send files via modem — look what happens to your modem phone bill... it almost disappears!

d-Fastest! dB Fast compiles and links in a blistering 3 seconds. Clipper slugs along at 4 minutes. dB Fast compiled programs also run faster. A program that took over 1 full minute to run using dBase III Plus and an additional 17 seconds using Clipper, ran in just 6 seconds with dB Fast!

d-Cheapest! See for yourself why dB Fast is d-Biggest Bang for d-Buck! Nowhere can you get all these features for such a low price:

- dBase III Plus compatible
- LAN compatible
- Unlimited runtime
- Protected source code
- No need to modify your .PRG files
- Speed, efficiency, price



60 day Guarantee

Try dB Fast for 60 days. If you're not totally satisfied for any reason, just send it back for a full refund (less \$10 handling fee).

Call today! 1-800-356-6356

sales information call 1-206-392-0368

Dealer inquiries welcome

	Qty _____	Subtotal _____
	dB Fast _____ @ \$149 _____	
	Shipping: \$4 U.S., \$25 outside U.S. (add \$4 for each additional package)	
	WA residents add 8.1% sales tax.	
	Total _____	
		(U.S. funds only)

Name: _____
 Company: _____
 Address: _____
 City: _____ St: _____ Zip: _____
 Phone #: _____
 Payment (circle one): VISA MC AMX Check
 Card #: _____
 Expires: _____



Name on Card: _____ 1420 Gilman Blvd. 1B
 dB Fast is a trademark of dB Fast Inc. Suite 2B57
 dBase III Plus and Clipper are registered trademarks of Ashton Tate Corp. Issaquah, WA 98027-5399
 and Nantucket Corp. respectively.

Smalltalk: It treats everything as an object, including numbers. It includes the unary, binary, and keyword messages of Smalltalk, with single-path method inheritance. The differences between Little Smalltalk and Smalltalk-80 are clearly spelled out in an appendix.

Given its nature as a simple implementation of Smalltalk, it should not be surprising that Little Smalltalk does not emulate the Smalltalk-80 programming environment. Little Smalltalk requires only line-oriented terminals to develop and run programs, but it also supports the cursor character graphics system of 4.1 BSD (Berkeley Standard Distribution) Unix, as well as the specialized Unix plot libraries for terminals such as the Tektronix 4014.

The Book

Inevitably, *A Little Smalltalk* will be compared to the three-volume PARC series also published by Addison-Wesley, particularly *Smalltalk-80: The Language and Its Implementation*. The three volumes are a comprehensive specification of Smalltalk-80, and, in their depth and style, they are most suitable for advanced readers. They have also been used as textbooks for courses on learning Smalltalk. In contrast, *A Little Smalltalk* is an intermediate-level text that attempts to cover the breadth of the language quickly. It is not a step-by-step tutorial. In the space of the first 40 pages, it attempts to give the reader the fundamental concepts and syntax of the language.

The remainder of the first section of the book is devoted to reinforcing language principles and introducing language subtleties through four topics: simulation, generators, graphics, and processes. The examples in this section were well chosen for teaching (rather than the author's amusement), and many include the output, a boon for those who don't have the software. Budd solves several classic problems using Little Smalltalk, including those of the eight queens and the dining philosophers. The end of each chapter includes a series of student exercises and references to further reading.

The final third of the book covers the internals of the Little Smalltalk implementation. It seems to be a good road map for modifying the system, although the feasibility of such modifications depends heavily on the style (or lack thereof) in the actual source code, which is not included. Still, this section offers insight into implementation considerations in moderate doses.

The book's bibliography is eclectic and a bit arcane. It includes a few obvious references, notably PARC's three Smalltalk-80 books. It also includes references that, while important, are inaccessible to the average reader, such as internal PARC reports and Alan Kay's Ph.D. thesis. It also includes items that are a bit tangential to the main thrust of the book, such as references to the Alphard, CLU, Act 1, Snobol, and GPSS programming languages.

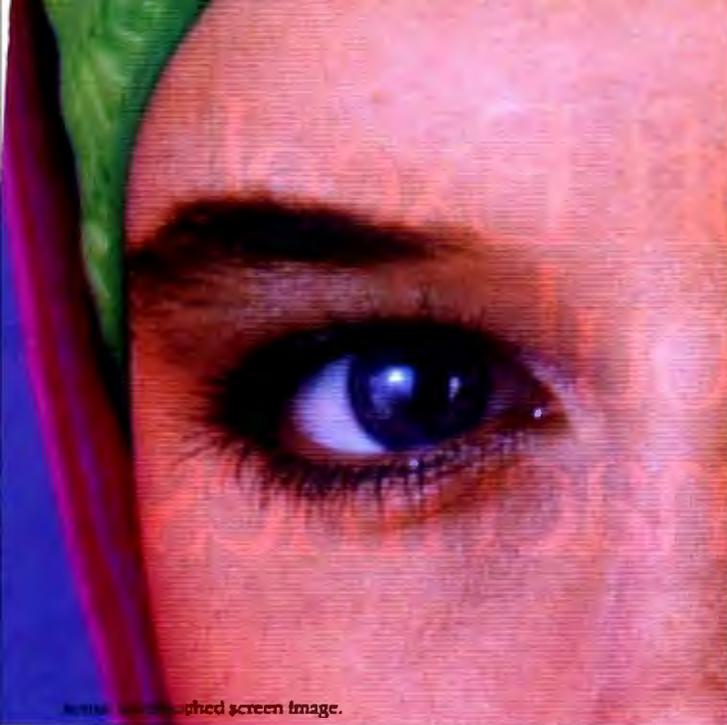
A Little Is a Lot

Budd seems to have fulfilled the goals he set out to achieve; as a companion to the software, *A Little Smalltalk* is ideally suited to a one-term course on object-oriented programming, and it would be my first choice if I were offering such a class.

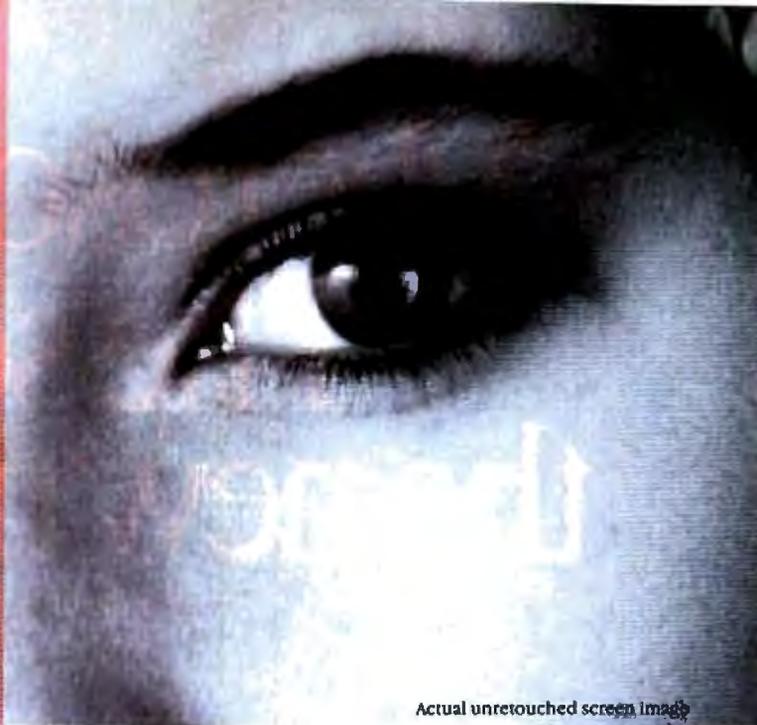
For those readers who are not in a classroom, the exercises at the end of each chapter are somewhat frustrating. As someone learning from a book rather than a class, I would like to have the answers to the exercises available.

Overall, *A Little Smalltalk* is clearly written and edited and is an inexpensive way to learn Smalltalk. ■

Joel West (P.O. Box 2733, Vista, CA 92083) is president of Western Software Technology. He recently completed the design of an object-oriented language for discrete simulation based on Modula-2.



Actual retouched screen image.



Actual unretouched screen image.

Screen stars with The Visible Edge.

What gives Princeton's new generation of screen stars the Visible Edge is a screen image of incomparable clarity and resolution. Where brilliant colors and infinite shades of gray, with striking contrast and dimension, are commonplace.

The versatility of the Princeton family of monitors gives the new generation (and present generation) of computers, the greatest autosynchronous horizontal/vertical scan range combination available. The clarity of .28mm dot pitch. 1050x770 display resolution. And the entire spectrum of color, with the ease and comfort that can only accompany an ergonomically designed monitor.

Experience a world of unlimited vision. And the technology that's made our high level of quality, service, value and performance, second nature. Experience the Visible Edge. And see what we do best. For more information call (609) 683-1660 x 100.

PSC-28



IBM PS/2 COMPATIBLE

PSM-03



ULTRASYNC



IBM PCXTAT & PS/2 Macintosh II COMPATIBLE

MAX-15



PRINCETON
GRAPHIC SYSTEMS
THE VISIBLE EDGE

801 Ewing Street, Building A, Princeton, New Jersey 08540 (609) 683-1660

Circle 212 on Reader Service Card

NOW AVAILABLE FOR ULTRASYNC:
AC-100 DATA CABLE FOR MAC II

Microsoft Excel. The soul of the new machines.™



The computer world was different five years ago. Chances are your business was, too.

Software was limited by the limits of the old machines. Your work was limited by the limits of your software.

Enter Microsoft Excel.

It makes the new machines perform. With features that get the most from today's high-speed processors and high-resolution screens.

The new-generation spreadsheet. For the new-generation machines.

Display worksheets and charts together. View and link them in an intuitive, commonsense way. Then check your work with an array of built-in auditing tools.

Show exactly what those numbers mean with annual-report-quality spreadsheets. Add emphasis with typefaces, borders, and shading. Create vivid charts with just one keystroke. And produce stunning printouts.

You don't have to give up your old software. Microsoft Excel lets you load and save Lotus, 1-2-3, files. Convert old macros. Record new ones.

You'll be ready for tomorrow's software, too. Because Microsoft Excel has the same look and feel as OS/2 Presentation Manager from IBM and Microsoft.

Take a visible leap forward in spreadsheet power, capability, and convenience. And see the visible improvement it brings to your bottom line.

You've read the ad. Now see the movie.

Now you can preview Microsoft Excel. In a brand-new video that shows it in action.

It's dramatic. It's humorous. And it's free.

Call for your copy today: (800) 323-3577 ext. C55

Ask for the Microsoft Excel video. Or visit your local Microsoft dealer.

Find out why we're backing every copy of Microsoft

Excel with a money-back guarantee.

See what our soul can do for your machine.



Microsoft Excel



Note: Video is free to the first 10,000 callers. After that, there's a \$10 charge, but you receive a complete refund when you get Microsoft Excel. Video offer good in continental U.S. only.

Money-back guarantee good on purchases made through March 31, 1988 and valid only in the U.S. and Canada. Some restrictions apply.

Microsoft and the Microsoft logo are registered trademarks and The soul of the new machines is a trademark of Microsoft Corporation.

Lotus and 1-2-3 are registered trademarks of Lotus Development Corporation.

The output shown here was created using Microsoft Excel with Hewlett-Packard LaserJet Plus and LaserJet 2000 printers equipped with the Microsoft Z font cartridge.

Company names and data used in the output are fictitious.



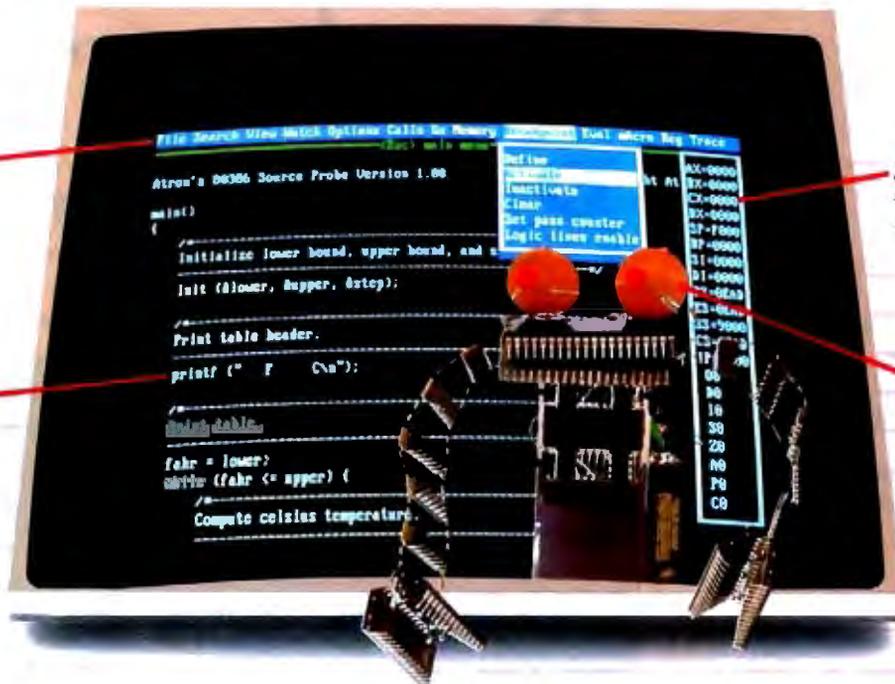
THE WORLD ACCORDING TO FELIX. Everybody has their own taste in pointing devices. Some people get around just fine on the cursor keys of a keyboard. **O**ther people like the feel of a mouse. Or a trackball because it stays put. Apostles of accuracy carry a torch for a tablet. Now comes Felix, which does in one square inch things a mouse, a trackball, or a tablet never dreamed of doing. **L**ets you intuitively race through 1-2-3, PageMaker, Ventura Publisher, AutoCAD, DOS and other programs. Lets you teach your fingers to think for themselves. **F**elix is built around a single moving part. **T**he one at the end of your wrist. **I**nvestigate this story at your local computer dealer. Or contact Lightgate, 6300 Telegraph Avenue, Oakland, CA 94609. 800-426-5324. **F**elix. Post-mouse input device. Think with your hands. *Circle 142 on Reader Service Card (DEALERS: 143)*

Products in Perspective

- 67 **What's New**
- 97 **Short Takes**
 - MultiSpeed HD
 - GOfer
 - TransImage 1000
 - RuggedWriter 480
 - Velan-2V
 - Book One
 - Surpass
- Reviews**
- 111 SQL Database Management Systems
- 121 BIX Product Focus: SQL-based Database Managers
- 127 PC Designs' GV-386
- 133 The Toshiba T3100/20
- 141 The Symmetric 375
- 151 High-Performance Graphics Boards
- 155 GCC's Personal Laserprinter
- 163 Allegro CommonLISP
- 167 Personal REXX
- 173 @Liberty and the Baler
- 176 Microsoft's Bookshelf
- 178 MGMStation CAD
- 185 **Computing at Chaos Manor**
by Jerry Pournelle
- 205 **Applications Only**
by Ezra Shapiro



IT'S TIME TO DO SOME SERIOUS 386 BUGBUSTING!



PROBE's menu bar and pull-down menus set a new standard for debugger interfaces.

POP registers up and down with a single key.

PROBE has source-level debugging to let you "C" your program.

This is an out-of-range memory-overwrite bug. Since it is interrupt related, it only appears in real time.

Welcome to your nightmare. Your company has bet the farm on your product. Your demonstration wowed the operating committee, and beta shipments were out on time. Then wham!

All your beta customers seemed to call on the same day. "Your software is doing some really bizarre things," they say. Your credibility is at stake. Your profits are at stake. Your sanity is at stake.

THIS BUG'S FOR YOU

You rack your brain, trying to figure something out. Is it a random memory overwrite? Or worse, an overwrite to a stack-based local variable? Is it sequence dependent? Or worse, randomly caused by interrupts? Overwritten code? Undocumented "features" in the software you're linking to? And to top it off, your program is too big. The software debugger, your program and its symbol table can't fit into memory at the same time. Opening a bicycle shop suddenly isn't such a bad idea.

THIS DEBUGGER'S FOR YOU

Announcing the 386 PROBE™ Bugbuster,* from Atron. Nine of the top-ten software developers sleep better at night because of Atron hardware-assisted debuggers. Because they can set real-time breakpoints which instantly detect memory reads and writes.

Now, with the 386 PROBE, you have the capability to set a *qualified breakpoint*, so the breakpoint triggers only if the events are coming from the wrong procedures. So you don't have to be halted by breakpoints from legitimate areas. You can even detect obscure, sequence-dependent problems by stopping a breakpoint only after a specific chain of events has occurred in a specific order.

Then, so you can look at the cause of the problem, the 386 PROBE automatically stores the last 2K cycles of program execution. Although other debuggers may *try* to do the same thing, Atron is the only company in the world to dequeue the pipelined trace data so you can easily understand it.

Finally, 386 PROBE's megabyte of hidden, write-protected memory stores your symbol table and debugger. So your bug can't roach the debugger. And so you have room enough to debug a really big program.



COULD A GOOD NIGHT'S SLEEP PUT YOU IN THE TOP TEN?

Look at it this way. Nine of the top-ten software products in any given category were created by Atron customers. Maybe their *edge* is — a good night's sleep.

Call and get your free, 56-page bugbusting bible today. And if you're in the middle of a nightmare right now, give us a purchase order number. We'll FEDEX you a sweet dream.



BUGBUSTERS

A division of Northwest Instrument Systems, Inc.
20665 Fourth Street • Saratoga, CA 95070
408/741-5900

*Versions for COMPAQ, PS/2-80x and compatibles. Copyright © 1987 by Atron. 386 PROBE is a trademark of Atron. Call 44-2-855-888 in the UK and 49-6-985-8020 in West Germany.

TRBA

WHAT'S NEW

Hi-Res TARGA System

The Personal Hardcopy System from Lasergraphics is a complete graphics system that lets you produce high-quality TARGA-format images on slide film, paper, and overhead transparencies. The system consists of the Rascol II controller board for the IBM PC and compatibles, the PFR (Personal Film Recorder), and PPS (Personal Printing System).

Using the Rascol II, the Personal Hardcopy System can generate color hard copy and slides of prerasterized images at any resolution produced by a variety of methods, including screen dumps and image capture. Maximum resolution of the PFR is 4096 by 2731 pixels by 24 colors.

The PPS printer is a thermal-transfer printer with 200- by 200-dot-per-inch resolution. It produces color or black-and-white images with 64 levels of gray for each of the three primary colors.

The system works best with graphics packages that use TARGA-format files. It can also produce lower-resolution graphics from standard PC-compatible graphics software such as AutoCAD, Lotus 1-2-3, and Freelance Plus.

Price: \$9995.
Contact: Lasergraphics, 17671 Cowan Ave., Irvine, CA 92714, (714) 660-9497.
Inquiry 751.

Unique-Looking Laptop from Amstrad

London-based Amstrad (with a U.S. subsidiary in Irving, Texas) has introduced its PPC 640 and PPC 512 PC-compatible portables. Unlike most of the current laptops, where the screen pivots up from the keyboard, the Am-



The Personal Hardcopy System creates hi-res images on film.

strads are long and thin, with a full-size 101-key keyboard that folds down from the system unit. The supertwist liquid-crystal screen—which has a true “television-style” aspect ratio—then pops up from inside the system unit.

Weighing 11½ pounds, the PPC 640 and PPC 512 are both based on an 8086 running at 8 MHz. As their names imply, they're shipped with 640K bytes and 512K bytes of RAM, respectively. The PPC 640 also has a built-in 2400-bit-per-second Hayes-compatible modem and comes with either single or dual 3½-inch 720K-byte floppy disk drives. Software shipped with the system includes MS-DOS 3.3 and SoftKlone's Mirror II telecommunications package. The PPC 512 comes with a single drive, MS-DOS 3.3, and no modem.

Both models have five power options. They'll run on AC, a car cigarette lighter, a rechargeable battery pack, or

even on 10 standard C-cell flashlight batteries. Serial, parallel, and RGB video ports are standard.

Price: PPC 640 with single drive, \$999; with dual drives, \$1099; PPC 512, \$799.
Contact: Amstrad Inc., 1915 Westridge Dr., Irving, TX 75038, (214) 518-0668.
Inquiry 752.

Traveling Software Links Peripherals

Desk-Link, a high-speed serial-transfer program, lets you share disk drives and printers between IBM PCs and compatibles, including laptops and networked computers.

With ordinary serial ports and up to 100 feet of RJ-11 wire, the company reports transfer speeds of up to 115,000 bps. The program comes with universal cable for the IBM PC and compatibles and 25 feet of RJ-11 wire.

To install Desk-Link, you

run an install program on both computers and connect the cable. A pop-up menu lists the auxiliary devices including local or remote hard disks, floppies, and printers. You can select or change the devices by popping up a menu and pressing a key. Talk Box is a feature that you can pop up when you want to use another computer's printer or disk.
Price: \$169.95.

Contact: Traveling Software Inc., North Creek Corporate Center, 19310 North Creek Parkway, Bothell, WA 98011, (206) 483-8088.
Inquiry 753.

Extra Control

Delta Technology's memory manager Extra gives you control over your memory-resident programs by letting you set up a menu and access up to 26 programs while using the RAM of only one. It operates by transferring each terminate-and-stay-resident (TSR) program from memory to disk. The program organizes your TSRs in a menu that you can define.

The program is menu-driven and offers hot-key operation, mouse support, and customizable screens.

Extra runs on the IBM PC, XT, AT, and compatibles, including the PS/2s. You'll need at least 256K bytes of RAM, a hard disk drive, either a 3½- or 5¼-inch floppy disk drive, and DOS 2.0 or higher. Extra runs with a color or monochrome monitor and is not copy-protected.

Price: \$99.
Contact: Delta Technology International, 1621 Westgate Rd., Eau Claire, WI 54703, (800) 242-6368; in Wisconsin, (715) 832-7575.
Inquiry 754.

SEND US YOUR NEW PRODUCT RELEASE

We'd like to consider your product for publication. Send us full information about it, including its price, ship date, and an address and telephone number where readers can get further information. Send to New Products Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Information contained in these items is based on manufacturers' written statements and/or telephone interviews with BYTE reporters. BYTE does not represent itself as having formally reviewed each product mentioned.

continued

Lotus Agenda

Agenda, a personal information manager from Lotus, lets you enter a series of thoughts or items, which you can then categorize and view in various ways. Agenda also automatically categorizes items. It will run on the IBM PC and compatibles and on the PS/2 family of computers, with versions for both DOS and OS/2.

Lotus calls Agenda an "item/category database." It allows you to type in a free-form series of items. Each item can be up to 350 characters long; you can attach "notes" up to 10K bytes long to each item. After you enter an item, you have the option of placing it in one or more categories.

An interesting thing about Agenda is that it can match category names with the contents of an item. If it finds a match, Agenda can automatically group that item under a matching category.

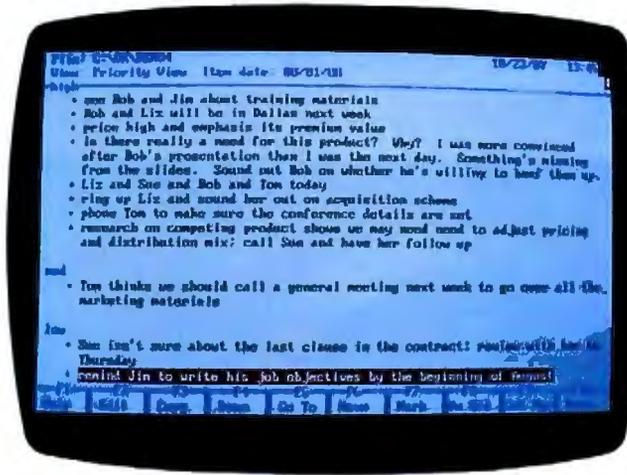
You can control how tight the match must be, and you can designate synonyms for category names. You can also enter rules pertaining to the categorization.

You can check the items you've entered by using a feature called a "view," which is analogous to a report in a standard database. You can construct a view by arranging the items and categories into a row-and-column format. You can set up a view showing each item you've entered, along with each company category (if any) that you've assigned to that category. You can also set up another view showing each company name, with all the associated items below it.

Price: \$395.

Contact: Lotus Development Corp., 55 Cambridge Parkway, Cambridge, MA 02142, (617) 577-8500.

Inquiry 755.



Lotus' personal information manager.

Hardware-Compatible VGA Board

Everex Systems says its EVGA graphics adapter for the IBM PC and compatibles—using a custom application-specific integrated circuit—is fully compatible with all 17 VGA modes at the hardware-register level, not just at the BIOS level. The board hooks up to any PS/2-compatible analog monitor.

The EVGA will also support EGA, RGB, and monochrome monitors and their respective software drivers. The board comes with both 9-pin (digital) and 15-pin (analog) monitor connectors.

Price: \$399.

Contact: Everex, 48431 Milmont Dr., Fremont, CA 94538, (800) 821-0806; in California, (800) 821-0807.

Inquiry 756.

Microsoft's Pageview

Pageview, from Microsoft, is a WYSIWYG (what you see is what you get) page-preview and graphics-integration program that runs with Word in a windows environment. To use Pageview's graphics capabilities, you need Windows 2.0 or Windows/386. You can insert graphics from other applications programs and move, resize, and preview them on-screen.

Pageview runs on the IBM

PC and compatibles and on the PS/2s. You need 512K bytes of RAM (640K bytes is recommended), DOS 3.0 or higher, and Word 3.0 or higher.

Price: \$49.95.

Contact: Microsoft Corp., 16011 Northeast 36th Way, P.O. Box 97017, Redmond, WA 98073-9717, (206) 882-8080.

Inquiry 757.

Ultra-Res Graphics from Texas

The Genesis 1280 is the latest incarnation of National Design's ultra-high-resolution graphics board. It uses Texas Instruments' high-powered TMS34010 graphics processor, handles resolutions of up to 1280 by 1024 pixels by 8 colors, and fits into a full-length slot in any PC AT or compatible.

Fully compatible with the Genesis 1024 graphics card, you can program the Genesis 1280 for virtually any analog RGB monitor up to the monitor's maximum resolution. The 1280 comes with 4 megabytes of on-board RAM (expandable to 32 megabytes on the card).

Graphics interfaces available for the board include the Texas Instruments Development Toolkit, Metagraphics' MetaWindows, Nova Graph-

ics International's Nova CGI, and GSS' DGIS and CGI interfaces. EGA emulation is optional.

Price: \$2995.

Contact: National Design Inc., 9171 Capital of Texas Highway N, Austin Bldg., Suite 230, Austin, TX 78759, (512) 343-5031.

Inquiry 758.

A Nonemissive Monitor

For those who still have doubts about the long-term safety of standard personal-computer monitors, even with lead-impregnated glass filters, a company named ASK LCD has a new liquid-crystal flat-screen monitor.

Because it uses a blue supertwist LCD, the Flat-Screen doesn't emit any radiation. The screen measures 12 inches diagonally. Its low weight (3 pounds) and low volume (5 percent of a standard monitor) are additional advantages.

The CGA-compatible Flat-Screen comes mounted on an "ergo-arm," a flexible arm that mounts the screen above your desk and lets you swivel the Flat-Screen up to 180 degrees and tilt it up to 120 degrees. An optional wall-mounting bracket is also available.

ASK LCD says that besides its lack of radiation, the screen is much easier on the eyes than standard monitors. For security-conscious organizations, its display can't be picked up by sophisticated RF surveillance devices.

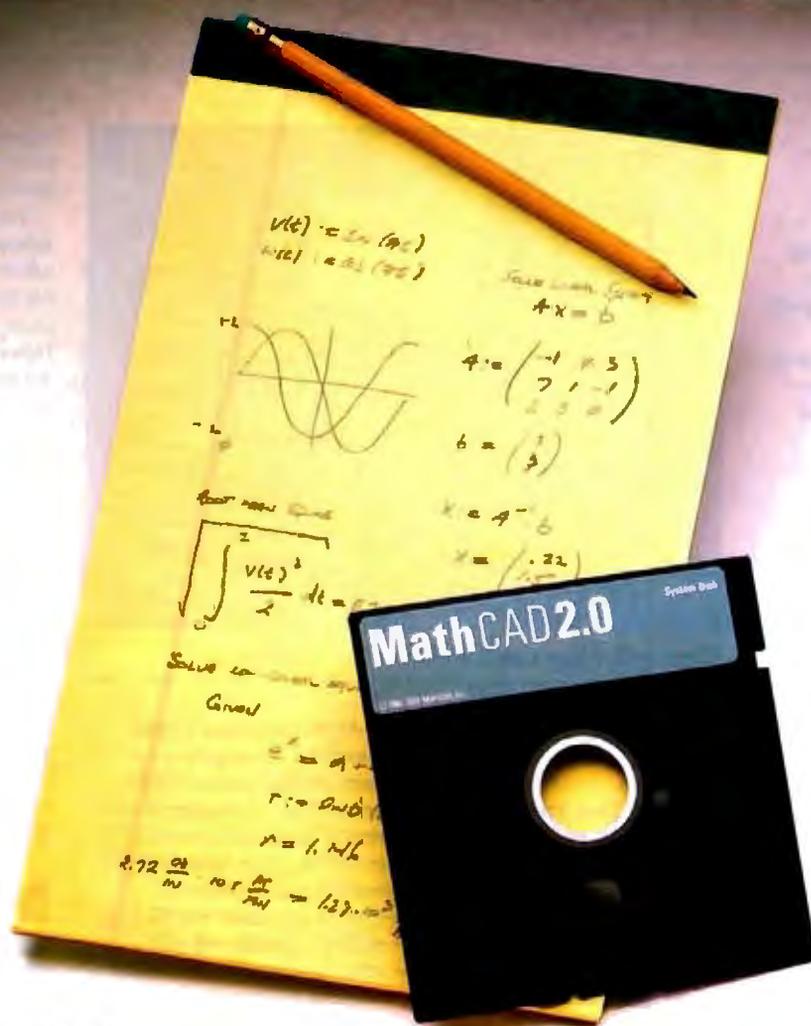
The Flat-Screen comes in two different configurations: one for the IBM PC and compatibles, and another that works with several laptops including the Toshiba T1100 Plus, Olivetti M15, and Zenith Z-181.

Price: IBM PC-compatible version, \$1150; portable computer version, \$1050.

Contact: ASK LCD Inc., 5 Dunwoody Park, Suite 116, Atlanta, GA 30338, (404) 399-5208.

Inquiry 759.

continued



Your pad or ours?

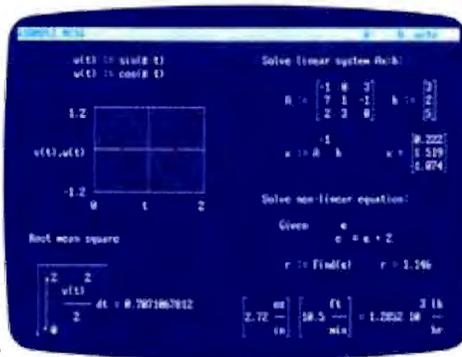
If you perform calculations, the answer is obvious.

MathCAD 2.0.

It's everything you appreciate about working on a scratchpad—simple, free-form math—and more. More speed. More accuracy. More flexibility.

Just define your variables anywhere on the screen. MathCAD formats your equations as they're typed. Instantly calculates the results. And displays them exactly as you're used to seeing them—in real math notation, as numbers, tables or graphs.

MathCAD is more than an equation solver. Like a scratchpad, it allows you to add



text anywhere to support your work, and see and record every step. You can try an unlimited number of what-ifs. And print your entire calculation as an integrated document that anyone can understand.

Plus, MathCAD is loaded with powerful

built-in features. In addition to the usual trigonometric and exponential functions, it includes built-in statistical functions, cubic splines, Fourier transforms, and more. It also handles complex numbers and unit conversions in a completely transparent way.

Yet, MathCAD is so easy to learn, you'll be using its full power an hour after you begin.

Requires IBM PC® or compatible, 512KB RAM, graphics card.
IBM PC® International Business Machines Corporation.
MathCAD® MathSoft, Inc.

What more could you ask for? How about the exciting new features we've just added to MathCAD 2.0...

- Built-in equation solver
- Full matrix operations
- Two to four times increase in calculating speed
- Easier full-page text processing
- Auto-scaled plots
- Memory enhancements
- Additional printer and plotter support
- And more.

If you're tired of doing calculations by hand or writing and debugging programs, come on over to our pad. MathCAD. The Electronic Scratchpad.

Call for a detailed spec sheet and the name of a MathCAD dealer near you.
1-800-MathCAD (In MA: 617-577-1017).

MathCAD®

MathSoft, Inc., One Kendall Sq., Cambridge, MA 02139

Low-Cost Multiuser System

The Kowin Three is a multiuser, multitasking computer system that runs Unix V.3 and comes complete with most of the software needed for a small business to get started in computerization. The combination host computer/workstation is based on a 68020 processor, with dual 68000 processors providing peripheral processing. It has a 12-inch monochrome display and an integrated telephone handset and built-in modem.

Internally, there's a 40-megabyte hard disk, a 1.2-megabyte 5 1/4-inch floppy disk drive, 4.5 megabytes of RAM, a network controller, four network ports, three RS-232C ports, and an ST-506 port.

Because the system is designed for business users with limited computer expertise, the Unix V.3 system is hidden by an interface shell. There are four template levels for the 15 function keys on the 101-key keyboard, giving a total of 60 preprogrammed function keys. Applications software shipped with the system includes voice/data communications, electronic mail, word processing, networking, forms management, graphics, calendar/scheduling, a calculator, a notepad, and a phone directory/dialer.

Each host/workstation can accommodate up to 32 workstations. Each workstation includes a 12-inch monochrome monitor, a telephone with autodialer, 64K bytes of display memory, a network port, and two RS-232C ports.

Price: Host/workstation, \$11,990; workstation, \$1190. **Contact:** Kowin Computer Corp., Kowin Bldg., 830 North Wilcox, Montebello, CA 90640, (800) 445-6946; in California, (800) 225-6946. **Inquiry 760.**



The Kowin Three uses a 68020 and dual 68000s.

Zenith Upgrades Laptop

Zenith Data Systems now has a 20-megabyte hard disk version of its popular laptop. And the twist in this model has nothing to do with the supertwist LCD display. Zenith is using a new CMOS-based hard disk controller along with run-length-limited (RLL) encoding on the hard disk.

The low-power consumption of the CMOS controller (70 percent less than a standard NMOS-based board), coupled with the efficient coding of RLL has resulted in, according to Zenith, the longest battery life for a hard disk laptop in the industry. Zenith is claiming the Z-183 will run up to 3 hours with the standard 2.5-ampere-hour rechargeable battery. An optional 4-ampere-hour battery (\$129) extends the running time to 5 hours, according to Zenith.

The running times are based on the company's own benchmark with a 20 percent disk-access frequency, and with both continuous backlighting and hard disk power on. You can extend the running time even further by turning the backlighting off, and you can set the hard disk to automatically power down after from 1 second to 5 minutes of non-use.

At the same time it introduced the 20-megabyte version, Zenith reduced the list price of the 10-megabyte version of the Z-183 from \$3499 to \$3199. (The 10-megabyte version uses neither the CMOS controller nor RLL encoding.) Zenith will also offer an upgrade kit that will upgrade current 10-megabyte Z-183s to 20 megabytes with the new controller. A company spokesperson says a price on the upgrade hasn't been set yet.

Price: \$3599. **Contact:** Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025, (800) 842-9000. **Inquiry 761.**

Animation Program for AutoCAD

AutoFlex, an animation program from Autodesk, generates animation sequences of AutoCAD drawings and AutoShade renderings. The program will be available in the first quarter of 1988 and will be priced at under \$500, according to Autodesk.

AutoFlex generates a series of user-defined "camera positions" into a set of frames, which can be replayed as an animated movie. You can define

camera positions, focal points, and other geometric properties of the viewing orientation.

You can also create kinetic animation with AutoFlex, which allows you to represent the motion of a moving machine part, for example.

However, you cannot specify the number of frames per second. AutoFlex compiles the frame sequence into a compressed file structure, using only about 5 percent of the original file space of each stored frame. The initial release of AutoFlex will support only the EGA graphics standard.

Price: Under \$500. **Contact:** Autodesk, 2320 Marinship Way, Sausalito, CA 94965, (415) 332-2344. **Inquiry 762.**

Mite-E.Mail

Mite-E.Mail, a data communications program that allows access to Telex, electronic mail, and on-line systems, runs with EIT's Fax modem. The program uses EIT's graphics windows software environment, automatically dialing asynchronous modems. The program includes auto-log-on and command sequences to a variety of services. It also includes a terminal mode for direct, interactive transmissions.

Mite-E.Mail supports Mite, XMODEM, YMODEM, and Kermit file-transfer protocols. It includes a command-line operating mode and a programming language that automates common communications procedures.

The program runs on the IBM PC, XT, AT, and compatibles with a 300-, 1200-, or 2400-bps asynchronous modem; an EIT Fax modem; and a graphics display adapter. It requires 640K bytes of RAM and DOS 3.0 or higher. **Price:** \$179.

Contact: Electronic Information Technology, 25 Just Rd., Fairfield, NJ 07006, (201) 227-1447. **Inquiry 763.**

continued



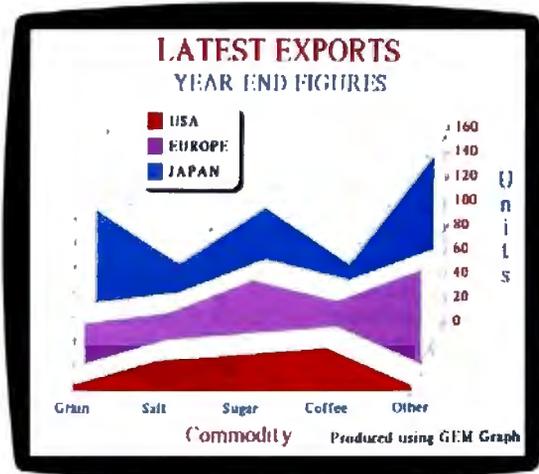
A GEM of a Deal

Free Software from Genoa! For a limited time only, every SuperEGA HiRes+™ card comes with a **FREE** copy of GEM Graph™—the popular business graphics package that normally retails for \$249!

What a combination—a quick, easy way to turn your spreadsheets and database files into stunning graphs, and SuperEGA HiRes+, the *only* Multisync-compatible 16-color EGA card with 800 x 600 resolution!

What can you do with the graphics card that brings you a full-page, readable display for Desktop Publishing? Run your spreadsheets in 132 x 60 columns. Run most VGA applications. Run Ventura,™ Pagemaker,™ AutoCAD,™ Windows,™ and more—all in dazzling 800 x 600 resolution!

Get in on Genoa's GEM of a deal! For the dealer nearest you, contact: Genoa Systems Corporation, 73 E. Trimble Road, San Jose, CA 95131
 FAX: 408-434-0997 Telex: 172319
 Telephone: 408-432-9090



Free GEM Graph Software with every purchase of a Super EGA HiRes+ card from Genoa! But hurry—offer expires March 31st!



©1987 Genoa Systems Corporation
 Offer begins October 1, 1987 and applies to SuperEGA HiRes and SuperEGA HiRes+.
 SuperEGA HiRes and SuperEGA HiRes+ are trademarks of Genoa Systems Corporation.
 GEM Graph is a trademark of Digital Research, Inc. Multisync—NEC Home Electronics;
 Ventura—Xerox Corporation; Pagemaker—Aldus Corporation; AutoCAD—AutoDesk, Inc.;
 Windows—Microsoft Corporation.

Circle 101 on Reader Service Card

Presentation Graphics Package for Windows 2.0

Pixie is a low-cost presentation graphics program from Zenographics that runs under Windows 2.0. The package features interactive editing of graph values and attributes directly on the graph. Working with a bar graph, for example, you can change a value on either axis, and the graph is automatically re-scaled. You can also alter the size of a bar or curve using the mouse; the new value of the curve is displayed in a window in the corner of the screen.

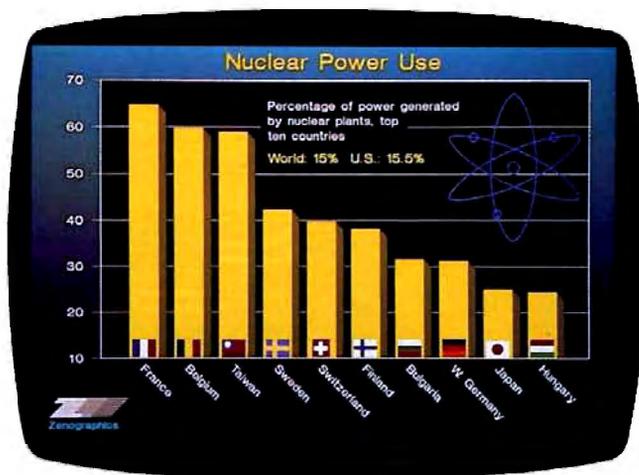
Another interesting feature of Pixie is the use of "modeless" dialog boxes, which reflect object selections in the dialog box simultaneously on the graph. Pixie also uses the Windows 2.0 clipboard, letting you cut and paste images that conform to data structures supported by Windows 2.0. This means that you can use Pixie to dress up clip art or to add text and charts to other graphic images. Pixie includes a built-in text processor and font library and a standard palette of 98 colors (user-definable colors of up to 16 million).

Pixie will ship this month. It represents the low end of Zenographics' line of presentation-quality business graphics software, according to the company. The program is compatible with Mirage .IMA files and supports a device driver for sending data to slide-making service bureaus. **Price: \$195.**

Contact: Zenographics, 19752 MacArthur Blvd., Suite 250, Irvine, CA 92715-9976, (714) 851-6352. **Inquiry 764.**

A Faster Clipper

Clipper Summer '87, a new version of the dBASE compiler, is significantly faster in compilation and execution times than the original and contains many new commands and functions along with entirely rewritten documentation.



Pixie running under Windows 2.0.

The new version also includes low-level file access, expanded string-handling capabilities, a rewritten debugger, and new utilities. It can use the DOS 3.3 capability to open 250 files per process. Clipper Summer '87 runs on the IBM PC, XT, AT, and compatibles with 256K bytes of RAM, a hard disk drive or dual floppy disk drives, and DOS 2.2 or higher.

Price: \$695.
Contact: Nantucket Corp., 12555 West Jefferson Blvd., Suite 300, Los Angeles, CA 90066, (213) 390-7923. **Inquiry 765.**

68000-based Single-Board Computer

The MS68K Single Board Computer is a complete 68000-based system on a 5 1/4-by-8-inch board. Besides its 8-MHz processor, the system has 256K bytes of RAM (expandable to 512K bytes), and up to 128K bytes of EPROM. There are also two serial ports, a parallel port, and a floppy disk controller.

Also on the board is a socket for a SCSI protocol controller, as well as an expansion bus. The MS68K requires only +5 VDC power, and it comes with ROM-based monitor software that contains a

line assembler, disassembler, and a debugger.

Price: \$249.95.
Contact: Marion Systems Corp., 1317 Fifth St., Suite 301, Santa Monica, CA 90401, (213) 451-8910. **Inquiry 766.**

Mac II Data Acquisition

GW Instruments has a new line of hardware and software to handle all aspects of data acquisition, data analysis, and external control applications on the Macintosh II. The MacADIOS II (which stands for Macintosh analog/digital input/output system) is a 10-board set that connects the Mac II to the outside world through a number of analog and digital channels.

The master MacADIOS II card can sample 12-bit data through one channel at 142,000 samples per second. Conversion time is 5 microseconds with +/- 0.02 percent accuracy. The software-programmable instrumentation amplifier has three gain settings: 1, 10, and 100 V/V. The AM9513A counter/timer chip has five 16-bit event counters.

You can attach nine daughterboards, which provide a variety of I/O functions, to the master board. Available software includes MacADIOS Manager II for nonpro-

grammers. If you're a more experienced bit jockey, you can program MacADIOS through any of half a dozen programming languages.

Price: \$1500 to \$10,000.
Contact: GW Instruments Inc., P.O. Box 2145, Cambridge, MA 02141, (617) 625-4096. **Inquiry 767.**

Multifeature Laser

The price of midrange laser printers, usually packed with standard features, continues to fall. A case in point is Kyocera Unison's F-1000A printer. This 10-page-per-minute printer has 79 resident fonts, including 8 foreign-language character sets.

Included with the printer are 512K bytes of RAM (expandable to 1.5 megabytes) and both parallel and serial ports. The F-1000A emulates seven printers, including the Diablo 630, Qume Sprint II, NEC Spinwriter, IBM Graphics Printer, Epson FX-80, Hewlett-Packard LaserJet II, and a generic line printer.

The printer has two card slots that accept customized IC cards, each of which store personalized logos, business forms, and even signatures. If you want to prepare cards, you'll need the optional Font/Logo Master software (\$300) and the IC Card Burner Kit (\$500). Blank IC cards are \$55 each.

Like other Kyocera laser printers, the F-1000A includes the Prescribe printer-command language, which accepts commands in straight ASCII. The printer has a 250-sheet feed cassette.

Price: \$2895.
Contact: Kyocera Unison Inc., 3165 Adeline St., Berkeley, CA 94703, (415) 848-6680. **Inquiry 768.**

continued

SOFTWARE ENGINEERING COMES OF AGE.

ANNOUNCING LOGITECH MODULA-2 VERSION 3.0

Modula-2 is the language of choice for modern software engineering, and LOGITECH Modula-2 is the most powerful implementation available for the PC. The right language and the right tools have come together to create superior products. Whether you're working on a small program or a complex project, with LOGITECH Modula-2 Version 3.0 you can write more reliable, maintainable, better documented code in a fraction of the time at a fraction of the cost.

**FREE TURBO PASCAL
TO LOGITECH MODULA-2
TRANSLATOR**

NEW, IMPROVED DEBUGGERS

Time gained with a fast computer can be lost if debug time without the right debugging tools. With the powerful Logitech Modula-2 Debuggers you can debug your code fast, and dramatically improve your overall

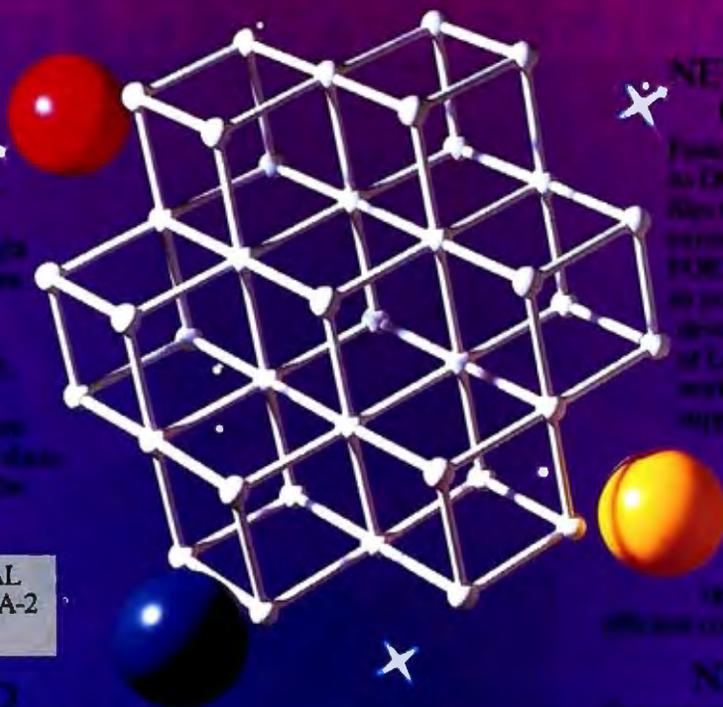


project throughput. The Post Mortem Debugger analyzes the status of a program after it has terminated, while the dynamic

Run Time Debugger monitors the execution of a program with user-defined break points. With their new, mouse-based, multiple-window user interface, these powerful debugging tools are a pleasure to use.

NEW, INTELLIGENT LINKER

Links only those routines from a particular module that you need, so you eliminate unreferenced routines and produce smaller, more compact executable files.



NEW, IMPROVED COMPILER

Faster and more flexible. Now its 68k linker can produce object files (.OBJ) can be linked with existing libraries in C, PASCAL, FORTRAN and ASSEMBLER - so you can build on previous developments and get the power of LOGITECH Modula-2 to work for you right now. Fully supports Turbo Pascal language definitions, including LCOMPNT and LCOMPSET, which provides large set support including SET of CHAR. Provides optimization for tighter, more efficient code generation.

NEW EDITOR

The new, mouse-based editor is fully integrated, easy to learn, fast and easy to use, and very customizable. Its multiple, overlapping windows and auto-scroll support make it easy to manage parts of one file or several files on the screen at one time. You'll love using it - with or without a mouse.

Just send \$1000 to our VAX/VMS version. See Logitech University Database, Dates & Distributor pricing.

Requires an order call toll free:

800-231-7717

In California:

800-552-8885

- LOGITECH Modula-2 V. 3.0 Compiler Pack** **\$99**
Compiler in overlay and fully linked form. Linkable Library, Post Mortem Debugger, Point Editor
- LOGITECH Modula-2 V. 3.0 Toolkit** **\$169**
Library sources, Linker, Run Time Debugger, MAKE, Decoder, Version, XRef, Formatter
- LOGITECH Modula-2 V. 3.0 Development System** **\$249**
Compiler Pack plus Toolkit
- Turbo Pascal to Modula-2 Translator** **FREE**
With Compiler Pack or Development System
- Window Package** **\$49**
Build true windowing into your Modula-2 code.
- Upgrade Package**
Call LOGITECH for information or to receive an order form.

Add \$6.50 for shipping and handling. California residents add applicable sales tax. Prices valid in U.S. only. Total Enclosed \$ _____

VISA MasterCard Check Enclosed

Card Number _____ Expiration Date _____

Signature _____

Name _____

Address _____

City _____ State _____

Zip _____ Phone _____

LOGITECH

LOGITECH, Inc.

1385 Kaiser Drive, Fremont, CA 94539
Tel: 415-795-8390

In Europe: LOGITECH, Switzerland
Tel: 41-21-87-9656 Telex: 438 217 Tech CH
In the United Kingdom: LOGITECH, U.K.
Tel: 44-4428-368171 Fax: 44-4428-37371

Circle 147 on Reader Service Card (READERS: 148)

JANUARY 1988 • BYTE • 75

**Who do you think of as
the world's largest
manufacturer of mice?**



Wrong.

It's not the name on the tip of your tongue.

But it's the name that soon will be: Logitech.

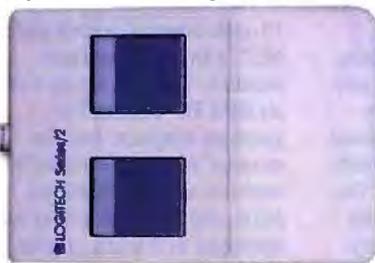
In our short history, we've manufactured over 750,000 mice. More than any other company in the world.

And we've supplied more mouse hardware, software and firmware to more major OEM's than anyone else.

And along the way, we've earned a reputation for our technological know-how in all facets of mouse production. That's because we design and manufacture our mice ourselves. We even publish our own software.

The result: A better, less expensive mouse. Which, when combined with our very affordable software, provides a complete solution for almost any graphics need.

But our achievements of the past are only a stepping stone for the future. Which is why we've designed the new LOGITECH Series 2 Mouse. It's 100% compatible with the



LOGITECH SERIES 2 MOUSE with Plus Software \$99
Our new mouse is 100% compatible with IBM. Plus Software includes driver, programmable pop-up menu system, Point and Click Shell for 1-2-3, and Point, the mouse-based text editor.

latest IBM Personal System 2™ And it plugs right into the mouse port, freeing the serial port for laser printers and other peripherals.

The LOGITECH Series 2 Mouse also offers superior hardware, and an ergonomic 2-button design which feels great to the hand. Plus it incorporates opto-mechanical technology, providing long-term reliability and excellent resolution.

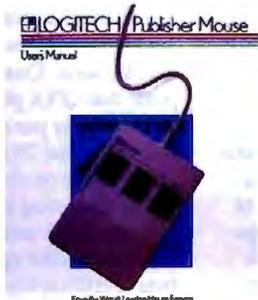
And like all Logitech products, the new LOGITECH Series 2 Mouse is an excellent value for the dollar. Especially since it comes with our Plus Software, which makes our mouse even easier to use.

If you want more information about our products or the name of the dealer nearest you, call 800-231-7717 (800-552-8885 in California) or write: Logitech, Inc., 6505 Kaiser Drive, Fremont, CA 94555. In Europe, call 41-21-869-9656.

Now, once again, who do you think of as the world's largest manufacturer of mice? Right!



LOGITECH MOUSE with Plus Software \$119
Consistently the reviewers' favorites, our Bus and Serial mouse products come complete with our Plus Software, which includes driver, Logimenu programmable pop-up menu system, Point and Click Shell for Lotus 1-2-3, and Point, the mouse-based text editor.



LOGITECH'S COMPLETE PUBLISHING SOLUTION \$179
Mouse, Plus Software and PUBLISHER software. Produces high-impact, professional looking documents. Design templates make page layout easy. For beginner and advanced.



LOGITECH'S COMPLETE PAINT SOLUTION \$149
With Mouse, Plus Software and LOGIPAIN'T. Creates files that move easily into both LOGICADD and Publisher documents.



LOGITECH'S COMPLETE CADD SOLUTION \$189
For beginner to advanced, it's a complete solution for dimensioned line drawing and CADD. Package includes Mouse, Plus Software, and LOGICADD.

Circle 149 on Reader Service Card
(DEALERS: 150)

GRiD Adds High-Powered Laptops

GRiD Systems has broadened its product line with laptops based on the 80286 and 80386 processors. The GRiDCase 1500 Series computers weigh about 12 pounds apiece. GRiD claims that the units are the only battery-powered 286 and 386 laptops.

Standard features of the AT-compatible 1500 series include a 10-inch diagonal supertwist backlit LCD screen, 1 megabyte of RAM (expandable to 8 megabytes), two 1.44-megabyte 3½-inch internal floppy disk drives, and up to 512K-byte ROM packs.

Options for the 1500 series include two different gas-plasma displays, 10-, 20-, or 40-megabyte internal hard drives, a math coprocessor, an internal modem, and a rechargeable battery pack.

The Model 1520 uses an 80C286 processor running at 10 MHz, while the Model 1530 has an 80C386 processor running at 12.5 MHz.

Price: 1520, \$3495; 1530, \$4695.

Contact: GRiD Systems Corp., 47211 Lakeview Blvd., Fremont, CA 94538, (415) 656-4700.

Inquiry 769.

PS/2 External 525 Drive

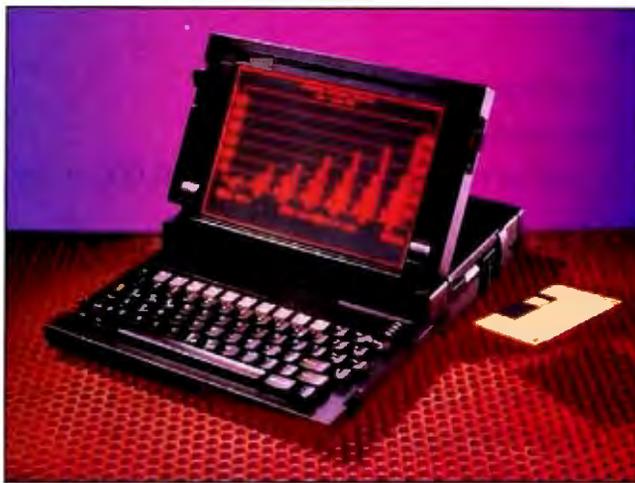
Delkin Devices' 525 Extra is a compact, low-cost external 5¼-inch floppy disk drive for all models of the IBM PS/2 series. The drive simply plugs into an existing connector inside the PS/2; it gets its power from the computer.

Measuring 9 by 6 by 2¼ inches, the 525 Extra installs in about 5 minutes with a standard screwdriver. It allows the PS/2 machines to read, write, and format standard 360K-byte floppy disks.

Price: \$325.

Contact: Delkin Devices U.S.A., 4655 Cass St., Suite 306, San Diego, CA 92109, (619) 273-8086.

Inquiry 770.



The GRiDCase 1500 comes with an 80286 or an 80386.

Datavue has 386 Transportable

And yet another entry in the growing list of 80386-based transportable systems comes from Datavue. Adding to its extensive line of laptop, portable, and transportable computers, its power-user system—called the Smoke386—will be available in both a 16-MHz system with a 40-megabyte hard disk drive and a 20-MHz version with a 100-megabyte hard disk drive. A company spokesperson says both will be available by the end of March.

The Smoke386 will run on AC power only. The unit's appearance is similar to the Datavue 25—the company's first portable. It has a vertical configuration and an appearance that some have compared with an electric toaster. Departing from screen types of previous Datavue portables, the unit uses a backlit twisted nematic LCD display with a 1-to-1 aspect ratio and a black-on-white (or inverse) VGA-type display featuring a resolution of 640 by 480 pixels.

The Smoke386 will come standard with 2 megabytes of RAM, expandable to 8 megabytes. Besides the hard disk drives mentioned above, several different floppy disk drive configurations are available, including single or dual 1.44-

megabyte 3½-inch floppy disk drives, as well as 1.2-megabyte 5¼-inch floppy disk drive.

Weighing about 16 pounds, the Smoke386 can handle two full-size IBM PC or AT expansion cards with an optional expansion chassis that mounts on the bottom of the unit. The box does add to the size, but the computer remains easily transportable.

Price: 16-MHz version, \$4995; 20-MHz version, price not yet available.

Contact: Datavue, One Meca Way, Norcross, GA 30093-2919, (404) 564-5555.

Inquiry 771.

Operating System for PS/2s

Quantum has a version of its QNX operating system for the IBM PS/2 family. The program provides 150 concurrent tasks in a protected-mode environment and 64 tasks in real mode. Quantum reports that QNX performs 3800 task switches per second in real mode and 2816 in protected mode on the Model 50.

The operating system provides up to 32 serial ports and can handle files up to 1 terabyte (a trillion bytes), according to Quantum. Running Quantum's DOS-emulator program, QDOS II, provides DOS compatibility.

Price: \$450.

Contact: Quantum Software

Systems Ltd., 175 Terrence Mathews Crescent, Kanata South Business Park, Kanata, Ontario, Canada K2M 1W8, (613) 591-0931.

Inquiry 772.

NEC MultiSync in Monochrome

NEC Home Electronics, whose MultiSync color monitors started a minor revolution in color graphics, has introduced a monochrome version. The "GS" in MultiSync GS stands for gray scale, and that's how it displays colors—in up to 64 shades of gray. It's available in green, amber, and paper-white phosphor models.

The MultiSync GS has a 13-inch diagonal screen and is NEC's first monochrome monitor. The unit works with all IBM PC-compatible graphics adapters, and the monitor's input is switchable between analog and digital. MDA and Hercules inputs are displayed as 3 levels of gray, CGA as 13 levels, EGA and EGA-plus as 64 levels, and MCGA and VGA depend on the mode.

The monitor's maximum resolution is 720 by 480 pixels. The scan rate, which automatically adjusts to the graphics adapter being used, is 15.7 to 31.5 KHz horizontal and 49.6 to 70 KHz vertical. Its screen is nonglare, with a flat CRT and square corners.

Why a monochrome MultiSync? An NEC spokesperson says the company's market research showed a need for MultiSync features in many business environments, but the cost of the color monitors coupled with often-tight budgets meant that workers who needed MultiSync features often didn't get them.

Price: \$279.

Contact: NEC Home Electronics U.S.A., Computer Products Division, 1255 Michael Dr., Wood Dale, IL 60191, (312) 860-9500.

Inquiry 773.

continued

SHOW AND TELL

Introducing The Complete Personal Communications™ family: hand scanner, fax and personal voice mail for your PC.

FAX IT

For only \$499 you can forget the dedicated phone line and long walk to the fax room. Introducing your personal facsimile machine: The Complete FAX™ board.

With CGA, EGA or Hercules-compatible graphics, you can instantly view incoming faxes on your PC's screen. Then save them to disk or print them on most dot-matrix or laser printers.

Create faxes with your favorite word processor and computer graphics program. Send them to any Group III fax machine in the world. And you

transmission to distribution lists all over the world. And CFAX is so smart, it can share the same phone line when you . . .

TURN YOUR PC INTO THE WORLD'S SMARTEST ANSWERING MACHINE

The SHOW wouldn't be complete without the TELL. We started the whole personal communications revolution with our \$349 best-selling Complete Answering Machine™ (CAM™) personal voice mail system.

Why irritate people by making them talk to a dumb answering machine? Give frequent callers their own voice mailboxes. Tell callers your computer will transfer them to another extension or track you down to deliver their messages.

Because it runs in background, CAM won't disturb anything else you're doing on your PC. And the business possibilities for CAMs are endless.

With up to four phone lines and CAM boards, you can turn a dedicated PC into your most dedicated employee.

Now you can have voice mail and facsimile on the same phone line.



SCAN IT

Show and tell. They were the first communications skills you used. Isn't it time to get more from your personal computer than word processing, spreadsheets and databases? Now you can put on a SHOW with The Complete Hand Scanner™ accessory.

Desktop publishing will never be the same. For only \$249 you can capture logos, signatures and photographs into popular graphics programs. The Soft Stationery™ program included with the scanner lets you merge text and graphics as easy as point-and-click.

Scan a 2½ inch wide image at a resolution of 200 dots per inch. Merge it. Crop it. Rotate it. Insert it. Scale it. Color it. Then print it with your dot-matrix or laser printer. You can even . . .



can scan in your signature with The Complete Hand Scanner.

Background CFAX™ software is always ready to send and receive faxes *without interrupting* the other PC programs you're using. You can even schedule outgoing faxes to take advantage of lower late-night phone rates for



THE COMPLETE PC

More from your personal computer

521 Cottonwood Drive • Milpitas, California 95035
(800)634-5558 • (408)434-0145 • FAX (408)434-1048

*The Complete PC products are available at MicroAge Computer Stores and other quality resellers. To order by phone, call R + R Direct at (800)654-7587.

Copyright © 1987 by The Complete PC, Inc. The Complete PC, Complete Personal Communications, CPC, The Complete FAX, CFAX, The Complete Hand Scanner, Soft Stationery, The Complete Answering Machine, CAM and ProCAM are trademarks of The Complete PC. The other companies mentioned own numerous registered trademarks. TRBA

PageMaker 3.0

Among other features, PageMaker 3.0 will provide automatic text flow throughout a document, automatic text wraparound of irregularly shaped graphics, support for color, image controls for scanned photographs and bit-mapped illustrations, user-definable style sheets, and 20 page-design templates.

The image-control feature lets you control brightness, adjust contrast between an object and its background, define the angle and density of an image's lines and dots to create special effects, and easily modify images.

With version 3.0, new pages are automatically created for text overflow, and a Snap to Rulers command for precise alignment has been added. You can also import tagged formats from word-processing, database, and spreadsheet applications.

The new version of PageMaker will require a Windows-compatible PC AT or PS/2 that has at least a 10-megabyte hard disk drive.

Price: \$795.

Contact: Aldus Corp., 411 First Ave. S, Suite 200, Seattle, WA 98104, (206) 628-2375.

Inquiry 774.

80386 Computer Kit

In one or two evenings of simple assembly work, you can build yourself a high-powered computer system with Heath's H-386 kit. Based on an 80386 processor running at 16 MHz, the standard H-386 kit also includes a 1.2-megabyte 5 1/4-inch floppy disk drive, a combination floppy/hard disk controller, serial and parallel ports, ROM-based diagnostics, and a 101-key keyboard.

The Heath Z-449 video board that comes with it is EGA-, CGA-, and MDA-compatible. Software includes Zenith's MS-DOS 3.2+ and Integrated 7+, an integrated software package that includes a spreadsheet, word

processor, database manager, graphics, and communications.

You don't need any special tools or skills to put the H-386 together. No soldering is required, and the completed system has five full-length open slots. Options include hard disk drives, additional floppy disk drives, and monochrome or color monitors.

Price: \$3349.95.

Contact: To obtain kit, write to the Heath Company, Dept. 350-010, Hilltop Rd., Benton Harbor, MI 49022.

Inquiry 775.

Lotus 1-2-3 Add-on Relational Database

Windjammer Software believes that its product, NexView, is the first relational spreadsheet program. The Lotus 1-2-3 add-on gives you access to data in spreadsheets without having to write any special formulas. You can consolidate a number of spreadsheets into one and work on up to 10 windows simultaneously. The program formats reports and lets you bring entries from one spreadsheet to another.

NexView runs on the IBM PC XT and compatibles with 640K bytes of RAM, a monochrome or color monitor, and a hard disk drive.

Price: \$595.

Contact: Windjammer Software Inc., 567 Park Ave., Scotch Plains, NJ 07076, (201) 322-6363.

Inquiry 776.

Transportable Wide-Carriage Printer

Diconix, a subsidiary of Eastman Kodak, now has a wide-carriage version of its transportable printer. The Diconix 300W takes paper up to 14.8 inches wide, measures 3 by 9 by 19 inches, and weighs just 12 pounds.

The printer uses ink-jet technology and has a rated noise level of only 48 decibels. Draft print speeds are

310 cps (elite) and 258 cps (pica); near-letter-quality mode prints at 73 cps (elite) and 61 cps (pica); and letter-quality mode prints at 48 cps (elite) and 40 cps (pica). A condensed draft-quality mode is also available, and the printer can print full-size graphics at 192 by 192 dots per inch.

Emulating the IBM Printer, IBM Quietwriter, and the Epson FX-85/100 printers, the Diconix 300W is available in both parallel and serial models.

Price: \$749.

Contact: Diconix Inc., 3100 Research Blvd., Dayton, OH 45420, (800) 342-6649.

Inquiry 777.

Skok Announces CAD Programs

Skok Systems began shipping four new drawing programs in December. The first, Drawbase HLR, is a hidden line-removal program that works with other Drawbase software.

Drawbase 2000 is a two-dimensional program that includes construction geometry, interrupt command structure, and DXF import/export capability. Drawbase 3000 is a two- and three-dimensional program that features two- and three-point views, as well as orthographic and wire-frame views. The last program in the series, Drawbase 4000, includes a database package and the program Space Accounting, which tracks area and perimeter values of any graphic object.

Skok reports that all the Drawbase programs are integrated, enabling you to move drawings back and forth between them without a translation procedure. None of the announced products is copy-protected.

Price: Drawbase HLR, \$495; Drawbase 2000, \$1995; Drawbase 3000, \$2995; Drawbase 4000, \$3995.

Contact: Skok Systems Inc., 222 Third St., Cambridge, MA 02142, (617) 868-6003.

Inquiry 778.

Forget-Me-Not

The programmable message system Forget-Me-Not tells your system to execute batch-file applications unattended and can be used for sending and receiving electronic mail in a LAN environment.

The program reads SideKick calendar programs as well as six other files you create. You can pop up a message window using the SideKick notepad, EDLIN, WordStar, or other ASCII text editors. You can program the window to appear at a certain time or place, and the message can contain multiple windows.

Forget-Me-Not is file-driven and written in assembly language. It requires 25K bytes of RAM, one disk drive, and MS-DOS or PC-DOS 2.0 or higher.

Price: \$59.

Contact: Sterling Castle Software, 702 Washington St., Suite 174, Marina del Rey, CA 90292, (800) 722-7853; in California, (800) 323-6406.

Inquiry 779.

FORTRAN Compiler with GEM Documentation

Prospiero Software's program development environment, Prospero FORTRAN for GEM, runs on the Atari ST and the IBM PC. An enhanced version of Pro FORTRAN-77, the new compiler offers a four-window source editor, a development environment, a symbolic debugger, and an improved linker.

The package is a complete validated ANSI-standard FORTRAN-77-level compiler, Prospero reports. The IBM PC version lets ST programmers recompile source programs to run on the PC and compatibles under GEM.

Price: \$199.

Contact: Prospero Software Inc., 100 Commercial St., Suite 306, Portland, ME 04101, (800) 327-6730.

Inquiry 780.

continued



Perfect matches to DEC user needs. Hip. Hip. And Hooray.

One-size-fits-all is an attribute best reserved for inexpensive socks. In the realm of PC-based emulation and communications software for DEC mainframe users, it's important to match specific user needs with specific product attributes. We have.

SmartTerm® 240 features exact four-color emulation of a DEC® VT241 terminal. Along with delivering full-screen ReGIS® and Tektronix® 4010/4014 graphics, SmartTerm 240 offers precise VT220, VT102, VT100, and VT52 text emulation.

For non-graphics applications, SmartTerm® 220 duplicates virtually every SmartTerm 240 text, communication, and ease-of-use feature. Three error-free file transfer protocols, including Kermit and Xmodem, are provided. Downloading minimizes on-line time requirements to boost overall system efficiency. And an optional network package allows direct LAN access to shared modems, printers, as well as host mainframes.

As SmartTerm 240 and 220 focus on graphics and text, new SmartMOVE® makes PC-to-the-rest-of-the-World communications sharper than ever. Speed connect, auto redial, and background file transfer features make this VT100 emulator a loud and clear choice for advanced communications requirements.

Graphics, text, and communications. If you're looking for a perfect fit, seek the software sized and priced to match your needs. Persoft has it. Period.

See us at DEXPO West Booth 1024, visit your dealer, phone us at 608-273-6000, or use inquiry code 50.

© 1987 Persoft, Inc. All rights reserved. Persoft, SmartTerm and SmartMOVE are registered trademarks of Persoft, Inc. DEC, VT and ReGIS are trademarks of Digital Equipment Corporation. Tektronix is a registered trademark of Tektronix, Inc.

persoft®

Mainframe Runs MS-DOS

The Centaur II Mainframe is an MS-DOS-compatible, multiuser, multiprocessing system that runs under the Novell NetWare operating system. It can be expanded to handle up to 100 simultaneous terminal users or up to 500 occasional switched terminal users. Each user's terminal is connected to a circuit card that incorporates an NEC V40 processor running at 8 MHz, 786K bytes of RAM (640K bytes is user-accessible), and two COM ports: one for attaching the terminal, the other for a printer or modem.

The main file processor for the mainframe is either 80286- or 80386-based and includes 2 megabytes of RAM (expandable up to 16 megabytes). The peripheral controller included can handle up to six floppy/hard disk systems and a tape backup unit.

The Mainframe itself consists of a standard 19-inch computer cabinet and from one to six rack-mounted Centaur II chassis. Each chassis houses from 1 to 14 application processors. A full range of storage peripherals is available. Centaur II supports most ASCII terminals, including DEC VT-100s and compatibles, as well



The Centaur II is MS-DOS-compatible.

as standard PC-type terminals such as those available from DVSC, Link, Kimtron, Tele-Video, and WYSE.

Price: Starting at \$50,000 (30 to 40 users).

Contact: Data/Voice Solutions Corp., One Newport Place, Mail Stop 800, Newport Beach, CA 92660, (714) 752-8181.

Inquiry 781.

Toshiba's 386 Portable

Toshiba's T5100 portable computer gets its power from a 16-MHz 80386 (switchable to 8 MHz). There's also a socket for an 80387 coprocessor. Other standard internals of the portable are 2 megabytes of RAM (expandable to 4 megabytes), a single 1.44-megabyte 3½-inch floppy disk drive that Toshiba says is fully compatible with IBM PS/2 drives, and a 40-megabyte hard disk drive with an average access time of 29 milliseconds. The T5100 requires AC; it will not operate on battery power.

On the outside, the T5100 measures 12¼ inches wide by 14¼ inches deep by 3½ inches high. Like other Toshiba portables, the screen flips up. Like the Toshiba T3100, the screen has a gas-plasma display. With a resolution of 640 by 400 pixels (equal to the EGA standard), it displays graphics using four shades of gray. There's also a port for an external EGA-compatible monitor.

The unit has an RS-232C serial port, a parallel port, a port for connecting an external 5¼-inch floppy disk drive, and a Toshiba standard internal expansion slot. Software includes MS-DOS 3.2 and Lotus Metro, the memory-resident desktop manager from the 1-2-3 mavens.

Options for the T5100 include a 2-megabyte memory expansion board (price not



Toshiba's new portable is 80386-powered.

yet announced). There's also an internal 1200-bps modem (\$399), an external 5¼-inch floppy disk drive (\$499), and Floppy Link, a \$199 package that lets you connect the T5100 to a desktop PC. A carrying case is also optional. **Price:** \$6499.

Contact: Toshiba America Inc., Information Systems Division, 9740 Irvine Blvd., Irvine, CA 92718, (800) 457-7777.

Inquiry 782.

PageLink Merges Text and Graphics

Qume's PageLink is a self-contained hardware/software system that merges text and graphics from existing word-processing and spreadsheet programs to produce typeset-quality documents. It's available in two versions: PageLink has 1.2 megabytes of internal memory to combine text with partial-page graphics. PageLink Plus has 2 megabytes of memory, enough to combine text with full-page bit-

mapped graphics.

The PageLink system has 111 built-in fonts, and software enhancers allow automatic kerning, optimized character spacing, and true typesetting functions such as italics. You can create page frames, shades, and patterns. You can also integrate scanned images into documents.

PageLink operates in two basic modes. In the PageLink mode, the controller outputs video directly into the imaging unit of your laser printer. In native mode, PageLink acts only as a buffering multiplexer to the standard laser-printer controller. The system lets you connect up to nine microcomputers to a single laser printer, and it operates with pop-up software.

Price: \$3795; PageLink Plus, \$3995.

Contact: Qume, 2350 Qume Dr., San Jose, CA 95131-1893, (408) 432-4000.

Inquiry 783.

continued

SHELF-BASED EXPERT SYSTEM.



An expert system is like borrowing someone else's experience and expertise on a given subject. UNDERSTANDING COMPUTERS by TIME-LIFE BOOKS is exactly that, an expert system on the subject of computers.

It's not software based, so it can't crash. And since it's not machine-specific, it won't become outdated easily, which means you'll find it an invaluable, long-lived reference whether you have an IBM®PC, an Apple II®, a multimillion dollar Cray®, or no computer at all right now.

A BRAND NEW SERIES THAT PRESENTS COMPUTERS IN A WHOLE NEW WAY.

UNDERSTANDING COMPUTERS is a new series of books that presents computers in a unique, broad-based way, unlike any other computer book you've ever seen. It gets "under the hood," right down to the nuts and bolts of computers to explain what you need to know about them in plain English.



On a digital record, sound is carried by pits and spaces, which are read by a laser beam.

The first volume, *Computer Basics*, unwraps the mystery of writing binary code... the concept of logic gates... how chips are designed... how a light pen works for graphic effects... the sequence of events in a computer from the first clock pulse to the last. And much, much more.

Succeeding volumes cover *Software*, *Input/Output*, *Graphics*, *Networking*. The entire gamut of computer topics.

EVERY IMPORTANT CONCEPT IS ILLUSTRATED TO HELP ASSURE YOU UNDERSTAND.

Not only does UNDERSTANDING COMPUTERS give you all the computer background you want that you won't find elsewhere, it also shows you



what it's all about. Full-color illustrations help make every concept crystal clear. And glossaries of terms help ensure your understanding. Each volume is a big 9 1/4" x 11 1/8" hardcover book with approximately 128 pages.

FREE 10 DAY EXAMINATION. NO OBLIGATION.

Begin to expand your computer know-how now by examining *Computer Basics* for 10 days free. Keep it and pay only \$14.99 (\$18.99 in Canada), plus shipping and handling. Then you can continue to receive other volumes every other month, always with a 10-day free trial. Keep only the books you want. And you can cancel any time. Or return *Computer Basics* and owe nothing.

Return the coupon today, and start to bridge the gap from computer buff to computer expert.

IBM is a registered trademark of International Business Machines Corporation. Apple II is a registered trademark of Apple Computer, Inc. Cray is a registered trademark of Cray Research, Inc. © 1987 Time-Life Books. Box C-32066, Richmond, VA 23261-2066



How a transistor operates as a switch.

UNDERSTANDING COMPUTERS STARTS HERE.

Mail to: TIME-LIFE BOOKS
Box C - 32066,
Richmond, VA 23261-2066

YES! Send me *Computer Basics*, as my introduction to the shelf-based expert system, UNDERSTANDING COMPUTERS. I agree to the terms outlined in this ad.

D1CNQ3

Name _____

Address _____

City _____

State or Province _____ Zip or Postal Code _____

All orders subject to approval. Price subject to change.

TIME
LIFE
BOOKS

UNDERSTANDING COMPUTERS

Introducing the two on earth



The new COMPAQ DESKPRO 386/20™

The world now has two new benchmarks from the leader in high-performance personal computing. The new 20-MHz COMPAQ DESKPRO 386/20 and the 20-lb., 20-MHz COMPAQ PORTABLE 386 deliver system performance that can rival minicomputers'. Plus they introduce advanced capabilities without sacrificing compatibility with the software and hardware you already own.

Both employ an industry-standard Intel® 80386 microprocessor and sophisticated 32-bit architecture. Our newest portable is up to 25% faster and our desktop is actually up to 50% faster than 16-MHz 386 PC's. But we did much more than simply increase the clock speed.

For instance, the COMPAQ DESKPRO 386/20 uses a cache memory controller. It complements the speed of the microprocessor,

providing an increase in system performance up to 25% over other 20-MHz 386 PC's. It's also the first PC to offer an optional Weitek™ Coprocessor Board, which can give it the performance of a dedicated engineering workstation at a fraction of the cost.

They both provide the most storage and memory within their classes. Up to 300 MB of storage in our latest desktop and up to 100 MB in our new portable.

It simply works better.

most powerful PC's and off.



and the new 20-MHz COMPAQ PORTABLE 386™

Both use disk caching to inject more speed into disk-intensive applications and both will run MS' OS/2.

As for memory, get up to 16 MB of high-speed 32-bit RAM with the COMPAQ DESKPRO 386/20 and up to 10 MB with the COMPAQ PORTABLE 386. Both computers feature the COMPAQ Expanded Memory Manager, which supports the Lotus/Intel/Microsoft Expanded Memory Specification

to break the 640-Kbyte barrier imposed by DOS.

With these new computers plus the original COMPAQ DESKPRO 386™, we now offer the broadest line of high-performance 386 solutions. They all let you run software being written to take advantage of 386 technology, including Microsoft Windows/386 Presentation Manager. It provides multitasking capabilities with

today's DOS applications to make you considerably more productive. But that's just the beginning. For more information, call 1-800-231-0900, Operator 43. In Canada, call 416-733-7876, Operator 43.

Intel, Lotus, Microsoft, and Weitek are trademarks of their respective companies.
©1987 Compaq Computer Corporation.
All rights reserved.

COMPAQ®

PERIPHERALS

**Citizen Speeds
Low End**

Citizen America now has a faster version of its popular low-cost 120D printer. The 180D is, as its name implies, a 180-cps (draft) dot-matrix printer. It also has three additional modes: data processing at 150 cps, high-speed NLQ at 31 cps, and NLQ at 29 cps.

The 180D uses a nine-wire print head and is compatible with both Epson and IBM printers. You can also print graphics in seven resolutions up to 240 dots per inch. The unit can generate over 200 type styles, including compressed and expanded characters.

You can feed paper into the 180D through either the rear or the bottom of the unit. A parallel interface is standard; a serial interface is optional. **Price:** \$259.

Contact: Citizen America, 2401 Colorado Ave, Suite 190, Santa Monica, CA 90404, (213) 453-0614. **Inquiry 784.**

**High-Speed AT
Hard Disk**

Micro Systems Group has a new series of hard disk drives for the IBM PC AT and compatibles that feature ultra-fast access times and are designed to take advantage of the 16-bit bus and faster clock speeds of 80286-based computers. The fastest of the lot is the MSG-HS40, a 40-megabyte unit with an average access time of 8.2 milliseconds.

The drives are also available in capacities of 82, 120, and 150 megabytes, each with an average access time of 16 ms. All models are full-height 5 1/4-inch drives and come complete with an ESDI controller with proprietary firmware for maximum data transfer.

Price: From \$3495 to \$5495. **Contact:** Micro Systems

Group Inc., 2117 Stonington, Hoffman Estates, IL 60195, (312) 882-5666. **Inquiry 785.**

Low-Cost Modems

A new series of modems for the IBM PC and compatibles from Advanced Computer Technology has four different models. The Expert 24E is a 2400-bps external modem; the 24I is a 2400-bps internal modem. Likewise, the Expert 12E and 12I are 1200-bps external and internal models, respectively.

All use the industry-standard AT command set and are compatible with most communications software. Each has a two-year warranty and includes auto-dialing, on-screen help menus, multiple-number storage, automatic speed adjustment for noisy lines, and extensive self-testing and diagnostics. A built-in speaker and dual telephone jacks are also standard.

Price: 24E and 24I, \$199; 12E and 12I, \$109. **Contact:** Advanced Computer Technology, Worcester-Providence Turnpike, Sutton, MA 01527, (800) 654-6464; in Massachusetts, (617) 865-3304. **Inquiry 786.**

**High-Speed Modem
for Normal Lines**

Ven-Tel's EC18K-34 is a very high-speed 18,000-bps asynchronous modem with integral data compression that the company claims can boost throughput up to 19,200 bps, even on poor lines.

The modem automatically corrects errors using 16-bit CRC in high-speed mode and MNP error correction at 1200 bps and 2400 bps. It can also dynamically adjust itself to changing phone-line conditions. Unlike many competing high-speed modems, the

EC18K-34 can fall back in speed by 100-bps increments if the line degrades.

At high speed, the modem uses PEP (Packetized Ensemble Protocol) multicarrier modulation. At lower speeds, it is Hayes-compatible and automatically adjusts itself to the highest speed supported by the modem on the other end. The EC18K-34 has advanced self-testing and can be configured via telephone line from a remote location.

Price: \$1300. **Contact:** Ven-Tel Inc., 2121 Zanker Rd., San Jose, CA 95131, (408) 436-7400. **Inquiry 811.**

Fast Mac II Drive

With a data transfer rate that's faster than the transfer rate of the Macintosh II, the PRO 140 II/i is a 140-megabyte internal hard disk drive that's designed especially for Apple's top-of-the-line model.

The disk has an average access time of 26 ms and features automatic head parking. There's also a dynamic brake-lock system that protects sensitive areas of the disk while it's being transported. The PRO 140 II/i comes with the CMS SCSI Utilities program that helps you format, initialize, and install the drive.

Price: \$2695. **Contact:** CMS Enhancements Inc., 1372 Valencia Ave., Tustin, CA 92684, (714) 259-9555. **Inquiry 787.**

**Fingerprint Your
Computer**

ThumbScan is a "biometric identification system" that analyzes fingerprints to make sure that only authorized users get access to a computer equipped with the unit. The system consists of a small fingerprint-scanning device that connects to your sys-

tem, as well as software.

The software initializes your fingerprint by requesting that you place a thumb or finger on the scanner's image area. The ThumbScan then digitizes and encrypts the fingerprint. Later on, it will compare your fingerprint with the encrypted image. If it matches, you can access the system. It takes about 5 minutes to initialize a user, and thereafter about 5 seconds to check if the user is authorized.

ThumbScan is compatible with MS-DOS systems, as well as DEC VAXes and IBM mainframes, which require additional software.

Price: \$995. **Contact:** ThumbScan Inc., Two Mid-America Plaza, Suite 800, Oakbrook Terrace, IL 60181, (312) 954-2336. **Inquiry 788.**

Heavy-Duty Laser

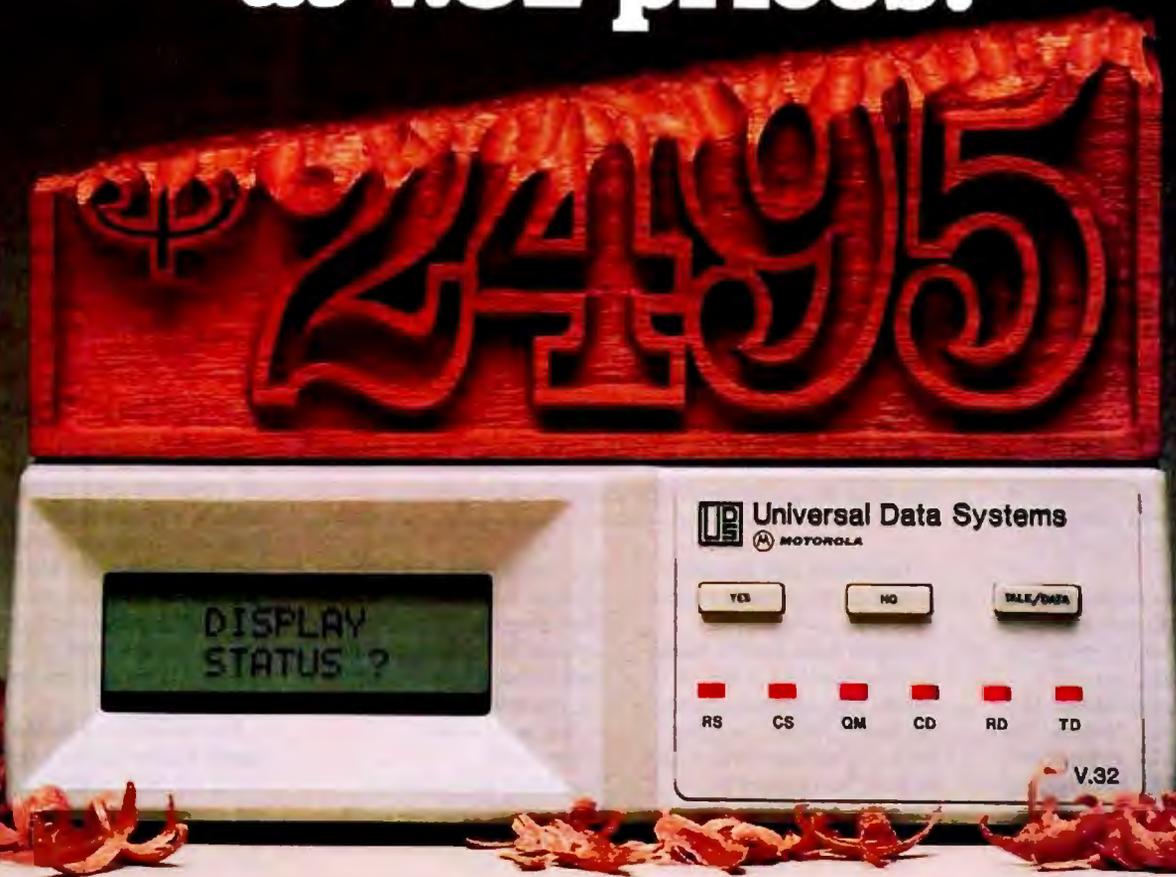
With a target volume of 10,000 pages per month and a rated print-engine life of 600,000 pages, the Facit P7080-A laser printer is designed for heavy use in a busy environment. The printer comes with six fonts in two sizes; plug-in cartridges are available to provide additional fonts, PostScript and HPGL emulation, and bar-code printing.

Rated at 8 pages per minute, the P7080-A emulates the Diablo 630, Hewlett-Packard LaserJet Plus, and Epson FX printers. It has both parallel and serial interfaces, and it comes standard with 512K bytes of RAM, expandable to 2 megabytes. The feeder and output trays both handle 250 pages, and the output is collated face-down.

Price: \$5895. **Contact:** Facit Inc., 9 Executive Dr., Merrimack, NH 03054, (603) 424-8000. **Inquiry 789.**

continued

UDS is chipping away at V.32 prices!



Full duplex 9600 bps communication over dial-up telephone lines becomes more cost-effective than ever, as UDS announces a 36% price cut for the popular V.32 modem.

A unique echo cancellation technique (patent pending) permits reliable performance over all types of surface and satellite links. Set-up and operation are greatly simplified by a 3-key system of responses to menu prompts on an integral LCD screen. The same screen displays results from the modem's extensive self-test regime.

1595

New Quantity One Price

The unit also features auto dial, auto answer, call progress detection and adaptive line equalization. If degraded line quality prevents 9600 bps communication, a 4800 bps fallback mode is available.

If modem cost is the reason you haven't upgraded your dial-up system to V.32, the rules have just changed.

For detailed specifications and quantity prices, contact Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Telephone 800-451-2369; Telex 752602 UDS HTV.



Universal Data Systems



MOTOROLA INC.
Information Systems Group

ADD-INS

High-Speed EGA/VGA

Ahead Systems has two new video cards for the IBM PC and compatibles that feature both EGA and BIOS-level VGA compatibility. The EGA Wizard and EGA Wizard Deluxe have maximum resolutions of 640 by 480 pixels and 800 by 600 pixels, respectively.

Both cards display CGA and EGA colors as 16 shades of gray on monochrome monitors and support 132-column modes. Both also have a proprietary turbo mode, which the company claims improves video display speed by up to 300 percent by reducing the number of wait states to less than half that of standard EGA cards.

The cards are shipped with a number of custom software drivers for such popular applications as Lotus 1-2-3, AutoCAD, PageMaker, Ventura Publisher, Generic CAD, Dr. HALO III, Framework, and FastCAD. Both also support extensive PC-to-mainframe and PC-to-minicomputer communications with emulation support for the IBM 3278/3279, S3G, VT-100/VT-220, HP, and Tektronix 4005/4010/4015.

Price: Wizard, \$249; Wizard Deluxe, \$349.

Contact: Ahead Systems Inc., 1977 O'Toole Ave., Suite B105, San Jose, CA 95131, (408) 435-0707.
Inquiry 790.

Cableless 386 Upgrade

If you want to upgrade your AT or compatible to an 80386, the Master 386 from Aox lets you do it easily, without removing chips or installing cables. Installation is a simple matter of plugging in the board and installing software. The Master 386 is available in both 16-MHz and 20-MHz versions, with high-speed cache memory and a socket for an optional 80387 coprocessor.



The EGA Wizard series is VGA-BIOS-level-compatible.

The Master 386 includes special circuitry that the company claims will prevent problems caused by the recently announced bug in the 80386. The company claims the Master 386 will run flawlessly in protected mode with an 80387 as required by Unix, PC-MOS/386, and Windows/386.

Using its on-board connectors, you can equip the Master 386 with true 32-bit memory using Aox's optional memory-expansion board. A 2-megabyte card (expandable to 10 megabytes) is \$1250; a 4-megabyte card (expandable to 16 megabytes) is \$1995.

Price: 16-MHz version, \$1595; 20-MHz version, \$2195.

Contact: Aox Inc., 486 Totten Pond Rd., Waltham, MA 02154, (617) 890-4402.
Inquiry 791.

SCSI for the PS/2

The MCS-350 SCSI host adapter from Future Domain is an add-in for the IBM PS/2 Models 50, 60, and 80. It interfaces the computers with any of the wide variety of SCSI peripherals.

The MCS-350's transfer rate is 1.67 megabytes per sec-

ond, and it offers full Micro Channel compatibility with an IBM-assigned ID number. It also has all the features you need to run advanced operating systems such as OS/2, Xenix, and Novell.

Price: \$390.

Contact: Future Domain Corp., 1582 Parkway Loop, Suite A, Tustin, CA 92680, (714) 259-0400.

Inquiry 792.

Acquire Data for the PS/2 50, 60, and 80

The MDL-16 is a real-time and event-based data acquisition system for the PS/2 Models 50, 60, and 80. It includes a multifunction Micro Channel data acquisition board with both RS-232C and RS-422/485 communications ports.

The system comes with the TransParent Interface, a real-time background data collection program. Its features include interfaces for Borland's Turbo Pascal, Turbo Basic, and Turbo C, as well as Microsoft's GWBASIC and C. Language variables are updated in real time and directly interfaced with analog and digital inputs and outputs.

Hardware features include 16 13-bit analog inputs, 16 TTL-level digital inputs, 16

TTL-level digital outputs, 96 alarms, a battery-backed real-time clock, and stand-alone data logging with time and date stamping. Options include a 1200-bps modem, a temperature sensor board, I/O rack adapter cards, and isolation modules.

Price: \$499.

Contact: The Automation Group Inc., 848-R Nandino Blvd., Lexington, KY 40511, (606) 254-6916.

Inquiry 793.

Your Computer Speaks

The Heath HV-2000 is an expansion card for the IBM PC and compatibles that gives your computer a wide variety of voices. It's a half-size plug-in card that, according to the company, translates ASCII data as well as high- or low-level languages into intelligible speech.

This add-in consists of a speech synthesizer on a circuit board, an audio amplifier, and an external speaker. A Speak utility program lets you add vocal prompts to batch files. It will also read ASCII text files, as well as ASCII data received through a serial port. The board has XON/XOFF handshaking and a 60K-byte buffer. There's also terminal-emulator software that adds speech to modem communications.

The HV-2000 uses 64 phonemes to create words, phrases, and sentences. Other attributes include four durations, 16 rates, 4096 inflection levels, 32 transition levels, eight transition rates, eight articulation rates, and 49 musical notes. The audio output has 16 amplitude settings.

Price: \$89.95.

Contact: To obtain kit, write to the Heath Company, Dept. 350-020, Hilltop Rd., Benton Harbor, MI 49022.
Inquiry 794.

continued



Oracle Corporation, the world's fastest growing software company,¹ has just climbed past Ashton-Tate to become the world's largest supplier of database management software and services.² Why?

- Because ORACLE[®] runs on PCs, plus mainframes and minicomputers from IBM, DEC, DG, HP, Prime, Wang, Apollo, Sun, etc. — virtually every computer you have now or ever will have. Ashton-Tate's dBASE runs only on PCs.
- Because ORACLE is a true distributed DBMS that connects all your computers — PCs, minicomputers and mainframes — into a single, unified computing and information resource. dBASE supports only primitive PC networking.
- Because Oracle has supported the industry standard SQL language since 1979. Ashton-Tate promises to put SQL into dBASE sometime in the indefinite future.
- Because ORACLE takes advantage of modern 286/386 PCs by letting you build larger-than-640K PC applications on MS/DOS today, and run them unchanged on OS/2, once OS/2 is available. dBASE treats today's 286/386 PCs and PS/2s like the now obsolete, original PC.

Don't go down in flames. Bail out from dBASE. Call 1-800-ORACLE1 and order your \$199-PC copy of ORACLE[®] today. Or just ask and we'll send you information on ORACLE, the number one selling DBMS on minicomputers and mainframes.

ORACLE[®]
COMPATIBILITY • PORTABILITY • CONNECTABILITY

**Call 1-800-ORACLE1,
ext. 149 today.**

Feature:	dBASE	ORACLE
SQL	Promises, no dates	IBM DB2 Compatible
Mainframes	No Way	IBM MVS & VM/CMS
Minis	Nope	DEC, HP, Sun, etc.
PCs	All, PC Jr. too	286 & 386 PCs
MS/DOS	< 640K programs	> 640K programs
OS/2	Ask Ashton-Tate	Yes, first day
Multuser	Primitive	Mainframe quality
Networking	PC Nets only	PC, mini & mainframe
Fault Tolerant	You must be kidding	CPU & Disk Recovery

**THE LAST DBMS
ONLY \$199
CALL 1-800-ORACLE1**

Dear Oracle,

PC ORDER PROCESSING
Oracle Corporation
20 Davis Drive • Belmont, CA 94002

I want ORACLE to be THE LAST DBMS for my 286/386 PC. Enclosed is my Check or VISA MC AMEX credit card authorization for \$199 (California residents add 7% sales tax). I understand this copy is for PC development only. Offer valid only in the US and Canada.

Print Name _____ Date _____
 Title _____
 Company _____
 Street (P.O. Box numbers not acceptable) _____
 City _____
 State _____ Zip _____
 Phone _____
 Credit Card Number _____
 Card Expiration Date _____

Signature _____ **BYE**
 I am a value-added reseller (VAR) YES NO

¹ Revenue doubled in 8 of Oracle's 18 years. ² Sales rate over \$200 million in current fiscal year. ³ For PC development use only. Requires a 286/386 PC plus 1-MB extra extended memory. Offer valid only in US & Canada. © 1987 by Oracle Corp. ORACLE[®] is a reg. trademark of Oracle Corp. dBASE is a reg. trademark of Ashton-Tate. Microsoft & IBM are numerous reg. trademarks. TARA

Micron Memory Boards

**EXTENDED
MEMORY**



4 Meg AT ZIP Board

- EMS emulation software included
- Fully populated and tested with 4 MB of Micron memory on a single PC board!
- Designed to work with 80286 and 80386 based systems
- Compatible with OS/2, DOS, UNIX and XENIX
- Operating speeds up to 8 MHz zero wait-state and 12 MHz with one wait-state
- Backfills conventional memory
- Switch selectable on 4 MB boundaries at 1 MB or 2 MB starting address
- RAM diagnostics, RAM disk and print spooler software included
- All boards are tested under a wide range of environmental conditions to insure high reliability and quality
- Warranted for 2 years to registered users
- Made in the USA

Operating Speeds	Order Number	
	Standard Board	Board with 384 KB Offset*
Up to 6 MHz w/no wait-state		
Up to 10 MHz w/1 wait-state . . .	MB-46-12	MB-46-32
Up to 8 MHz w/no wait-state		
Up to 12 MHz w/1 wait-state	MB-48-12	MB-48-32

*For systems with a 1 MB or 2 MB motherboard

2/4 Meg AT DIP Board

- EMS emulation software included
- Purchase 2 MB mothercard and 2 MB daughtercard separately or together to fit in a single slot!
- Designed to work with 80286 and 80386 based systems
- Compatible with OS/2, DOS, UNIX and XENIX
- Operating speeds up to 8 MHz zero wait-state and 12 MHz with one wait-state
- Backfills conventional memory
- Switch selectable on 1/2 MB boundaries starting at 1024K or 1408K
- RAM diagnostics, RAM disk and print spooler software included
- All boards are tested under a wide range of environmental conditions to insure high reliability and quality
- Warranted for 2 years to registered users
- Made in the USA

Operating Speeds	Order Number	
	2 MB	4 MB
Up to 6 MHz w/no wait-state		
Up to 10 MHz w/1 wait-state	MB-26-D	MB-46-D
Daughtercard for MB-26-D	MB-26-DD	
Up to 8 MHz w/no wait-state		
Up to 12 MHz w/1 wait-state	MB-28-D	MB-48-D
Daughtercard for MB-28-D	MB-28-DD	

16 Meg AT DIP Board

- EMS emulation software included
- Purchase 6 MB mothercard and 2, 4, 6 or 10 MB daughtercard separately or together to fit in a single slot!
- Fully populated and tested with Micron's own 1 megabit CMOS Dynamic RAMs
- Designed to work with 80286 and 80386 based systems
- Compatible with OS/2, DOS, UNIX and XENIX
- Operating speeds up to 8 MHz with zero wait-state and 12 MHz with one wait-state
- Backfills conventional memory
- Switch selectable on 128KB boundaries
- RAM diagnostics, RAM disk and print spooler software included
- All boards are tested under a wide range of environmental conditions to insure high reliability and quality
- Warranted for 2 years to registered users
- Made in the USA

Memory Capacity	Order Number	
	10MHz**	12MHz***
6 MB	MB-66-D	MB-68-D
8 MB	MB-86-D	MB-88-D
10 MB	MB-106-D	MB-108-D
12 MB	MB-126-D	MB-128-D
16 MB	MB-166-D	MB-168-D

**Up to 6 MHz w/no wait-state up to 10 MHz w/1 wait-state
***Up to 10 MHz w/no wait-state up to 12 MHz w/1 wait-state

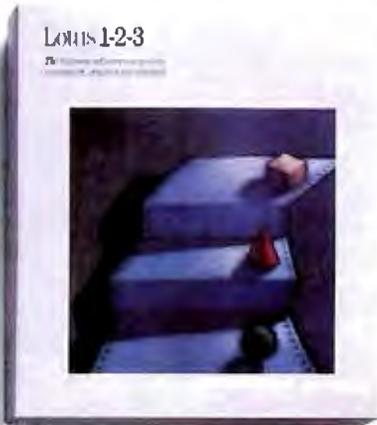
Micron Technology, Inc.
Systems Group
2805 East Columbia Road
Boise, Idaho 83706
1-800-642-7661
(208) 386-3800

MICRON

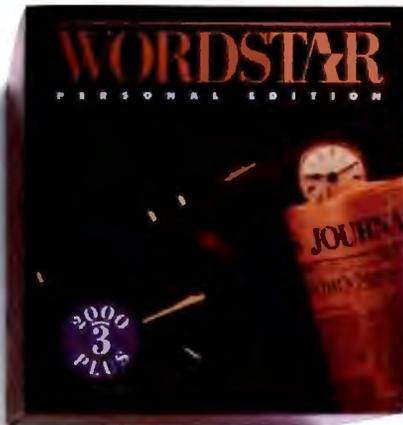
TECHNOLOGY, INC.

UNIX is a trademark of Bell Laboratories—XENIX is a trademark of Microsoft Corporation—IBM PC, XT, AT and OS/2 are trademarks of IBM Corporation

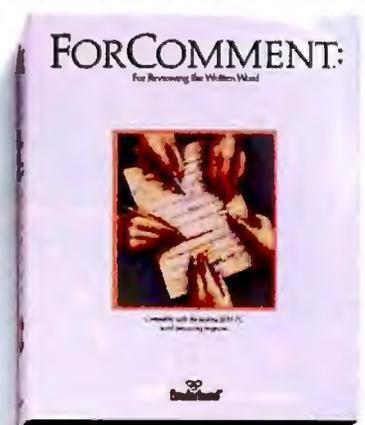
You Already Know Best Reasons for



123 Ver. 2.2
Display more data with no loss of speed; pop up graphs on same screen as spreadsheet.



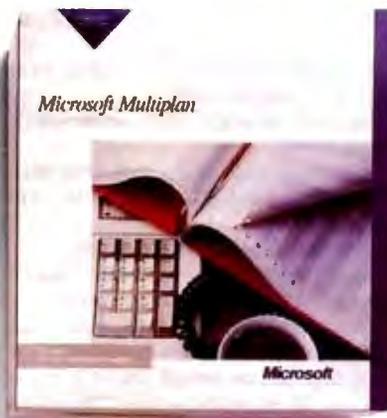
Wordstar 2000 Plus Ver. 3
Display sub/superscripts, italics, boldface, strikethrough.



For Comment
Display more text with no loss of speed.



WordMARC
Display foreign characters at text mode speeds.



Microsoft Multiplan
Display more data with no loss of speed.

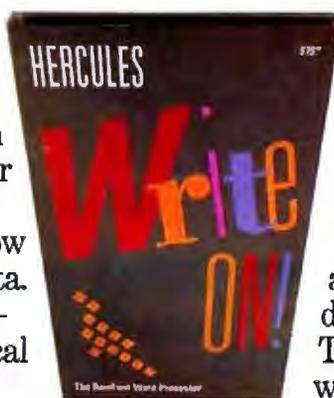


Symphony
Display more data with no loss of speed.

Now, Here's

It's hard to find a business application that can't run better with RamFont.™

Spreadsheets show nearly twice the data. Word processors display foreign, technical and other special



characters. All with no loss of scrolling speed—in fact, it often improves.

Now for a real look at what RamFont does, there's Write On! This unique RamFont word processor from

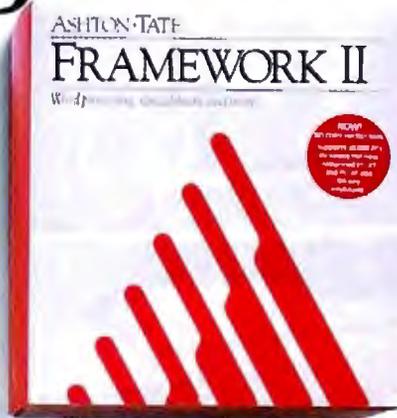
Hercules displays several type styles and sizes at text-mode speeds, complete with headline-size type, custom and foreign characters, underscore and true boldface. See them on-screen like they'll appear in print, brightening memos, overheads and prompt cards.

Hercules is a registered trademark of Hercules Computer Technology, Inc. RamFont and InColor are trademarks of Hercules Computer Technology, Inc. Other products are trademarks of their respective holders.

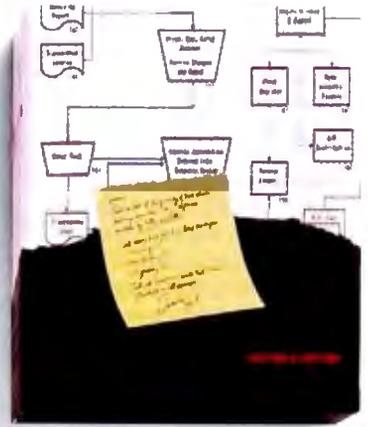
Now Some of the Having RamFont.



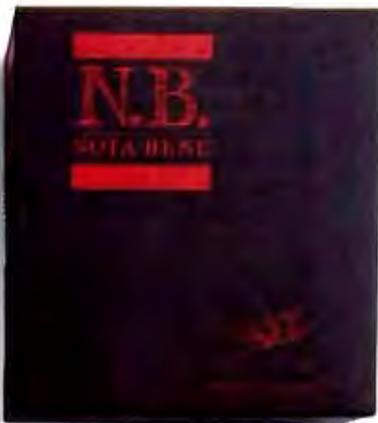
Brief
Display more text with no loss of speed.



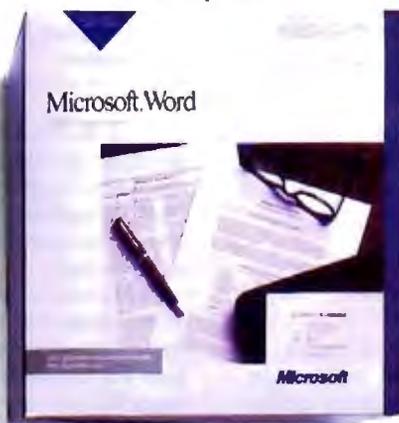
Framework II
Display more data with no loss of speed; display boldface and italics in the word processor.



Flow Charting II
Display special symbols at text mode speeds.



Nota Bene
Display foreign character sets at text mode speeds.



Microsoft Word 4.0
Scroll much faster than in graphics mode, retaining all on-screen fonts and attributes.



Manuscript
Display sub/superscripts, italics, boldface and strikethrough.

One More.

Create new documents with Write On! or import any ASCII text file. You get full editing functions plus pull-down menus and mouse support for easy font changes. You'll turn plain text files created with other word processors into dazzling communications in seconds!

If you already own a Hercules Graphics Card Plus or InColor Card, call us toll-free at 800-532-0600. We'll tell you how to get your copy of Write On!

For a limited time, you get a *free* copy of Write On! with every Hercules Graphics Card Plus or Hercules InColor Card.*

Both are at your Hercules dealer, complete with our exclusive RamFont mode that makes it all possible.

There have never been so many reasons for RamFont. But as any software publisher will tell you, there will soon be a whole lot more.

Hercules.

*RamFont by Hercules.
Exclusively in the Graphics Card Plus
and InColor Card.*

CAD/CAM on the Mac

The Professional System from Douglas Electronics now supports the Macintosh II as well as color and unlimited layers. The program is made up of three parts—Schematic Capture, a layout program, and an Autorouter.

To run the program, you need at least 512K bytes of RAM on a Mac or a Mac II. Input is via a mouse; you will need no additional hardware. You begin by designing a schematic with the Schematic Capture program; then you draw an outline with the layout software. Using the Parts Placement facility, you position the components on the grid. The Autorouter completes the process by automatically routing the circuit connections.

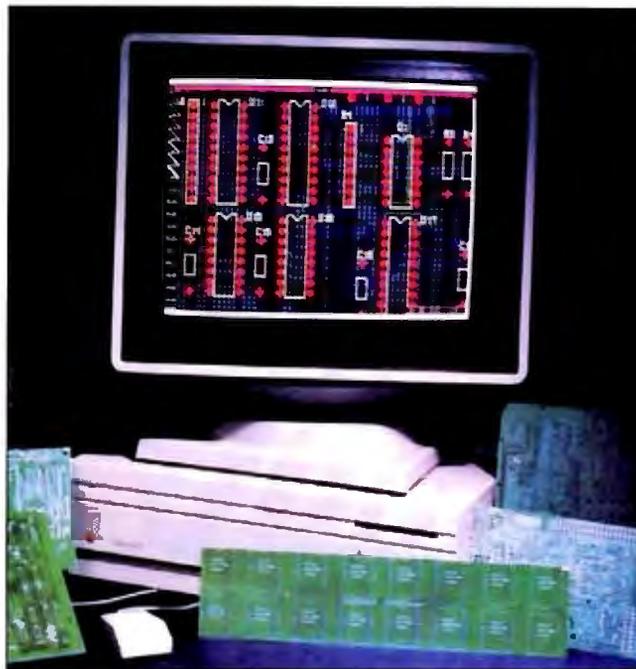
The Schematic Capture module features interactive circuit logic simulation that you define; and large TTL, CMOS, and discrete parts libraries. You can use symbols from the library or design your own.

The layout system features board designs of up to 32 by 32 inches, an unlimited number of layers, and 50 levels of magnification. You can view the layers separately or all at once, and, choosing from eight colors, you can assign a color to each layer.

The routing parameters are controlled via a command file, which provides options for grids, line widths, and maximum trace length. Douglas reports that the router is based on a maze router algorithm. A text file lists unroutable connections and shows them on the layout as rat's-nest lines.

Output options include dot-matrix, LaserWriter, pen plots, and Gerber files. Douglas will also provide you with artwork or finished circuit boards if you send the layout files via modem or mail.

Price: Professional Layout, \$1500; Schematic Capture, \$700; Autorouter, \$700.



Douglas Electronics' Professional System offers schematic capture, a layout program, and an autorouter.

Contact: Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577, (415) 483-8770.
Inquiry 800.

CAMSmith

CAMSmith, based on the Graphics Entity and Operation Unification theory (GEOU) technology, offers advanced CAD and manufacturing capabilities. These include drafted walls, variable drafted walls, compound planes, intersection of any combination or arbitrary and regular surfaces, and interactive viewing of cutter path with dynamic scaling, rotation, and translation.

GEOU is based on research being conducted at 3D Science Laboratories. The company explains that in a typical CAD system, if you have n curve/shape types and m possible operations to perform between curves, then you must code $n \times n \times m$ procedures. The resulting program is large, so GEOU unifies all possible shapes into one,

reducing the number and variety of operations you would need to perform. GEOU's implementation in CAMSmith simplifies the user interface.

CAMSmith is a menu-driven system that lets you create three-dimensional surfaces and three-axis simultaneous NC code to cut the surface. You can view both the surface and the three-dimensional tool path graphically. The program is compatible with CAD systems and two-dimensional CAM systems, and it supports file formats such as IGES.

CAMSmith runs on the IBM PC AT or compatibles with at least 640K bytes of RAM, a math coprocessor, a hard disk drive, and an EGA card.

Price: 3D machining system with 3D graphics will sell for about \$8750; the machining system plus 2D CAD/CAM with 3D graphics will sell for about \$9350; and the 3D CAD system will sell for between

\$600 and \$3500.

Contact: 3D Science Laboratories, 3090 Avon St., Burbank, CA 91504, (818) 841-2121.

Inquiry 801.

Compute Air and Water Vapor in Four Units

Psychrometry is a program for use in engineering, physics, and meteorology. You can compute 10 properties of air and water vapor mixtures in four-unit systems including MKS, SI, English, and English (grains).

The program's algorithms are based on thermophysical properties: specific heat, specific heat of air, heat of vaporization, and vapor pressure of water vapor.

You begin by selecting two properties followed by inputting the magnitudes. The program computes the remaining eight and tabulates dry bulb temperature, adiabatic saturation temperature, dew-point temperature, relative humidity, humidity ratio, enthalpy, entropy, density, humidity ratio at adiabatic saturation, and enthalpy at dew point. You can repeat the process 12 times, or you can opt to transfer a specified property over some or all repetitions.

The temperature range of the program is -105°C to 255°C (-157°F to 491°F).

You can run the program at standard pressure, standard pressure corrected for elevation, or at any pressure from a few hundredths of an atmosphere to a maximum of 10 atmospheres of partial pressure.

Psychrometry runs on the IBM PC with DOS 2.0 or higher and on the Mac with at least 512K bytes of RAM.

Price: \$37.60.

Contact: Jim Lang, P.O. Box 307, Oneida, WI 54155, (414) 869-2691.

Inquiry 802.

continued

Turn N.Y. on its head!

You don't need the power of a mainframe to turn N.Y. on its head — just your own creativity and DynaPerspective™ from Dynaware. Perfect for conceptual design, visual analysis and presentations, DynaPerspective™ lets you easily zoom in and out, change the declination, elevation, compass direction, and rotate your model through 360° for a full walk-around effect. Advanced hidden-surface functions free you from the time-consuming line deletion typical of wire-frame line drawings. This powerful software package also gives you full surface color and light-source shading for unsurpassed solid surface modelling.

DynaPerspective™ does away with computerese. User-friendly screen icons and pull-down menus eliminate the need for remembering complicated commands. And DynaPerspective™ is fast as well as powerful. After initial compilation, even major changes are reflected in the model in seconds. A variety of powerful time-saving features have also been incorporated, such as a large parts library file for frequently used components. Conceptual design and visual analysis have never been easier. Whether you're an architect, graphic artist, urban designer, or one of the new wave of multidisciplinary professionals, DynaPerspective™ will save you valuable time and make your job easier.

DynaPerspective™ also allows you to network, since it can communicate with other DXF compatible PC CAD systems. No wonder it's been called the most powerful user-friendly 3-D solid modeling design software ever created for a personal computer.

Already available for the IBM® PC, AT and compatibles, Dynaware will soon release versions for the HP-9000™ and Macintosh II™. For your added convenience we have established a brand new headquarters in San Francisco to handle all inquiries.

A powerful tool that lets you maximize your time, DynaPerspective™ is priced at only \$975. Take the opportunity to turn N.Y. on its head, and have the city at your feet...

Try a new perspective — a DynaPerspective™

■ System Requirements
Computers: IBM® PC, AT
and compatibles
(Minimum 640K RAM)
Hard disk recommended
but not required.
Graphic card
Input: Tablet or mouse
Output: Platter or printer



Suggested Retail Price **\$975**

DYNAPERSPECTIVE™
3D Modeling Design and Presentation Software

Please send me more information.

Name _____ Computer _____

Address _____

City _____ State _____ Zip _____

DYNARE™

©1987 Dynaware Corp.

1163 Chess Drive, Suite J, Foster City, CA 94404

TEL (415)-349-5700 FAX (415)-349-5879

IBM PC and AT are registered trademarks of International Business Machines Corp. Macintosh is a trademark of Apple Computer, Inc. HP-9000 is a registered trademark of Hewlett-Packard Corp.

Circle 86 on Reader Service Card

Page produced on a 1024 x 768 dot graphic board.

Silverado

Computer Associates describes Silverado as a database that operates as a window inside a spreadsheet. It lets you import multiple databases for analysis and reporting and to link databases together. You can import and analyze Lotus 1-2-3, SuperCalc4, dBASE III, and ASCII text files. "Hotlinks" connect information between the database and the spreadsheet, with database changes automatically transferred to the spreadsheet.

Silverado operates with 1-2-3- and SuperCalc-style commands and reads 1-2-3 and SuperCalc4 file formats. You can sort and resort data with no limit on the number of sort fields. Totals and subtotals are available at any level, and you can analyze data from most views.

The program utilizes background processing, shortening the time required for report generation.

Database outlining is another one of Silverado's features. It enables you to view information at any level of sub-totaling or detail.

You also have a choice of several ways to view information, including the Spreadsheet View, Form View, Crosstab View, and Report View.

Silverado also features virtual data memory that automatically accesses available memory devices. Small files use the available standard memory and will use expanded memory if it is present. Files that exceed the memory capacity are swapped to disk.

The program runs on the IBM PC, XT, AT, and compatibles with two floppy disk drives or one floppy drive and one hard disk drive. At least 512K bytes of RAM is required, as well as MS-DOS or PC-DOS 2.0 or higher, and Lotus 1-2-3 version 2.0 or higher or SuperCalc4. **Price:** \$149.

Contact: Computer Associates International Inc., 2195



Silverado operates as a window inside a spreadsheet.

Fortune Dr., San Jose, CA
95131-1820, (408) 432-1727.
Inquiry 803.

Finance Manager II

Finance Manager II consists of general ledger, account-reconciliation, financial-utilities, accounts receivable, and accounts payable modules. You can purchase the modules separately or run them as an integrated system.

The general ledger module lets you set budgets, compare expenses, keep track of tax deductions, record all transactions, and calculate your net worth. You can produce general-journal, income-statement, accounts-listing, balance-sheet, and budget-listing reports by month, quarter, year, or year-to-date. You can store up to 1999 accounts and up to 30,000 transactions per year.

The account-reconciliation module runs with the general ledger module and enables you to balance bank statements, keep track of outstanding checks, verify charge-card transactions, and produce automatic balance statements.

The financial-utilities module helps you make calcu-

lations, create a depreciation schedule for your assets, and calculate loan payments. You can produce loan amortization schedules and calculate present and future values of annuities.

With the accounts receivable module you can calculate finance charges, print customer lists and mailing labels, and produce cash flow forecasts. Reports provided include an accounts receivable journal, balance-forward statements, customer invoices, and a schedule of receivables.

The accounts payable module lets you maintain a permanent record of purchases and print checks, vendor lists, and mailing labels.

Finance Manager II modules run on the IBM PC, XT, AT, and compatibles with MS-DOS or PC-DOS 2.0 or higher, 256K bytes of RAM, and two floppy disk drives or one floppy disk drive and a hard disk drive. All modules can run independently except the account-reconciliation module, which requires the general ledger.

Price: General ledger, \$40; account reconciliation, \$15; financial utilities, \$20; accounts receivable, \$30; accounts payable, \$30.

Contact: Hooper International, P.O. Box 08430, Fort Myers, FL, 33908-8430, (813) 466-0050.
Inquiry 804.

Expert Tax Advice

Ask Dan About Your Taxes is a rule-based tax preparation program that gives you a personalized analysis of your taxes, taking the most recent tax-law changes into account, and carries results to on-line tax forms.

Using an expert system, Ask Dan runs you through individually tailored question-and-answer sessions, automatically completing relevant tax forms or lines in the process. Legal Knowledge Systems reports that you can override the expert at any time, change your answers, and let Dan recompute your tax forms. The program asks yes/no, multiple choice, and fill-in-the-blank questions. It also offers a customized checklist that describes deductions, income items, credits, and additional tax debts you may have.

The program can assist you on IRAs, filing status, exemptions, alimony, medical deductions, taxes paid, charitable deductions, interest and dividend income, capital gains, sale of a home, child care credit, and moving expenses.

With each answer, your tax form is recomputed spreadsheet-style on-screen. The program contains Form 1040, schedules A through F, R, SE, and about 20 others. You can print the forms on any printer, the company reports, and they are suitable for submission to the IRS.

The program runs on the IBM PC and compatibles with at least 512K bytes of RAM and a hard disk drive or two floppy disk drives. The company reports that Ask Dan will ship in mid-January. **Price:** \$69.95.

Contact: Legal Knowledge Systems Inc., 195 Maplewood St., Watertown, MA 02172, (617) 923-2322.

Inquiry 805.

continued

Now you can develop picture-perfect applications at lightning speed.



It's easy with CLARION.

Picture this: Envision the convenience and versatility of all the development tools you need, combined with a powerful new language that's easy to learn and even easier to use. The result is CLARION.

Instant development: From prototyping to source code in a flash. Generate screens and reports, and compile and test the complete range of PC applications—**many** times faster than you do now!

CLARION runs on any IBM PC, PS/2, or true compatible with 320kb of memory and a hard disk drive.

The results are worth framing: CLARION gives you the power and time to create better, richer applications for single users or networks. Without run-time cost. You can even create .EXE programs with the optional Translator. If you can picture it in your mind, CLARION can make it a reality.

Get the CLARION advantage: Give CLARION a run for the money. Priced at just \$395 plus shipping, it's easy to switch to our picture-perfect development tool. If you're not completely amazed by the results you get, simply return it within 45 days for a full, unconditional refund. MasterCard, American Express and VISA accepted.

To order CLARION or to receive a sample program, simply call toll-free: **1-800/354-5444**

CLARION[®]
from BARRINGTON SYSTEMS, INC.

150 East Sample Road
Pompano Beach, Florida 33064-3597
305/785-4555 FAX: 1-305/946-1650



Networking Reports

The Snow Report Writer network version merges data from multiple sources such as Lotus 1-2-3, dBASE, and over 55 others, including languages.

You can create columnar reports, forms, mailing lists, labels, form letters, and business graphics. Windowing and help is provided throughout the program. It also has record locking and file protection.

The Snow Report Writer runs on the IBM PC and compatibles with at least 384K bytes of RAM. A hard disk drive is recommended. The program supports Novell, PC NET, Token Ring, and 3-Com networks.

Price: \$995 for eight workstations.

Contact: Snow Software, 2360 Congress Ave., Clearwater, FL 34621, (813) 784-8899.

Inquiry 806.

Waveform Editing

With Sound Designer Universal you can edit the waveforms and digital signals of musical samples on the Macintosh. The Universal edition of the program supports a variety of MIDI samplers. You can display up to three waveforms on the Mac screen and edit each sound with up to 1/50,000-second accuracy, according to Digidesign.

Looping is done with a special loop window and a flexible cross-fade looping function. You can digitally mix, merge, equalize, and compress sounds, as well as perform complex frequency analysis using the program's three-dimensional fast-Fourier-transform display.

You can also use Sound Designer Universal to transfer sounds between samplers. The Universal edition of Sound Designer does not contain the

Month	Region	Product	Units	Sales \$	Margin
Jan 87	Eastern	Deluxe	34	\$6,123	30
		Economy	45	\$8,234	33
		Standard	2	\$288	34
Total for Eastern			81	\$14,557	32
	Southern	Deluxe	45	\$4,890	36
		Economy	32	\$3,690	29
		Special	67	\$6,799	32
Total for Southern			144	\$14,499	32
	Western	Deluxe	27	\$2,678	35
		Economy	33	\$3,495	30
		Standard	65	\$8,799	28

The Snow Report Writer network version.

front-panel editing and Karplus-Strong digital synthesis capabilities.

To run Sound Designer, you need a 512K-byte Macintosh or a Mac II.

Price: \$395.

Contact: Digidesign Inc., 1360 Willow Rd, Suite 101, Menlo Park, CA 94025, (415) 327-8811.

Inquiry 807.

Graphic Design and Technical Report Writing

Word-CAD combines the functions of a word processor with those of a CAD program.

With Word-CAD, you can place lines, rectangles, ellipses, and polygons in engineering units of your choice on scalable grids. The program also has zoom and scaling, move and delete, rotation, perspective, and dimensioning. The program includes a line generator that lets you draw irregular shapes directly into memory. You can save drawings as symbols and call them into a drawing for placement at any point.

The word-processing portion of the program is called Word-Edit. It lets you enter copy, move, change, and cut-and-paste operations. You also have bold, compressed,

expanded, italic, underline, and subscript and superscript text at your disposal. Up to three fonts are resident in RAM at any time, along with bit-mapped text. You also have the ability to format headlines and subheads and to flow columns of text around graphics.

Word-CAD supports ASCII text. It requires an IBM PC with at least 512K bytes of RAM; one floppy disk drive; and a CGA, EGA, or Hercules monochrome adapter. It is designed for use with a dot-matrix printer, enabling it to produce drawings up to 13½ inches wide and up to 30 feet long.

Price: \$99.

Contact: Iam, P.O. Box 2545, Fair Oaks, CA 95628, (916) 961-8082.

Inquiry 808.

Fix That Database

Hilco Software has combined two of its database utilities, added some features, and named it QuickFix-2. The MS-DOS program repairs dBASE II and III files, as well as files from Clipper, FoxBASE, and WordTech databases, by performing combinations of the following func-

tions: resetting the record counter in the header, replacing corrupted headers, re-aligning data within the database, replacing high bits and control characters, and removing invalid end-of-file markers.

QuickFix-2 has no limit to file size. The vendor says the program will recover any data in the DOS directory. The software also has context-sensitive help, the ability to view database records, and a feature that lists records containing bad bytes.

The program requires MS-DOS 2.0 or higher and 192K bytes of RAM.

Price: \$29.

Contact: Hilco Software, 11266 Barnett Valley Rd., Sebastopol, CA 95472-9555, (707) 829-5011.

Inquiry 809.

AP Stylebook on Disk

The KeyNotes AP Stylebook works with your word-processing program. When you need access to AP style or reference information, you press a hot key, which opens a menu of entries in the stylebook. Or, you can use the automatic search mode.

The Stylebook offers you information on capitalization, abbreviation, punctuation, spelling, and numbers and their usage. It also gives you guidelines on sports and business writing, and there are individual guides to punctuation and computer terms.

The program is available for the IBM PC with PC-DOS or MS-DOS 2.0 or higher; another version is available for Macs with at least 128K bytes of RAM.

Price: \$49.95.

Contact: Digital Learning Systems, 4 Century Dr., Parsippany, NJ 07054, (201) 538-6640.

Inquiry 810.

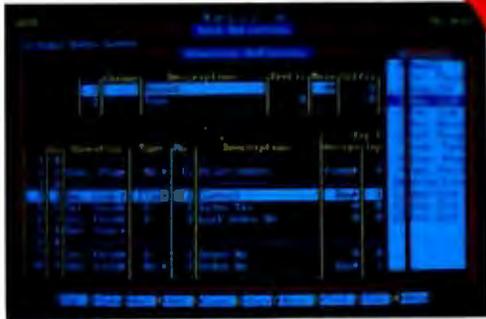
MAGIC PC: A REVOLUTION IN POWER, PRICE & PROGRAMMING SPEED.

You know how database applications are created — by hacking out line after line of time-consuming code. Most DBMS' and 4GL's give you some programming power. But when it comes to serious applications, they keep you bolted to your seat writing mountains of tedious code. And rewriting it all over again with every design change.

Imagine how much faster you'd be if you could replace the painful coding phase with an innovative visual technology which takes only a fraction of the time: Introducing Magic PC—the revolutionary Visual Database Language from Aker Corporation:

High-Speed Programming:

With Magic PC's visual design language you quickly describe your programs in non-procedural Execution Tables. They contain compact programming operations which are executed by Magic PC's runtime engine. You fill-in the tables using a visual interface driven by windows and point-and-shoot menus. One table with 50 operations eliminates writing more than 500 traditional lines of code. Yet with Magic PC you don't sacrifice any power or flexibility.



With a powerful set of high-level non-procedural operations you program at only a fraction of the time

Maximum Power AND Simplicity:

With Magic PC, you can generate robust DBMS applications including screens, windows, menus, reports, forms, import/export, and much more! Plus, Magic PC has one of the friendliest user interfaces you've ever seen. Using Magic PC you can look-up and transfer data through a powerful Zoom Window system. Magic PC even lets you perform command-free queries.

Btrieve Performance:

Magic PC incorporates Btrieve, the high-performance file manager from SoftCraft. This gives you exceptional access speed, extended data dictionary capabilities, and automatic file recovery!

Virtually Maintenance-Free:

With Magic PC you can modify your application design "on the fly" without any manual maintenance. Magic PC automatically updates your programs and data files on-line! This also makes Magic PC an ideal tool for prototyping complete applications in hours instead of days.

FREE Networking:

Magic PC comes complete with LAN features. Develop multi-user applications for your LAN with Magic's file and record-locking security levels.

Stand-Alone Runtime:

Distribute your applications and protect your design with Magic PC's low cost runtime engine.

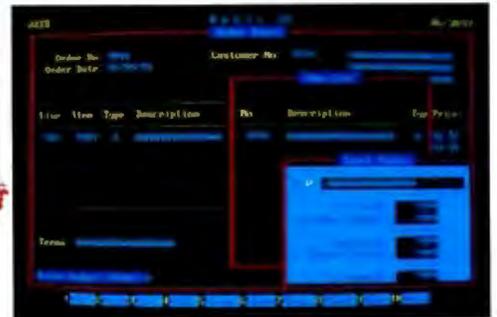
All For Only \$199:

Best of all, Magic PC is an unbeatable bargain. For a limited time, Magic PC's price has been reduced to only \$199! Yes, this is the same Magic PC that normally lists for \$695! And Magic PC eliminates the need for a separate DBMS, compiler, or application generator. It comes complete with all the tools you need to develop your own database applications instantly.

\$199 - With A Money-Back Guarantee!

For a limited time, you can get Magic PC for only \$199. And even at this low price, Magic PC is risk-free. If you're not completely satisfied, simply return it within 30 days and we'll buy it back (less \$19.95 restocking fee). And if you'd like a preview, Magic PC's Tutorial Demo is available for just \$19.95.

But you'd better hurry — Magic PC's special \$199 price won't last long!



Pop up Zoom Windows run multiple programs per screen — with point-and-shoot data transfer between windows!

Join The Magic PC Revolution

To unleash your DBMS design power, order your \$199 copy of Magic PC right now by calling toll-free or returning the coupon below.

ORDER NOW: CALL
(800) 345-MAGIC
In CA (714) 250-1718

"Magic PC's data base engine delivers powerful applications in a fraction of the time... there is truly no competitive product."

Victor Wright — PC Tech Journal

Also recommended by: PC Magazine, PC World, PC Week, Computer Language, Data Base Advisor, and many other publications worldwide.

MAGIC PC
The Visual Database Language

by **AKER**



Yes! I want to generate powerful applications much faster!

Rush me my copy of Magic PC at the special promotional price of \$199 (add \$10 P&H, and tax in CA. International orders add \$30). I understand I can return Magic PC for a refund within 30 days, if I'm not completely satisfied.*

Rush me a copy of Magic PC Tutorial Demo at \$19.95 (add \$5 P&H, and tax in CA. International orders add \$15).

Name _____

Company _____

Street Address (no POB) _____

City _____ State _____ Zip _____

Check enclosed Charge to my VISA MC AMERICAN EXPRESS

Account No _____

Acct. Name _____ Exp. Date _____

Signature _____

Return to: Aker Corp., 18007 Sloopark Cir B2, Irvine, CA 92714

System requirements: IBM PC XT, AT, PS/2 or 100% compatible with 512K RAM, hard disk and DOS 2.0 or later. 1/4" format, two copy protected. Dealer pricing available. *Business policy valid in US only.

Aker, Magic PC, The Visual Database Language are trademarks of Aker Corporation. All other trademarks acknowledged. © Copyright 1987, Aker Corp.



DBMS PROGRAMMERS:
DEVELOP APPLICATIONS
10 TIMES FASTER
WITH MAGIC PC
FOR \$199 —
Now \$199 —

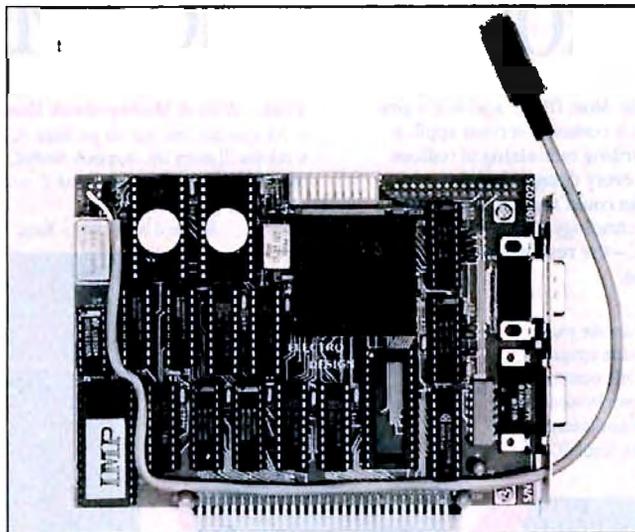
PACIFIC COAST

Touch, See, and Hear with AVM Board

The Audio/Video/Mouse Board fits into a half-slot in your IBM PC, XT, AT, or compatible and provides either monochrome or color graphics with a 640- by 200-pixel resolution from a single video port.

The AVM Board features a Microsoft-compatible mouse port and dual-channel music/voice synthesizers. You can program the synthesizers to provide voice commands and sound effects and to play digitized music. Each synthesizer provides three channels of audio signal with a frequency response of up to 30 KHz.

You can use up to four AVM Boards in one computer, with different program information presented by each card.



The AVM Board combines graphics, sound, and a mouse port.

Price: \$395.
Contact: Electro Design Inc., 690 Rancheros Dr., San

Marcos, CA 92069, (619) 471-0680.
Inquiry 867.

Send Data at Speed of (Infrared) Light

Hewlett-Packard's HP82242A infrared printer-interface module plugs into any of the HP-41 calculator's I/O ports. It transmits data via an infrared light beam at a rate of 78 characters per second to Hewlett-Packard's HP82240A infrared printer. Your calculator can be up to 18 inches away from the printer.

Price: \$65.

Contact: Inquiries Manager, Hewlett-Packard Co., 1000 Northeast Circle Blvd., Corvallis, OR 97330; for telephone inquiries, call (800) 752-0900, Dept. 772A, for the location of your nearest Hewlett-Packard dealer.
Inquiry 868.

continued

Computers For The Blind

Talking computers give blind and visually impaired people access to electronic information. The question is how and how much?

The answers can be found in "The Second Beginner's Guide to Personal Computers for the Blind and Visually Impaired" published by the National Braille Press. This comprehensive book contains a Buyer's Guide to talking microcomputers and large print display processors. More importantly it includes reviews, written by blind users, of software that works with speech.

This invaluable resource book offers details on training programs in computer applications for the blind, and other useful information on how to buy and use special equipment.

Send orders to:
National Braille Press Inc.
88 St. Stephen Street
Boston, MA 02115
(617) 266-6160

\$12.95 for braille or cassette, \$14.95 for print. (\$3 extra for UPS shipping)

NBP is a nonprofit braille printing and publishing house.

Now You Have A Friend In The Computer Business®

Authorized Autocad and Novell Dealer
6 Good Reasons To Buy

<p style="text-align: center;">1</p> <p>COMPAQ 286-12 640K, 1.2 floppy, 40 MB HD monochrome system</p> <p style="text-align: center;">\$2895 IN STOCK 386/20 mhz</p>	<p style="text-align: center;">2</p> <p>AST PREMIUM 286</p>  <p>512K RAM, 1.2 Floppy, 40 MB Fast HD, hi-res mono card, mono monitor, DOS 3.2, GW Basic</p> <p style="text-align: center;">\$2195 Call for all AST products!</p>	<p style="text-align: center;">3</p> <p>WYSE 286 System 512K RAM, 1.2 floppy, 40MB HD full monochrome system</p> <p style="text-align: center;">\$2179 IN STOCK! WYSE 386/WYSE Terminals</p>
<p style="text-align: center;">4</p> <p>LAPTOP SPECIALS</p>  <p>NEW TOSHIBA T-1000 \$879</p> <p>NEC Multispeed EL \$1695 NEW! ZENITH 181/183-20 \$1649/2590</p>	<p style="text-align: center;">5</p> <p>SAMSUNG COMPUTERS</p>  <p>300S Full HD Mono System \$1195</p> <p>500S 286 Processor Call for Best Prices</p>	<p style="text-align: center;">6</p> <p>ACER 910/286 SYSTEM</p>  <p>(Formerly Multitech) 512K memory, 20 MB HD, 6/10 0 wait state full mono system</p> <p style="text-align: center;">\$1195 IN STOCK!</p> <p>Acer 386 machine</p>

We carry a full line of HP, IBM, Intel, Diconix products at best prices in town.

SOFTWARE SPECIAL

Word Perfect \$194
 Microsoft Word 209
 Lotus 305
 Call for any software—we deliver it to you in 24 hours!

PRINTER SPECIAL

Epson LX800 \$215
 Epson EX800/1000 399/499
 Epson LQ800/1000 469/549
 Epson LQ2500 899
 Epson LQ850/1050 IN STOCK
 NEC P6/P7/2200 414/615/415
 Toshiba P321SL/P351SL IN STOCK

Authorized Repair and Service Center. Fast turnaround, carry-in/carry-out, pick-up/drop. Call us for Service Contract information.

We Sell, Deliver, Install, & Repair

Registered trademark of Munsie Enterprises, Stockton, CA
 IBM is a registered trademark of International Business Machines, Inc.
 Samsung is a trademark of Samsung Semiconductor & Telecommunications.
 Compaq is a trademark of Compaq.
 Epson is a registered trademark of Epson America, Inc.
 All prices subject to change on availability without notice.

AUTHORIZED DEALER FOR

Novell Networks
 Epson Computers & Printers
 AST
 Samsung
 Zenith
 Toshiba
 Wyse Computers
 AT&T
 Autocad
 Iomega ~~IBM~~ ~~Hard~~ ~~Disk~~

Okidata
 NEC
 Canon
 Universal Data Systems
 HAYES
 Ashton Tate
 Paradox (Ansa Software)
 Microsoft
 Ventura
 Aldus (PageMaker)

Computown Pleasant Hill

1527 Contra Costa Blvd.
 Pleasant Hill, CA 94523

(415) 634-TOWN
 (415) 634-8696

NEW LOCATION!

Computown-Mountain View

2455 M Old Middlefield Way
 Mountain View, CA 94043

(415) 962-TOWN
 (415) 962-8696

Computown-San Francisco

760 Market Street, Suite 219
 (Phelan Building)
 San Francisco, CA 94102

(415) 956-TOWN
 (415) 956-8696
 FAX (415) 989-TOWN



COMPUTOWN

Merge Text and Graphics with The Complete Fax

The Complete Fax is a \$499 facsimile board that plugs into a full slot in your IBM PC, XT, AT, or compatible. You can receive and send facsimiles in the background at up to 4800 bits per second.

The board lets you send facsimiles at a predetermined time. You can also send facsimiles to multiple recipients in a single session, poll with password protection, and log incoming facsimiles with time stamps.

With The Complete Fax you can send ASCII word-processing documents. You can also merge text and graphics. It supports CGA, EGA, and Hercules cards, as well as Dr. HALO II, PC Paintbrush, and Microsoft Windows programs.

The Complete Fax runs on the IBM PC, XT, AT, and compatibles running MS-DOS or PC-DOS 2.1 or higher. It requires 384K bytes of RAM, a hard disk drive, a standard telephone line with an RJ-11 or RJ-14 connector, and a Touch-Tone telephone.

Price: \$499.

Contact: The Complete PC, 521 Cottonwood Dr., Milpitas, CA 95035, (408) 434-0145.

Inquiry 869.

3-D Helicopter Simulator

This simulation puts you in the pilot's seat of either the "Sierra Helicopter" or an Apache attack helicopter. You can fly alone or with an opponent or partner via modem.

The 3-D Helicopter Simulator features views of three-dimensional objects in 16 colors and 360-degree views of

the landscape. It provides flight, target practice, single-player combat, and dual-player combat modes. You can fly backward or sideways, take off vertically, and watch yourself fly from a ground, satellite, or tracking-camera perspective.

3-D Helicopter Simulator comes with eight scenery files. It runs on the IBM PC and compatibles with MS-DOS or PC-DOS 2.0 or higher and 256K bytes of RAM. It supports Hercules monochrome, InColor, CGA, EGA, Tandy 1000, and PCjr color cards, Hayes-compatible modems, and joysticks.

The program comes on both 3½- and 5¼-inch floppy disks.

Price: \$49.95.

Contact: Sierra On-Line Inc., P.O. Box 485, Coarsegold, CA 93614, (209) 683-6858.

Inquiry 870.

Hyundai 80286

The heart of the Super-286C computer is an 80286 microprocessor running at either 8 or 10 MHz. It includes 640K bytes of RAM (expandable to 1 megabyte) four 16-bit and two 8-bit expansion slots, an EGA video card, a clock/calendar, two serial ports, one parallel port, and one floppy disk drive.

The Super-286C also includes a 101-key keyboard and a monochrome monitor. Electric Desk software that comes bundled with the computer includes database management, word processing, a spreadsheet, and a communications program.

Price: \$1499.

Contact: Hyundai Electronics America, 4401 Great America Parkway, 3rd Floor, Santa Clara, CA 95054, (408) 986-9800.

Inquiry 871.

100% IBM Compatible 30 Day Money Back Guarantee One Year Warranty On Parts



Elite 88-\$399

XT Compatible Base System
640K Motherboard (256K installed)
8088 Micro-Processor
1/2 Height 360K Drive & Controller
150 Watt Heavy Duty Power Supply

Base Systems Include:

- *Assembly & Testing
- * Phoenix Bios
- *8 Expansion slots*FCC Class B
- *AT Keyboard *Surge protector
- *Floppy & Controller *Software

Elite 88 Options:

640K \$80
Turbo \$20
Second drive \$95

Elite 286 Options:

640 K \$30
10 Mhz (0/1 W) \$49
12Mhz (0/1 W) \$99



Elite 286-\$899

AT Compatible Base System
1 Meg Motherboard (512K installed)
10 Mhz (Norton SI 9.8)
1.2 Meg Drive & Controller
200 Watt Heavy Duty Power Supply

Monitors

Composite Monochrome \$90
TTL Monochrome \$90
Color RGB \$275
Color EGA \$435

Video Cards

Color graphics (640 X 200) \$60
Color graphics/printer \$70
Monographics/printer \$70
EGA color (640 X 350) \$135

Hard Drives & Contr.

20 Meg 1/2 Ht 68 mSec \$345
30 Meg 1/2 Ht 68 mSec \$399
40 Meg 1/2 Ht 38 mSec \$560

Printers

Citizen 120D \$199
Citizen MSP-10 \$299
Citizen MSP-15 \$399
Citizen MSP-20 \$359

Order Now 1-800-253-4001 Free Catalog
Innovative Technology, Ltd.

Shipping & insurance 3% * Satisfaction Guaranteed * Systems in stock for immediate shipping * VISA/MC No Surcharge * AMEX ADD 4%
Technical info., OK residents, (405) 243-1559 PO Box 726 Elk City Oklahoma 73648 * IBM registered trademark-International Business Machines



EPSON
(w/Nation-Wide Protection Plan)

EQUITY I+

- 360K Floppy
- 20 Meg Hard Disk
- 640K Ram
- Serial/Parallel Port
- Monochrome Card
- Monochrome Monitor
- MS DOS
- GW Basic

\$1295

EQUITY II TURBO

- 360K Floppy
- 20 Meg Hard Disk
- 640K Ram
- Serial/Parallel
- C/C
- Monochrome Monitor
- Graphic Card
- MS DOS
- GW Basic

\$1395

EQUITY III+

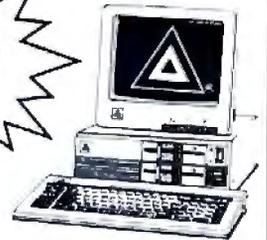
- 80286 CPU 6-8 10 MHz
- 1 2 MEG Floppy
- 30 MEG Hard Disk
- DOS 3.2 Mono Monitor & Graphic Card

\$2595

**LOW
 PRICE
 LEADER**

LEADING EDGE
 MODEL "D"TM

**CALL FOR
 NEW LOW
 PRICES**



ALL Configurations In Stock!

NEW IMS Bernoulli Dual Speed

MODEL "D" IS A REGISTERED TRADEMARK
 OF LEADING EDGE PRODUCTS, INC.

Authorized Dealer Service Center

COMPAQ

Desk Pro 20 meg	1495
286 30 meg	2875
386 40 meg	4335
386 60 meg/20 MHz	5650
Portable III 40 meg/20 MHz	5450
CARD & MONITOR EXTRA	

IBM

PS/2 model 30/20 meg	1695
PS/2 model 50/20 meg	2595
PS/2 model 60/40 meg	3825
PS/2 model 60/71 meg	4595
PS/2 model 80/40 meg	5100
MONITOR EXTRA	

LAP-TOP

Toshiba 3100-20	Call
Toshiba 1000	Call
NEC Multispeed	1395
NEC Multispeed EL	1695

WE STOCK

CITIZEN
OKIDATA

TOSHIBA
NEC

PRINCETON GRAPHICS
SONY

AMDEK
HAYES

PC MOUSE
MICROSOFT MICE

IRWIN & ARCHIVE
TAPE BACK

HARD DISK

Seagate 20 meg	305
Seagate 30 meg	365
Seagate 4038	495
Seagate 251	465

SOFTWARE

Microsoft Word	215
Word Perfect 4.2	215
Lotus 1-2-3	325
dBase III+	385
Microsoft Works	135
AND MANY, MANY MORE!	



NOVELL

Authorized Dealer
Netware

AST

AST 286 model 80	1495
AST 286 model 120	2350
AST 286 model 140	2650
CARD & MONITOR EXTRA	

EPSON
PRINTERS

Epson FX86E	315
Epson 286E	448
Epson EX800	425
Epson EX1000	499
Epson LX800	210
Epson LQ800	405
Epson LQ1000	549
GQ3500	1295
Epson LQ850	550
Epson LQ1050	725
HP LASER II	1750

WE ACCEPT LC, CASHIER CHECKS, MONEY ORDERS, VISA, MC, AmEx
 3% charge on VISA, MC & American Express

COMPUTER LANE

HOURS:
M-S 10-6

(818) 884-8644

22107 ROSCOE BLVD.
 CANOGA PARK
 1/2 BLOCK W. OF TOPANGA

CORPORATE ACCOUNTS WELCOME
 CALL FOR VOLUME DISCOUNTS

Prices subject to change without notice

Compaq is a Registered Trademark of Compaq
 IBM is a Registered Trademark of International Business Machines

SURAH a computer company... Where Quality Counts

WHOLESALE outlet direct from factory

LOCATED in the Silicon Valley

SERVES thousands of Satisfied Customers



286 AT

IBM AT Compatible

6 / 10 MHz 16 Bits

512K RAM on 1024K Mother Board
360K Floppy & 20Mb HARD DRIVE with Controller
Monographic Video Card with Printer Port
Tilt & Swivel TTL Monitor Amber or Green
AT style Keyboard, Turbo/Reset Push Buttons

with **40 Mb**
Hard Drive
\$ 1429

OTHER OPTIONS:

ADD:

- XT 10MHz Turbo Mother Board \$ 30
 - AT 384K RAM Upgrade to 640K \$ 55
 - AT 512K RAM Upgrade to 1024K \$ 78
 - Additional 1.2Mb Floppy Drive \$ 95
 - Additional 360Kb Floppy Drive \$ 70
 - Enhanced Keyboard with 12 Function Keys. \$ 29
 - In/output Multifunction Card \$ 61
 - RGB Color Conversion \$300
 - EGA Color Conversion \$555
- Printer your choice for LOW LOW prices, CALL

Full Software Compatibility

RUN Lotus 1-2-3, PageMaker, Ventura, autoCAD, dBASEIII, PTREE and all other similar programs.



FULL WARRANTY

DEALERS-OEM-GOVERNMENT
SCHOOLS & UNIVERSITIES
INQUIRES WELCOME

NOT responsible for typographic errors Shipping & Handling extra



Apple
Apple MAC II
with 40Mb Hard Drive **\$3973**
Apple MAC Plus \$1670
Apple MAC SE with 20Mb H/D \$2712
Apple IIGS \$ 777
*Keyboards not included
Call for other MODELS/upgrade options



IBM
P/s2 Model 50
with 20Mb Hard Drive **\$2690**
P/s2 Model 30— 2 Floppy Drives \$1270
P/s2 Model 30— 20Mb Hard Drive \$1721
P/s2 Model 60— 44Mb Hard Drive \$3890
Call for other MODELS/upgrade options



AST
Premium
286 Premium
Model 80 **\$1299**
286 Premium Model 80 + 40Mb HD \$1799
386 Premium 20MHz \$CALL
Call for other MODELS/upgrade options



COMPAQ
286 Portable III
Model 20
with 20Mb H/D **\$3750**
286 Portable III Model 40 \$4350
386 Portable III 20MHz \$CALL
Call for other MODELS/upgrade options



HEWLETT
PACKARD
HP Laserjet
Printer Series II **\$1699**
HP Scanjet Desktop Scanner \$1152
HP Graphic Plotter 7475A \$1516
Call for other MODELS/upgrade options

Other Famous Brand
PRINTERS, MONITORS, PERIPHERALS
ADD-ON-CARDS and SOFTWARE
also available

IBM P/s2, XT, AT, AST Premium, HP Laserjet, Compaq, Apple, MACII,
Plus, SE, IIGS are registered trademarks of respect.



SURAH 786

IBM XT Compatible

4.77 / 8 MHz 8 Bits

256K RAM on 640K 4 layer Mother Board
360K Floppy & 20Mb HARD DRIVE with Controllers
Monographic Video Card with Printer Port
Tilt & Swivel TTL Monitor Amber or Green
AT Style Keyboard and Baby AT Case

with **30 Mb**
Hard Drive
\$ 799



the 386 originale'

16 MHz 32 bits

1Mb RAM on 2Mb board, expandable up to 16Mb
1.2Mb Floppy & floppy/Hard disk Controller
2 Serial & 2 Parallel Ports off Mother Board
EGA* on System Board, Supports YGa, 640x480
Graphic, CGA, MDA & Hercules emulation
AT Style Keyboard. (**Monitor NOT included)

\$1998

PRICES valid till supplies last. ADD sales tax where applicable

SURAH INC.

45461 Fremont Blvd., Suite #9, Fremont, CA 94538
Telex 5106017247 (ab) SURAH UQ

OPEN MON. - FRI. 9 AM - 6 PM
SATURDAY 11 AM - 4 PM

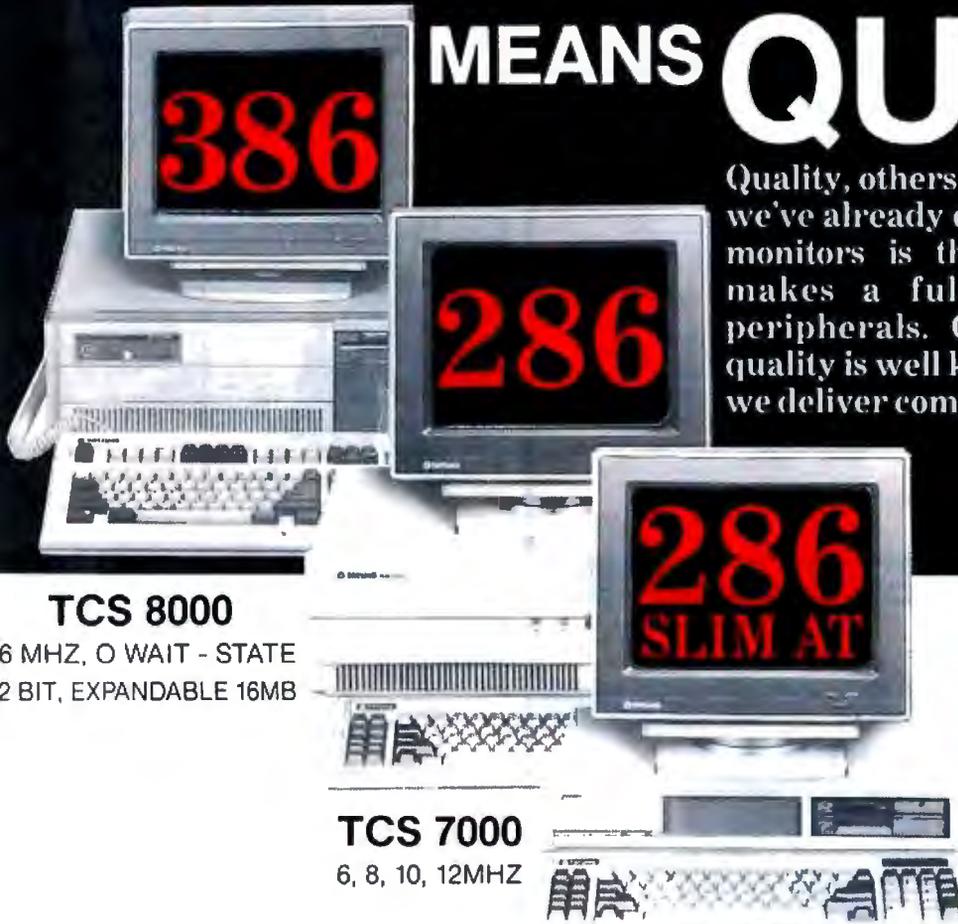
PHONE TOLL FREE **800-543-1001**

NOW IN California (415) **651-5101**

3,000,000 PCS

MEANS QUALITY

Quality, others promise, we deliver. The fact we've already delivered over 3,000,000 color monitors is the best proof. Tatung also makes a full line of computers and peripherals. Our reputation for superb quality is well known around the world. And we deliver complete after sales service to you.



TCS 8000

6 MHZ, 0 WAIT - STATE
2 BIT, EXPANDABLE 16MB

TCS 7000

6, 8, 10, 12MHZ

TCS 4000 (6/10MHZ)

EQUIVALENT OF 5 EXPANSION SLOTS

OMNISCAN

14" MULTI - SCAN
COLOR MONITOR

RES: 800 X 600
4 MULTI-COLOR MODE

12" MULTI - SCAN
MONO MONITOR

RES: 800 X 600

COLOR MONITOR

MODEL	RES.
• CM 1322N	640 X 200
• CM 1370A	720 X 400
• CM 1380F	640 X 350
• CM 1495	800 X 600

MONO MONITOR

MODEL	RES.
MM 1222	800 X 350
MM 1422	800 X 350
MM 1295	800 X 600

TERMINAL

ET - 10 SERIES
14" DARK - TINTED ANTI-GLARE FLAT CRT H10 (AMBER) H17 (PAPER/WHITE)

Circle 485 on Reader Service Card

EXCLUSIVE COMPUTERS HEADQUARTERS TEK COMPUTER

THE VALUE LEADER IN COMPUTERS

Guaranteed When You Buy
LOWEST PRICES ON
 IBM • COMPAQ
 • EPSON •
 • TOSHIBA •
 NEC

SELECTION: We stock and sell products made by the world's largest and most trusted names in Computers, Printers and Software Manufacturers.

VOLUME: Since we have multiple locations and our overhead is low, we buy and sell an incredible volume.

EXPERTISE: Since we deal exclusively with EPSON, TOSHIBA, COMPAQ, IBM, we get special factory training giving us the know how nobody else has.

ATTENTION: Our job is not finished unless you are satisfied. You *must* be happy.

Assurance After You Buy
 Service from factory trained technicians

• **Free Radio Watch \$19.95 Value** •

Buy 2 boxes of Janus diskettes at \$14.95 and get a digital watch and radio free

AST PREMIUM/286
 • 80286 Processor
 • 1.2 MB Disk Drive
 • 40 MB HD
 • Enhanced Keyboard
 • Monochrome System
\$2249

MACINTOSH™
 • MAC SE
 2 Drives \$2149
 • MAC SE
 1 Floppy 20 MB .2799
 • MAC PLUS.....1549
 • Apple Laser Writer ..In Stock

NOW HERE-IN STOCK
COMPAQ 386
20 MHz SYSTEM
 Lmt. Quanties Available

MONTHLY LAPTOP SPECIALS

NEC Multispeed EL/20 MB	\$1599/2450
Toshiba 1000/1200/3120 w/2 MB HD	\$875/2450/3199

MONTHLY PRINTER SPECIALS

IBM PROPRINTERS	TOSHIBA
X24/XL24	\$599/840 321/341SL..... \$499/785

Boards

IBM Mono Adapter	\$99
AST Six Pack 64K + Sidekick	149
AST Advantage Expansion Board for AT w/128K	349
Vega Board by Video 7 Deluxe	275
Hercules Graphics Plus	190
Hayes 1200/2400B w/SW	349/399
NEC EGA	430
Migent Pocket Modem	159
Everex Evercom 1/2 card 1200B	90
Everex Evercom III 2400B	200

Computers

IBM AT 339K	\$3399
IBM Sys 2 Model 25	945/1190
IBM Sys 2 Model 30	1275/CALL
IBM Sys 2 Model 50 10 MHz, 20 MB 2624	
IBM Sys 2 Model 60 10 MHz, 44 MB 3499	
IBM Sys 2 Model 80 40/70	CALL
COMPAQ Port 2 Dr	1545
COMPAQ Port II 1 Dr/20 MB	2899
COMPAQ Port III 40/20	CALL
COMPAQ 286 Desk Pro 12 MHz	1949
COMPAQ 386 Mod 40/70	4499/5499
AST Premium	
All Models Available	Best Price

Aldus Pagemaker	485
Multimate Advantage II	440
Ability/Enrich by Migent	LOW

Hard Cards

Plus Development Card 20/40	\$599/899
lomega Bernoulli Box IMS Disk Available	

Software

Lotus 1-2-3/Hal/Metro	\$309/120/85
Symphony	410
Framework 2	365
D Base III+	395
WordPerfect 4.2	219
Microsoft Windows	69
Xerox Ventura Publisher	499

Printers

Okidata 292/293	\$425/599
Epson 850/1050	545/745
Epson LQ800/1000	489/649
Epson LX86/FX85	199/349
Epson EX800/1000	498/649
Epson LQ2500	1099
Epson FX86E/FX286E	359/475
IBM Proprinter II	399
IBM Quietwriter III	1299
NEC Laser Printer	3895
HP Laser Jet II	1699

Hard Disks

20MB/30MB/40MB	\$259/369/599
40/80MB Hard Disk for AT	699/1099
20MB/60MB Tape Back-Up	599/799
120MB Hard Disk	2600

Monitors

IBM Color Monitor 8513 PS/2	\$512
IBM Mono Monitor 8503 PS/2	200
IBM Color Monitor 8512/8519	485/1198
Princeton SR12P	CALL
NEC Multisync II	575
Sony Multiscan	629
Amdek 410A/422	159/489
Samsung RGB/EGA	299/369

2740 El Camino Real
 Santa Clara, CA 95051

139 Kearney (and Market)
 San Francisco, Ca 94108

(408) 296-0455

FAX
 (408) 986-1883

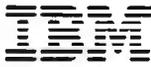
(415) 362-6870

*All Good While Quantities Last • Prices Subject To Change • Cash Prices

Call For
Complete
Catalog

Dealers
We Want
Your Business

Limited
Offer
Call Now



Model 30-2 drive	'1359
Model 30-20 MB	'1799
Model 50-20 MB	'2768
Model 60-44 MB	'4077
Model 70-70 MB	'4847
IBM PC AT 339 30 MB	'3520
IBM PS/2 14" Color (8512)	'504
IBM PS/2 12" Color (8513)	'548
IBM PS/2 14" Color (8514)	'1192



LASER JET 5 "	'1895
HP PLOTTERS ALL MODELS	
HP SCAN JET	'1225
HP QUIET JET	'BEST
Fonts Tray available	
Toner	'83
Legal Tray	'62
Memory Exp: 1MB/2MB	'398/783

Seagate ST225

20MB w/controller **\$259***

QTY 5 Cash Price Installation Available

HARD DRIVES

Seagate ST225 20 MB w/CI	'259
Seagate ST238 30 MB w/CI	'299
Seagate ST4038 AT	'499
Seagate ST251	'429
Miniscribe 6053 44MB 28MS	'599
Miniscribe 6085 71MB 28MS	'799
Atasi 3046 39MB	'399
Maxtor 1140 140MB	'1995

COMPAQ

386 Model 40 MB	'4572
386 Model 70 MB	'5320
386 Model 130 MB	'6790
Portable III 20 MB	'3999
Portable III 40 MB	'4899
268 Model 1 12 MHz	'1995
DeskPro Model 2 2Dr	'1079

EPSON

LX-800 9 Pin-Narrow	'189
EX-1000 9 Pin-Narrow	'339
FX-286E 9 Pin Wide	'449
EX-800 9 Pin Narrow	'399
EX-1000 9 Pin-Wide	'565
LQ-800 24 Pin Narrow	'479
LQ-1000 24 Pin-Narrow	'685
LQ-2500 24 Pin-Wide	'899
GO 3500 Epson Laser	'1499
Tractor & Cut Sheet Feeder	Available

AST COMPUTERS

Ast Premium 286 AT Model	
80	'1535
Ast Premium 286 AT Model	
120	'2395
Ast Premium 286 AT Model	
140	'2695
Ast Premium 286 AT Model	
170	'3195

INTEL

80387-16	'489
80287-10	'299
80287-8	'245
Intel 286 (512K)	'387
Intel Inboard	'1203

FLOPPY DRIVES

Toshiba 3 1/2"	'108
Fujitsu 360K	'69
Fujitsu 1 2 MB	'98

SOFTWARE

Lotus 1-2-3	'302
Xerox Ventura	'449
IBM DOS 3.3	'97

PRINTERS

IBM ProPrinter	'382
----------------	------

CITIZEN

120 D.	'169
MSP-10	'257
MSP-15	'325

MSP-25	'392
Premium 35	'415
Tribute 224	'565
Citizen Printers All Models	Best \$

HARD DISKS

Miniscribe	
3425 20 MB w/cont.	'289
3650 40MB	'342
6053 44MB	'599
6085 72MB	'789
WD 1003-WA2 Hard & Floppy Controller	'129
Watson Voice Recording Sys	'472

MISC

Wyse Terminals	Best \$
Plus Card 20MB	'615

LAPTOP COMPUTERS

NEC Multispeed	'1299
Zenith 181 2 Dr	'1675
Zenith 183-92 (10MB)	'2460

TAPE BACKUP DRIVES

Irwin 110 10MB	'219
Irwin 120 20MB	'375
Irwin 145 40MB	'405
(New) Archive 40MB	'329

Talltree J.Laser — Still a Great Value

The original HP Laserjet (and similar lasers built on the Canon engine) are still widely used. But the desktop publishing performance with 300 dpi graphics is awful. We suggest the Talltree J.Laser interface combined with the Talltree JRAM memory card. This looks to your computer like an EMS RAM card, but transfers data direct to the printer's laser head. Speed improvement > 15 x. The memory card with 1 MByte RAM (expandable to 2 MByte).

the piggyback laser interface, and the HP style cable (automatically switches between J.Laser and conventional serial port); package price \$475

This Month's Special

FREE Desktop Publishing Software.

For limited time only from Quality Micro w/ purchase of Logitech Mouse List Price \$299

Our Cost **\$149**

POLICIES

- Blue Label or Next Day Delivery Available
- Letters of Credit & Corporate Accounts Accepted
- We accept certified checks, cashier checks, wired funds
- All orders over \$500 must be paid by cashier check.
- Minimum order \$100
- Allow 1 week for personal & company checks (maximum amount \$500)
- Prepaid orders get 1% discount
- Add 3% for Visa/Master Card Purchases
- Allow one week for shipping
- 15% Restocking Fee
- On all return merchandise

QUALITY MICRO

(213) 474-3764

800-553-3339 in CA orders only

1-800-MICRO 86 (642-7686) in U.S.

West Coast Office 10551 W. Pico Blvd., Los Angeles, CA 90064
East Coast Office 313 Post Ave. Westbury, NY 11590 516-338-4949
For Technical Service Call Watson Line (213) 470-8073

See you at **COMDEX Fall '87**
Nov. 2-6, 1987, Las Vegas, NV
Booth R8101

All prices subject to change without notice

When you need competitive prices, prompt service & complete support, call us

Quantity 5 cash price, installation available

IRWIN

ARCHIVE

MINISCRIBE

KURTA

Good News! Since DP-Tek's breakthrough, Halftones From "Publisher's ImageMaker,"

Desktop Publishers no longer have a dim view of their photo reproductions - and it's

now compatible with Xerox Ventura Publisher



You are looking at the complete picture printing solution from camera to page. When you add Publisher's ImageMaker exclusive halftone technology to your work station, you get B/W Video Camera, Stand, Lens, 9" Monitor, LaserPort, (a laser printer controller for AT compatible personal computers), with PicturePlus software (for cropping, scaling and placement of pictures) and QuickCapture software (for capturing images, modifying contrast and brightness, rubber-band box and rotation for cropping and printing various size images with screen density choices).

Now you can print your photos in 64 shades of gray, preserve detail as small as 1/300 of an inch, choose 70, 85 and 100 line screens. No more costly bills from a photographer or photo lab for sizing, cropping and screening.

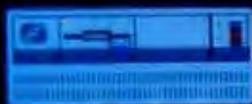
Add Publisher's ImageMaker, the simple inexpensive way to compose and print your own full pages, complete with offset-quality photo reproductions. Call or write for free information today.

DP-TEK, inc.

(316) 269-3068 245 N. Hydraulic, Wichita, Kansas 67214

Ventura Publisher is a trademark of Ventura Software, Inc.

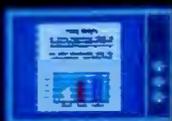
Circle 479 on Reader Service Card



16 color UGA Support



Smooth Command



Grid Command



3 & 4 Point Curve Command



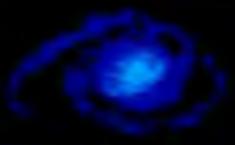
Capture almost any screen



EGA PAINT 2005



Dual Brush Modes



Airbrush Command

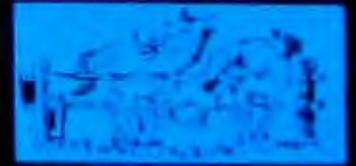


360° Rotate Command



FullPage Printing

Screen Pan



PC QuikArt Support

Additional Features

- ENGLISH SPEAKING (NO ICONS)
- FULL-SCREEN EDITING
- DYNAMIC ZOOM (4X or 8X magnification)
- EXTENSIVE AIRBRUSH CONTROLS
- SMALL COMMAND (reduces files 50 to 90%)
- AUTOMATIC PAN (page mode)
- AUTOMATIC COLOR SMOOTHER MODE
- SOPHISTICATED SLIDE SHOW (w/dissolve-maker)
- XLATE UTILITY (translate between resolutions)
- 34 FONTS (with over 25 control combinations)

One Picture Is Worth A Thousand Words!

Step up to state-of-the-art in EGA graphics generation technology. Our 2005 version is not just another paint program or another version of the "same old thing." EGA PAINT 2005 is a complete restructuring of our 2001 program (itself the recipient of the PC TECH JOURNAL award for excellence in program design). We believe the end-user comes first and instead of merely patching on more features (as all the others do) we went to a whole new (much easier and faster) way to create truly startling business presentations & EGA color illustrations. Take another look at some of our features (some of which are available only on programs costing hundreds more) and decide for yourself.

Also available from RIX:

EGA SCREEN ENHANCER

This easy to install device enables older EGA cards to utilize EGA PAINT 2005 in 640x480 & 752x410 resolution modes. Our ESE comes complete with a special test pattern diskette for only \$49.95 (+ \$5.00 for shipping and handling).

All this and more for just:

\$99.00

ORDER NOW!

in CA - (800) 233-5983 out CA (800) 345-9059



RIX SoftWorks, Inc.

18552 MacArthur Bl. Suite 375, Irvine, CA 92715

SHORT TAKES

BYTE editors offer hands-on views of new products.

NEC MultiSpeed HD: A Best-Seller Gets a Big New Feature

The NEC MultiSpeed certainly ranks as one of the most popular IBM PC-compatible laptop computers. The dual-processor speeds, twin 720K-byte floppy disk drives, super-twist LCD screen, and full-size keyboard of the original have been upgraded twice, first with an electroluminescent screen (the MultiSpeed EL) and now with a 20-megabyte internal hard disk drive.

I had a chance to look at a preproduction sample of the MultiSpeed HD, and I found that the sum of the parts is a fast, highly usable, very portable computer. The hard disk drive is, of course, the most notable component in this version. According to the CORETEST, the 20-megabyte hard disk drive has an average seek time of 75.6 milliseconds and a data transfer rate of 260.3K bits per second. I'm a dedicated fan of hard disk drives, and I found this one to be fast enough to be well worth the cost in battery life.

According to NEC, the nickel-cadmium battery in the MultiSpeed HD should power the machine for 4 to 6 hours if the screen backlighting and hard disk drive are not used; 2 to 4 hours if the backlighting and hard disk drive are used occasionally (or if the backlighting is adjusted to a low intensity); and 1 to 2 hours if the backlighting is at full bright and the hard disk drive is accessed frequently. A full recharge of the battery (from a fully discharged state) takes 8 hours. According to NEC, you can operate the computer from AC power without the battery in place.

There will be slight cosmetic changes between the computer that I saw (and we photographed) and the final version shipped to purchasers.

The MultiSpeed HD is bundled with MS-DOS version 3.2 and the NEC set of memory-resident programs. The pop-up software includes a telecommunications program; notepad, filer, outliner, dialer, and setup software; and on-line help screens. You can disable the memory-resident software by using the Killpop program supplied with the computer.

This promises to be a solid laptop computer, offering most of the functionality of a desktop turbo XT computer in a package that can be carried easily and used without an AC umbilical



The Facts:

NEC MultiSpeed HD
\$3695

Software included:

MS-DOS version 3.2; NEC pop-up software.

NEC Home Electronics (U.S.A.) Inc.
1255 Michael Dr.
Wood Dale, IL 60191-1094
(312) 910-1776
Inquiry 852.

cord. If I were planning to carry this computer a lot, I would definitely buy the optional carrying case (\$99). The MultiSpeed HD does have a built-in handle, but the rather bulky AC adapter and numerous holes and slots in the plastic case of the computer cry out for a case to corral and protect the machine.

—Curt Franklin

GOfer: RAM-Resident Text Searcher

Frequently, I've got to find a block of text fast. Deadlines are approaching, and I have nothing for clues but a couple of key words. This is when GOfer, a pop-up text finder from Microlytics for MS-DOS machines, comes in very handy.

After loading the program (it normally occupies 79K bytes of RAM, but you can load it to use more or less, or you can use it as a stand-alone package), I loaded XyWrite III Plus and called up GOfer. The search process starts at a window wherein you specify the text you want found by filling in one to eight blanks, each of which can take 20 characters.

You don't have to remember the exact word (or words) you're hunting for; you just have to be close (case and spelling don't have to match precisely). With the capability to fine-tune these searches, you can be very specific or you can play the old "sounds like" charades game. I sent GOfer after words I was sure were buried in some text file and after words that were similar. Each time, it came back with a hit. Search strategies can also be based on logical relationships.

Before the program goes looking for text, you tell it where to look by specifying drives, paths, or subdirectories. If you're

continued

not sure where you want it to look, you can tell it to look at all the files on the disk. I sent GOfer into the jungle of my hard disk to see if, as Microlytics claims, there's no limit to the number of files the program can search.

The only times I ran into problems were when I missed a step in the procedure. It does take a few minutes to tell GOfer what you want it to look for and where you want it to look, but the program then whips through files in its search for text.

When the program finds the word, it flashes the chunk of surrounding text on the screen, with the first letter of the searched word highlighted. (At the top of the screen are the name and the location of the file.) GOfer will then send the found text to a printer, to a disk file, or to another program. I was able to easily export snippets of text from my hard disk to XyWrite documents.

I've also used GOfer to jump out of XyWrite and browse through disk files, which saved me from having to shut down the file I was in, calling up a suspect, and then storing it and calling back the document I was in.

If you're cursed with tons of text files but not blessed with great powers of recall, GOfer can save you from spending lots of time wandering in the wilds of your hard disk in search of that certain word.

—D. Barker

The Facts:

GOfer
\$79.95

Requirements:

IBM PC or compatible with 256K bytes of RAM, MS-DOS 2.0 or higher, and one disk drive.

Microlytics
300 Main St.
East Rochester, NY 14445
(716) 377-0130
Inquiry 853.

The TransImage 1000: Versatile OCR in a Low-Cost Package



The Facts:

The TransImage 1000
\$2495

Requirements:

IBM PC, XT, AT, or compatible; MS-DOS 2.0 or higher.

TransImage Corp.
910 Benicia Ave.
Sunnyvale, CA 94086-2887
(408) 733-4111
Inquiry 851.

The TransImage 1000 is a product that relieves you of the burden of deciding between high functionality and low cost. The package contains three components: the TransImage scanner, the TransImage controller board, and software to make it all work. The controller board gives the scanner its power. It is centered on a Motorola 68000 processor and a series of custom logic chips.

The custom chips contain the heart of the TransImage's topological-recognition scheme. By using a topological-recognition algorithm, instead of the template-matching algorithm used by most low-cost optical-character-recognition scanners, the TransImage scanner is able to recognize a much broader range of typefaces, including typeset, italic, and kerned fonts, than most scanners available for less than \$10,000.

The scanner itself must have been designed with ergonomics in mind, as the scanning unit fit into my hand quite well. Six programmable keys on the top of the scanner, if programmed judiciously, can substantially reduce the number of times you must move between the scanner and the computer keyboard during input.

An important design feature of the scanner is the set of broad rollers on the bottom of the unit. These rollers help keep the scanner moving in a straight line while scanning, increasing the accuracy of the scanning process.

The software of the TransImage includes stand-alone and memory-resident programs. The stand-alone program lets you set exposure levels, practice with the scanner, and train the scanner to recognize new or confusing characters. The program is menu-driven, with rudimentary on-line help available. The memory-resident portion lets you choose among driver files that interface with applications programs. Interface files for a number of popular programs (including Lotus 1-2-3, WordStar, WordPerfect, and dBASE II) come with the scanner, and you can program interface programs for many other applications.

I found the TransImage easy to use, although there was a marked increase in scanning accuracy as I became more practiced in centering the scanner on a line and moving it smoothly and evenly across the page. In my tests, I was able to scan pages from BYTE and *Fortune*, several press releases and advertising brochures, and a tabloid newspaper.

The TransImage was quite accurate, although it had trouble with multiple white spaces and very small, closely spaced type (TransImage recommends scanning text that is set between 8 and 14 points). I was impressed with its versatility and accuracy, especially compared to low-cost scanners that work only with typewritten, monospaced typefaces.

—Curt Franklin
continued

What the PC did for computing, GoldWorksTM now does for expert system building.

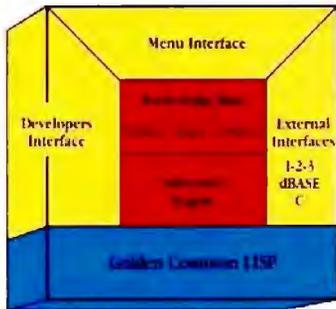
Remember computing before the PC?

Climate-controlled rooms behind "Restricted Area" signs. DP gurus speaking a language nobody else knew. Mystified end-users. Then technology evolved, the PC emerged and serious desktop computing became affordable. The economics of computing changed forever.

Now, GoldWorks uses PCs to transform the economics of expert system building.

On your 286- or 386-based PC, *"...allows us to leverage thousands of installed PCs..."*
 —Dr. David Shpilberg, Coopers & Lybrand

GoldWorks offers the functionality and power of high-end expert system tools, plus the ease of use and low cost of PC shells. With **GoldWorks**, you can *develop and deliver* serious expert systems *cost-effectively*.



GoldWorks is the most powerful expert system tool available on PCs.

With GoldWorks, you don't have to compromise.

Easy-to-use shells run on PCs, but lack real functionality. Powerful high-end tools can't integrate with existing PC applications or deliver expert systems on PCs. GoldWorks combines the best features of both.

"...a powerful combination of expert system development and end-user support."
 —Bruce M. Gras, Arthur D. Little, Inc.

It's as easy to use as a shell...

The Menu Interface lets you prototype and build expert system applications fast, without knowing the underlying programming environment. On-line help and tutorials make you productive quickly.

...and as function-rich as a high-end tool.

GoldWorks offers frames, rules, object programming and powerful control mechanisms, just like the high-end tools. And GoldWorks runs on advanced PCs, so expert systems you build can be *delivered* cost-effectively to end-users.

"...power comparable to ART or KEE..."
 —Kenneth Levine, Lektion, Inc.

GoldWorks lets you integrate with existing PC programs.

You can integrate expert systems with dBASE III, Lotus 1-2-3 and C...plus build and deliver expert systems in network environments.

See this powerful, flexible tool for yourself. Order the GoldWorks Demonstration Kit.

You'll get an 18-minute videotape, showcasing many GoldWorks features in a sample application. You'll also receive a copy of the actual 282-page Expert System

"Any Fortune 1000 organization can easily cost-justify...this tool."
 —Randy Reiter, Albenia Group

User's Guide that comes with GoldWorks.

We'll credit your \$49 to your GoldWorks purchase.

For more information, or to order, call toll-free:

1-800-242-5477.
 In Mass., call (617) 492-2071.

GoldWorks from Gold Hill. The expert in AI on PCs.



Gold Hill Computers, Inc.
 163 Harvard Street
 Cambridge, MA 02139

*The only software tool
for FAMICOM*

FMC Adaptor-II

*Now
available!!*



This is the key to debug the custom CPU FMC-2A03 of the FAMILY COMPUTER (Nintendo). All you need is this unit! Then, you can debug and develop your software for the FAMICOM without much knowledge on hardware of the FAMICOM.

This clever adaptor can evaluate the famous SOUND SUPPORT!

Think FMC Adaptor-II if you are touching to FAMICOM!

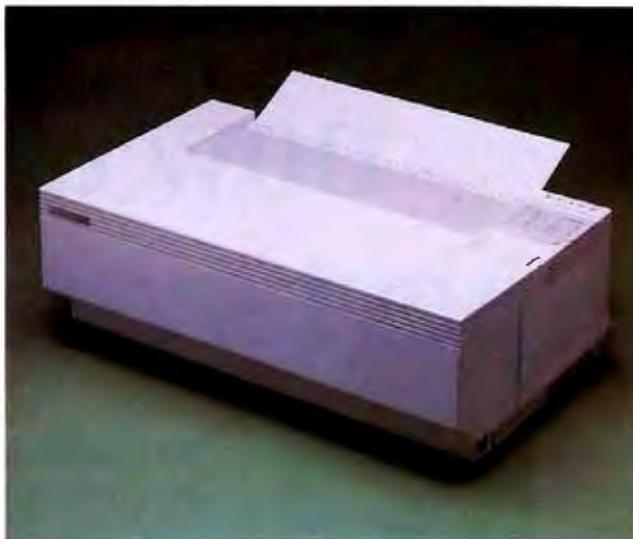
CONTACT US TODAY!



Atten: Paul Kiraoka, Sales manager
Mani Bldg., Shibuya, 37-10, Udagawa-cho, Shibuya-ku,
Tokyo, 150 Japan.
Phone: (03)466-5400 Fax: (03)466-5522
Telex: J27832 NPS JAPAN

Family computer is a trade mark of Nintendo

RuggedWriter 480: Hewlett-Packard's Fast 24-pin Printer



The Facts:

RuggedWriter 480
\$1695

Hewlett-Packard
3000 Hanover St.
Palo Alto, CA 94304
(415) 857-1501
Inquiry 854.

Options:

Serial/HP-IB interface, \$200;
optional automatic sheet
feeder, \$250; optional font
cartridge, \$150.

Hewlett-Packard's new RuggedWriter 480 dot-matrix printer has the highest throughput of the 16 24-pin printers BYTE has tested during the past year. On the five-page test document (described in the April 1987 BYTE on page 203), the \$1695 unit achieved a draft throughput rate of 189 characters per second and a near-letter-quality (NLQ) throughput of 143 cps.

The closest competitors among units BYTE has tested are the C. Itoh C-815 Supra at 187 cps draft throughput and the Nissho NP-2410 at 104 cps NLQ throughput. Graphics throughput of the RuggedWriter was 726 cps; only two 24-pin units had a higher rating, the Fujitsu America DL 2600 (933 cps) and the Nissho NP-2410 (833 cps).

The subjective NLQ print quality of the unit was superior—comparable to the best of the 24-pin units BYTE has tested—but the draft-quality rating was only average. Graphics quality was second only to JDL's 850 EWS printer. The noise level of the printer was in the lower half of the group. For example, the NLQ noise level was 72 decibels. The other 24-pin units tested ranged from 68 dB to 78 dB (four were quieter, six were louder, and five had the same rating).

The RuggedWriter is a wide-carriage printer and handles up to four-part forms. The unit has two paper-handling systems built in: hand feed and fanfold tractor feed. An automatic cut-sheet feed tray is available for \$250. A control panel makes it easy to switch between the three paper paths.

If you select automatic sheet feed or hand feed while forms are loaded, the printer automatically retracts the fanfold paper from the platen without completely releasing it; when you reselect the fanfold path, the unit returns the fanfold paper to the platen area. Another important feature for office use is the

continued

Announcing the latest dBASE® upgrade.



If you can't wait for a new version of dBASE to come out, you don't have to. Because now, there's the Quicksilver™ Diamond Release. A compiler that gives the dBASE world what it's been waiting so long for.

The next generation of the dBASE language.

Which shouldn't be too surprising. After all, WordTech Systems has long been the leader in bringing improvements to dBASE. With features like the first true windowing. VALID. User Defined Functions. And true native code compiling, for blazing speed.

Now, with the Quicksilver Diamond Release, dBASE has been expanded like never before.

New capabilities include a long list of extended language features. Like a new GRAPH FORM command that lets you create graphs and charts from your data. Plus the ability to export graphs and data to a format that works directly with desk-

top publishing packages like Xerox Ventura Publisher™. There are multi-dimensional arrays, for easier, more sophisticated memory variable management. And ON EVENT/SET EVENT commands for communications multitasking, like sorting a database while you receive a modem transmission.

What about networking? With WordTech's all new Networker Plus™, you can run Quicksilver compiled programs and dBASE III Plus™ on the same network, at the same time.

That's not all. Quicksilver lets network users know who has data locked, and lets them send a message requesting its release. In fact, users can send any message, including exact copies of screens, to anyone on the network. If data has been changed, edit sensing lets you know—it even tells you who changed it. And with Quicksilver's distributed processing feature you can send projects off to unused workstations.

The Quicksilver Diamond Release runs on DOS 3.1, and compatible networks. And it runs around \$599. Your software store or computer dealer has more information. Or give us a call.

And see why this is the one dBASE upgrade you'll be glad you waited for.

QUICKSILVER™
WORDTECH SYSTEMS

WordTech Systems, Inc. P.O. Box 1747, Orinda, CA 94563 (415) 254-0900 Fax: (415) 254-0288 Telex: 503599

Not copy protected. Networker Plus is a trademark of WordTech Systems, Inc. Quicksilver is a trademark of Quicksilver Software, Inc. licensed to WordTech Systems, Inc. dBASE and dBASE III Plus are trademarks of Ashton-Tate. Xerox Ventura Publisher is a trademark of Xerox Corporation.



NEW!
SafeSkin™
Keyboard Protector

Finally! A Keyboard Protector That:

- **PROTECTS CONTINUOUSLY - 24 HOURS A DAY** - Against computer downtime due to liquid spills, dust, ashes, staples, paper clips and other environmental hazards.
- **REMAINS IN PLACE** during the operation of your keyboard. SafeSkin is precision molded to fit each key - like a "second skin."
- **EXCELLENT FEEL** - The unique design eliminates any interference between adjacent keys, allowing smooth natural operation of your keyboard.
- **SafeSkin IS VIRTUALLY TRANSPARENT** - Keytops and side markings are clearly visible. In fact, SafeSkin is so clear, sometimes you may not know it's there!
- **DURABLE - LONG LASTING** - SafeSkin is not a "throw-away" item. Many of our protectors have lasted over 3 years under continuous daily use, without failure.

SafeSkin is available for most popular PC's and portables including: **IBM, APPLE, AT&T, COMPAQ, DEC, EPSON, KEYTRONICS, NEC, TANDY, TOSHIBA, WANG, WYSE, ZENITH.** Specify computer make and model. Send \$29.95. Check or M.O.. VISA & MC include exp. date. Dealer inquiries invited. Free brochure available.

Merritt Computer Products, Inc.

4561 S. Westmoreland / Dallas, Texas 75237 / 214/339-0753

ability to tear off a form and resume printing at the top of the next form.

Other front-panel controls include selection of NLQ, draft, and compressed typefaces. When an optional font cartridge (\$150) is installed, the front-panel button also allows selection of four additional fonts or a downloaded font. The RuggedWriter comes with a 2K-byte input buffer; the font cartridge adds 16K bytes of additional buffer space.

For software control, the RuggedWriter emulates an Epson LQ-1000; it also recognizes Hewlett-Packard's printer control language. The standard printer comes with a parallel and serial interface. An optional serial/Hewlett-Packard Interface Bus (HP-IB) interface costs \$200.

—George A. Stewart

Velan-2V: Video-Port Expander

The Velan-2V video-port expander lets you connect two analog monitors to one analog video port. It works with the IBM PS/2 computers and VGA-compatible video cards.

Setup and operation are easy. Simply disconnect the monitor from the video port. Connect the video port to the input port of the Velan-2V. (This cable is included with the unit.) Then plug the two analog monitors into the output1 and output2 analog ports of the Velan-2V. Flip on the power switch on the front panel, and both monitors can display the same picture.

The unit contains active amplifiers for the red, blue, and green analog signals, with a 100-MHz bandwidth for no loss in resolution. This boost in video signal permits positioning the monitors up to 25 feet from the computer, using a standard cable, or up to 50 feet from the computer, using the optional low-loss video cables.

I tested the unit on an IBM PS/2 Model 80 and on an IBM PC using a Sigma Designs Sigma VGA card. I used the IBM 8513 and NEC MultiSync XL color monitors for the tests.

On the Model 80, the unit performed flawlessly. Both monitors displayed the same screen with good color and resolution. It is possible to simultaneously use both a monochrome and a color monitor on a PS/2 computer with the Velan-2V. The Model 80 reads the ID bits of the monitor (lines 4, 11, and 12 on the video cable) and configures the output of the VGA port for that particular monitor. Network Technologies recommends that you attach the monitor with the lowest functionality to the output1 port. Both monitors will then operate at the lowest common mode.

When I ran the test on the Sigma VGA card, again both monitors operated correctly. The NEC MultiSync monitor had the advantage of adjusting itself to whatever mode the Sigma VGA card was in. The IBM 8513 monitor could operate only in its standard mode of 640 by 480 pixels.

The Velan-2V is ideal for situations where a group of people need to see the output from one computer.

—Stan Wszola

The Facts:

Velan-2V
\$279

Options:
Low-loss video-extension cables: 25 feet, \$70; 35 feet, \$80; 50 feet, \$90.

Network Technologies Inc.
19145 Elizabeth St.
Aurora, OH 44202
(800) 742-8324
Inquiry 855.

continued

Computerfone™
Interactive Voice Response System

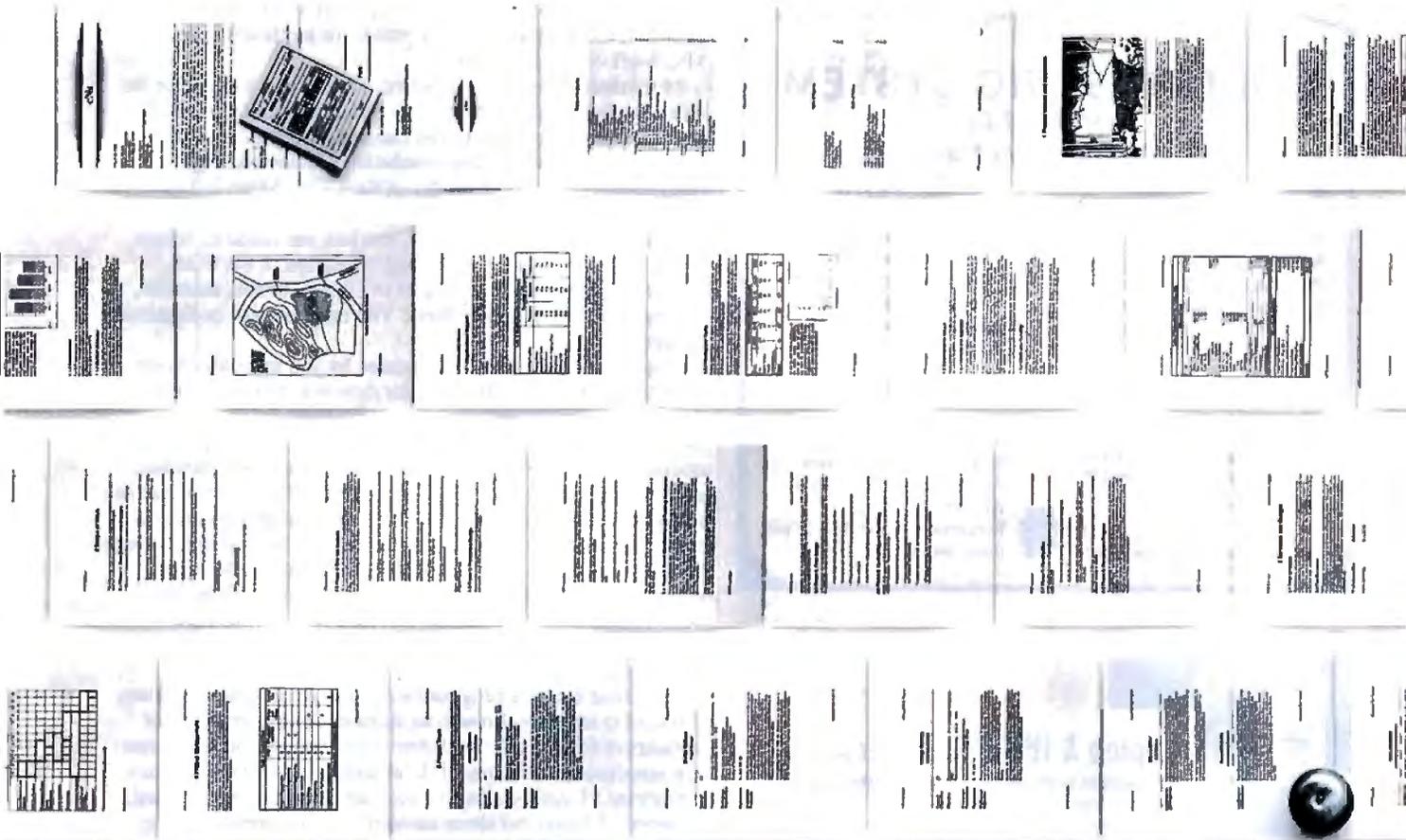
TouchTone In/Voice In/Text In
Voice Out
Excellence
in-Voice Quality

- Text-to-Speech
- Digitized Speech
- Synthesized Speech
- Auto Answer/Auto Dial
- Host Independent

Call to hear our demo:
1-904-476-5742

• 1986 Suncoast Systems, Inc. **24 Hrs./7 Days/Wk.**

How to process documents instead of words.

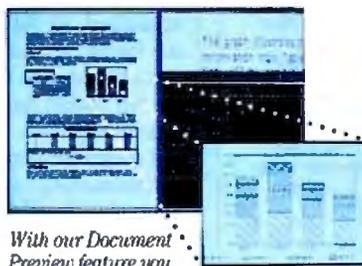


Ho hum, your word processor enables you to process words. But today, when you're creating a wide range of business documents, you often have to process much more. Graphics, columns, tables, equations, etc.

Lotus Manuscript® is a complete document creation system that can handle anything from a one-page memo to an 800-page manual. Manuscript can mix text and graphics on the same page, graphics from Lotus® 1-2-3®, Symphony®, Freelance® Plus, and Graphwriter II®. It can also import spreadsheets and charts, plus diagrams and scanned images.

With our Integrated Outliner you can collapse a document to navigate the outline, or move any size section with just a few keystrokes.

You can globally format an entire Manuscript document, or format by sections.



With our Document Preview feature you can see how any page will look before it's printed. Zoom capability lets you take a closer look at graphics and equations.

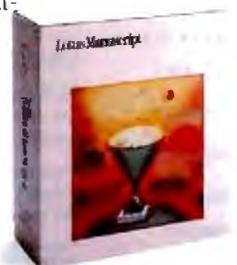
Manuscript's Document Compare feature highlights changes between revisions for foolproof proof-reading.

Our powerful Print Formatter gives you control over the look of your document, from position and size of graphics, to fonts, point sizes and more.

Manuscript also takes full advantage

of today's printing technology, from dot-matrix to laser, including PostScript® printers.

Manuscript is designed to work on most IBM® PCs and compatibles.* Its familiar 1-2-3 interface makes it easy to use. And our Manuscript evaluation kit makes it easy to try. For \$10.00, you'll get a presentation disk, working software, and a tutorial manual. To get your evaluation kit, call **1-800-345-1043** and ask for demo kit YB-1450.



Lotus Manuscript

AMX 86

KADAK's
engineers bring
years of practical real-time
experience to this mature

MULTI-TASKING SYSTEM (version 2.0)

for the IBM® PC, PC/XT and PC/AT

- No royalties
- IBM PC DOS® support
- C language support
- Preemptive scheduler
- Time slicing available
- Source code of the C interface and device drivers is included
- Intertask message passing
- Dynamic operations:
 - task create/delete
 - task priorities
 - memory allocation
- Event Manager
- Semaphore Manager

AMX86™ operates on any 8086/88, 80186/88, 80286 system.

Demo package \$25 US
Manual only \$75 US
AMX86 system \$2195 US
(shipping/handling extra)

KADAK Products Ltd.

206-1847 W. Broadway
Vancouver, B.C., Canada
V6J 1Y5
Telephone: (604) 734-2796
Telex: 04-55670



Also available for 8080, Z80, 68000



Laptop & IBM PS/2 Users:

The solution to bridge the gap between your 5¼ & 3½ inch drives.

"It's a steal. It allows you to use your favorite DOS shell for selective file transfer and it even lets you use your PC's peripherals from your laptop... In short: An exceptionally fast and functional transfer utility... The Brooklyn Bridge is the perfect solution for people who use a laptop almost exclusively as a portable machine that travels from PC to PC. It's terrific!" — Howard Marks, PC Magazine, July 1987*

Rated as one of the best of the best utilities by John Dvorak.

"This is one of those rare programs that you enjoy the minute you take it out of the box, especially when you discover that a cable is included... Excellent product." — PC Magazine, June 23, 1987*

End users are "sold on Brooklyn Bridge... Dvorak is certainly correct in describing White Crane Systems' Brooklyn Bridge as 'Fabulous... and I love it.'" — G. Schochet, Letter to the Editor, PC Magazine, May 12, 1987*

PS/2 users: The Brooklyn Bridge allows data transfer and drive access in either direction so you may also transfer your data back to your 5¼ inch PC.

Priced at \$129.95, call White Crane Systems to order or for more information.

*Reprinted from PC Magazine, copyright 1987 Ziff Communications Company

WHITE CRANE
SYSTEMS

404-394-3119

Suite 151

6889 Peachtree Ind.

Boulevard

Norcross, Georgia

30092



Book One: Interactive Authoring

Book One helps you create interactive presentations by combining color pictures, sound, text, and animation using the model of a book to organize your work. You place elements on a page, combine these pages into chapters, and the chapters into a book. Book One currently works only on the EGA and CGA. It also can use either the keyboard or a Microsoft-compatible mouse.

More than 40 fonts are supplied, as well as a font editor for creating your own. There are four graphics modes: A, B, E, and P. If you have a CGA, you can use modes A, B, and P. Modes A and B are the low-resolution 4-color and high-resolution monochrome modes of the CGA. Mode P displays the top or bottom of a page, using a 400- by 200-pixel resolution. If you have an EGA, you can use mode E, which is the 16-color, 640- by 350-pixel resolution of the EGA.

The graphics elements consist of circles, boxes, sketches, fill patterns, and graphics fonts. You can also pull in digitized pictures.

The program's animation features let you manually move objects by specifying the steps for drawing, removing, and drawing the object again in another position, or you can have Book One animate the object by specifying a starting and an ending position. With sketch animation, given two sketches, each with the same number of dots, Book One will animate the transformation of one into the other. Font animation takes a series of small predefined pictures that can be displayed at high speed to create the illusion of motion. Sound elements are entered as a four-element string consisting of the note, the octave, note lengths, and rests. Book One provides commands for controlling the flow of the program and waiting for user input.

You need not be a programmer to use Book One, but it was difficult to navigate through its features. The user interface consists of 55 icons divided over three menus, and submenus are associated with many of these icons. In theory, you must memorize 11 symbols from which the icons are constructed. However, I found the sheer number of icons overwhelming, and often it was not obvious how they worked together.

The documentation, which consists of an introductory guide, an advanced guide, and a reference manual, is not well organized. In the introductory guide, the directions for using the fill command neglect to say that you must choose a border color to stop the fill in graphics modes A and E. Otherwise, the fill covers the whole screen. The reference guide contained this information.

I found the demonstrations included with Book One slow and unexciting, and the sound effects accompanying them were annoying. In all fairness, I think the performance is limited by the hardware it's running on. (I used a Compaq 386 with an EGA.) But if you want build animated presentations on an IBM PC, XT, or AT, Book One is certainly easier to use than a general programming language.

—Eva White

The Facts:

Book One
\$295

Parallax Software Publishers
2550 Ninth St.
Berkeley, CA 94710
(415) 848-9898
Inquiry 856.

Requirements:

IBM PC, XT, or AT with
512K bytes of RAM, an EGA
or CGA, and a high-density
floppy disk drive and a hard
disk drive or two high-density
floppy disk drives.

continued

NEW MENUING
INTERFACE AND
RELIABILITY PROCEDURE

GET SERIOUS



...ABOUT ANALYZING YOUR DATA. You might be spreading your spreadsheet a little too thin. Or maybe you're starting from scratch. But if you're serious about data analysis, you're ready for SPSS/PC+™ – a full software family that brings you eight high-powered ways to complete any data analysis task.

Enter it. SPSS Data Entry II™ is a fully integrated data entry, cleaning and editing tool.

Analyze it. The SPSS/PC+ base package provides a powerful array of statistical and reporting procedures.

Picture it. SPSS/PC+ Graph-in-the-Box™ featuring New England Software's Graph-in-the-Box™ offers full color "snapshot" graphics.

Examine it. SPSS/PC+ Advanced Statistics™ lets you get more serious with your data.

Predict it. SPSS/PC+ Trends™—our latest option—is the complete time series analysis/forecasting tool.

Table it. SPSS/PC+ Tables™ produces presentation-ready tables instantly.

Chart it. SPSS/PC+ Graphics™ featuring Microsoft® Chart creates show-stopping graphs and charts.

Map it. SPSS/PC+ Mapping™ featuring MAP-MASTER™ creates maps where vast amounts of data can be summarized and presented in one, simple picture.

SPSS/PC+ products are being put to productive use by serious fact finders in business, government and education. For countless purposes such as market research. Wage and salary studies. Survey analysis. And quality control. Plus each product is superbly documented and supported by SPSS Inc., a leader in statistical software for nearly 20 years. While specially tailored customer support is available through the VALUE PLUS™ plan. And SPSS now offers a SPSS/PC+ version for Novell LANs.

So if you're serious about data analysis, step up to SPSS/PC+. For details, contact our Marketing Department.

CALL 1/312/329-3315

SPSS inc.

SPSS Inc. • 444 North Michigan Avenue, Suite 3000 • Chicago, Illinois 60611

In Europe: SPSS Europe B.V. • P.O. Box 115 • 4200 AC Gorinchem, The Netherlands • Telephone: + 31183036711 • TWX: 21019

SPSS/PC+ runs on IBM PC/XT/ATs with hard disk. Contact SPSS Inc. for compatible microcomputers. SPSS/PC+, SPSS Data Entry II, SPSS/PC+ Graph-in-the-Box, SPSS/PC+ Advanced Statistics, SPSS/PC+ Trends, SPSS/PC+ Tables, SPSS/PC+ Graphics and SPSS/PC+ Mapping are trademarks of SPSS Inc. VALUE PLUS is a trademark of SPSS Inc. Chart and Microsoft are trademarks of Microsoft Corporation. MAP-MASTER is a trademark of Ashton-Tate. Graph-in-the-Box is a trademark of New England Software, Inc.

© 1987, SPSS Inc.

Circle 257 on Reader Service Card

JANUARY 1988 • BYTE 105

COMPUTER PARTS GALORE

POWER SUPPLIES

UNINTERRUPTIBLE SUPPLY

The DESIGN UPS-300W UPS-400W and the UPS-600W provide high watt efficiency 95% reliable battery back-up power protection for systems of all sizes. Made with industrial grade gel cells for safe off-line use. These units are the most reliable we have found and we recommend them.

UPS-300W...\$295.00
UPS-400W...\$379.95

1. High efficiency
2. Internal MD-SPCL built
3. Autoable power loss
4. Fast transfer time
5. 4 sealed batteries
6. Fractional Metering

Dealers welcome ASK



ASTEC 200W AT SUPPLY \$129.95

Use the ASTEC AT power supply because they are 100% good & reliable units. With full FCC UL and CSA approvals you know they are good. After all only a few thousand dollars of good USA made stuff on one of these 1L CHEAP power supplies you see for a bit less money. Most of them have no LV regulation in their fly back drives all the time. And the warranty is no good because it won't replace what was burned up. All they will do is give you another day so you can burn on some more good stuff.

KEYTECHNICS RT-101 KEYBOARD

100% AT/XT compatible

RT-101 \$99.95

1 Year Warranty

Our reasons for selling the KEYTECHNICS RT 101 keyboard are similar to those for selling the ASTEC power supply and the AT/ATX 286 mother board. NO ONE is ever burned by good quality merchandise. What can we say? KEYTECHNICS is the acknowledged world leader in keyboards. They run forever. They last very good. They look very good. And they are only slightly more money than the IBM/MS products. Why is ONLY KEYTECHNICS has a real good on their labour cost is as low as IBM's. The only extra is good parts. And they are the good ones. no question have a nice meal!

AT SYSTEM KITS

DELUXE AT KIT...\$999.95

Our AT system kits are made with the famous AT/ATX 286 motherboard. What a deal! We send you our ASTEC 200W power supply, a nice FLIP TOP AT case, an AT/ATX 286 motherboard with 512K of RAM, a DTC hard floppy drive controller, a PRASASOUR 1.2R drive, and a KEYTECHNICS RT-101 Keyboard. That means you can have a full AT compatible system at a very low price.

STANDARD AT KIT...\$799.95

We also have a lower cost kit for those of you who need to save as much money as possible. The only change in the keyboard will be a DTC 5000L drive controller or 5007/1.2 floppy only controller and with extra RAM on board.

BASIC AT KIT...\$599.95

Just for those who want just the basics we have the basic AT kit. Just an AT/ATX 286 motherboard, an ASTEC 200W Power Supply and a great AT Flip Top Case.

The IBM system and BIOS in above prices on each kit.

XT SYSTEM KITS

COMPLETE BMHZ XT TURBO KIT...\$599.95

- Flip top Case
- 150W Power Supply
- 512K AT/XT Keyboard
- 8MHz turbo with BIOS
- Drive card & Cable
- 2 Panasonic drives
- Video card (2' mono)
- Clock, test, fan, fan parts
- 10 diskettes software
- Full assembly manual

BARE BONES BMHZ KIT...\$249.00

All the above kits are made with good quality parts and are warranted for 30 days. The manual is very good and anyone can make a kit in an hour or less. KA holders assume full responsibility for obtaining FCC approval for finished kits.

IBM PERIPHERALS

- NEW MULTI I/O VIDEO CARD, MAKES A SINGLE CARD AT \$120.00
- A great new card with Drives, Clock, Ser. Par Game, Video (RGB/TV), Hercules!
- NEW SMART VIDEO + PRINTER CARD \$74.00 477/12MHz with printer Hercules or IBM keyboard, both same price
- NEW BARRY AT HD THE HOBNOB 6-10MHz XT size, Model 1 MB, 80 AT case, MODEL BIOS 1/2 XT case \$399.95
- BIOS AT 1/2 XT CASE - POWER SUPPLY \$192.95
- MAC, IBM, 54" wide for small desktop, takes 2 floppy & 1 HD \$84.00
- NEW MULTI I/O SHORT CARD WITH 1.5 CHIPS \$24.00
- ALL HD with 2 or 10 1/2" Floppy Case, Call Game Drive, all you need for 2 card system \$248.95
- NEW ENHANCED GRAPHIC ADAPTOR \$248.95
- 1.5" floppy with full 1GB AND HD DISKLES compatibility
- Color graphics \$58.95
- Monochrome/RAM \$78.95
- HS 232 \$24.95
- Game I/O \$24.95
- Mouse Graphics + Pt \$68.95
- MULTI I/O \$84.95
- Printer \$29.95
- HS 232 - Clock/Cat \$44.95
- Clock/Cat \$24.95

COMPUTER PARTS GALORE INC. 54 HAWKSTER AVE. BATAVIA, NY 14020 USA TEL: 716-343-6123 FAX: 716-343-9912

CALL TOLL FREE 1-800-431-9008

Surpass: 1-2-3 Superset

Surpass is a powerful new program that's a worthy competitor to Quattro, Excel, PlanPerfect, and similar spreadsheets that challenge the dominance of Lotus 1-2-3.

Instead of being a clone, Surpass is a functional superset of 1-2-3. Thus, all your current Lotus worksheets, macros, and learned keystroke sequences should work with Surpass. (We tested a late beta version and found no incompatibilities.)

The added commands and functions are what really make Surpass stand out. For example, you can have up to 32 different spreadsheets open and at least partially in view at any time (via overlapping windows). Of course, only the three or four windows "on top" will be large enough and visible enough to work on. But you can access other open spreadsheet windows with as few as four keystrokes. (The total number of spreadsheets you actually can open depends on the size of the spreadsheets and available memory. Surpass requires at least 512K bytes of RAM and can use up to 8 megabytes of Lotus/Intel/Microsoft Expanded Memory Specification [LIM/EMS] memory.)

Having multiple spreadsheets on-screen makes it easy to use Surpass's slick "hot link" feature: You can link any cell or range of cells to any others simply by opening the appropriate spreadsheet window and using familiar, Lotus-like commands. (You can also link to nonopened spreadsheets.) Once linked, changes in one spreadsheet automatically force recalculations of all other spreadsheets in the linked chain.

Fortunately, Surpass is intelligent about recalculations: You can choose to have them proceed in the background, or you can select "dependency recalc," in which only the cells affected by the new data are recalculated.

If you've ever struggled with 1-2-3's column-width settings, you'll like Surpass's automatic column-width sizing: With this option, the columns automatically adjust themselves to fit your largest numbers.

Surpass has a built-in macro recorder, and you can store macros in "libraries" accessible from any worksheet. Its Undo command works just as you'd expect it to. Surpass supports Lotus-style graphics, but with the extra eye appeal of a third dimension (the third dimension does not convey information, but just gives a more polished look).

Surpass also has a "find" feature that makes it easy to locate any numeric or alphabetic string in any worksheet. Also, it comes with a point-and-shoot "visual file manager" that lets you select files from anywhere on your disk without having to type long path names.

Surpass has something else going for it: Seymour Rubenstein. His name may not be a household word, but you have heard of the last major product he was associated with: WordStar. It's too soon to say whether or not Surpass will become the "WordStar of spreadsheets," but if you need a spreadsheet program that offers enhancements over 1-2-3 without sacrificing compatibility, Surpass is worth a look.

—Fred Langa

The Facts:

Surpass \$495

Surpass Software Systems
14 Commercial Blvd.
Suite 131
Novato, CA 94949
(415) 382-8840
Inquiry 857.

Requirements:
IBM PC, XT, AT, or PS/2 with a 1.5-megabyte hard disk drive, 512K bytes of RAM, and DOS 2.1 or higher. Supports all current graphics standards and a math coprocessor.

Hayes compatible MODEM

INTERNAL MODEM FOR XT AT 386

300 1200 **\$69**

300 1200 2100 **\$139**

(Auto dial, auto answer, w ph & line jack)

EXTERNAL MODEMS for XT/AT, Apple.

Commodore, Atari, etc.
Fully Hayes compatible
Auto dial, auto answer with 8 LED,
Speaker, Dip switch, aluminum Case. **\$89**

300 1200 **\$89**

300 1200 2100 **\$160**

7 DAYS MONEY BACK

(less \$15 for modems & \$50 for computers as restocking & Shipping)

6. 10 MHz 80286 \$595

- * 80286 6/10 MHz hardware switch.
 - * 512K memory, expandable to 1 MB.
 - * 84 keybas keyboard, 180 watt supply
 - * Mono-graphic card w. printer port
 - * 360/1.2 MB control card (No drive & no monitor)
- \$299**

TURBO 10 MHz XT

- * 4.77-10 MHz w 256K Memory, expandable to 640K
- * Mono graphic card w. printer port
- * 360 K floppy control card (No drive & no monitor included)

FOSTER TECHNOLOGY INC.
#3, 810 Peace Portal, Blaine, Wa 98230
Phone: (206) 332-5081
IN CANADA: 343 Railway, Vancouver, B.C. V6A 1A4
Phone: (604) 684-2368 (Add 16% for Canadian orders)

How to tell the difference between DESQview™ 2.0 and any other environment.

Selecting DESQview, the environment of choice, can give you the productivity and power you crave, without the loss of your old programs and hardware. If you like your existing programs, want to use them together, transfer data between them, print, sort, communicate with or process-in-background, yet still have the need to keep in place your favorite PC(8088, 8086, 80286 or 80386), DESQview is the "proven true" multitasking, multi-windowing environment for you. Best of all, DESQview 2.0 is here now, with all the money saving, time saving, and productivity features that others can only promise for the all-too-distant future.

And with DESQview's new graphics enhancements for Hercules, CGA, EGA, and VGA, Version 2.0 still offers the same award winning and pioneering features for programs that earned DESQview its leadership, only now you can also run desktop publishing programs, CAD programs, even GEM™, Topview™, and Microsoft Windows™ specific programs. In some cases you'll add as little as 10-40K to your system overhead. Now you can have multi-tasking, multi-windowing, break the 640K habit too and still get an auto dialer, macros, menus for DOS and, for advanced users, a new complete application programmer's interface capability. No wonder that over the years, and especially in recent months, DESQview, and now DESQview 2.0 have earned extravagant praise from some of the most respected magazines in the industry.

"Product of the Year" by readers vote in InfoWorld.

"Best PC Environment" by popular vote at Comdex Fall in PC Tech Journal's "System Builder" Contest.

"—I wouldn't want to run an IBM



One picture is worth a thousand promises.

or compatible computer without DESQview"—InfoWorld, Michael Miller.

"A colossus among windowing environments"... "will run almost anything"—PC Week, Marvin Bryan.

"Windows, promises, but DESQview delivers"—MICRO-TIMES, Birell Walsh.

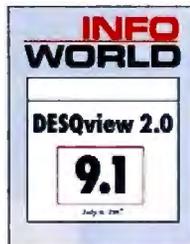
No other environment has consistently pioneered features, openness, and productivity. See for yourself. Send in the coupon. The possibilities are endless with DESQview 2.0.

Attention Programmers: For more information about Quarterdeck's API, and future 386 program extensions, call us today.

SYSTEM REQUIREMENTS

IBM Personal Computer and 100% compatibles (with 8086, 8088, 80286 or 80386 processors) with monochrome or color display; IBM Personal System/2 • Memory: 640K recommended; for DESQview itself 0-145K • Expanded Memory (Optional): expanded memory boards compatible with the Intel AboveBoard; enhanced expanded memory boards compatible with the AST RAMPage • Disk: Two diskette drives or one diskette drive and a hard disk • Graphics Card (Optional): Hercules, IBM Color/Graphics (CGA), IBM Enhanced Graphics (EGA), IBM Personal System/2 Advanced Graphics (VGA) • Mouse (Optional): Mouse Systems, Microsoft and compatibles • Modem for Auto-Dialer (Optional): Hayes or Compatible • Operating System: PC-DOS 2.0-3.3; MS-DOS 2.0-3.2 • Software: Most PC-DOS and MS-DOS application programs; programs specific to TopView 1.1, GEM 1.1 and Microsoft Windows 1.03 • Media: DESQview 2.0 is available on either 5 1/4" or 3 1/2" floppy diskettes

Rush me DESQview 2.0! Today!				BYTE 1/88	
No. of Copies	Media 3 1/2" 5 1/4"	Product	Retail Price ea.	Total	
		DESQview 2.0	\$129.95	\$	
		Shipping & Handling	USA \$ 5.00 Outside USA \$ 10.00	\$	
		Sales Tax (CA residents)	6.5%	\$	
Payment: <input type="checkbox"/> Visa <input type="checkbox"/> MC <input type="checkbox"/> AMEX <input type="checkbox"/> Check			Amount Enclosed	\$	
Credit Card: Valid Since _____ / _____			Expiration _____ / _____		
Card Number: _____			_____		
Credit Card Name _____			_____		
Shipping Address _____			_____		
City _____ State _____			Zip _____ Telephone _____		
Mail to: Quarterdeck Office Systems, 150 Pico Boulevard, Santa Monica, CA 90405.					
NOTE: If you own DESQview call us for a special upgrade offer, or send in your DESQview registration card. AST Special Edition users included.					



Quarterdeck Office Systems • 150 Pico Boulevard, Santa Monica, CA 90405 • (213) 392-9851

DESQview is a trademark of Quarterdeck Office Systems. AboveBoard is a trademark of Intel Corporation. Hayes is a trademark of Hayes Micro-Computer Products Inc. IBM, PC, Personal System/2 and TopView are trademarks of International Business Machines Corporation. Microsoft Windows and MS are registered trademarks of Microsoft Corporation. Mouse Systems is a trademark of Metagraphics/Mouse Systems. RAMPage is a trademark of AST Research, Inc. GEM is a trademark of Digital Research. Hercules is a trademark of Hercules.

This ad is for people who don't know where to find Smalltalk. Or why.

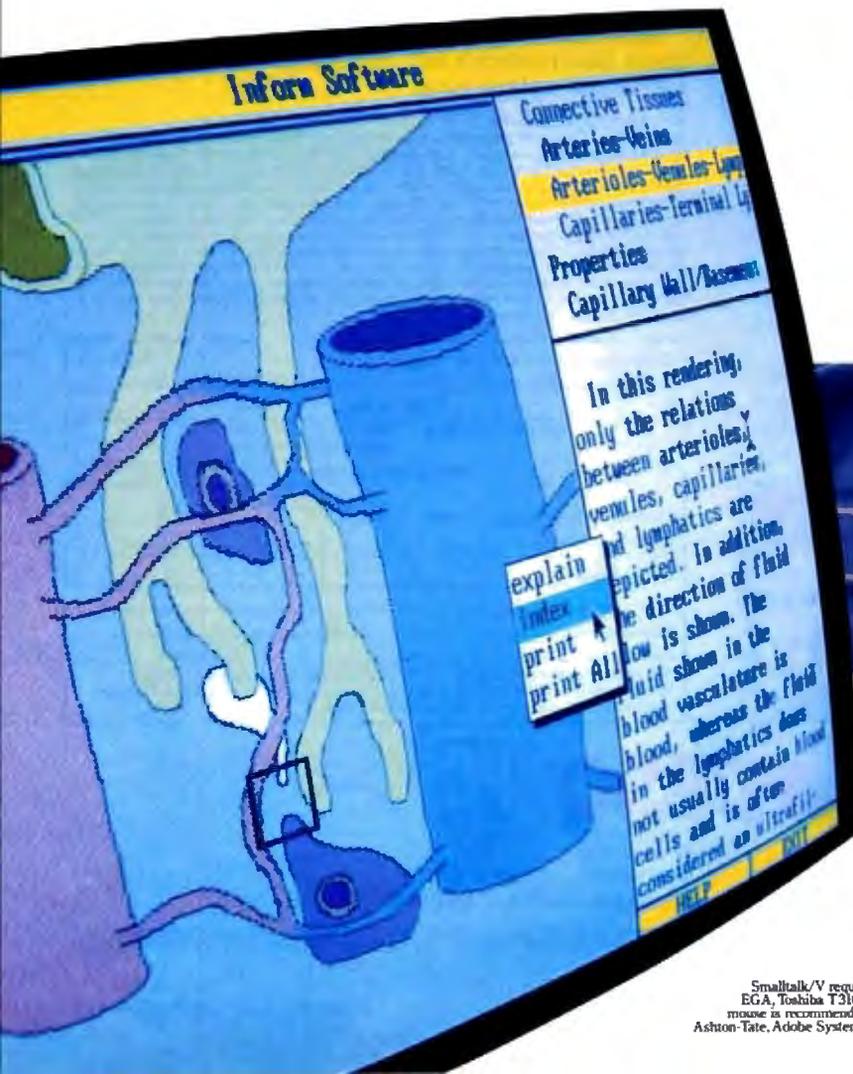
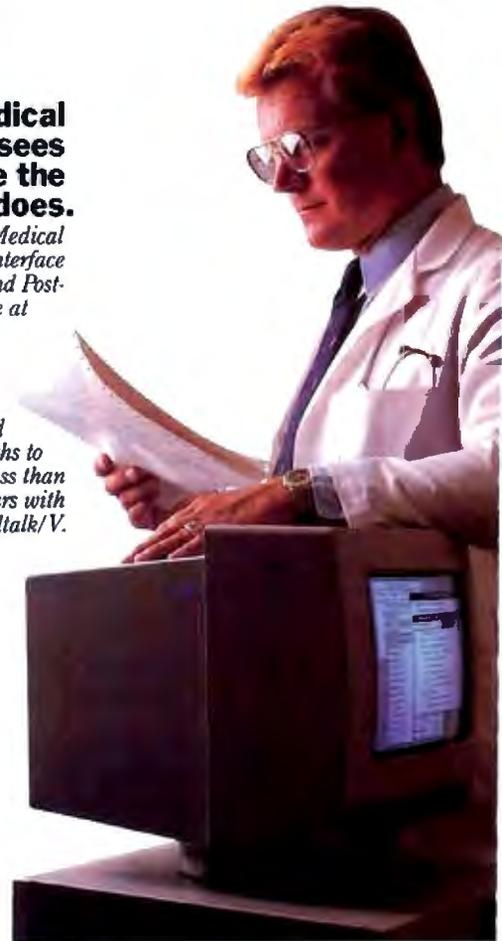
Today, the single most important emerging software technology is OOPS, object-oriented programming. It's destined to dramatically change the way you use your personal computer. You'll find it doing things you never expected. And by people you never suspected.

In an emergency room in Vancouver, it's saving lives through animation.

What if a medical textbook could come to life? What if it could show the effects emergency treatment might have on patients? And do it all through moving pictures? These thoughts led Folkstone Design, Edge Training & Consulting, and Inform Software in Vancouver, B.C., to create the first animated, interactive textbook for emergency room technicians and in-training paramedics. They found Smalltalk/V could easily facilitate a combination of text, color graphics and animation to illustrate various physical processes and the results of medical intervention.

At the UCLA Medical Center, it sees patients before the doctor does.

Mike McCoy, M.D., at the UCLA Medical Center, found that he could easily interface Smalltalk/V with dBASEIII and PostScript. His application, now in use at the Clinic, turns a functional status questionnaire on each new patient into a laser printed, advisory analysis for the doctor to review prior to seeing the patient. A program like this would normally take a specialist months to produce. It took Dr. McCoy less than 100 hours with Smalltalk/V.



It's working on Florida's freeways.

Running on IBM's new PS/2, a Smalltalk/V application developed by Greiner Engineering's Mike Rice, lets highway engineers create highly sophisticated graphic analyses of any proposed reconstruction. So now, instead of having to deal with a gridlock of Federal and State regulations, engineering specifications and endless calculations, an engineer can quickly explore alternative design strategies using a mouse, windows and VGA color graphics.

Smalltalk/V requires DOS and 512K RAM on IBM PC/AT/PS or compatibles and a CGA, EGA, Toshiba T3100, Hercules, or AT&T 6300 graphic controller. A Microsoft or compatible mouse is recommended. Not copy protected. dBASEIII, PostScript and PS/2 are trademarks of Ashton-Tate, Adobe Systems and International Business Machines Corporation respectively.



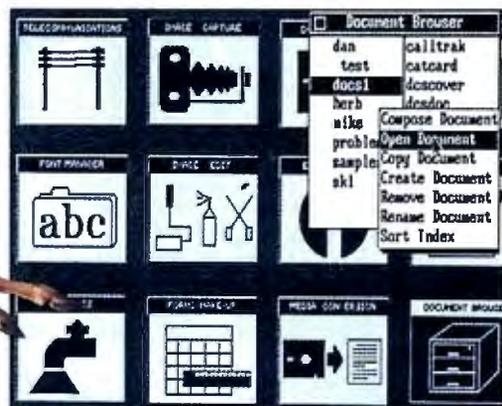
It's tracking white-tail deer on the Barrier Islands of Georgia.

Dr. Lee Graham, a National Park Service ecologist chose Smalltalk/V to write an application to help manage the white-tail deer population on the Barrier Islands of Georgia. Dr. Graham found that Smalltalk/V, with its visual interface and class structure, is a perfect tool to graphically simulate the complex, ecological interactions of natural systems.



You can find it in space.

On a project commissioned by NASA, Dr. Christine Mitchell at the Georgia Institute of Technology, chose to use Smalltalk/V as an integral part of a new man-machine interface. The application, written in Smalltalk, continually monitors the commands of the Satellite Network Operator, the state-of-the-network and the overall mission plans. To NASA, Smalltalk/V means real-time. Real OOPS. Real results.



It's making headlines in Arizona.

When Digital Composition Systems sat down to build an electronic typesetting system, they had three major requirements. It had to have the most advanced user interface. It had to be fast. And, it had to be able to turn untrained personnel into high quality typographers. Of all the languages in the world, they chose Smalltalk/V. The result is the Signature Series, recognized and reviewed by The Seybold Report. It's now marketed by Digital Composition Systems and one of the largest digital typesetting firms in the world, Vartyper AM International.

What thousands of people have found is OOPS.

Object-Oriented Programming (OOPS) is programming by defining objects, their inter-relationships and their behavior. Objects can represent both real-world entities like people, places, or things. They can also represent useful abstractions such as stacks, sets and rectangles.

OOPS models the way you think and the way things really are. It lets you solve problems by breaking them down into easily handled sub-problems and their inter-relationships. The solutions you come up with can be re-used to solve new problems. Ultimately, OOPS makes programming a simple,

logical process of building on the work of others.

Why thousands more are finding their way to Smalltalk/V.

First of all, Smalltalk/V makes OOPS easy.

It's also fast. In fact, it's the fastest OOPS programming available on a PC.

And it's easy to learn. It comes complete with a tutorial that's the best introduction to OOPS available.

Smalltalk/V also has a few other features worth noting. Like a user-extendable, open ended environment. Source code with browser windows for easy access and modification. A huge toolkit of classes and objects for building a variety of applications. A sophisticated source-level debugger. Object-oriented Prolog integrated with the Smalltalk environment. And bit-mapped graphics with bit and form editors, just to name a few.

Then, there's its unbelievable price of only \$99.95. (Optional application packs at \$49.95 include Communications, EGA/VGA Color and Goodies.)

And it has a 60 day, money-back guarantee.

With all this to offer, it probably won't come as a surprise to you that more people are solving more problems with Smalltalk/V than any other OOPS.

See your nearest dealer today for your own Smalltalk/V. Or, order it direct with MasterCard or Visa at (800) 922-8255.

Or, write to Digitalk, Inc., 9841 Airport Blvd., Los Angeles, CA 90045. Then discover all the great things you can do with your PC and Smalltalk/V.

Smalltalk/V

digitalk inc.



*Now that you've found us, write us. Tell us some of the great things you're doing with Smalltalk/V. You could be in our next ad.

WATCH WHAT YOU'RE DOING.



Introducing UniLab 8620 analyzer-emulator with InSight.

■ There's nothing like InSight™ A feature of the new 8620 that lets you actually watch your program go through its paces. So you can debug faster. And speed up microprocessor development. For demanding applications like the automotive controller shown.

■ An exciting industry first, InSight blends analyzer/emulator techniques to give you continuous, real time monitoring of key processor functions. See changing register contents, I/O lines, ports, user-defined memory windows. With your own labels. And all at once. Interactively. Without stopping your program.



■ InSight is made possible by the 8620's advanced bus state analyzer, its 2730-bus-cycle trace buffer, and a new high-speed parallel interface that eliminates RS-232 bottlenecks.

■ The fast interface also speeds data throughput. From your hard drive, you can load a 64K program into emulation memory in five seconds.

■ On top of that, you get a new, crystal-controlled 1 μ sec clock for super precise event timing.

■ Computer integrated instruments from Orion prove debugging needn't be costly or tedious. For more than 150 processors. Like all our analyzer-emulators, the 8620 debugs by symptom. Via advanced truth table triggering. Always included is enough breakpointing and single stepping (now faster than ever) to assure optimum efficiency. We even provide a stimulus generator and built-in EPROM programmer to help finish the job.

■ Get serious about price/performance. Save big on design, test, and support costs. UniLab 8620 analyzer-emulator.

■ Look into it.

Toll free: 800/245-8500. In CA: 415/361-8883.

ORION
INSTRUMENTS

Computer Integrated Instrumentation
702 Marshall Street, Redwood City, CA 94063
Telex: 530942

*InSight is a trademark of Orion Instruments, Inc.

Circle 195 on Reader Service Card



SQL Database Management Systems

Richard Finkelstein and Fabian Pascal

Everybody seems to be talking about SQL (Structured Query Language) for relational database management systems (RDBMSes). But even though most major database suppliers have announced future support of SQL in their products, only a half-dozen database software packages for the IBM PC or PC AT currently claim to use SQL: Informix-SQL, Ingres for PCs, Oracle, SQLBase, XDB II, and XQL.

The major strength of SQL is that it deals with *sets* of data. In fact, SQL is defined by relational mathematics—the very base of relational databases. It therefore needs no new constructs to solve any database management problem. Moreover, the nature of SQL lets you simply tell the RDBMS “what” you want done without having to tell it “how.” Also, SQL offers a standard (as defined by ANSI and IBM) method to query very large databases and exchange data with mainframes.

The problem is that SQL has created a lot of confusion. At the heart of this confusion is the standards issue. Based on IBM's Database 2 (DB2) mainframe product, ANSI defined two levels of SQL: Level 1, which is a rudimentary definition, and Level 2, which is more comprehensive.

All implementations but XQL come close to matching Level 2 and then go beyond that by offering several enhancements. Also, the way in which the query optimizer is implemented can greatly affect the performance of the database. [Editor's note: See “Fast Data Access” by Jonathan Robie on page 243.]

Informix-SQL

Informix-SQL 2.0 (\$795) from Informix Software has three major components: an interactive SQL capability, an application development tool (Perform), and a report writer (Ace). It requires an IBM PC, PC AT, or compatible with a hard disk drive, 640K bytes of RAM, and DOS 2.1 or higher.

A look at the six packages for the IBM PC or PC AT that now use SQL

The interactive portion of the package lets you enter an SQL query, store it, retrieve a previously stored query, and execute a query. Results are displayed on the screen, and you can then scroll forward through them. Options to change databases, create tables, execute queries, and so forth are displayed at the top of the screen.

Perform lets you develop screens to maintain the tables in the database. It is composed of nonprocedural commands that describe the screen, specify editing criteria for the fields, and permit some basic assignment and arithmetic commands to manipulate screen data.

Ace has a similar architecture, composed of nonprocedural commands that describe the report layout and the data items that appear on the report.

Unfortunately, Perform and Ace do not use SQL. To compensate for this, Informix Software developed Informix-

4GL 1.0 (\$995). Its purpose is to provide an application developer with a fully functional development tool that can access databases using SQL. Developers can retrieve, update, and insert sets of rows with SQL.

You can also use SQL to provide sophisticated, yet concise, editing logic. Informix-4GL contains a full complement of statistical functions, string-manipulation commands, and array-handling capabilities. It also contains basic assignment and looping constructs.

Informix-4GL doesn't have a screen painter, which could be a time-saver during the screen-design process. Informix-4GL is portable to a wide variety of platforms, including many Unix machines and DEC's VMS operating system.

Informix-SQL 2.1 and Informix-4GL 1.1, which feature improved performance characteristics, are now available.

Informix offers two types of network architectures. It can support local-area networks (LANs) (e.g., Novell, PC Network, and IBM's Token-Ring) by having Informix software at each workstation access a database residing on a file server.

If a system can use a Unix system as a database server, Informix offers an alternative requester/server network called StarLAN, which places one copy of the Informix database manager on a central Unix node. Applications built using Informix-SQL or Informix-4GL access all database information through this central

continued

Informix-SQL

Ingres for PCs

Oracle

SQLBase

XDB II

XQL

Richard Finkelstein is a senior consultant with Codd and Date Consulting Group (25 East Washington St., Suite 1500, Chicago, IL 60602) and author of the upcoming book Using SQL on the PC, to be published by Howard W. Sams.

Fabian Pascal (2950 Van Ness St. NW, #524, Washington, DC 20008) is an independent consultant specializing in SQL DBMSes. He has published a report concerning optimizers and performance for SQL PC database products.

Because Oracle 5.1 mimics mainframe versions, it requires 1 megabyte of extended memory.

node, while executing their program logic on the local IBM PC workstations. This type of system provides better recovery, locking, and security than a file-server approach, while reducing network traffic for increased performance.

Recently, Informix introduced a high-performance database server called Turbo. Besides increasing performance even further, Turbo has better concurrency control and recovery than did its predecessors.

Informix offers several other tools for the IBM PC. One of them is the Informix Datasheet Add-In (\$199.95), which merges a Lotus 1-2-3 worksheet with an Informix database. Informix also gives programmers the capability of writing programs in procedural languages with embedded SQL using an embedded-language interface. While Informix provides C, Ada, and COBOL embedded-language capabilities in its Unix versions, the IBM PC version currently has only a C interface available (ESQL/C for \$595).

Ingres for PCs

Ingres for PCs 5.0 (\$950) from Relational Technology has its roots in the mini-computer world, as do Informix-SQL and Oracle. It requires an IBM PC, PC AT, or compatible with two floppy disk drives, 640K bytes of RAM, and DOS 2.1 or higher. Ingres was originally developed at the University of California at Berkeley and was one of the first RDBMSes.

The commercial implementation of Ingres for mainframes (a public domain version also exists) has the largest installed base among DEC VAX users. The IBM PC version maintains the same front end as the mainframe version of Ingres, but it was rewritten to take full advantage of the PC architecture.

Ingres has always been known for its strong internal architecture. It has sophisticated optimizer algorithms that greatly enhance performance. The basic product supports both SQL and Ingres's proprietary relational language called QUEL. Even though QUEL is very powerful, Relational Technology has chosen to also support SQL to maintain the industry standard.

You can access Ingres's databases with command-language statements or with a query-by-example facility. (This facility, which is forms-oriented, lets you manipulate data in designated fields in a fill-in-the-blank way.) The command-language interface allows queries to be stored and retrieved. You can scroll the results up, down, left, and right.

The Query-By-Forms (QBF) tool creates default screens for tables, views, or JoinDefs. Views store logical table definitions and let you access those defined tables just as any other table. JoinDefs are defined joins of two tables. You can update tables through JoinDefs but not through SQL views. End users can enter queries using QBF in a query-by-example mode by simply entering values and Boolean operations in the screen fields. Results are retrieved, and users can browse through them a screen at a time.

For more sophisticated applications, Relational Technology offers Ingres 4GL (\$500). Ingres 4GL is powerful in that it handles complex entry and update applications, like those that require multiple tables per screen, and it is well integrated with QBF, SQL, and the Ingres report writer. It can also access programs written in Ingres's C interface. The screen painter that comes with Ingres 4GL is easy to use, and it lets a developer build and change screens quickly and easily.

Ingres's report writer is also nice, but it is missing the Report-By-Forms (RBF) interface supplied on the mainframe versions of Ingres. RBF allows reports to be designed on a screen. The company says RBF will be available early in 1988.

Relational Technology recently announced several gateway products that let users access non-Ingres databases. On the PC, Ingres now offers a gateway to dBASE III files.

Oracle

Oracle 5.1 (\$1295), recently released by Oracle Corp., is a direct port of Oracle's minicomputer and mainframe counterparts. Because version 5.1 includes many new capabilities and mimics Oracle's mainframe versions, it requires a minimum of 1 megabyte of extended memory on an otherwise standard IBM PC AT with a hard disk drive and DOS 3.1 or higher.

While this is a nonstandard hardware environment, it does provide more room than the other programs for application code by leaving most of the 640K bytes of main memory free. Also, it increases performance with sophisticated data-buffer management. Oracle will run on 100 percent IBM compatibles like the Compaq, but it may have problems running on other clones because of ROM

BIOS sensitivity. The company maintains a list of manufacturers it supports.

You can enter, edit, and save SQL queries using SQL*Plus. Multiple rows of retrieved data are displayed a screen at a time. When the screen becomes full, the user is asked if more rows should be displayed. Unfortunately, no scrolling is supported.

An earlier version of Oracle, 4.1, supported an end-user query tool called Easy*SQL. This package prompted users with questions and built SQL commands automatically. Casual users, therefore, did not have to know SQL to use Oracle. Easy*SQL is currently not available for version 5.1, but it is due out in 1988. Oracle has also announced Oracle QMX for 1988. This is a query-by-example interactive interface similar to IBM's QMF mainframe product.

SQL*Forms is Oracle's nonprocedural application development tool. It has a nice window interface and also contains a screen painter for screen design and "triggers," which execute SQL procedures at specific points on the forms (e.g., on entry or on exit from fields and on exit from a form). Procedures consist of SQL commands and other types of instructions (e.g., assignment and string-manipulation operations).

Packages like Ingres, Informix-SQL, and XDB II combine explicit statements like IF... THEN... ELSE statements with SQL to control the program logic. In Oracle, this is done implicitly with triggers, which execute SQL statements and can activate other triggers depending on whether a return condition is true or false. Both of these environments are very powerful and much easier to work with than procedural languages. For those who need procedural languages, C and FORTRAN interfaces for Oracle are included, and a COBOL interface is available for \$395.

SQL*Reports is a capable tool, but it is limited in that it cannot handle heavily formatted reports. However, Oracle is promising a highly functional report writer in early 1988. In the meantime, you can purchase SQR (\$295) from SQ Software (2000 Lee Rd., Cleveland, OH 44118, (216) 397-0551). This package, which is also available for SQLBase, greatly enhances Oracle's report-writing capabilities by letting you generate complex reports.

Oracle bundles an add-in module with the package that you may find helpful. SQL*Calc is an integrated spreadsheet that can access Oracle databases. Oracle has also announced a Lotus 1-2-3 interface for users who need to interface directly with 1-2-3 worksheets.

If you want to run Oracle in a network,

Networkstation Oracle provides a link between an Oracle application running on a PC with an Oracle database residing on a minicomputer.

Oracle also offers a distributed database product, SQL*Star. While this has limited optimization—it cannot decide whether a distributed database join, for example, should be done on the mainframe or the IBM PC—and does not include distributed update capabilities, it does let you transparently access Oracle databases at remote sites.

Oracle has also announced a database server that will be able to run on the IBM PC AT under the Xenix operating system. According to the company, this product should now be available.

SQLBase

SQLBase from Gupta Technologies was the first DBMS to implement a requester/server architecture on a LAN using a PC AT at the server node. SQLBase 3.2.2 (\$995, single-user; \$1995, multiuser) was specifically designed to work in a requester/server environment and can manage its own multitasking under DOS. It requires a PC AT or compatible with a hard disk drive, 640K bytes of RAM, and DOS 3.1 or higher. (Gupta should be shipping version 3.3 by the time you read this.)

At the time of this review, several other SQL vendors, including Oracle, Relational Technology, and Software Systems Technology, had announced database servers for the PC AT, but Gupta Technologies is the only company to implement an SQL server under DOS.

Database servers can centrally control database locking, recovery, and security. All this is done automatically by the database server, relieving the programmer from the problems of transaction and recovery management.

Under typical networked database configurations, each workstation includes its own copy of the RDBMS. Each time an application requests rows of information from tables, the RDBMS goes to the file server to retrieve all the rows from all the tables that are part of the request. The RDBMS then selects particular rows from the tables at the workstation.

In a requester/server environment, all database processing is performed by the server. Only those rows that are specifically needed are sent back to the requester (workstation), reducing network traffic and increasing performance. All database transaction and recovery management (locking, commit, rollback, security, and so forth) are centrally controlled by the server, providing a stable network environment. The workstation

continued

Table 1: The basic list of SQL commands. A "Yes" indicates the package includes a particular command; a "No" indicates it does not. All packages except for XQL meet at least the ANSI Level 1 SQL implementation.

SQL Command	Informix 2.0 (\$795)	Ingres 5.0 (\$950)	Oracle 5.1 (\$1295)	SQLBase 3.2.2 (\$995)	XDB II (\$395)	XQL 1.0 (\$795)
DML						
SELECT	Yes	Yes	Yes	Yes	Yes	Yes
COLUMNS	Yes	Yes	Yes	Yes	Yes	Yes
EXPRESSIONS	Yes	Yes	Yes	Yes	Yes	No
DISTINCT	Yes	Yes	Yes	Yes	Yes	No
FROM	Yes	Yes	Yes	Yes	Yes	Yes
WHERE	Yes	Yes	Yes	Yes	Yes	Yes
GROUP BY	Yes	Yes	Yes	Yes	Yes	Yes
HAVING	Yes	Yes	Yes	Yes	Yes	Yes
ORDER BY	Yes	Yes	Yes	Yes	Yes	Yes
SUBQUERIES	Yes	Yes ⁶	Yes	Yes	Yes	Yes
UPDATE SET	Yes	Yes	Yes	Yes	Yes	Yes
WHERE	Yes	Yes	Yes	Yes	Yes	Yes
SUBQUERIES	Yes	Yes	Yes	Yes	Yes	No
INSERT INTO	Yes	Yes	Yes	Yes	Yes	Yes
SUBQUERY	Yes	Yes	Yes	Yes	Yes	No
DELETE FROM	Yes	Yes	Yes	Yes	Yes	Yes
SUBQUERY	Yes	Yes	Yes	Yes	Yes	Yes
UNION	Yes	Yes	Yes	Yes	Yes	No
CORRELATED QUERIES	Yes	Yes	Yes	Yes	Yes	No
DML Predicates						
BETWEEN	Yes	Yes	Yes	Yes	Yes	Yes
LIKE	Yes	Yes	Yes	Yes	Yes	No ¹
IS NULL	Yes	No	Yes	Yes	Yes	Yes
EXISTS	Yes	Yes	Yes	Yes	Yes	No
ALL	Yes	Yes	Yes	Yes	Yes	No
ANY	Yes	Yes	Yes	Yes	Yes	No
SOME	No	No	No	No	No	No
[NOT]	Yes	Yes	Yes	Yes	Yes	Yes
DML Functions						
AVG	Yes	Yes	Yes	Yes	Yes	Yes
COUNT (*)	Yes	Yes	Yes	Yes	Yes	No
COUNT	Yes	Yes	Yes	Yes	Yes	Yes
MAX	Yes	Yes	Yes	Yes	Yes	Yes
MIN	Yes	Yes	Yes	Yes	Yes	Yes
SUM	Yes	Yes	Yes	Yes	Yes	Yes
DDL						
ALTER TABLE	Yes	No	Yes	Yes	Yes	Yes
CREATE TABLE	Yes	Yes	Yes	Yes	Yes	Yes
NOT NULL	Yes	No	Yes	Yes	Yes	No
CREATE INDEX	Yes	Yes	Yes	Yes	Yes	Yes
CREATE UNIQUE INDEX	Yes	No	Yes	Yes	Yes	No ²
CREATE VIEW	Yes	Yes	Yes	Yes	Yes	Yes
DROP TABLE	Yes	Yes	Yes	Yes	Yes	Yes
DROP INDEX	Yes	Yes	Yes	Yes	Yes	Yes
DCL						
GRANT	No ³	No ⁴	Yes	Yes	Yes	Yes
REVOKE	No ³	No ⁴	Yes	Yes	Yes	Yes
Other						
COMMIT WORK	Yes	No ⁵	Yes	Yes	Yes	No
ROLLBACK WORK	Yes	No ⁵	Yes	Yes	Yes	No

¹ XQL supports CONTAINS, which is a subset of LIKE.

² XQL supports UNIQUE indexes with field attributes in the CREATE INDEX statement.

³ Informix supports GRANT and REVOKE on its multiuser versions.

⁴ Ingres supports GRANT and REVOKE on its multiuser versions.

⁵ Ingres supports COMMIT WORK and ROLLBACK WORK on its multiuser versions.

⁶ Ingres subqueries cannot include built-in functions.

still executes the program logic but is relieved of all DBMS activity.

SQLBase can manage several servers on a network, and the program on a given PC can connect to any database on any server. The SQLBase catalog keeps track

of which server contains which database. This capability implements a form of distributed database processing. Programmers must still manage their own commit logic (in SQL terms, all modifications are tentative until they are made firm [com-

mitted] or erased [rolled back]) when updating across multiple servers.

Gupta Technologies now offers a companion product called SQLNet, which costs \$20,000 per mainframe and \$1995 per PC gateway. This provides an APPC (advanced program-to-program communication) link to mainframe relational databases like DB2. Essentially, this lets the program on the PC interact with a mainframe database in the same way that it interacts with any other database on the network. The APPC link will send SQL requests to DB2 and receive back any rows returned by DB2.

SQLBase's end-user and development tools consist of an interactive SQL capability and a C interface that contains embedded SQL statements. According to the company, SQLWindows, a top layer to SQL that provides 4GL capabilities, should be available in the first quarter of 1988. Developers who need to create reports can use SQ Software's SQR report writer, which is available from Gupta Technologies for \$295.

XDB II

What distinguishes Software Systems Technology's XDB II (\$395) from its competitors are its friendly end-user interface and application development tool set. It requires an IBM PC, PC AT, or compatible with two double-sided floppy disk drives (a hard disk drive is recommended), 512K bytes of RAM, and DOS 2.0 or higher. The company clearly understands the types of tools required on the PC and has built them so that they can be quickly learned by novice users.

Upon entering XDB, you are presented with a menu listing all the options. The first option lets you create or alter tables using a table-definition screen. You can also use the SQL command language, but you will probably find the ease of the table-creation facility more to your liking.

Another option gives you update or query capabilities on single tables using XDB's Edit program. Edit creates a default screen for a table and lets you enter new rows, update existing rows, and delete rows in a table. If you want to browse through the table, you can enter search criteria in the fields, and XDB will retrieve all rows that meet the criteria. If more than one row is retrieved, you can use the PageUp and PageDown keys to browse through the rows.

XDB's interactive SQL lets you store queries and retrieve them for later use. The queries can be stored with a comment to assist you in recalling the correct query. Results of queries are displayed on the screen multiple rows at a time. You

continued

Table 2: Extensions that vendors have implemented. While each company may not explicitly implement the extension in the same way, similar functions are grouped under the same command. You should refer to a vendor's documentation for the exact definition and SQL command for the indicated function.

SQL Extension	Informix	Ingres	Oracle	SQLBase	XDB II	XQL
DML						
Outer join	Yes	No	Yes	No	No	No
Update statistics	Yes	No	No	No	No	No
Select into temp	Yes	No	No	No	No	No
Recursive select	No	No	Yes	No	Yes	No
Edit masks	No	No	Yes	No	No	Yes
Update set Subquery	No	No	Yes	No	No	No
Functions						
Statistical	No	No	Yes	No	Yes	No
Arithmetic	No	Yes	Yes	No	Yes	No
String functions	No	Yes	Yes	Yes	Yes	No
Date and time	Yes	Yes	Yes	Yes	Yes	No
DDL						
Create table						
with check option	No	No	No	Yes	No	Yes
Create table as select	No	Yes	Yes	No	Yes	No
Create synonym	No	No	Yes	Yes	Yes	No
Rename table	Yes	No	Yes	Yes	Yes	No
Modify columns	Yes	Yes	Yes	Yes	Yes	Yes

Table 3: We conducted the following nine tests on each package. Descriptions accompany the SQL queries.

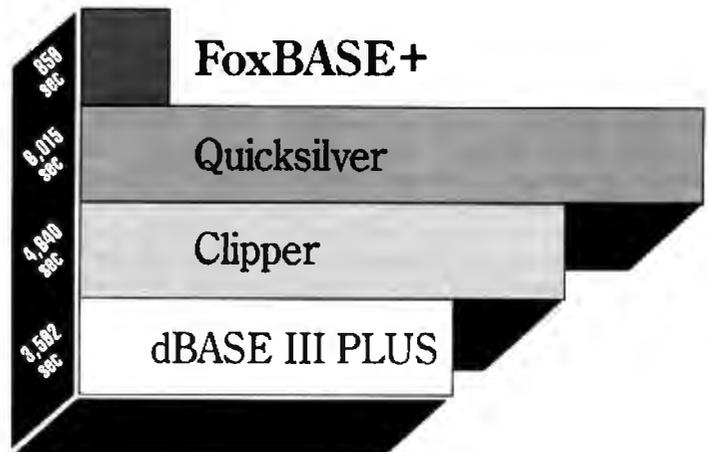
1. Load 1000 records.
2. Create a unique index on sequence number (SEQNO).
3. Create an index on ZIP.
4. SELECT * FROM PERSONS WHERE ZIP = '60606' AND SEQNO < '999'
(Tests the ability of the optimizer to choose the correct index. In this case, performance is increased by using the index ZIP.)
5. SELECT * FROM PERSONS WHERE ZIP = '60606' OR SEQNO = '999'
(Tests the ability of the optimizer to use indexes in OR logic. In this case, using both indexes reduces the query to select just those rows that meet the ZIP-code or sequence-number criteria, but simply scanning the full table takes a great deal of time. Note that if the query was SEQNO < '999', the index should not be used.)
6. SELECT * FROM PERSONS WHERE SEQNO > '980' ORDER BY ZIP
(Tests the ability of the optimizer to use the ZIP index so that the query does not require an external sort.)
7. SELECT SUM(SALARY) FROM PERSONS
(Tests the aggregate [mathematical] functions.)
8. SELECT ZIP FROM PERSONS GROUP BY ZIP HAVING COUNT(*) > 5
(Grouping requires a sort with the additional grouping functions. Packages with efficient sorts will fare best on this test.)
9. SELECT A.SEQNO, B.SALARY FROM PERSONS A, PERSONS B
WHERE A.SEQNO = B.SEQNO AND A.ZIP LIKE '606%'
(Tests self-join with LIKE selection algorithms. There are several ways of executing this query. For example, the rows that contain '606%' can be chosen first and then joined, or the optimizer can join all rows first and select only those with a ZIP of '606%.')

dBASE Users!
Independent Reviewers Say:

Nobody Beats The Fox ...Nobody's Even Close



Data Based Advisor



BYTE Magazine

FoxBASE+ Fastest By Far

BYTE* benchmarks show that FoxBASE+ takes only 14 minutes to do what dBASE III PLUS needs an hour to do. The others are even slower. Clipper needs an hour and 17 minutes. Quicksilver needs an hour and 40 minutes.

Nobody beat FoxBASE+ in *even one* of the 27 BYTE benchmarks.

FoxBASE+ zipped through the exhaustive Data Based Advisor** benchmarks in just 15.5 minutes. New FoxBASE+/386 ran them in only 7 minutes! By contrast Clipper took 53

minutes, Quicksilver took 59 minutes, and dBASE III PLUS took an hour and 18 minutes.

Why Waste Your Time?

BYTE's data shows FoxBASE+ is up to 7 times faster. DBA's benchmarks show FoxBASE+ is over 5 times faster.

You can *run* with Fox... or you can *crawl* with them.

FoxBASE+ Delivers Now... The Others Only Promise

We're totally committed to insuring that FoxBASE+ will *always* be fastest... now and in the future. *You can't buy a faster product.*

But that's not all...

FoxBASE+ offers other great features like: true compatibility... familiar interactive commands like BROWSE and EDIT... "dot-prompt" programming... major language extensions... ideal development environment... and a *money-back guarantee*.

So call us for the details. After all...

Nothing Runs Like a Fox.

FOXBASE™ 

FoxBASE, FoxBASE+, and FoxBASE+/386 are trademarks of Fox Software. dBASE III PLUS is a trademark of Ashton-Tate. Clipper is a trademark of Nantucket. Quicksilver is a trademark of WordTech Systems.

*Using the benchmark timings published in BYTE, September 1987.

**Using the suite of benchmarks published in Data Based Advisor, March 1987.

Fox Software
118 W. South Boundary, Perrysburg, Ohio 43551
(419) 874-0162 Telex: 6503040827 FOX
FAX: (419) 874-8678

can scroll right, left, up, and down to review the results of a query. Query results can be printed immediately or formatted with the interactive report writer.

The report writer is accessed directly from the interactive SQL facility. Once loaded, the report writer can format a report by moving columns to different positions on a line or to different lines. You can add titles, perform calculations, change column names, assign report breaks, and define the physical-report format page and margin sizes.

Throughout this process, you can see the effects of each command immediately on the screen. When the report is completed, you can print it out or save the commands in a special report file. The commands can then be executed again with another interactive SQL query, or they can be run in a batch mode.

The application development tools of XDB include the optional Forms generation package (\$295), which lets you paint a screen, define edit logic, and use SQL for inserts, updates, and deletes. The system is window-oriented and easy to use. Forms can also be run in a batch mode and can be used to create complex reports beyond the scope of XDB's report writer.

XDB also includes a simple-to-use menu generator that is used to integrate a set of reports, forms, .BAT files, DOS commands, or other menus into an application. You can purchase an optional graphics package for \$69. Other options include C and COBOL interfaces for \$295 and \$395, respectively. These interfaces let you embed SQL commands into your programs.

XQL

XQL 1.0 (\$795) comes from Novell Development Products Division, formerly SoftCraft, the developers of the well-known and highly regarded Btrieve. XQL requires an IBM PC, PC AT, or compatible with a hard disk drive, 512K bytes of RAM, and DOS 2.1 or higher. Btrieve 4.10, necessary but sold separately (\$245, single-user; \$595, multiuser), provides a sophisticated file management system that application developers can include in BASIC, Pascal, and C programs.

XQL is an attempt to place a relational database layer on top of the Btrieve system. However, XQL does not conform to any SQL standard. Unfortunately, Novell touts it as being an SQL product, which only clouds the otherwise good improvements to Btrieve that XQL delivers.

XQL has its own syntax that does not match any SQL database mentioned in this review. SQL users will be frustrated with this unique implementation. XQL is missing many important SQL operations, including subquery capabilities, from

which SQL derives its name (the "structured" in "structured query language" comes from its subquery functions). Refer to table 1 for more details on XQL's syntax limitations.

XQL also has an awkward optimizer. All tables require at least one index, and the secondary-table column in a join must be indexed. The optimizer is very crude and frequently disrupts the query. For instance, if you restrict a SELECT command (by using a WHERE clause), the XQL optimizer will attempt to use an index to increase performance.

On the other hand, if the command includes an ORDER BY, it will override the optimization. A developer is therefore forced to make a decision between optimization and sorting. Other peculiarities of the XQL optimizer are conscientiously discussed in the documentation.

Despite these serious limitations, XQL does provide an interactive retrieval capability. Only forward scrolling is supported, but results can be output to any device. XQL queries can be stored or retrieved for future use.

The XQL query language can be embedded into BASIC, Pascal, and C programs. XQL lets programmers manipulate both application-defined tables and system-catalog tables. Table and field definitions can be interrogated and modified, and security can be maintained from within a program.

Novell offers a network database server called Btrieve/N, which implements the database server/requester architecture. It has fairly good locking and recovery facilities, though not on a par with SQLBase, in that it does not provide precise record and page locking.

There is much merit in what Novell has attempted, but we strongly disagree with labeling this language SQL. The company recognizes the limitations of XQL and says it is in the process of developing a full SQL implementation. In the mean-

time, Btrieve users will probably appreciate the XQL interface, but they should not confuse it with SQL.

Standard SQL Features

Table 1 lists standard SQL DML (data-manipulation language), DDL (data-definition language), and DCL (data-control language) commands. These are found in the ANSI and IBM standards. The DML contains the basic SELECT, UPDATE, INSERT, and DELETE commands.

All commands should have subquery capabilities. The EXISTS predicate is particularly important, since it is required for the relational division operation. IS NULL supports null values, and the UNION command supports the relational union operation.

The DDL is used to define tables, indexes, and views. All packages support these commands, but each differs on the data types supported. ANSI Level 2 also requires a PRIMARY KEY specification, which all the packages are missing.

COMMIT WORK and ROLLBACK WORK are transaction-management commands that let you physically commit or roll back database modifications. All the packages that implement this command can be

continued

Table 4: A description of the PERSONS table created by the performance tests.

```
SEQNO CHAR(4)
NAME CHAR(30)
TITLE CHAR(30)
COMPANY CHAR(30)
DEPARTMENT CHAR(30)
ADDRESS CHAR(30)
ADDRESS2 CHAR(30)
CITY CHAR(20)
STATE CHAR(2)
ZIP CHAR(10)
SALARY MONEY
```

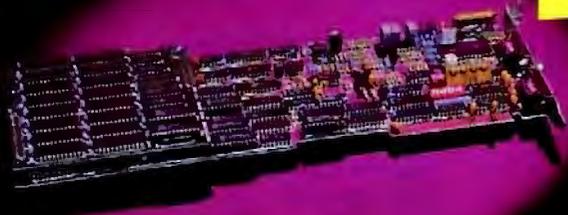
Table 5: Performance test results. All times are in seconds.

Query No.	Informix	Ingres	Oracle	SQLBase	XDB II	XQL
1	23	29	76	35	64	316 ¹
2	43	30	21	46	16	1
3	78	22	24	48	18	23
4	39	6	5	2	1	4
5	20	13	5	23	9	29
6	10	21	24	22	7	6
7	26	9	8	17	9	44
8	124	41	15	9	30	37
9	19	33	24	46	40	12

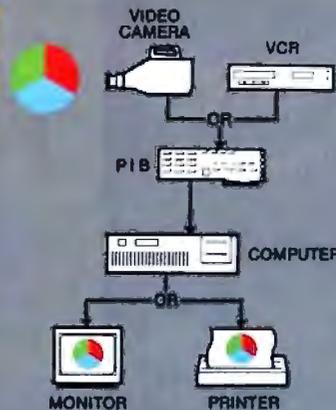
¹ XQL requires that a unique index exist when the table is initially defined. The results of test 1 include the time required for test 2. The XQLUTIL utility was used, which loads a table with a series of SQL inserts. Loading may be faster using the Btrieve load utility.

Professional Image Board 512 x 512
Professional Image Board 512 x 256

Capture Up To
32,768
Colors



Displays on the New IBM PS/2 Analog Color Monitor



Creating
With
Pictures
Just Got
Easier!

Will RUN
OS/2 Software



ATI-6/12 System 286

Norton 3.0
SI Rating 18.7



ATI-286 8/16 MHz
System Board

ADVANCE TO THE NEXT LEVEL

Professional Image Board 512 x 256

Just plug the PIB board into your IBM PC/XT/AT or compatible which allows an ordinary home video camera (color or B/W) or home VCR to be plugged into your system. Now, live, fast action images can be instantly captured and frozen (1/30 second) in a full 32,768 colors. The frozen picture is as close to television quality as can be, digitized by the software package we bundle with PIB board. This software package HALOVISION Written by MEDIA CYBERNETICS INC. allows you to edit, cut, paste, copy, rotate, brush, zoom, scale, add text (21 text fonts) free hand draw, print, etc. . . The PIB is also compatible with the new IBM PS/2 Model 30 and the image can be displayed on IBM's new analog color monitor. Or you can convert the image to EGA display mode. The image can be stored on floppy or hard disk and transmitted to any remote location in the world via modem.

ATI-6/12 System 286

The ATI-6/12 SYSTEM 286 runs at an amazing speed of 12MHz. That's 20% faster than new IBM PS/2 model 50 and 60. To protect your existing software investment, we build-in a normal speed 6MHz, a simple combination of keystrokes will change the speed of the system at any time when necessary. 6/8MHz, 6/10MHz zero wait state and 1 wait state systems also available. Runs all existing software written for IBM PC/XT/AT, including new OS/2 development software.

Professional Image Board Plus 512 x 512

Same features as the PIB 512 x 256 with resolution enhanced to 512 x 512 pixels.

ATI-8/16MHz System Board

This system board runs at 16MHz, 1 wait state Norton 3.0 rating is 18.7 (Compaq deskpro 386 and the new IBM PS/2 Model 80 rating is 18.00 to 18.7). With a fraction of the cost of 386 systems, you can upgrade your 286 system to 386 system performance by replacing your existing 286 system board. Almost all existing add-on cards still work with this system board. This system boards standard feature is a 1MB high speed memory also switchable to 8MHz by keyboard when necessary.



**ATronics
International Inc.**

We Deliver Advanced Technology

1830 McCandless Dr. Milpitas CA. 95035 USA
(408) 942-3344 TLX: 510-600-6093 FAX: (408) 942-1671

Circle 21 on Reader Service Card

IBM, PC/XT/AT, PS/2, OS/2, is a trademark of International Business Machines, Inc.
COMPAQ DESKPRO386, is a trademark of Compaq Inc.
ATRONICS is a trademark of Atronics International, Inc.

Southern California Contact: **CNT Marketing**
16580 Harbor Blvd., Ste. J. Fountain Valley, CA 92780 (714) 839-3724

IEEE-488 Solutions



for your
IBM PC

- Interfaces and Software for
 - PS/2 Micro Channel™
 - IBM PC/XT/AT and compatibles
 - IBM PC Convertible
 - COMPAQ and other 80386 PCs

COMPARE THESE BENEFITS

- Most extensive software library
 - program in your language
- ON SRQ interrupt response
- Applications Monitor
 - real-time error checking and program tracing with pop-up windows
- Highest performance available
 - up to 1M bytes/sec data transfer rate using NI Turbo488™ gate array
- Best price/performance
- FREE technical support with toll free telephone service
- 30-day money back guarantee
- 2-year warranty



NATIONAL INSTRUMENTS™

The Leader in IEEE-488

12109 Technology Blvd.
Austin, Texas • 78727-6204

CALL FOR FREE CATALOG
800/531-4742 • 512/250-9119

SQL DATABASE MANAGEMENT

Company Information

Gupta Technologies Inc.
1020 Marsh Rd., Suite 210
Menlo Park, CA 94025
(415) 321-9500
Inquiry 942.

Informix Software Inc.
4100 Bohannon Dr.
Menlo Park, CA 94025
(415) 322-4100
Inquiry 943.

Oracle Corp.
20 Davis Dr.
Belmont, CA 94002
(800) 672-2531
Inquiry 944.

Relational Technology
1080 Marina Village Parkway
Alameda, CA 94501
(800) 446-4737
Inquiry 945.

Novell Development Products Division
6034 West Courtyard Dr., Suite 220
Austin, TX 78730
(512) 346-8380
Inquiry 946.

Software Systems Technology
7309 Baltimore Ave., Suite 219
College Park, MD 20740
(301) 779-5486
Inquiry 947.

used interactively.

The commands in table 2 are nonstandard and are meant to increase the functionality and usability of SQL. The OUTER JOIN query is important when a row in one table does not have a matching value in the secondary joined table. The outer join ensures that all rows are returned in a query. Packages that do not have an outer join can simulate the command by using UNION.

The UPDATE STATISTICS command is used to update the system catalog with statistical information that the optimizer can use. The recursive SELECT is useful for bill-of-material explosion-type problems.

Three packages (see table 2) let you create tables using a SELECT statement. When used with a CREATE statement, the tables will be permanent. Informix-SQL is the only product that allows the creation of temporary tables. Of course, all packages let you drop tables or indexes (this is not part of either ANSI level) when they are no longer needed. All the systems also let you modify column definitions after a table is created. (IBM's SQL only lets you add new columns.)

Performance Tests

The performance tests we ran were designed to exercise the SQL optimizer and test conformance of the SQL syntax. Keep in mind that the performance you experience is relative to the given environment and application you work with. An application that relies heavily on updates may not require tables to be joined. Some applications may require several tables to be joined, while others may consist primarily of two table joins. In looking over the test results, be advised to ex-

amine your own application needs.

We conducted our SQL queries on an 8-MHz IBM PC AT with 640K bytes of main memory and 1 megabyte of extended memory. The table that we used contained 1000 rows, and each row contained about 150 bytes of information, with a maximum length of 325 bytes. Information was derived from a real mailing list. Table 3 is a list of the nine tests that were executed. Table 4 is a description of the table created. Table 5 contains the test results.

All the products were able to execute the SQL queries without modification, with two exceptions. Ingres uses an asterisk instead of a percent sign with its LIKE predicate. XQL requires double parentheses around the join expression in test 9. Also, XQL uses a BEGINS WITH or CONTAINS predicate instead of LIKE. LIKE is slightly more powerful, since wild cards can be intermixed within the character string.

XQL is also very unforgiving. It requires a blank space preceding and directly after an equal sign. It also requires all field names to be unique in a database. While creating the test table (PERSONS) in XQL, we received several duplicate field error messages that did not indicate where the problems were. After listing the directory, we managed to define unique field names.

Each product has strengths and weaknesses depending on the type of query. In some cases, it may be possible to address these problems by fine-tuning the query to make better use of the optimizer. Generally, products that make better use of indexes perform best. Overall, the optimizers did well—even though most of the SQL products are fairly new to the PC. ■



USE THE BRAINS YOUR IBM WASN'T BORN WITH.

Right at your fingertips in CompuServe's IBM® Forums.

Our IBM Forums involve thousands of users worldwide who will show you just how easy it is to get the most from your IBM and IBM compatibles.

The IBM New Users Forum lets you ask basic questions of PC experts. The IBM Junior Forum is perfect for PCjr® users. Trade tips with other IBM PC and AT users in the IBM Software Forum. Ask questions and get answers directly from the manufacturers in the PC Vendor Support Forum. And if you have telecommunication questions, visit the IBM Communications Forum. Or try the IBM Hardware Forum for discussions on hardware topics and product updates.

Circle 60 on Reader Service Card

Information you just can't find anywhere else.

Download first-rate, non-commercial software, shareware and utility programs. Upload your own programs free of connect time charges. Use the Forum Message Board to send and receive electronic messages. Join ongoing, real-time discussions in a Forum Conference. Communicate with industry experts, including the programmers who write your favorite programs. Enjoy other useful services too, like electronic editions of popular computer magazines.

You can also order The Best Of IBMNET—with nearly 600 software file listings—from CompuServe. Just type GO ORDER or call CompuServe for details.

Standard rates, 24 hours a day.

CompuServe's standard online charges are as low as 10¢ a minute. This

low-cost standard rate is in effect 24 hours a day, every day. And in most areas, you can go online with a local phone call. Plus, you'll receive a \$25.00 Introductory Usage Credit when you purchase your CompuServe Subscription Kit.

To buy your Subscription Kit, see your nearest computer dealer. To receive our free brochure, or to order direct, just call. If you're already a CompuServe subscriber, type GO IBMNET (the IBM Users' Network) at any ! prompt to see what you've been missing.

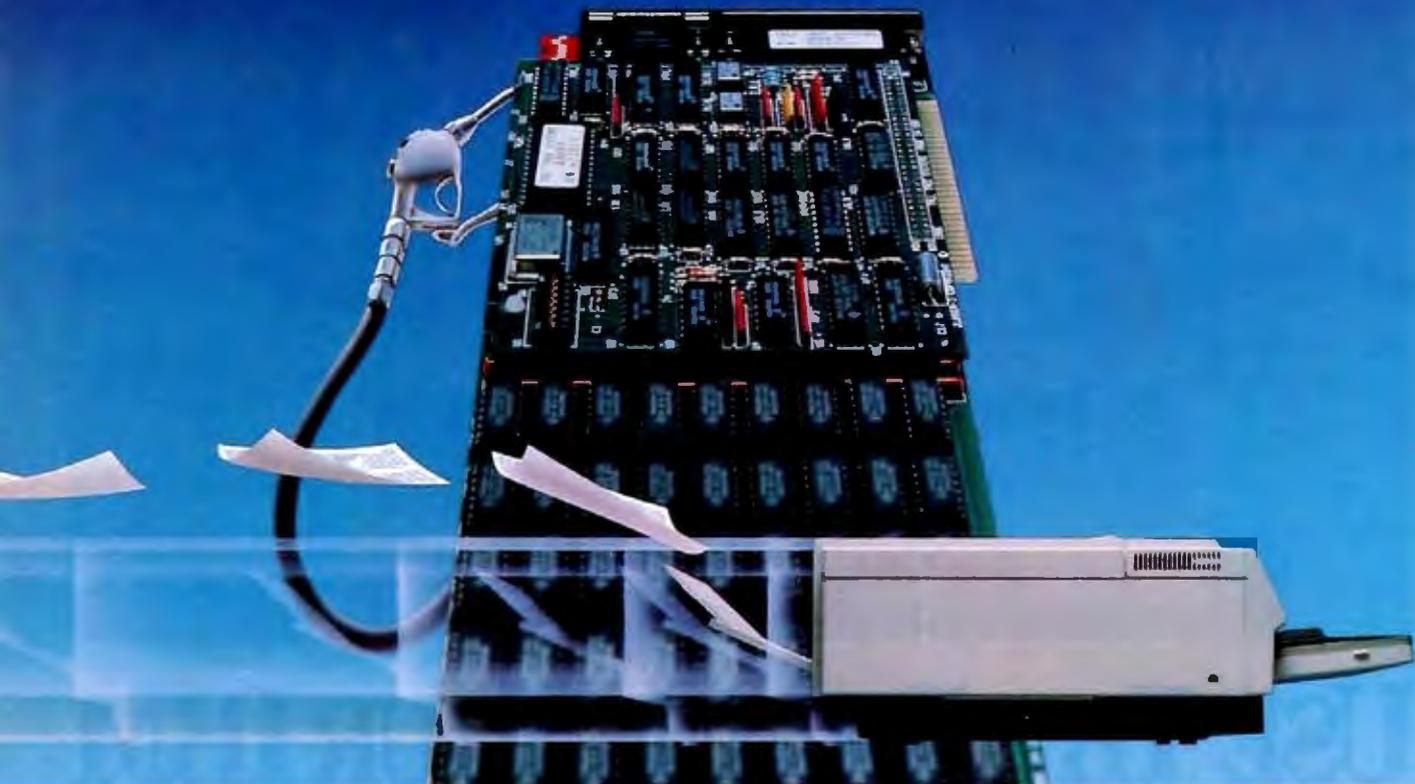
CompuServe®

Information Services, P.O. Box 20212
5000 Arlington Centre Blvd.
Columbus, Ohio 43220

800-848-8199

In Ohio or Canada, call 614-457-0802
An H&R Block Company

JLASER PLUS



HIGH OCTANE PERFORMANCE FOR YOUR LASER PRINTER.

Your laser printer does a great job printing graphics. It just doesn't do it fast.

Actually, it's downright slow.

And while you're drumming your fingers waiting for the output, you're probably wondering if there is a better, faster way.

There is.

The JLASER Plus board from Tall Tree Systems.

Insert it into your PC or compatible and watch your laser printer generate even the most graphics intensive documents at incredible speeds. For example, you can print an entire page of graphics in *less than 30 seconds* with supporting software.

But high performance means more than raw speed. So JLASER Plus gives you more:

HIGH RESOLUTION.

JLASER Plus lets you print unrestricted full-page text and graphics at 300 dpi. With sup-

porting software, it can double the horizontal resolution to 600 dpi.

NOW, MORE DOWNLOADABLE FONTS.

JLASER Plus can print from 6 to 120 points and use all available H-P LaserJet downloadable fonts.

EXPANDED COMPATIBILITY.

JLASER Plus interfaces with virtually all Canon-based laser printers, *even the new H-P LaserJet Series II.*

It works with most of the leading desktop publishing software packages, including Ventura Publisher, PageMaker, PC Paint-Brush+, PageBuilder, PagePerfect, Halo DPE, LePrint, Printrix, FancyFonts, and DeskSet Design.

ECONOMICAL.

JLASER Plus gives you unbeatable value. It controls both the printer *and* scanner, giving

you a printing and scanning interface in one slot. It also comes with 2Mb of RAM which can be used for other EMS software programs when not printing.

When you consider all the features and advantages JLASER Plus has to offer, you'll agree that it gives you the highest performance at the lowest cost.

Once you install it, you'll wonder how you ever got along in desktop publishing without JLASER Plus.



TALL TREE SYSTEMS

2585 E. Bayshore Road, Palo Alto, CA 94303
(415) 493-1980 Telex: 9102404041

Canon, TM Canon USA; LaserJet, TM Hewlett-Packard; PageMaker, TM Aldus Corp.; Ventura Publisher, TM Ventura Software, Inc.; PC PaintBrush+, TM ZSoft Corp.; PageBuilder, TM White Sciences, Inc.; PagePerfect, TM IMSI; Halo DPE, TM Media Cybernetics, Inc.; LePrint, TM LeBaugh Software Corp.; Printrix, TM Data Transforma, Inc.; FancyFonts, TM SoftCraft, Inc.; DeskSet Design, TM G.O. Graphics.

Circle 265 on Reader Service Card



SQL-based Database Managers

Microcomputer databases with mainframe tools

Dealing with complex data sets requires small-system programmers and users to depend on powerful tools. For many database applications, this means using a database manager based on IBM's SQL. The consultants, programmers, and end users on BIX discussed three of the most popular SQL-based packages for microcomputers: Informix-SQL, Oracle, and Ingres. They also mentioned Btrieve, which has an SQL-based version, Btrieve-XQL.

Most love the power and flexibility that these complex packages offer, but there are also some concerns about trade-offs in speed and ease of use.

The BIX Product Focus presents a variety of informal, diverse opinions from users of a selected class of products. (For more information on the terms and technologies discussed, see the preceding Group Review.) Messages selected for publication may be edited for length or clarity. The views expressed here are those of each message's author, and they do not necessarily reflect those of BYTE or BYTE's reviewers.

INFORMIX-SQL

dbms/app_builder #194, from wsmith (William Smith).

I purchased Informix-SQL because versions are available for Xenix machines, MS-DOS machines, and most minicomputers. When purchased with File-it, an Informix-compatible file manager, simple applications remain simple to implement. It took only about 10 minutes to set up and enter data into an address database. The system can manipulate strings of up to 32,000 characters, but the data-entry program Perform is awkward to use for strings of greater than 80 characters. There is no full-screen report writer, but the system comes with its own report programming language, Ace, which makes it very easy to output records consecutively. If you take the time to learn a few tricks, Ace will even let you output different records on the same line, a feat that is surprisingly difficult for most databases.

dbms/app_builder #196, from rbrenner (Rick Brenner).

We spent a month converting menus and many programs from C to Informix. We were astonished; simple menu selections that happened instantaneously under BTree took up to 40 seconds. I'm not talking about searching files; I'm talking about just opening up files and getting set to be able to do something. We paid approximately \$2000 for the package and the phone support and another \$3000 in programming time, only to finally trash the whole effort after about 30 days and go back once again to our superfast BTree.

dbms/app_builder #271, from schin (Sam Chin).

I agree that Informix is very powerful, but its SQL and Ace run times give me terrible error messages like "Syntax Error" without telling me where the error occurred. I still use it, though, because there doesn't seem to be anything better and it is totally flexible.

dbms/other #136, from schin.

I use Informix-SQL and Informix-ESQL/C on a Unix machine and on a Novell network. ESQL/C is an implementation of an embedded SQL for C. You can actually embed SQL statements in C by prefacing them with a \$. You define variables that are shared between ESQL and C so that you can extract data through ESQL and message it with C. A preprocessor converts the ESQL and C code mix to pure C code after checking the SQL for syntax, and you then compile it with your favorite C compiler (ESQL/C libraries on the PC use the Microsoft C Compiler version 3.0). Informix also provides versions that do automatic file and record locking on Unix, Xenix, and any network that conforms to the MS-NET standard for file and record locking (such as 3Com's 3+, IBM's Token-Ring, and NetWare 2.0). Other Informix products are ESQL/COBOL; C-ISAM, a file manager (built into Informix); and Informix-4GL, an integrated fourth-generation language based on SQL.

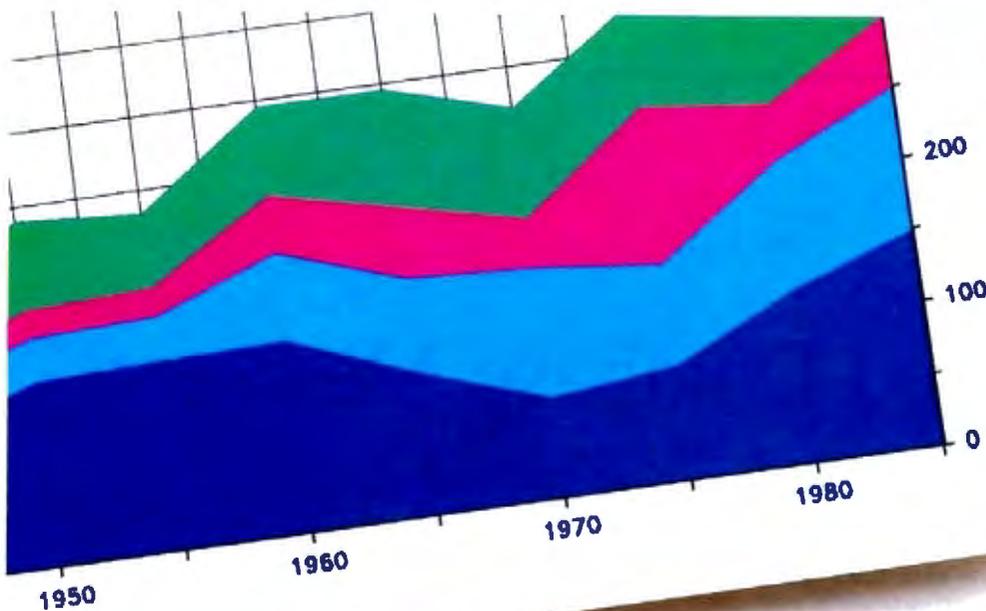
ORACLE

dbms/other #115, from wseeley (Bill Seeley).

The main problem with SQL is that it provides only a data-definition and data-manipulation language (DDL/DML) and has not been fleshed out by IBM with a full set of integrated fourth-generation tools, such as screen painters, report generators, and a data dictionary. It is also not available on anything but IBM mainframes (it is called SQL in the VM/CMS environment and DB2 in the MVS environment). Oracle has a complete set of fourth-generation tools and runs on PCs, a wide variety of minicomputers (both under Unix and proprietary operating systems), and IBM mainframes under both VM/CMS and MVS. It also has a built-in microcomputer-to-mainframe link and an optional spreadsheet called SQL*Calc. The microcomputer version has an optional end-user interface called Easy*SQL.

I've just spent the last couple of weeks doing a hands-on evaluation of these products, and in general they seem pretty good. The one problem Oracle seems to have is keeping all the versions for all the various machines in sync. Some of the subsystems are not yet available under all versions. Another problem with Oracle is that it is a superset of SQL and thus

continued



Graphic created with Microsoft Chart 3.0 software

The new HP PaintJet color graphics printer. Great color is only 1/2 the story.



© 1987 Hewlett Packard Co

BIX PRODUCT FOCUS

doesn't guarantee portability of code or data to other SQL systems (i.e., it is only downward-compatible with SQL, and it can't read/write IBM SQL databases).

Focus is a proprietary product developed by Information Builders and is a mature product that has been around a number of years. The DDL/DML is not quite as elegant as SQL, but it has a rich feature set. It has a nice system for table generation and query (Filetalk and Tabletalk) that enables end users to easily create relational tables and extract data from them. It also has a nice screen painter and a quasiprocedural language for controlling data entry and validation. Focus is also available for PCs, selected minicomputers (not as many as Oracle), and IBM mainframes, and it has a built-in microcomputer-to-mainframe link. Focus evolved out of the Information Center environment, and one of its major strengths is its ability to interface with a wide variety of other mainframe DBMSes (e.g., Cullinet's IDMS/R, IBM's SQL and VSAM, and Computer Corporation of America's Model 204). I've also had an opportunity to do a hands-on evaluation of Focus, and it seems a bit easier to use than Oracle and more consistent across the microcomputer-to-mainframe versions.

INGRES

dbms/other #270, from jrobie (Jonathan Robie).

I just received two copies of Ingres last week. The basic design is almost identical to that of the minicomputer implementation. Documentation is also quite similar—the Ingres Quickdemo section is incorrect for the PC version, but it is correct for the VMS version!

I played with it a little, and I really like the user interface. It has real SQL and QUEL, is callable from C, and has a good forms

editor and report writer. This is a real relational database, and the minicomputer version was voted database product of the year in *Digital Review*. My initial impressions are favorable. It does have problems with memory management, though. I hope it gets a little more solid with time.

dbms/dbwars #141, from jrobie.

Ingres, Oracle, and Informix will all run on a wide variety of machines, all support some form of distributed database, and all allow external programs to make calls to their utilities. If you can afford them (they are expensive), these might be logical choices. They make great demands on your computer systems, though.

dbms/dbwars #182, from jrobie.

Ingres is a very nice relational database that is much more powerful than dBASE, R:base, Condor, and the like. It has both SQL and QUEL—a superior query language that did not become the standard. It has good query optimization (very important for large data sets) and runs on any machine you might be considering. It is expensive, eats RAM, and takes a lot of disk space. This is not the best solution for someone who needs a simple filing system.

BTRIEVE

dbms/callable #13, from pmahoney (Peter Mahoney).

Btrieve is very good and very fast. The multilanguage interface is nice also. C-tree is also a good product. Faircom, its

HP PAINTJET PRINTER**Description**

Desktop color graphics printer for business use

Color

6 colors plus black at 180 dpi; 330 colors at 90 dpi

Text-Speed

NLQ at 167 cps (average page printed in 30-40 seconds)

Software

Popular word processing, graphics, and spreadsheet software

Compatibility

HP Vectra PC, IBM PC and compatibles, Apple Macintosh

Media

8 1/2" x 11" paper or transparency film

Price

\$1,395 US list

For a PaintJet-Pack, call 1 800 752-0900 EXT. 9048

700 never
stop
asking

WILLIT

It can also print a page of text
in 30 seconds flat.



**HEWLETT
PACKARD**

© 1987 Hewlett-Packard Co

BIX PRODUCT FOCUS

developer, is good with support and upgrades. It is also as portable as they claim. I developed an application under DOS and then ported it to RSX-11 using C-tree under RSX-11. No small task, but possible. C-tree is for C only, though.

dbms/callable #22, from jcoombs (James J. Coombs).

"Memory-resident DBMS" sounds a lot like Btrieve. I don't use it, but a lot of people speak highly of Btrieve. I do know that it runs resident and can optionally be evicted upon termination of the application. I tried a shareware file cataloger that used the program and left the DBMS in RAM. I don't recall how much RAM was being consumed, but I would guess that it was around 100K. I would call them up for more definite information. Also, people on the BOSS BBS use Btrieve. In fact, I think the BBS itself uses Btrieve. The author, Dan Doman, would probably be happy to discuss its merits with you (BOSS at (201) 568-7293-C language conference [registration required]; PCSI [Doman's home board] at (212) 529-0498).

My impression is that if you don't need source code and can live within Btrieve's limitations (e.g., maximum record length), then Btrieve is the best choice. If its limitations are a problem, you would be well-advised to negotiate a solution before purchasing Btrieve; I have heard complaints from at least one person who was having trouble working out an arrangement for customization or purchasing source code. If you need source code for porting or customizing, then C-tree is the best choice (assuming you are coding in C). Oh, yes, report generation is handled through a separate program—Btrieve—and there is another called Xtrieve. The company is SoftCraft, and they advertise regularly. There might be some other

possibilities, such as purchasing a run-time library for a DBMS and writing your own TSR routine. The run-time library would still provide you with the management functions.

dbms/callable #29, from abender (Andrew L. Bender).

Btrieve is very good in terms of security. The preimaging files protect the user against data corruption quite well. As to security in terms of intrusion, a user code will scramble the file beyond recognition so that one would have to be quite a hacker to figure out what it says.

dbms/other #186, from abender.

If you really want to get an application up to maximum speed once you get it going in an interpretive language like Revelation, KMan, or even dBASE III Plus, I suggest that you give serious thought to getting away from that kind of database administration and going with a different approach. I transferred an entire KMan system (six floppies) to Lattice C using Btrieve/N as my file handler and Vitamin C as a screen handler. There is no comparison in speed, and Btrieve's excellent recovery and preimaging make for an almost breakproof system. You can do any kind of field validation in Vitamin C. I stayed away from Clipper and such things because that kind of compiler is tied so tightly to the dBASE III procedural language that I found it very inflexible without considerable "own code" stuff. ■

Curtis Franklin Jr. is a technical editor for BYTE. He can be contacted at BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, or on BIX as "curtj."

NEW DATABASE
OS/2 API
AVAILABLE NOW!

Finally. A pro for people who h

Nobody ever said programming PCs was supposed to be easy.

But does it have to be tedious and time-consuming, too?

Not any more.

Not since the arrival of the remarkable new program in the lower right-hand corner.

Which is designed to save you most of the time you're currently spending searching through the books and manuals on the shelf above.

The Norton On-Line Programmer's Guides are a quartet of pop-up reference packages that do the same things in four different languages.

Each package consists of two parts: A memory-resident instant access program. And a comprehensive, cross-referenced database crammed with just about everything you need to

know to program in your favorite language.



GUIDES DATA

- Instant Access Program**
- Memory-resident — uses just 71K.
 - Full-screen or moveable half-screen view, with pull-down menus.
 - Auto lookup and searching.
 - Tools for compiling your own databases.

- ASSEMBLY (600K of data)**
- DOS Service Calls: All INT 21h services, interrupts, error codes, FCB and PSP fields, standard handles and more.
 - ROM BIOS Calls: All ROM calls plus low RAM usage.
 - Instruction Set: All 8088/86 instructions, addressing modes, flags, bytes per instruction, clock cycles and more.
 - MASM: Pseudo-ops and assembler directives.
 - Tables: ASCII chart, line-drawing charts, keyboard scan codes and more.

- BASIC (270K each database)**
- IBM BASICA, Microsoft QuickBASIC and TurboBASIC.
 - Statements and Functions: Describes all statements and built-in library functions.

- Tables: Line-drawing characters, ASCII chart, keyboard codes, error codes, operators, etc.

- C (600K each database)**
- Microsoft C and Turbo C: Describes language, including statements, operators, data types and structures.
 - Library Functions: Detailed descriptions of all functions, from abort () to write ().
 - Preprocessor Directives: Describes commands, usage and syntax.
 - Tables: ASCII chart, line-drawing characters, keyboard codes, error codes, operators, etc.

- PASCAL—Turbo (360K of data)**
- Language: Describes statements, syntax, operators, data types and records.
 - Library: Describes the library procedures and functions.
 - Tables: ASCII chart, line-drawing characters, keyboard codes, error codes, reserved words, etc.

(If you don't believe us, you might want to take a moment or two to examine the data box you just passed.)

You can, of course, find most of this



programming tool ate manual labor.

information in the books and manuals on our shelf.

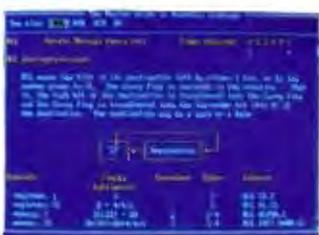
But Peter Norton—who's written a few books himself—figured you'd rather have it on your screen.

In seconds.

In either full-screen or moveable half-



A Guides reference summary screen (shown in blue) pops up on top of the program you're working on (shown in green).



Summary data expands on command into extensive detail. And you can select from a wide variety of information.

screen mode.

Popping up right next to your work. Right where you need it.

This, you're probably thinking, is precisely the kind of thinking that produced the classic Norton Utilities.

And you're right.

But even Peter Norton can't think of

everything.

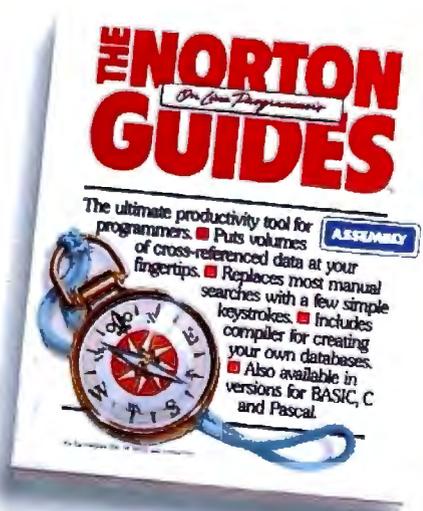
Which is why there's a built-in compiler for creating databases of your own.

And why all Guides databases are compatible with the instant access program in your original package.

So you can add more languages without spending a lot more money.

To get more information, call your dealer. Or call Peter Norton at 1-800-451-0303 Ext. 40.

And ask for some guidance.



Peter Norton
COMPUTING

Create dBASE® Reports in Half the Time, Without Programming, or Your Money Back!

"The [time] savings we gained with R&R were remarkable."

InfoWorld, 5/25/87

"The consummate dBASE report writer."

PC World, 3/87

". . . a powerful tool that's executed beautifully. . . ."

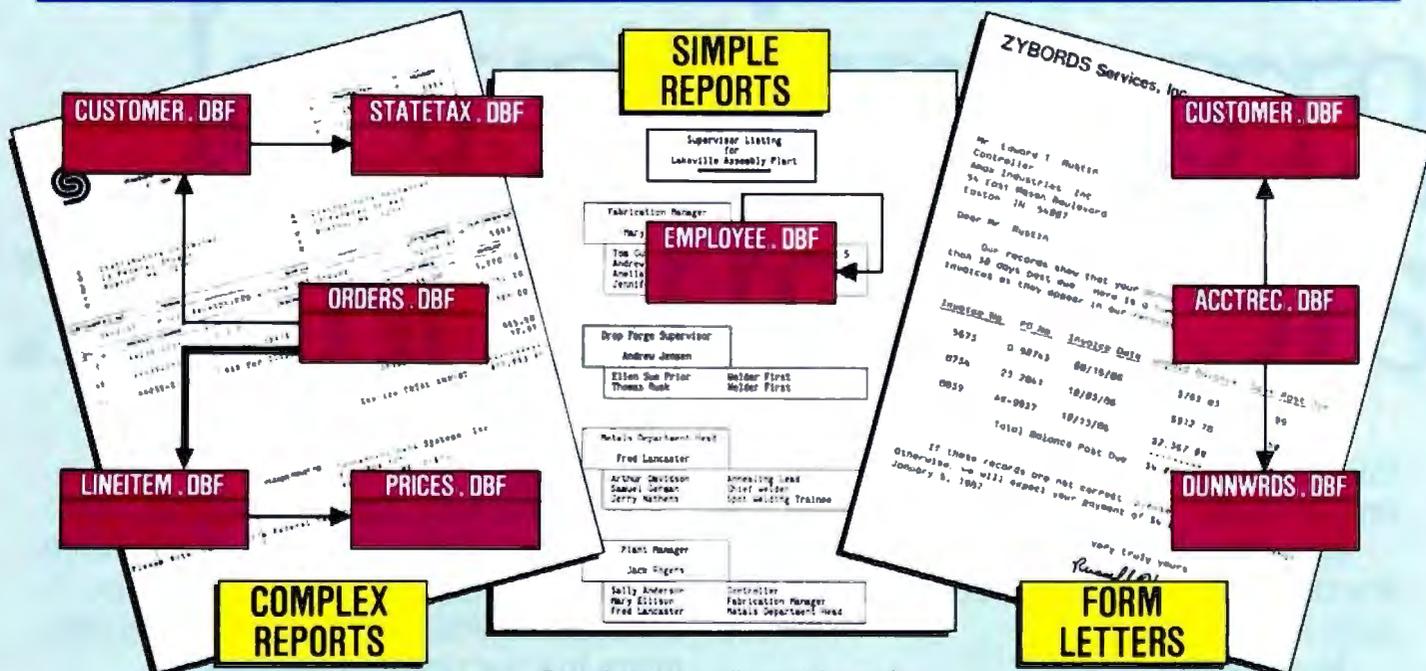
PC Magazine, 1/13/87

"Constructing a report layout with R&R is easy and quick. . . ."

Business Software, 2/87

". . . run, don't walk, to the nearest phone and place your order. . . ."

PC Week, 11/11/86



A proven timesaver.

R&R users say they can create reports in half the time or less, compared with programming in dBASE. So can you.

More flexibility than you'll ever need.

Relate and report from up to 10 files at once using one-to-one and one-to-many relations. Place free-form text and fields anywhere. Calculate new fields using more than 70 functions.

Eight sort levels. Eight levels of record grouping. Page and group headers and footers. Totals, subtotals. Memo field support including query. Use **bold**, underline, *italics*, combinations, and *different fonts*. Hundreds of other features.

The ease of use for fast results.

Lotus®-like commands. Plain English query. Automatic trim. Standard field formats such as currency, commas, and word-wrap.

But what you *really* want is results. Fast. And R&R quickly delivers reports like those shown here. Complex reports such as multi-page invoices. Simple reports such as employee listings. (Actually the "simple report" shown here is not so simple without R&R.) Even form letters are just reports created with R&R's relational merge feature.

Relate and Report, then rest and relax —with R&R.

Only \$149!*

Satisfaction guaranteed.

Try R&R. If you aren't satisfied for any reason, return it within 30 days for a full refund (if purchased directly from Concentric or a Concentric Authorized Reseller).

For the name of your nearest dealer, or to order, call:

800-325-9035

In Mass., call 617-366-1122.

Major credit cards, checks, COD, and POs (from major corporations and institutions) accepted. Add \$3 shipping, \$2 if COD, 5% tax in Mass.

R&R works with dBASE III®, III PLUS®, Quicksilver™, and other dBASE-file-compatible products. Clipper™ and FoxBASE+™ Module \$49.95* additional. Runtime included with unlimited use license.

Another timesaving tool from the authors of 1-2-3® Report Writer™.

Concentric Data Systems, Inc.
18 Lyman Street, PO Box 4063
Westboro, MA 01581-4063

R&R Relational Report Writer
for dBASE®

*On 5.25" diskettes. With 5.25" AND 3.5" diskettes, \$165 for R&R and \$55 for Module.

Trademarks dBASE, dBASE III, dBASE III PLUS by Ashton-Tate. Lotus, 1-2-3 Report Writer by Lotus Development Corporation. Quicksilver by WordTech Systems, Inc. FoxBASE+ by Fox Software. Clipper by Nantucket Corporation. R&R Relational Report Writer by Concentric Data Systems, Inc.



Cache in the Chips

Ed McNierney

*The PC Designs
GV-386 offers more speed
and less wait*

The PC Designs GV-386 is another hybrid entry into a growing field of 16-megahertz 80386 computers that use the speed and performance of the 80386 CPU while still retaining full IBM PC AT compatibility. Although it runs at the same clock speed as most other 80386 systems, it uses clever design components to squeeze as much performance as possible out of the system. The result is a high-powered PC AT-compatible computer.

As reviewed, the GV-386 came with 4 megabytes of RAM, a Priam 40-megabyte hard disk drive, and a Toshiba 1.2-megabyte 5¼-inch floppy disk drive. The computer has eight expansion slots, two 8-bit and six 16-bit. The two 8-bit slots were filled with a half-length Everex EGA-compatible display card and a half-length Everex serial/parallel card. One 16-bit slot contained the full-length combination floppy disk/hard disk controller card.

An 80287 math coprocessor running at 6, 8, or 10 MHz is supported, and the review system was equipped with a 10-MHz version. The system unit also features a keylock on the front panel and a convenient Reset switch next to the power, disk-access, and Turbo (16-MHz) indicator LEDs. The power supply is rated at 200 watts and is switchable from 115 volts AC to 220 volts. An NEC MultiSync monitor was included with the review system.

The system comes with a one-year warranty for parts and labor and a 30-day money-back guarantee of IBM compatibility. The list price for the entire package is \$5221.

Software Features

The GV-386 uses the American Megatrends 386-BIOS. This BIOS, composed



of four 27256 ROMs, lets you interrupt and cancel the power-on RAM test by pressing the Escape key. Since the unit can be configured with a lot of RAM, this shortcut is a real convenience, especially if you do software development that may require frequent use of the Reset switch. After the self-test, you can press the Delete key to enter the ROM-based Setup utility; no separate disk is required. Configuration CMOS RAM is powered by four AA batteries.

The Quarterdeck Expanded Memory Manager 386 (QEMM) and DESQview 2.0 are bundled with the system, as are MS-DOS 3.2 and GWBASIC 3.2. The QEMM software lets you use the extended memory in the system as Expanded Memory Specification (EMS) expanded memory; when used in conjunction with DESQview 2.0, it provides a power-

ful multitasking environment. You can run multiple DOS applications in separate windows at the same time.

Fast RAM

The PC Designs motherboard is unusual in that it can hold up to 4 megabytes of RAM. Other 386-based systems, such as the Compaq Deskpro 386, use a separate 32-bit memory board and slot. All RAM on the GV-386 motherboard is accessed by the processor through a 32-bit-wide data path, so the RAM sockets must be fully populated for the system to operate properly. The board is designed to accept 64K-bit, 256K-bit, or 1-megabit RAM chips; the 36 sockets provide 256K bytes, 1 megabyte, or 4 megabytes of parity-checked RAM.

The memory consists of 120-nanosecond dynamic RAM (DRAM); this type of RAM requires the insertion of two wait states for processor access. Although this is normally a severe performance penalty, 120-ns DRAM is relatively inexpensive and readily available, so upgrading a base 1-megabyte system to 4 megabytes is affordable. PC Designs has enhanced the performance of this DRAM system with a 64K-byte cache of 45-ns static RAM (SRAM) that can run with zero wait states, allowing full processor access to memory without delay. The SRAM cache has access to all 16 megabytes of the machine's addressable memory, so memory added on an expansion board is cached just as effectively as system board memory.

The use of cache memory is not free,
continued

Ed McNierney is a principal engineer at Lotus Development Corp. He can be reached at 54 Pleasant St., Groton, MA 01450, or on BIX as "mced."

PC Designs GV-386

Company

PC Designs Inc.
2500 North Hemlock Circle
Broken Arrow, OK 74012
(800) 322-4872
(918) 251-5550 in Oklahoma

Size

21 1/2 by 17 1/2 by 6 1/2 inches; 45 pounds

Components

Processor: Intel 80386 running at 16 MHz with zero wait states or at 8 MHz; 6-, 8-, or 10-MHz Intel 80287
Memory: 1 megabyte of zero-wait-state DRAM on motherboard (system maximum of 16 megabytes); 64K bytes of 45-ns static cache RAM
Mass storage: One half-height 1.2-megabyte 5 1/4-inch floppy disk drive; one 40-megabyte hard disk drive
Display: Everex EGA-compatible display adapter with an NEC MultiSync monitor
Keyboard: 101-key modified AT-style enhanced keyboard
I/O interfaces: One parallel port (DB-25); two serial ports (one DB-9, one DB-25); six 16-bit PC AT-compatible expansion slots; two 8-bit PC-compatible expansion slots

Software

Quarterdeck Expanded Memory Manager 386; ROM-based Setup utility

Options

Hard disk drives (from 20 to 230 megabytes): \$475 to \$2495
Tape backup units: \$589 to \$759
Graphics cards: \$75 to \$285
Display monitors: \$95 to \$599
Internal modems: \$109 to \$199
EGA graphics cards: \$159 to \$350
10-MHz 80287-10 math coprocessor: \$355
MS-DOS 3.2 with GWBASIC 3.2: \$99
3-megabyte expansion RAM on motherboard (total of 4 megabytes of RAM): \$885
NEC MultiSync monitor: \$599
MS-DOS version 3.2: \$99

Documentation

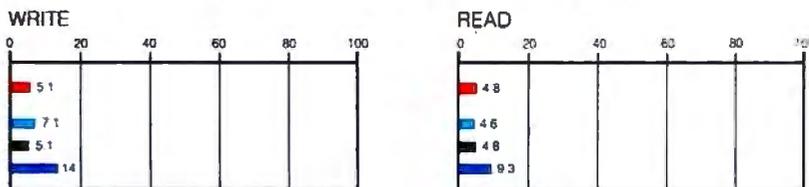
User's Guide and Operations Manual; DESQview and QEMM user documentation

Price

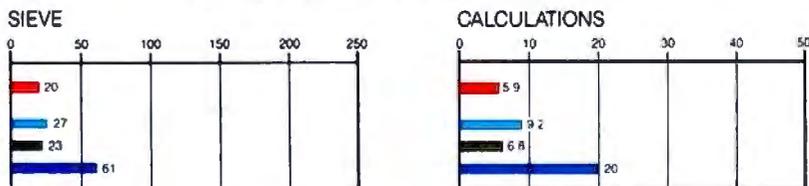
Base system (1 megabyte of RAM, 40-megabyte hard disk drive, 1.2-megabyte floppy disk drive): \$3124
System as reviewed: \$5221

Inquiry 885.

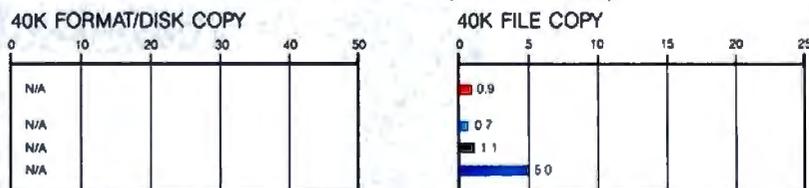
DISK ACCESS IN BASIC (IN SECONDS)



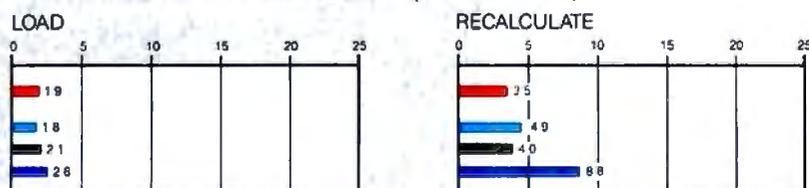
BASIC PERFORMANCE (IN SECONDS)



SYSTEM UTILITIES (IN SECONDS)



SPREADSHEET (IN SECONDS)



■ PC DESIGNS GV-386 ■ IBM PS/2 MODEL 80 ■ COMPAQ DESKPRO 386 ■ IBM PC AT (8 MHz)

Test	GV-386	Model 80	Compaq 386	Compaq 386	IBM PC AT
	10-MHz 80287	16-MHz 80387	8-MHz 80287	16-MHz 80387	8-MHz 80287
Dhrystone*	4356	3626	3748	3748	1590
Fibonacci	48.55	57.26	53.12	53.11	126.22
Float	5.80	1.62	6.80	1.43	10.98
Savage	18.05	9.49	21.53	8.95	37.30
Sieve	5.07	6.45	5.99	5.98	24.60
Sort	6.29	7.74	5.58	5.58	43.17

*Higher numbers denote faster performance.

The Disk Access benchmarks write and then read a 64K-byte sequential text file to a hard disk. Sieve runs one iteration of the Sieve of Eratosthenes. Calculations performs 10,000 multiplication and division operations. The 40K Format/Disk Copy benchmark is not performed on computers with only one floppy disk drive. The 40K File Copy benchmark copies a 40K-byte file on the hard disk. The Spreadsheet tests load and recalculate a 100-row by 25-column Multiplan (1.06) spreadsheet. All BASIC benchmark programs were run with MS-DOS 3.20 and GWBASIC 3.20 on the PC Designs GV-386; PC-DOS 3.3 and BASICA 3.3 on the Model 80 and PC AT; and Compaq DOS 3.1 and Compaq BASIC 3.11 on the Deskpro. The table contains the results of C language benchmarks (see "A Closer Look" by Richard Grehan in the September 1987 BYTE). All times are in seconds, except for the Dhrystone, which is in Dhrystones per second.

REVIEW: CACHE IN THE CHIPS

however. When data is written to memory, it must be written to both the cache RAM and the standard DRAM. As a result, data writes do not benefit from the cache; they run at the two-wait-state speed expected from the 120-ns DRAM. Also, if the processor needs to access data that is not currently stored in the cache, the system must perform a read from the DRAM as well as update the cache memory with the new data. This delay slows down reads from noncached memory to three wait states.

Of course, the entire principle of cache memory relies on the fact that software retains a certain frequency of reference; that is, memory that has been read recently is likely to be read again. Although such redundant data reads may not be common in well-designed software, caching applies to instruction fetches as well and can greatly improve the performance of tight programming loops.

The cache memory system in the GV-386 is tested as part of the system's power-on self-test. If the cache is found to be faulty, the system disables it and displays an error message; the system can still be operated normally. The cache can also be selectively enabled or disabled from the keyboard. This feature is designed to provide maximum compatibility with copy-protected or timing-sensitive software. All the tested software operated properly with the cache enabled.

The result of PC Designs' performance efforts is significant. Designing a cache memory system that really boosts execution speed of real-world applications is not easy, but PC Designs has succeeded. By using a rather large cache size, the GV-386 ensures a high ratio of cache hits and therefore a measurable benefit to the user. The BYTE Dhrystone benchmark rates the GV-386 at 4356 Dhrystones per second when the cache is enabled, a performance level that is 15 percent higher than the Compaq Deskpro 386 and 20 percent higher than the IBM PS/2 Model 80.

The value of the cache system is further demonstrated by the fact that the GV-386's Dhrystone performance drops to 3259 Dhrystones per second, well below the Compaq and PS/2 machines, when the cache memory system is disabled. The BASIC benchmarks also show an increase in performance with the cache enabled on the GV-386 as compared to the Compaq 386. All benchmark results shown on page 128 were produced with the 64K-byte cache enabled.

Hardware Features

The disk system on the reviewed machine consisted of a 1.2-megabyte floppy disk drive and a 40-megabyte hard disk drive.

The hard disk was set up as two 20-megabyte DOS partitions through the use of the Priam disk driver software. The hard disk drive has an access time of 27.4 milliseconds and a data-transfer rate of 238.8K bytes per second (as measured by the CORETEST utility). The disk also showed a remarkably low track-to-track seek time of 4.1 ms. The Priam hard disk drive is a full-height drive and fills the entire left disk bay. The right disk bay has space for three half-height devices, all accessible from the front of the computer.

PC Designs GV-386 offers a keyboard- or DIP switch-selectable clock speed of 16 MHz or 8 MHz. When the clock speed is set at 8 MHz, the cache can still be enabled or disabled, but it makes no measurable difference in performance. The standard system RAM is fast enough to keep up with the 8-MHz speed.

Because disk-based copy-protection schemes are sensitive to clock speed, most other 80386 systems automatically slow the processor down to 8 MHz whenever the floppy disk drive is being accessed. The slowdown in system speed is unnoticeable since the floppy disk drive is the real limiting factor, and the compatibility gained is worth the trade-off. Unfortunately, the GV-386 slows down the processor for only the operations required by the DOS FORMAT and DISK-COPY programs, not for all floppy disk accesses. As a result, Lotus 1-2-3 Release 2 would start up only if the processor was slowed down to 8 MHz. Once the program started, however, the speed could be brought back up to 16 MHz.

The keyboard is a Maxi-Switch 101-key unit that uses a modified enhanced AT keyboard layout. Except for the L-shaped Enter key and backslash key to the left of the Backspace key, the keyboard is identical to the enhanced layout. The MaxiSwitch keyboard has a switch on the underside that lets you swap the positions of the Caps Lock and left Control keys. The GV-386 documentation claims that the Escape key can be moved, but it gives no instructions for accomplishing this. The keyboard feel is soft and quiet.

The system unit contains eight full-length expansion slots. To maintain compatibility with the majority of PC add-on cards, the I/O connectors are run at a clock speed of 8 MHz, independent of the processor speed. Since most add-on boards are not designed to run any faster than 8 MHz, this feature lets you purchase new hardware without worrying about compatibility.

Documentation

The *User's Guide and Operations Manual* supplied with the GV-386 is very in-

continued

The fastest Modula-2 software development system for

AMIGA \$199

Extremely fast single-pass compiler, integrated into the Amiga Workbench, full support for documented functions (Intuition, Exec, Graphics, etc.), double-precision numeric types, including FFP, produces optimised machine code, links in just a few seconds! The comprehensive development system contains an editor, compiler, linker, library modules (Standard & Amiga libraries), manual and introductory Modula-2 book. Minimum configuration: 512K, 1 drive.

Demonstration disk \$5

the IBM PC range & compatibles \$99

With M2SDS you develop your Modula-2 programs in a powerful window environment, where all the tools are integrated for speed and efficiency:

- syntax directed editor
- incremental compiler - much faster than a conventional compiler
- fast linker - produces stand-alone executable programs
- library manager - modules are compact and ergonomically managed
- clock, ASCII table, calculator
- all modules are provided in source form

M2SDS supports the 8087 maths co-processor, REAL arithmetic calculates to 15 digits accuracy and easy access to the MS-DOS/PC-DOS/Concurrent-DOS operating environment. Programs and data may use up to the full 640K DOS memory. No other software development system has as many tools and toolboxes as M2SDS.

SDS-XP \$249

Debugger \$79

M2SDS demonstration disks \$5

Turbo-Pascal to Modula-2 source code translator \$59

IBM/370 Mainframes \$11500

One of the fastest compilers in the world (single-pass, 36000 lines/minute), full 32 bit arithmetic, separate compilation of modules with all the benefits of Modula-2 (version control, type checking between modules, etc.), interface to Assembler and Fortran, support of project libraries, produces high efficient native code (including arithmetic checks) for linker and loader.

Annual contract for support \$1850

All these products with full support are available from

**INTERFACE
TECHNOLOGIES**

3336 Richmond, Suite 323
Houston, Tx 77098-9990 (713) 523 8422

Dealer Inquiries welcome

A A. + L. Meier-Vogt (USA)
Im Späten 23
CH-8906 Bonstetten/ZH
Switzerland
Tel. (41) (1) 700 30 37

E-Mail: APLUSL@komsys.fh.ethz.ch (UUCP)

teresting; it's unlike any comparable manual. Nearly 200 pages of information are presented in a somewhat disorganized manner. The preface covers the compatibility guarantee and warranty information. The first chapter of the manual is devoted to a well-written overview of the technical features of the 80386 processor. Although a note indicates that the chapter is of interest only to programmers, it is still a bit daunting to have the first page of chapter 1 contain such terms as "barrel shifter" and "prefetch queue."

The manual is clearly and concisely

written. It appears to be written for the technically competent owner who is likely to buy a stripped-down machine and who feels comfortable adding disk drives, memory, and I/O boards. The manual includes a potpourri of technical information, supplying I/O address maps, tables of hard disk drive parameters, system-board switch settings, system error messages, and programming information. A comprehensive set of troubleshooting suggestions is provided to assist the user with most of the common setup and installation problems. Separate booklets

are included for the Priam hard disk drive and the serial/parallel card.

Interspersed with this technical information are chapters that go into great detail describing keyboard commands in BASIC (a topic covered much better in the supplied GWBASIC manual) and a useful but slightly condescending tutorial for new users that is laid out in a question-and-answer format. Perhaps the best indication of the tone of the entire documentation set comes from the first page of the chapter entitled "For New Users." Although it states that "This chapter is written specifically for the person who has never used a personal computer," the first step in the orientation process is to remove the cover of the system unit so that you can look inside.

Compatibility

The GV-386 demonstrated excellent compatibility with the PC AT and with 80386-specific software. Lotus 1-2-3 version 2.01, Microsoft Word 3.0, the Microsoft Bus Mouse, Microsoft Windows version 1.03, and SideKick version 1.56A all ran correctly, except that Lotus 1-2-3 had to be started at 8 MHz or installed onto the hard disk. I also used Borland's Turbo C to test compatibility and system performance. The sample MicroCalc spreadsheet program supplied with Turbo C (7700 lines of C code) compiled in only 25 seconds, as opposed to 71 seconds required by the Compaq Deskpro 386.

The 80386 control software and operating systems I tested included Digital Research Concurrent DOS 386, PC-MOS/386, DESQview 2.0, Microsoft Windows/386, and a prerelease version of Microsoft OS/2 version 1.0. All worked without any problems.

Final Judgment

The system requires little technical skill to set up and use. In addition to the excellent warranty, PC Designs offers a toll-free help line to registered owners, so buyers can get ready assistance and information.

The PC Designs GV-386 is a compatible, high-speed personal computer. It is well-suited for any application that requires an 80386 processor or high processing speeds, ranking at or near the top of the 80386 range in all the benchmarks and tests. Its cache memory system is well-designed and produces a measurable increase in system throughput when compared to other 80386 systems. The GV-386 is a solid, robust machine; its designers paid attention to features and detail. Given the trend toward software with large memory requirements, the GV-386's ability to hold 4 megabytes of RAM on the motherboard is a valuable asset. ■

BACK ISSUES FOR SALE

	1985	1986	1987
Jan.	\$4.25		
Feb.	\$4.25	\$4.25	\$4.25
March	\$4.25		\$4.25
April	\$4.25		\$4.25
May	\$4.25		\$4.25
June	\$4.25	\$4.25	\$4.25
July		\$4.25	\$4.25
Aug.	\$4.25	\$4.25	\$4.25
Sept.	\$4.25	\$4.25	\$4.25
Oct.	\$4.25	\$4.25	\$4.25
Nov.	\$4.25		\$4.25
Dec.	\$4.25	\$4.25	\$4.25

SPECIAL ISSUES and INDEX	
BYTE '83-'84 INDEX	\$1.75
BYTE 1985 INDEX	\$2.00
1984 SPECIAL GUIDE TO IBM PCs	\$4.75
1985 INSIDE THE IBM PCs	\$4.75
1986 INSIDE THE IBM PCs	\$4.75
APPLICATIONS SOFTWARE TODAY SPECIAL	\$4.00

Circle and send requests with payments to:

BYTE Back Issues
P.O. Box 328
Hancock, NH 03449

Check enclosed

Payments from foreign countries must be made in US funds payable at a US bank.

VISA MasterCard

CARD # _____ EXP. DATE _____

SIGNATURE _____

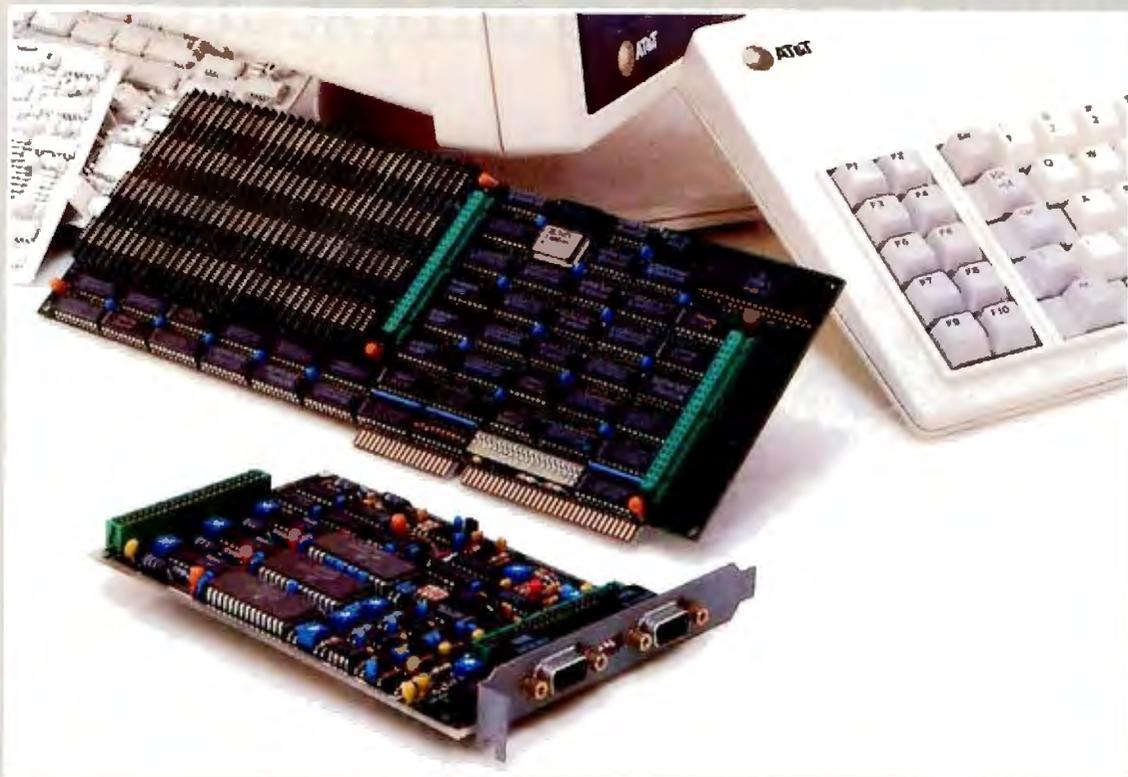
The above prices include postage in the US. Please add \$.50 per copy for Canada and Mexico; and \$2.00 per copy to foreign countries (surface delivery). Please allow 4 weeks for domestic delivery and 12 weeks for foreign delivery.

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Advancing the state of the art in raster graphics.



With TV-quality resolution.

Presenting the AT&T Truevision[®] Advanced Raster Graphics Adapter (TARGA[™]) series. Five separate models address the spectrum of your continuous-tone imaging needs. Each single-slot TARGA digitizes and displays electronic photographs with your AT&T- or IBM-compatible PC.

TARGA captures images in real time from standard video sources. And because the images are digitized files of information, you can store and retrieve them. Display them with striking clarity. And manipulate them with incredible subtlety.

At varying pixel depths.

TARGA provides up to 512 X 482 pixel resolution at different

pixel depths.

TARGA 8 (\$1,595): 256 levels of grey

TARGA M8 (\$1,995): 256 levels of grey or 256 colors from a palette of over 16 million

TARGA 16 (\$2,995): 32,768 colors plus overlay

TARGA 24 (\$3,995): 16,777,216 colors

TARGA 32 (\$4,995): 16,777,216 colors plus overlay and 128 levels of mixing for sophisticated blending of live video and stored images.

And with elegant engineering.

TARGA is elegantly engineered for performance, efficiency, and reliability. Its powerful gen-lock capability lets you grab from VCRs and videodisc players as well as

video cameras. Our proprietary video controller limits memory contention to less than two percent.

And TARGA incorporates a number of sophisticated hardware features, including 2X, 4X, and 8X zoom. Smooth, independent horizontal and vertical panning. Bit plane masking. And a wide range of programmable options provides unlimited flexibility in working with continuous-tone images.

And elegant applications.

TARGA C language programming utilities and Halo drivers enable you to create your own applications. Or you can use one of the many software packages developed for TARGA by AT&T and others.

Our Truevision Image Processing (TIPS, \$1,250), for example, provides powerful paint, text, and image manipulation functions.

Advance the state of your art.

If you have an idea for an application, talk to us. We'll provide the technical support to help you advance the state of your art. With Truevision. We're changing the way personal computers see things.

For additional information or to locate a Truevision dealer, please write or call: AT&T, Electronic Photography and Imaging Center, 7351 Shadeland Station, Suite 100, Indianapolis, IN 46256-3921. **1-800-858-TRUE.**



AT&T

The right choice.

Truevision is a registered trademark of AT&T. IBM is a registered trademark of International Business Machines Corporation. Compaq is a registered trademark of Compaq Computer Company. HALO is a registered trademark of Media Cybernetics. Truevision Design and development by: RADAKAKACACCCEJHDIHJHBDJCMGMBPLRASTSJSBSJW © 1987 AT&T

Switching from computer paper to letterhead is as simple as 1...2...3.



Push a button. Pull a lever. Push a button. It's that easy to switch from computer paper to letterhead using a Fujitsu DX2000 Series 9-wire dot matrix printer. There's no wrestling with continuous forms or optional tractors. No wasting time loading and unloading paper. And automatic feeding of cut sheet paper is faster with the optional, single-bin sheet feeder.

More Efficient, More Productive. Now you can choose from four printers that can produce between 111 and 135 lines of copy per minute. Or an average-size memo in draft quality in just 11 seconds. Print speeds range from 44-54 characters per second in near-letter quality mode, to 220-324 cps in draft quality, depending on which model you choose.

Each printer can create letters, spreadsheets, descriptive charts and professional graphs. For brilliant 7-color printing, you can get an easy-to-install optional color kit.

Quiet, Reliable, Compatible. Listen. The DX2000 printers are quiet. What's more, they can give you years of trouble-free printing without taking time off. And that's not all. Each printer is compatible with the most popular software packages, using Epson® FX80, JX80,

IBM® Graphics Printer® or IBM Proprinter® commands. For pricing, more information and a demonstration of the DX2000 series or any of our complete line of daisywheel, dot matrix, band or laser printers, call 800-626-4686. Make the easy switch to Fujitsu printers.



A COMPANY WITH CHARACTER AND DRIVE



FUJITSU AMERICA
Computer Products Group

FOR MORE INFORMATION ON THE DX2000 SERIES PRINTERS, CALL 800-626-4686



The Toshiba T3100/20

Curtis Franklin Jr.

*This laptop strikes
a balance between portability
and power*

If an AT-class machine is part of your normal working environment, the Toshiba T3100/20 (\$4699) can let you work with your usual tools when you are traveling. The T3100/20 is built around an Intel 80286 micro-processor running with one wait state at 8 MHz, switchable to 4 MHz. It comes standard with 640K bytes of 120-nano-second RAM, which allows it to run software that runs on desktop ATs. Mass storage for the T3100/20 consists of a 720K-byte 3½-inch floppy disk drive and a 20-megabyte hard disk drive with a run-length-limited (RLL) controller. The size of the hard disk drive and the fact that it uses RLL encoding are the only differences between the T3100/20 and the older T3100 with a 10-megabyte hard disk drive.

A highly readable gas-plasma display tops the system. The display swings up to reveal a full-size 81-key keyboard with 10 function keys running across the top. A template (a blank is provided with the computer) can sit in a shallow well above the function keys. Above the template, the T3100/20 sports seven LED indicators for Power/Speed, disk use, external monitor, and keylocks. With RGB, parallel, and 9-pin serial ports lined up across the rear of the computer, the I/O of the T3100/20 is complete, especially for a laptop computer. The power supply is switchable between 115 and 230 volts.

Toshiba does not provide a battery pack for the T3100/20; the company has designed the system to operate from an AC power outlet. While this limits the use of the computer to times when an electrical outlet is handy, the convenience of a hard disk drive and an easily readable screen may be more important in some situations. [Editor's note: *For those who*



want a laptop that does not need an electrical umbilical cord, see the text box "The Toshiba 1000" on page 135.]

All these AT-class features are packed into a compact 15-pound box, measuring approximately 12 by 3 by 14 inches, which comes standard with a padded nylon carrying case. The unit also comes with MS-DOS 3.2 and Lotus Metro, a desk accessory that provides a notepad, an appointment book, and a clipboard (among other features).

The unit I reviewed had an optional RAM upgrade (\$1699), providing 2 megabytes of Expanded Memory Specification (EMS)-compatible RAM for programs that can make use of it, and an optional 1200-bit-per-second internal Hayes-compatible modem (\$399). As reviewed, with added memory and modem, the system retails for \$6797. Other op-

tions include an IBM PC-compatible five-slot expansion chassis (\$999) and a 5¼-inch external floppy disk drive (\$499). See page 134 for a complete list of options with prices.

The Power

When compared with other popular laptop computers, the Toshiba is at least twice as fast as most that operate at 4.77 MHz and is about 20 percent faster than the NEC MultiSpeed operating at 9.54 MHz. [Editor's note: See "The NEC MultiSpeed" by David Satz in the September 1987 BYTE.] You can easily switch the speed of the T3100/20's processor from the keyboard by using a three-key combination.

In addition to the advantage in calculation speed, the 3100/20's internal hard disk drive gives it an obvious advantage in disk access over floppy disk drive-based portables. For example, the spreadsheet used in the BYTE benchmarks took

approximately 7 seconds to load from the MultiSpeed's floppy disk drive. The spreadsheet loaded from the 3100/20's hard disk drive in just over 1 second. In comparison to the PC AT's hard disk drive, the Toshiba's hard disk drive turns in a slightly better performance. The CORETEST gives the data transfer rate of the T3100/20's hard disk drive as 107.4K bytes per second, and the average seek time as 77.7 milliseconds.

The Toshiba stands out most not in calculation speed, which is impressive, but in clarity of display, which is amazing. Its resolution is 640 by 400 pixels, giving a

continued

Curtis Franklin Jr. is a BYTE technical editor. He can be reached at One Phoenix Mill Lane, Peterborough, NH 03458, or on BIX as "curtf."

Toshiba T3100/20

Company

Toshiba America Inc.
Information Systems Division
9740 Irvine Blvd.
Irvine, CA 92718
(714) 538-3000

Size

12 1/8 by 3 by 14 1/8 inches; 15 pounds

Components

Processor: 16-bit 80286 running at 4 or 8 MHz

Memory: 640K bytes of RAM, expandable to 2.6 megabytes internally

Mass storage: One 720K-byte 3 1/2-inch floppy disk drive and one 20-megabyte hard disk drive

Display: Red-orange 5 3/4- by 7 1/2-inch flat gas-plasma with 25-line by 80-column text and 640- by 400-pixel monochrome graphics; also emulates IBM CGA graphics

Keyboard: 81 keys; 10 function keys; separate cursor keys; LED indicators for Caps Lock, Num Lock, and Scroll Lock keys

I/O interfaces: RS-232C 9-pin male connector; 25-pin female parallel connector; RGB video 9-pin female connector

Software

MS-DOS version 3.2; Lotus Metro

Options

Internal 1200-bps modem: \$399

5 1/4-inch external floppy disk drive: \$499

Floppy link file-transfer board/cable: \$199

15-key numeric keypad: \$99

IBM PC-compatible five-slot expansion chassis: \$999

Interface card for expansion chassis: \$199

2-megabyte RAM upgrade: \$1699

Documentation

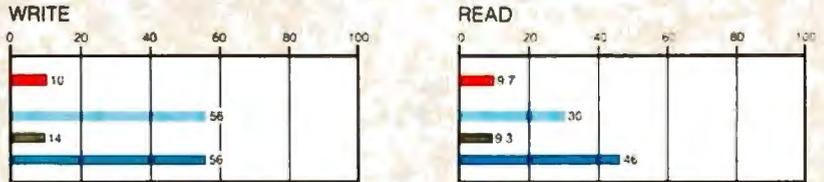
168-page *Toshiba T3100 Portable Personal Computer User's Manual*

Price

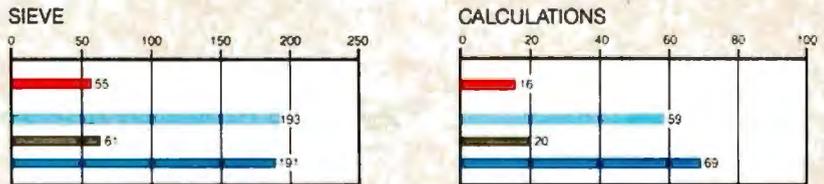
\$4699

Inquiry 887.

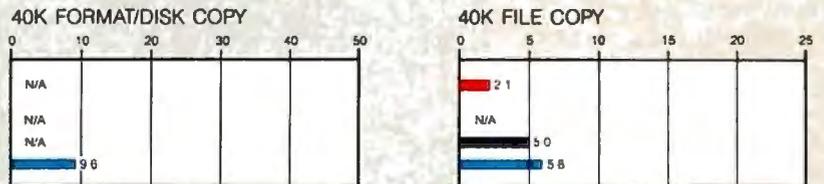
DISK ACCESS IN BASIC (IN SECONDS)



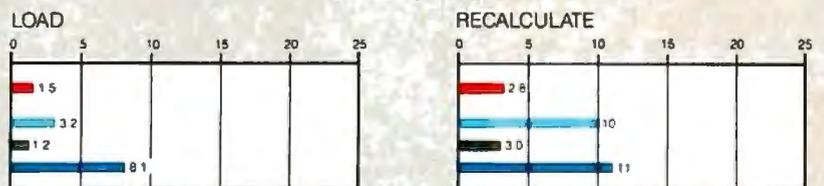
BASIC PERFORMANCE (IN SECONDS)



SYSTEM UTILITIES (IN SECONDS)



SPREADSHEET (IN SECONDS)



■ TOSHIBA T3100/20
■ TOSHIBA T1000 ■ IBM PC AT (8 MHZ) ■ IBM PC

The Disk Access benchmarks write and then read a 64K-byte sequential text file to a hard disk. Sieve runs one iteration of the Sieve of Eratosthenes. Calculations performs 10,000 multiplication and division operations. The 40K Format/Disk Copy benchmark is not performed on computers with only one floppy disk drive. The 40K File Copy benchmark copies a 40K-byte file on the hard disk. The Spreadsheet tests load and recalculate a 25- by 25-cell Multiplan (1.06) spreadsheet. GWBASIC 2.1 was used for the disk access and basic performance tests. On the T3100/20 and the IBM PC AT, the disk access, file copy, and spreadsheet tests were performed from the hard disk drive; on the T1000 and the IBM PC, the disk access, file copy, and spreadsheet tests were performed from the floppy disk drives.

full 25 lines by 80 columns. The red-orange gas-plasma display is a large part of the T3100/20's appeal and usefulness, and there is no question that it is far more readable than even the best LCD screens. The character set of most LCDs is blocky at best. The characters on the Toshiba are sharp and easy to read, due in part to the screen's 1-to-1 aspect ratio. In addition,

LCD displays tend to "ghost" as information scrolls down the screen, making it difficult to read information from the MS-DOS TYPE command, or from a bulletin board or on-line information service at 1200 bps. The T3100/20's screen showed no lag or ghosting and no flicker under fluorescent lights.

For all its virtues, however, the To-

shiba's display has a serious drawback: The surface of the screen is smooth and highly reflective. In my office, the fluorescent lights overhead caused considerable glare. The screen reflected light from the overhead fixtures, the image of my clothing, and anyone who happened to walk into my office. All this activity in front of the characters on the screen was

Toshiba T1000**Company**

Toshiba America Inc.
Information Systems Division
9740 Irvine Blvd.
Irvine, CA 92718
(714) 538-3000

Size

12½ by 2 by 11 inches; 6½ pounds

Components

Processor: 8-bit 80C88 running at 4.77 MHz

Memory: 512K bytes of RAM, expandable to 1.2 megabytes internally

Mass storage: One 720K-byte 3½-inch floppy disk drive

Display: Supertwist LCD with 25-line by 80-column text and 640- by 200-pixel monochrome graphics

Keyboard: 82 keys; 10 function keys; separate cursor keys

I/O interfaces: RS-232C 9-pin male connector; 25-pin female parallel connector; RGB video 9-pin female connector; RCA-type composite monochrome connector

Software

MS-DOS version 2.11 (in ROM);
Borland SideKick

Options

Internal 1200-bps modem: \$399

Internal 768K-byte memory card: \$549

External 5¼-inch floppy disk drive:
\$499

Automobile power adapter: \$59

17-key numeric keypad: \$99

Floppy Link: \$199

Universal AC adapter (100 V to 264 V AC): \$59

Carrying case: \$59

MS-DOS 3.2 (on floppy disks): \$75

Documentation

116-page *Toshiba T1000 Portable Personal Computer User's Manual*

Price

\$1199

Inquiry 888.

The Toshiba T1000

The Toshiba T1000 (\$1199) presents a nearly complete contrast to its bigger brother, the T3100/20. Where the T3100/20 trades elements of portability for power, the T1000's scales are tipped in favor of portable convenience. In fact, the T1000 is the first laptop I've seen that's better than the venerable Tandy model 100 for the type of work (writing on the road) for which I need a portable.

The T1000 (see photo A) is a full IBM PC-compatible computer in a compact 6½-pound package. In its standard configuration, the T1000 comes with an 80C88 running at 4.77 MHz, 512K bytes of 100-ns RAM, MS-DOS version 2.11 in ROM, a single 720K-byte 3½-inch floppy disk drive, a 25-line by 80-column supertwist LCD screen with a resolution of 640 by 200 pixels, a full-size 82-key keyboard, and video (RGB and composite), parallel, and serial ports.

The machine that I reviewed had the optional 1200-bps internal modem (\$399). It also had a memory-expansion board with 768K bytes of 100-ns RAM (\$549) that could be configured as a nonvolatile RAM disk. Like the T3100/20, the T1000 is covered by a one-year warranty, with an extended two-year warranty available at extra cost. For a complete list of the available options and their prices, see the box at left.

Without the RAM disk, the T1000 harks back to the olden days of personal computing, when disk space was precious and users often had to spend a considerable amount of time swapping disks with files back and forth in laborious "housecleaning." With the RAM disk in place, the T1000 becomes the most portable IBM PC-compatible computer I've ever used, free not only from the power cord but also from the extra baggage of numerous floppy disks.

After setting up the RAM disk (a one-time, 1-minute procedure), I installed the XyWrite III Plus word processor, the



Photo A: The Toshiba T1000 is a 6½-pound 80C88-based laptop that operates from rechargeable batteries.

communications program PC-Talk, and Lotus 1-2-3 on the RAM disk. There was still plenty of room left over for files that I needed to work on, and working completely from the RAM disk was both much faster and less of a battery drain than working from the floppy disk drive.

As with any battery-powered device, battery life is an important issue for the T1000. The nickel-cadmium battery on the computer lasted from 3 to 5 hours before the low-battery indicator was activated; the exact time depended on how much disk activity had taken place. According to Toshiba, the nonvolatile RAM is safe as long as any charge remains in the battery. One user's RAM disk was still intact 2 days after the low-power light came on; however, I would recommend that you recharge the battery as soon as possible after the light appears.

Of course, the T1000 is no match for the T3100/20 in computing speed, but then, a PC is no match for an AT. Life is filled with decisions and compromises. In this case, the T1000 trades bulk, expandability, and speed for functionality and tremendous portability at a reasonable price.

more than a little distracting. The screen angle is adjustable across a wide range, but no angle (at least, no angle that left the screen visible from my chair) could eliminate the glare. In fairness, my office lighting is tough on displays, and the sparse incandescent lighting found in most hotel rooms is perfect for the gas-plasma display. The problem with glare

also turns up with the screen on the Compaq Portable III, which has a gas-plasma screen that is very similar to the Toshiba T3100/20's.

Using the Power

I ran a number of programs on the T3100/20, including Lotus 1-2-3 Release 2, XyWrite III Plus, WordStar 4.0, Pib-

term 3.2.5, PC-Talk III, GWBASIC 2.1, and Reflex version 1. All ran quite well. The only problems arose when CGA graphics were displayed on the gas-plasma screen in such a way that the "colors" were indistinguishable from one another.

As mentioned earlier, the computer comes packaged with MS-DOS version

continued

3.2 and Lotus Metro. As a longtime user of SideKick, I was impressed by Metro's ease of use and the flexibility and power of the various desk accessories.

The T3100/20's keyboard is a solid, middle-of-the road affair. It does not offer the tactile feedback of the IBM keyboards or an audible key click, but it is far superior to some of the mushy keyboards sold with clones. The lack of a separate numeric keypad may be important to some users, but I found the layout easy to use and work with. An optional numeric keypad is available for \$99 for those who need one.

The *Toshiba T3100 Portable Personal Computer User's Manual*, included with the system, is thorough, clearly written, and well organized. A one-year warranty is standard on all components; a two-year warranty on all components is available at additional cost.

The Beauty and the Blemishes

The T3100/20's predecessor, the T3100, achieved the rank of status symbol among many of America's regular business travelers. A major factor in the status of the T3100, and of the T3100/20 as well, is the laptops' appearance. These machines, with their angular, sleek, matte-gray plastic cases, conjure Eurotech visions of an elegant office. The only part of the T3100/20 that seems out of place is its handle.

It's not that the handle is useless; it makes a dandy stand to bring the machine and its keyboard to the proper angle for typing. The problem is that the handle might suggest that the computer can be carried around without its case. From desk to desk in an office, this is OK, but venturing outside with a bare T3100/20 would be a major mistake. For one thing, there's no place to put the power cable. For another, the case has holes in it. There are cooling slots in the back of the display panel and an opening for the cooling fan in the rear of the computer, thus affording lots of opportunities for water and assorted detritus to get in and wreak havoc on this beautiful and rather expensive machine.

Another drawback of the T3100/20 is its cooling fan. Obviously, in a computer based on the components used by this machine, forced-air cooling is a must. Unfortunately, the fan in the Toshiba makes a sound at a pitch and volume optimal for making my teeth itch. The noise is made worse by an apparent interaction with the hard disk drive: Disk activity causes a definite change in the noise pitch of the fan, in addition to the normal sounds of disk access.

The third problem has to do with the power consumption of the T3100/20,

which is high enough to require connection to an AC power outlet. I didn't think the power requirements would be a severe handicap; I simply planned my work for places where I could expect to find an electrical outlet. I didn't reckon on the security forces at LaGuardia Airport. Their hand-check of a computer is simple: Turn it on, and if the screen does computer-like stuff, it's a computer. We searched the X-ray machine for an outlet while the passengers for the 6:00 shuttle stacked up behind me. This episode aside, I found that a portable computer is most useful when it can be used in a car, on a plane, or in an airport waiting area. All this is sacrificed with the Toshiba T3100/20.

A Stiff Competitor

The Toshiba T3100/20 is certainly at or near the top of the portable computer field in both price and performance. I expect it to compete directly with two other computers on the market: the NEC MultiSpeed, which runs faster than the crowd of 8088-based portables, and the Compaq Portable III, which uses an 80286 CPU clocked at 12 MHz. The T3100/20's hard disk drive speeds operations and reduces the number of floppy disks in your carrying case. In sheer screen readability, the Toshiba comes out well on top. On the other hand, the MultiSpeed frees you from dependence on an AC power supply—and does it for \$2195, a considerably lower price than that of the T3100/20.

The Compaq Portable III shares many features with the Toshiba T3100/20. They both have 80286 CPUs, internal hard disk drives, and gas-plasma displays. The price of a Portable III with a 20-megabyte hard disk drive is \$4999, which is about the same as that of the T3100/20, and it too has to be plugged into an electrical outlet.

The Compaq's advantages include its capability (through a piggyback unit) to use full-size AT add-in boards, and its speed, from a 12-MHz system clock. The Toshiba gets the nod for pure portability: The Compaq is 5 pounds heavier, and its lunch-box configuration is more cumbersome than the Toshiba's flat shape. Lastly, the Toshiba is a simply a better-looking computer than the Portable III. This didn't make my spreadsheets recalculate faster or replace the AC power cord, but it did please my sense of aesthetics. [Editor's note: *For more information on the Compaq Portable III, see the review "Compaq's new Carry-on" by John Unger in the May 1987 BYTE.*]

The Toshiba T3100/20 is expensive, but for the money you get 80286 power and greater portability than any other AT

compatible. You can buy computers that are more portable, and you can buy faster computers, each for less money than the Toshiba. But if you need speed and portability in one package, the Toshiba T3100/20 should be at the top of your list. ■

VIEWS FROM BIX: T3100/20 and T1000

laptops/reviews #4, from Tom Moran.

I do software development and must occasionally visit distant customers. I've taken the T3100/20 to Europe and Asia. With the hard disk, I can take along essentially a duplicate software development environment and make any changes, or show any demonstrations, on the spot. The disk can also be a "data briefcase" for taking large files to and fro. My customers and my hotels always have electricity, and the plane or airport between customers is the last place I need to use the computer. The T3100/20 often draws admiring and curious crowds. I think that has had a positive effect on my meetings.

laptops/reviews #5, from Richard Berry.

I am using a T3100/20. The fan pitch is actually a high-voltage leak from the power supply, as near as I can tell. I had a previous T3100 that sounded like nails on a chalkboard. It appears that the stronger the power draw, the quieter the noise is. To demonstrate this, close your screen with the machine on. It should be quite strong at that point. I simply took my machine back and had it replaced. My present machine has no noise at all. Since Toshiba offers an excellent service policy, you may wish to send it back to be repaired. My only experience with service has been with the 20-meg upgrade through the DYN service network, but I was extremely impressed, sending in my machine Monday night and receiving the upgraded machine Wednesday morning. As I said, the screeching is not unknown among the T3100s, but it isn't a necessity to operating the machine.

laptops/reviews #6, from Jean U. Thoma.

If the Toshiba T1000 had a seat for an 8087 coprocessor (which could take the physical space of the modem), it would reach a vast market in universities. Without it, engineering software runs 3 times slower or not at all, so I am unable to recommend it to students. I like the T1000 for portability and memory, but I sorely miss the coprocessor. I use only laptops, at home and on or off campus, and do not need batteries since I always find an electric outlet.

No One Computer Can Meet All Of Your Needs, But One Company Can.

Priorities. They're different for every department. Some need more power in a computer that takes up less space. Others want state-of-the-art performance today with engineering innovation to keep up with tomorrow.

What's the answer? **AST Premium/286**
AST Research. We've been providing quality enhancement boards, peripherals and connectivity solutions for years. Now, with our complete family of high-performance computers, AST provides a single source for a broad range of needs. And model for model, AST Premium™ computers feature solid compatibility and superior performance for the best value on the market.



AST Premium Workstation

Take the AST Premium/386, for example. With 20 MHz operation, advanced architecture and AT® hardware compatibility, it's an incredible power tool for MS-DOS®, MS OS/2™ and XENIX® applications.

For general office computing, the AST Premium Workstation™ provides the power and flexibility of competing machines three times its size. And for extraordinary compatibility and 10 MHz, 0 wait-state speed, the acclaimed AST Premium/286 is at the top of its class, with a built-in upgrade path to the next generation of microprocessors.

For a more productive, versatile environment, make AST products your top priority. Need more information? Fill out the coupon below, or call AST Research, (714) 863-0181, ask for operator AA003.

AST
RESEARCH INC.

	AST Premium/386	AST Premium/286	AST Premium Workstation
Microprocessor	80386	80286	80286
Speed (MHz)	20†	10/8/6	10/6
Wait States	0-1	0	1
Standard Memory	Up to 2 MB	1 MB	1 MB
Expandable to	13 MB	13 MB	4 MB
Video Adapter	Optional	EGA/HGC (most models)	EEGA/EGA/HGC module
Expansion Slots	7*	7**	2
Fixed Disk	40/90/150 MB	20/40/70 MB	40 MB
Diskette Size	5¼" or 3½"	5¼" or 3½"	5¼" or 3½"

† Three software selectable speeds for timing-sensitive programs.

* One 32-bit dedicated to memory, three AT-compatible 16-bit multibank and one 16-bit AT-compatible; and two 8-bit in standard models.

** One 8-bit, six 8/16-bit including 2 FASTslots™; and four user slots in standard models.

Please send me more information on the following:

- Premium/386
- Premium/286
- Premium Workstation
- Please have an AST representative call me.

Name _____

Title _____

Company _____

Address _____

City/State/Zip _____

Phone _____

AST Research, Inc., 2121 Alton Avenue, Irvine, CA
92714-4992 Attn: M.C.

BYTE 1/88

AST Markets products worldwide—in Europe and the Middle East Call: 44 1 568 4350; in the Far East call: 852 5 717223; in Canada call: 416 826 7514. AST and AST logo registered and AST Premium and AST Premium Workstation trademarks AST Research, Inc. MS-DOS and XENIX registered and MS OS/2 trademark Microsoft Corp. AT registered trademark International Business Machines Corp. Copyright © 1987 AST Research, Inc. All rights reserved.

The American Success Story Continues..



CLUB 286 (12MHz Zero Wait State) (16MHz Throughput) Mono System **\$1695**

- 12MHz, Zero Wait State 80286 /• 16MHz Throughput /• Small Footprint Chassis /• Secured Hardware Reset /• 12" Monochrome Monitor (800x350) /• Hercules Compatible 132 Column Video Card
- Speaker On/Off /• Standard **1MB** Memory /• Norton SI:15.3
- Keyboard Selectable Between 8/12 and Zero/1 Wait State
- Plus Basic System Features /• Made in U.S.A.

12MHz EGA System **\$2065**



CLUB 286 (10MHz Zero Wait State) (12MHz Throughput) Mono System **\$1529**

- 80286 10MHz Zero Wait State /• 8/10 Keyboard Switch
- 12" Monochrome Monitor (800x350) /• Hercules Compatible 132 Column Video Card /• Wait State Insertable Slots
- 12MHz Throughput /• 2 Serials, 1 Parallel Port Built In
- Norton SI:V(3.0) 11.5 /• Plus Basic System Features /• Made in U.S.A.

10MHz EGA System **\$1895**

Basic System Features:

- 80286 16-bit CPU /• 512K Motherboard Expandable to 1MB
- Clock Calendar with Battery Backup /• 195 Watt Power Supply 220/110V (UL, CSA) /• Fully Compatible AMI BIOS (Written in USA)
- 200 Page Documentation and User's Guide /• Limited One Year Warranty
- Optional Add Ons: 360KB Floppy Drives/ Enhanced Keyboard/ 720KB Floppy Drives 3 1/2"

286 System Options

20MB 65ms Half Height	\$280	80287-8	\$235
30MB 39ms Full Height	\$500	80287-10	\$310
44MB 28ms Full Height	\$575	Optical Mouse	\$99
72MB 23ms Full Height	\$920	Mechanical Mouse	\$69
71MB 28ms Full Height	\$870	14" Flatscreen Evrvision Mono Monitor	CALL
130MB 18ms Full Height	\$1800		
NEC Multisync	CALL		

ORDER BY MAIL: Check and Money Order. California add 7% Sales Tax.

ORDER BY PHONE: COD, Cashier Check, VISA (5%), American Express (4%), or Approved Company P.O.'s

Policy and Terms: All prices are subject to changes and quantities may be limited and we reserve the right to substitute equivalent items. Unauthorized returns are subject to a 15% restocking fee. RMA numbers must be attached to all returned items and must be sent shipping prepaid by customer. The limited warranty is 1 year on parts and 6 months on labor.



All 14" Evrvision monitors shown above are optional.

NEC, Hercules, Evrvision, CR/2, CR/1, Xenix, Unix, Dbase III+, Lotus, Framework, Slickick, Symphony, PC Limited, Compaq and Premium 286 are trademarks or registered trademarks of their respective companies.

And now, the most powerful line up of machines from the leading manufacturing, design and engineering company in America....

Introducing the 12MHz Pulse

The CLUB 286 Series of computers is ready for OS/2™ and OS/3™. The CLUB 286 Series will run Xenix, Unix, DBase III+, Lotus, Framework, Sidekick, Symphony and a host of all the popular software you can think of.

Call for our 386 Machine



**CLUB 286 (8MHz 1 Wait State)
8MHz Monochrome System**

- Includes Basic System /• 12" Monochrome Monitor (800x350) /• Hercules Compatible 132 Column Video Card /• Made in U.S.A.

Special Only
\$995

8MHz EGA System \$1399

**CLUB Turbo 4.77/8.0MHz
Monochrome System**

\$699

- 8088-2 Keyboard Selectable /• 256K Standard /• 12" Monochrome Monitor (800x350) /• Hercules Compatible 132 Column Video Card
- 135 Watt Power Supply

4.77/8MHz EGA System \$1150 **20MB System Add \$300**

Model	Pulse-286	IBM	PC Limited	COMPAQ	Premium 286
Processor:	80286-12	80286-10	80286-12	80286-12	80286-10
Clock speed					
Wait States	0	1	0	1	0
Norton SI (2.0)	15.3	10.1	13.3	11.5	11.5

Mon - Fri	7:30 - 6:30 (West Coast)
Mon - Fri	10:30 - 9:30 (East Coast)
Saturday	10:30 - 3:00 (West Coast)
Saturday	1:30 - 6:00 (East Coast)

International sales desk now open
Corporate Buyer call for Corporate Desk
University P.O.'s are welcome
Dealers and Quantity Discounts are available

CLUB

American Technologies, Inc.

3401 W. Warren Ave., Fremont, CA 94539
FAX (415) 490-2687 (24 hrs.)

(415) 490-2201 **Tech Support (415) 683-6580**



Who's got connections at AT&T...Rolm...DuPont... and 39 of the other top 50 Fortune 500?

USRobotics Courier™ modems.

The top Fortune 500 companies know data communications and look hard at their bottom line. What could persuade them to purchase USRobotics Courier modems?

**Superior performance.
At a fair price.**

With our complete line of dial-up modems—from 1200 bps to 17,400 bps—our customers get dependable performance under exacting conditions. Plus the assurance of dealing with a manufacturer who has over 10 years



experience and has sold over half a million modems.

Of course, it's easy to spend money for the false security you get from a more famous name. But with USRobotics, you pay only for what's important:

reliability, manufacturing quality,

ease of use, robustness, elegant technical design. And a company committed to service, support and caring for its customers.

Courier modems from USRobotics. Connect with us.

Call 1-800-DIAL-USR Ext. 67
In Illinois (312) 982-5001

USRobotics®

The Intelligent Choice in Data Communications.
8100 McCormick Blvd., Skokie, Illinois 60076.

USRobotics and Courier are trademarks of U.S. Robotics, Inc.



The Symmetric 375

Patrick Wood

Symmetric's new system brings Berkeley Unix to a portable box

The Symmetric 375 computer is a small, portable Berkeley Standard Distribution (BSD) 4.2 Unix system loaded with many useful features. Its small size (about that of a Compaq Portable II) and weight (22 pounds) make it the only portable BSD Unix system I know of. The list price of the system reviewed here (which includes a bundled terminal and printer) is \$8995, but Symmetric discounts the price to \$8,095 if it is prepaid.

System Hardware

The Symmetric uses a National Semiconductor NS32016 processor running at 11 megahertz with no wait states and a 64-bit NS32081 floating-point processor. The reviewed system came with 2 megabytes of 150-nanosecond dynamic RAM (expandable to 8 megabytes) and an 85-megabyte (unformatted size) hard disk drive. Due to a shortage of the 60-megabyte standard SCSI cassette tape drives, the review system came equipped with a 1-megabyte floppy disk drive.

The Symmetric has several ports on the back, including four serial ports that can be set from 50 bits per second to 38.4K bps, a Centronics parallel port, a 10-megabit "thick" Ethernet port, a SCSI port with an asynchronous transfer rate of 1 megabyte per second, an ST506 hard disk drive port, and a floppy disk drive port. The system also has a Reset button and an LED digital display located in the back. The digital display shows the current interrupt level, and you know the system has hung if the number doesn't change.

The hard disk drive is fairly fast, with a 28-millisecond average access time. The floppy disk drive can read both 40- and 80-track floppy disks in a number of configurations; it read a Xenix tar disk (made



on a 360K-byte floppy disk) with no trouble. The system comes with two commands for handling MS-DOS disks: `msdir` and `msget`. I was able to copy the BYTE benchmark files from MS-DOS formatted floppy disks with no problems.

The inside of the Symmetric is rather unexciting: There are no slots for expansion cards, and most of the circuitry is on the main board, with a few cables leading off to peripherals and a power supply.

System Software

The Symmetric runs a "plain vanilla" Berkeley 4.2 BSD Unix. It supports demand paging to disk with a 16-megabyte virtual memory address space for each process. The standard Berkeley features, such as job control and the new terminal driver, performed flawlessly, as did `vi` and the C shell. The Bourne shell was the

standard Seventh Edition version. The line-printer spooler worked fine (with a serial printer), and none of the system utilities I used showed any departure from a standard BSD system.

I ported several thousand lines of C code from a variety of sources designed to run on Berkeley Unix, and all of it compiled and ran without change, except for a problem with floating-point numbers (discussed below). Some code designed to run on System V and Xenix V ported over, but some of these programs simply wouldn't run at all. This is hardly surprising, given the differences between these versions of Unix. Symmetric says that, by the time you read this, a new version of the operating system will be available that supports both BSD 4.3 and the System V Interface Definition (SVID), the standard by which Unix systems are compared to AT&T's System V.

The Symmetric 375 is shipped with eight standard languages: C, FORTRAN-77, Pascal, BASIC, APL, assembly language, LISP, and ICON. Of these, I evaluated only the C compiler. The review system also came loaded with optional software, including T_EX, Ingres, EMACS, SPICE, TOP, GDB, Q-CALC, the Symmetrix Kernel Configuration Package, and a window manager for

continued

Patrick Wood (Pipeline Associates Inc., 49 Manito Ave., Lake Hiawatha, NJ 07034) is the coauthor of four books on Unix and C and is consulting editor for the Sams Unix System Library. He is also vice president of Pipeline Associates Inc., a company specializing in Unix and C training and consulting. He can be contacted on BIX as "patwood."

Symmetric 375**Type**

Portable 4.2/4.3 BSD Unix system

Company

Symmetric Computer Systems
40487 Encyclopedia Circle
Fremont, CA 94538
(415) 651-6090

Size

14 by 6 by 12 inches; 22 pounds

Components

Processor: 11-MHz National Semiconductor 32-/16-bit NS32016, with NS32081 floating-point unit and NS32082 memory management unit
Memory: 2 megabytes of zero-wait-state RAM, expandable to 8 megabytes; 8K-byte ROM start-up program
Mass storage: 85-megabyte (unformatted size) internal hard disk drive; internal 60-megabyte SCSI cassette tape drive
Ports: Four serial RS-232C ports, configured as DCE and speed-selectable from 50 bps through 38.4K bps; Centronics-compatible parallel port; 10-megabit Ethernet with TCP/IP support; external Shugart-style floppy disk interface; external SCSI interface; external ST506 hard disk interface
Other: DEC VT-52-NT-100-NT-220-compatible Esprit Opus 220 terminal with amber screen, detached keyboard, Epson-compatible printer, and clock/calendar with battery backup

Software

Berkeley Unix 4.2, FORTRAN-77, assembly language, Pascal, LISP, ICON, BASIC, APL, and C

Options

8 megabytes of RAM: \$2200
170-megabyte hard disk drive: \$1900
380-megabyte hard disk drive: \$3200
760-megabyte hard disk drive: \$4500
Q-CALC: \$750
University Ingres: \$20
EMACS: \$20
SPICE: \$15
TOP: \$15
GDB: \$20
Kernel Configuration Package: \$100
TEX: Contact company for availability

Documentation

The 375 Owner's Manual, 232 pages

Price

Symmetric 375 with terminal and printer: \$8995 (\$8095 prepaid)
Symmetric 375 low-end system with 50-megabyte hard disk drive, 1-megabyte 5¼-inch floppy disk drive and without SCSI port and Ethernet port: \$5550 (\$4995 prepaid)

Inquiry 886.

Apple Macintosh computers. Of these, I tested TEX, EMACS, Q-CALC, and GDB. All performed well. In all, 30 megabytes of software was supplied with the system, some of it in source code form. With the exception of Q-CALC and the Kernel Configuration Package, the optional software is available on floppy disks for a copying fee of either \$15 or \$20 per program. Software distribution on 50-megabyte TEAC cassette tapes is available at \$15.50 per tape.

The C compiler on the Symmetric seems slow because it spends a lot of its time in the optimization phase and produces tight code. Symmetric claims that its C compiler is "highly compatible with Berkeley VAX C" and that "all data types except float and double are bitwise identical to VAX convention." The float and double data types follow the IEEE 754 standard floating-point format, to support the NS32081 math chip. However, the compiler's floating-point compatibility leaves much to be desired. For example, the code

```
struct obj {
    float x;
    float y;
} obj;

test (p1, p2)
struct obj *p1, *p2;
{
    float y;

    y = p2->y;
    y = y * (p2->y - p1->y);
    /* dies on this line */
}
```

produces this error message:

```
"test.c", line 12: compiler error:
expression causes compiler loop:
try simplifying
```

This code compiles properly on a VAX running BSD 4.3, Xenix V, and Borland's Turbo C compiler. It also compiles properly on the Symmetric if the structure elements are anything but float or double, or if the pointers p1 and p2 are static.

GDB, a symbolic source-code debugger, was supplied with this system. I used it to debug a couple of programs that I had difficulty porting. I was able to find simple bugs with GDB's extensive on-line help facilities.

The Symmetrix Kernel Configuration Package allows the system administrator to customize the configuration of the operating system. It lets you add or remove device drivers, thus changing the amount of memory required by the kernel.

The Symmetric comes with a stripped

version of Donald Knuth's TEX text-formatting system (the full font package is around 300 megabytes). It doesn't include all the TEX font files, but it does include all the files for 300-dot-per-inch printers in sizes from 5 to 12 points, as well as 10-point fonts for printers of other resolutions. This represents an intelligent compromise: 300-dpi laser printers abound, and they are good devices for getting reasonable-looking output from TEX.

Communications Software

The Symmetric is shipped with a couple of networking packages: UUCP, the standard Unix networking software, and TCP/IP, the standard BSD Ethernet software, which includes commands for copying files to and from remote systems, remote command execution, and remote log-in. It also comes with SL/IP, a serial networking package.

The Berkeley version of UUCP that comes with the system had some problems communicating with my Xenix system at 9600 bps. I could send data from the Symmetric to my Xenix system (an AT&T PC 6300 running Xenix V) without any problems; however, data sent the other way caused UUCP's communications program uucico to fail. At 9600 bps, some files did make it through, but the effective transmission rate was around 400 bytes per second (probably due to the number of packet retries).

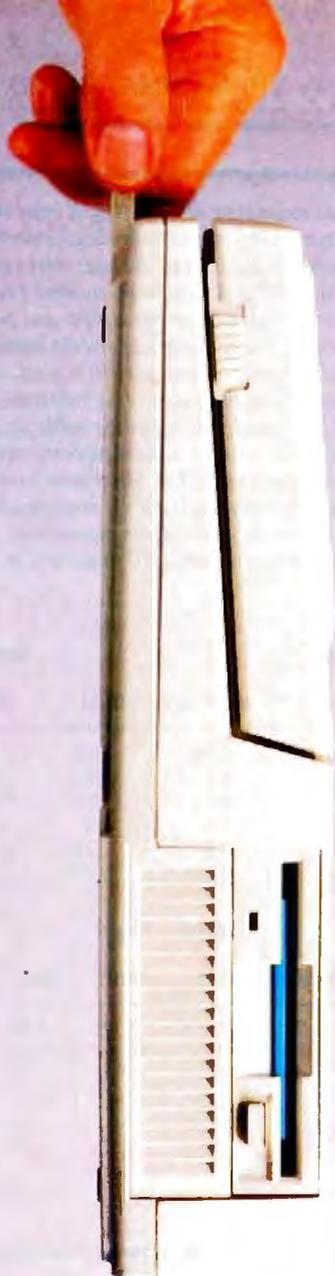
Communicating with other systems over the modem worked properly. The program tip, used to connect to the modem for logging into remote systems, worked well, and the uucico program transferred and received files with no problems. The only drawback of this system is that it has trouble dropping the DTR line, causing the modem to remain connected to some systems. Although there may be a way to fix this, I couldn't determine how from the documentation provided.

I didn't test the TCP/IP or SL/IP software because I didn't have access to an Ethernet network or another system that could run SL/IP; however, the local-host command (used to test the local part of TCP/IP via cooperating processes) worked fine.

Terminal, Printer, and Documentation

The Symmetric 375 is bundled with a VT-220-compatible Esprit Opus 220 terminal with a detached keyboard and an amber screen. The keyboard contains the full ASCII character set, an 18-key numeric keypad on the right, 18 programmable function keys across the top, and

continued



We're Making A Small Case For The Hard Disk.

The industry said it couldn't be done. You can't put a hard disk in a portable PC, make it powerful, and keep it under 11 lbs.

Well, with that challenge in mind, we immediately went to work to prove them wrong. Presenting the results. The new T1200.

With a footprint of only one square foot, it comes with a 20MB hard disk, one 720KB 3½" diskette drive, 1MB of RAM, MS-DOS® 3.2, and Borland Sidekick™ software. So you get desktop PC features, with the performance of a powerful PC-compatible 80C86 processor, running at 9.54 MHz.

But that's not all. Take a look around back. There you'll find

more ports than the California coastline. One for everything including parallel, serial, RGB and monochrome monitors, 5¼" floppy disk drive and numeric keypad.

The T1200 is easy to face, too. With its new super-twist LCD screen and a full-size keyboard. But better still, thanks to its removable, rechargeable battery, you can keep computing wherever you go.

Just call 1-800-457-7777 for your nearest Toshiba dealer and ask him to show you the new T1200.

Before they all get carried away.

In Touch with Tomorrow
TOSHIBA

Toshiba America, Inc., Information Systems Division

The T1200 is backed by the Exceptional Care program. One time enrollment required. See your dealer for details. MS-DOS is a registered trademark of Microsoft Corporation. Sidekick is a trademark of Borland International, Inc.



Table 1: Unix benchmarks. User time is time spent executing nonprivileged instructions. System time is time spent executing privileged (kernel) commands (i.e., system calls) plus system-level overhead (e.g., context switching between processes). Real time is elapsed time, and it is often not the sum of the user and system times; the difference is the time spent waiting for I/O operations to complete, waiting for a signal from another process, "sleeping," or being swapped into memory or out to disk. Pipe measures how long it takes to set up a pipe and pass 0.5 megabytes of data through it. System Call queries the operating system 25,000 times concerning its process identity with the getpid() system call. Function Call runs two programs: One uses a function call to accomplish a goal, and one doesn't use the function call for the same goal. The user time of the program not using the function is subtracted from the user time of the program using the function; the difference is function-call overhead, shown in the table as Delta user. Sieve runs one iteration of the Sieve of Eratosthenes. Write and Read test the random-access disk implementation. Write creates, opens, and writes a 256-by-512-byte file. Read reads this file and then removes it. The Shell tests invoke background processes. The shell statement wait causes the shell script in mult1.sh to pause until all the requested background processes have terminated. The background process tst.sh invokes several commonly used Unix commands and exercises disk access with them. Loop tests long-integer arithmetic and is mostly processor-bound. All times are in seconds.

Unix benchmarks

Machine	Unix version	Pipe			System Call			Function Call		
		Real	User	System	Real	User	System	Delta user		
Symmetric 375	4.2 BSD	13.53	0.01	6.75	6.98	1.13	5.70	0.90		
IBM PC XT	PC/IX	16.6	0.1	7.6	39.8	2.9	35.6	4.7		
AT&T PC 6300	Xenix V	11.70	0.07	3.62	15.32	1.10	14.05	1.52		
AT&T Unix PC	System V	4.2	0.0	1.6	8.1	0.2	7.5	0.7		
Sun-3/160	4.2 BSD	2.73	0.00	1.90	2.75	0.48	2.13	0.20		
VAX 8600	4.3 BSD	0.67	0.00	0.28	0.77	0.05	0.55	0.12		

Machine	Unix version	Sieve			Write	Read	Shell			Loop		
		Real	User	System	Real	Real	Real	User	System	Real	User	System
Symmetric 375		2.73	2.58	0.06	2.25	5.38	4.66	0.26	1.96	8.18	8.01	0.08
IBM PC XT		8.2	7.8	0.3	11.6	20.7	8.5	1.1	3.2	32.2	31.5	0.3
AT&T PC 6300		4.42	3.85	0.40	7.23	17.35	12.38	0.43	3.98	16.62	15.8	0.37
AT&T Unix PC		2.4	2.1	0.0	3.9	11.6	5.1	0.2	1.2	6.8	6.2	0.1
Sun-3/160		0.73	0.62	0.00	1.33	1.00	2.78	0.08	0.77	2.00	1.80	0.02
VAX 8600		0.32	0.28	0.00	0.32	0.13	1.07	0.00	0.15	0.73	0.60	0.00

Multitasking Unix benchmark (real time):

Machine	Unix version	Number of concurrent processes					
		1	2	3	4	5	6
Symmetric 375	4.2 BSD	4.65	6.42	8.15	9.80	11.61	13.29
IBM PC XT	PC/IX	10.6	23.4	42.8	74.1	84.2	130.7
AT&T PC 6300	Xenix V	12.52	16.38	22.97	28.33	35.78	43.33
AT&T Unix PC	System V	6.3	8.7	12.7	19.2	22.8	29.8
Sun-3/160	4.2 BSD	2.63	3.14	3.69	4.25	4.85	5.51
VAX 8600	4.3 BSD	1.17	1.51	1.83	2.17	2.53	2.83

Table 2: The BYTE C language benchmarks. (For more information, see "A Closer Look" by Richard Grehan in the September 1987 BYTE.) All times are in seconds, except for the Dhrystone, which is in Dhrystones per second. The Dhrystone version is 1.1, using no registers, for 50,000 iterations.

Test	Symmetric 11-MHz 32081 FPU	IBM PC AT 8-MHz 80287	Model 80 16-MHz 80387	AT&T PC 6300 No FPU	AT&T Unix PC No FPU	Sun-3/160 16-MHz 68881	VAX 8600
Dhrystone*	793	1590	3626	561.5	980	3333	8888.67
Fibonacci	206.16	126.22	57.26	356.45	185.4	44.13	33.40
Float	4.57	10.98	1.62	764.50	39.1	14.67	0.40
Savage	103.39	37.30	9.49	6607.00	1009.0	205.30	5.35
Sieve	46.19	24.60	6.45	59.03	41.0	11.23	4.55
Sort	47.08	43.17	7.74	105.42	51.9	12.07	4.27

* Higher figures denote faster performance.

11 cursor keys. It consumes under 50 watts of power.

I'm used to an IBM PC keyboard layout, and I found the layout of this keyboard almost unusable. For example, the Shift Lock key is on the left-hand side between the A and the Control key; the > and < symbols are on a special key on the left-hand side, to the left of the Shift key; and the | symbol is on a special key to the right of the Return key. These keys are used extensively on Unix systems, so I had trouble getting used to the layout. Since the Opus 220 lists for \$675, I would suggest getting a terminal you're comfortable with and asking Symmetric for a credit.

The printer was unavailable for review. However, considering the low cost of today's printers and the fact that many people already have one or two, it seems odd to bundle one in with this system. Again, I see no reason to get the printer with the system and suggest that you ask Symmetric for a credit for it or that you settle for the low-end version of the system, which doesn't include the printer or the terminal.

No printed documentation was available when the system was first sent to me. Symmetric explained that the documen-

tation was being revised and reprinted. However, the standard Berkeley Unix manual pages were on the computer, so I was able to navigate my way through the system. A few weeks later, I received *The 375 Owner's Manual*, which includes schematics of the CPU board but lacks an index and is very light on introductory material.

Performance and Problems

I ran the BYTE Unix benchmarks (see "Benchmarking Unix Systems" by David F. Hinnant in the August 1984 BYTE) and the BYTE 32-bit C benchmarks (see "A Closer Look" by Richard Grehan in the September 1987 BYTE) on the Symmetric 375, an IBM PC XT running PC/IX, an AT&T PC 6300 running Xenix V, an AT&T Unix PC running System V, a Sun-3/160 running Sun BSD Unix 4.2 release 3.2, and a VAX 8600 running BSD 4.3 (see tables 1 and 2).

As the Unix benchmarks show, the Symmetric's performance is roughly three times that of the PC 6300 and is about the same as the Unix PC's, except for the disk I/O and the multitasking benchmark (the Unix PC was tested with 1 megabyte of memory and a slower disk drive). The C benchmarks show that the

Symmetric tested slightly slower than the AT&T Unix PC, except in the floating-point benchmarks, where the Symmetric's floating-point unit (FPU) gave it an advantage. The Symmetric has less raw processing power than an 8-MHz IBM PC AT and isn't nearly as fast as the Sun. Ken McDonell's Monash benchmarks, which are more extensive workload-based Unix benchmarks, show the Symmetric running about 40 percent slower than a DEC MicroVAX II and a Sun-3/50 and about 60 percent slower than a Sun-3/160.

The Centronics port failed to work with my Okimate 20 printer with a parallel-port PC personality module. Although I tried a number of tests, technical support was unable to help me get the printer to work with the system. [Editor's note: *We attempted to use a Citizen Model 120D printer and experienced the same problem. We contacted Symmetric's technical support, and after we conducted several tests, technical support concluded that something had gone wrong with the handshake electronics to the printer port for the review system.*]

Under normal use, the system didn't crash. However, it did crash when I dis-

continued

The Word Is Out: Send Protected Data Over Any Modem.



Data Sentinel™
The Word Is Out.

Now you can secure your PC data files and keep modem transmissions completely private. With the Data Sentinel hardware key from Rainbow Technologies. And without passwords or modem-matching.

Simply plug the Data Sentinel into your PC's parallel port. Then follow the easy step-by-step menu to encrypt and compress your data files. Which can be opened only with a duplicate of your own personalized Data Sentinel key.

Up to now, it hasn't been easy to send secured files. You see, 'old' modems don't encrypt or compress data. And while 'new' ones can, they can't send the secured data to an 'old' one.

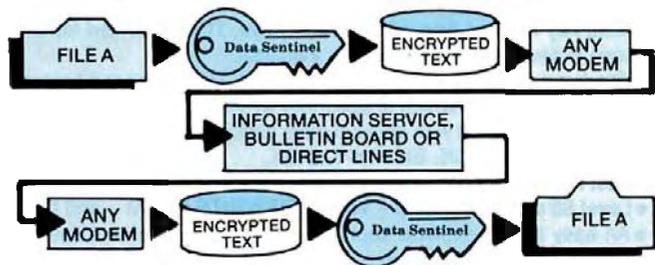
But to the Data Sentinel, that's a piece of the past. Because as long as your old-old, old-new, new-old or new-new modems at each end are compatible,

Data Sentinel-secured data can be transmitted. You can even send secured data to electronic bulletin boards and mail services like CompuServe and GENIE for a 'pickup' the next morning. And if you're not transmitting, you can use your Data Sentinel to protect your own personal files.

All of which ties up a lot of very loose ends. Very quickly. And at \$195 a pair, very affordably.

The word is out in data security. And the word is Data Sentinel.

Data Sentinel—How It Works.



Features: • For IBM PCs and Compatibles • Saves Transmission Time & Cost
• Proprietary Encryption & Compression - No Password - Easy Menu Prompts
• Plugs Into Parallel Port • Modem & Printer Transparent • DES System Compatible

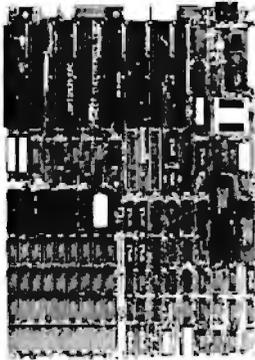
 **RAINBOW TECHNOLOGIES**

18011-A Mitchell South, Irvine, CA 92714 • (714) 261-0228
TELEX: 386078 • FAX: (714) 261-0260

©1987 Rainbow Technologies, Inc. Data Sentinel is a trademark of Rainbow Technologies.
IBM is a registered trademark of International Business Machines. CompuServe is a registered trademark of H&R Block.
Genie is a trademark of General Electric Information Services Company.

SPEED UP YOUR PC/XT NOW

NORTON SI = 9.4/10.3



You know that **SPEED** is the only thing your PC/XT never has. Its brain takes too much time to think. Have it transplanted now with the **EPC** motherboard and your system would yield an astonishingly high performance, exceeding even that of the PC-AT.

EPC is simply the **FASTEST PC/XT** Motherboard in the World that is fully compatible to all PC/XT hardware and software. It's 100% designed and made in **CANADA** and absolutely not a downsize AT clone. **EPC** comes with an **step-by-step** installation manual plus a **TWO-YEARS** warranty and prices only **US\$399.00** (with 0Kb)

SPECIFICATIONS

- 80286-10 CPU in 8088 mode
- Dual speed : 8Mhz/10Mhz
- Socketed for 80287
- Socketed for BIOS/640Kb RAM
- Industrial Grade 4-layer PCB
- 8 XT slots
- XT keyboard input
- XT Power supply input
- Dimensions: 8.5in.x14in. (fit most XT clone cases)

Dealer Inquiries Welcome

**SWEET
Electronics Inc.**

3800 Thimens Blvd.
St-Laurent, Quebec, CANADA H4R 1V6
Tel: (514) 745-2656

UTAH COBOL™

NEW
VERSION 4.0
\$ **69.⁹⁵**

For IBM®PC's, XT's, AT's and other DOS machines. This is the one you've heard so much about - with fast compile times, small object code modules, no royalties, and clear error messages. Version 4.0 is based upon ANSI-74 standards with new features including:

- Multi-key Indexed files with up to 24 keys. This advanced feature requires the software package Btrieve® which is optionally available.
- Windowing, pop-up's, color and overlays. This advanced feature requires the software package Saywhat?!™ which is optionally available.
- ACCEPT numerics with decimal point alignment, numeric checking, AUTO-SKIP, SECURITY, LENGTH-CHECK, EMPTY-CHECK.
- Fast memory mapped DISPLAY's (1, 5) ERASE, BEEP, ATTRIBUTE.
- Level 88's - READ INTO - WRITE/REWRITE FROM - and DELETE.
- An easy to use, COBOL source code EDITOR with auto line numbering, A-margin, B-margin tabbing with full screen cursor control.

Current customers can receive the new version by sending in their original diskette and \$30.00. This offer expires Dec. 31, 1987

Also available: Utah FORTRAN, Utah BASIC, Utah PASCAL, Utah PILOT, Btrieve and Saywhat?!. Used by 50,000 professionals, students and teachers in 40 countries.



SINCE 1977
ELLIS COMPUTING™
5655 Riggins Court, Suite 10
Reno, Nevada 89502

To order call:
(702) 827-3030

IBM is a registered trademark of International Business Machines, Inc. Btrieve is a registered trademark of Softcraft, Inc. SAYWHAT?! is a trademark of The Research Group. Utah COBOL is a trademark of Ellis Computing, Inc. © 1987 Ellis Computing Inc.

REVIEW: THE SYMMETRIC 375

connected the cables while troubleshooting the Centronics printer connections. The system also crashed when I tipped the unit 45 degrees forward and caused the disk to mistrack. The fourth time I did this, the system crashed and refused to boot properly. A call to technical support informed me that tipping the unit had affected the alignment of the disk's read/write head and subsequently had damaged a boot file. Technical support was able to talk me through booting from the floppy disk drive, checking the hard disk drive, restoring the damaged files, and getting the system operational again.

The person I dealt with from Symmetric's technical support was quite knowledgeable. Also, to my surprise, I wasn't bounced around to several people to find one who could fix my problem; instead, the first person I spoke with in technical support helped me with both the disk and printer problems.

Portable BSD Unix, But at a Price

The Symmetric 375 is a nice system for people who need a portable Unix system. Its portability is hampered, however, by the fact that you need a separate terminal to use it (unlike, say, a Compaq Portable). The many languages provided with the system make it ideal for program development for Berkeley Unix. It performed well, but the disk can't be subjected to much stress while running. The system is fast, but not as fast as the current generation of 80286/80386 PC clones. Its lack of high-resolution bit-mapped graphics puts it at a disadvantage with respect to Suns and VAXstations.

The real question for the prospective buyer of this system is whether its features justify its price compared to other small Unix systems. For about the same price, you can get a similarly configured Sun-3/50 or VAXstation 2000 running Berkeley Unix with an Ethernet port. For around \$5000, you can get a similarly configured 80386-based PC clone, without an Ethernet port, that runs Xenix V or Unix System V Release 3 and can easily outperform the Symmetric. The PC clone can also run multiple MS-DOS programs as processes under Unix. Note that all these other systems have bit-mapped displays, while the Symmetric uses an ASCII terminal.

If you're looking for a portable Berkeley Unix system, this is it. If you're looking for a portable software development system with a wide choice of programming languages, the Symmetric looks good. However, if you're looking for just a portable Unix system, you may want to look at the Compaq Portable III or one of the small 80386-based portables starting to come out now. ■

KAO. THE FIRST DISKETTES DESIGNED FOR THE FORTUNE 500.

Today's new generation of personal computers provides unprecedented power and capability. That's the good news.

Now the bad news. Your diskette media is stretched to the limit every time it's taken for a spin. And, as diskette densities increase, so does the chance of failure.

That's why Kao (pronounced cow) Corporation re-thought the diskette. And applied its 100 years of expertise in surface science technology to developing the first diskettes designed for today's high performance computers.

Kao diskettes employ patented, wear-resistant resins and surface-treated magnetic particles for better head-to-surface contact, the key to diskette durability and performance. And unique surface lubricants actually extend the life of your drive's read/write heads. Our new Canadian microdisk plant—the world's largest and most modern—ensures that Kao diskettes exceed every industry standard worldwide.

More than 12 million high performance Kao diskettes have been sold under many well-known brand names in the U.S.A. Now they're available from leading computer specialty and office products dealers under the Kao name. In a complete selection of sizes, densities, and colors—all the way to 2MBytes in 3.5". We even offer custom silkscreen designs—an innovative way to enhance marketing programs, improve security, and simplify diskette identification.

For the name of your nearest Kao dealer, call (800) 541-3475. (In CA: 800 548-3475). And get the first diskettes designed for the Fortune 500. Or companies that wish to join them.

KAO
Media from the Surface Scientists

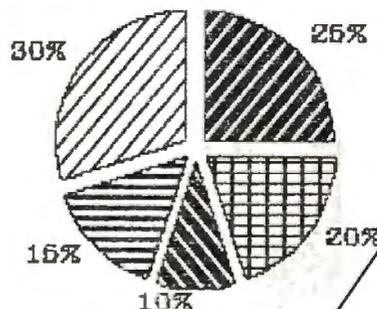


World Headquarters: Kao Corporation 14-10 Nhonbashi Kayabacho 1-chome, Chuo-ku, Tokyo 103 Japan. 813-660-7690 Fax 813-660-7789 Telex KAOJ Y0 J24816
In USA contact: Kao Corporation of America Infosystems Division, 2065 Landings Drive, Mountain View, CA 94043 (415) 965-4180 Fax (415) 965-0469
In Canada contact: Kao-Disk Ltd. P.O. Box 41, 10 Odawa Drive, Arryprior, Ont. K7S 3H2 (613) 623-7901 Fax (613) 623-8896 Telex 0533548
In Europe contact: Kao Corporation GmbH Infosystems Division, Wanheimer Str. 57 4000 Dusseldorf 30 F.R. Germany. 0211 476 0 Fax 0211 413050 Telex R587565 kaoe d

Corporate logos used are the trademarks of their respective companies. They are intended to illustrate the Kao custom silk-screen process and do not imply use of or endorsement by these companies of Kao diskettes. © 1987 Kao Corporation

HOW TO B

MARKET SHARE BY COLOR



9-pin printhead prints black and white only.

Top speed 200 cps for drafts, 40 cps for letter quality text.

As the chart above shows, red was the year's biggest selling color, commanding a 30% share of the market. Orange also performed brilliantly, earning a 25% share. The brightest surprise of all was green, at 20%, its share was double that of the previous year. As expected, both blue and yellow faded considerably in popularity.

Suggested retail price: \$549.

Control panel with 3 selections.

Noise level 63 dBA.

A "Pro" doesn't stand a chance next to the new ALPS ALQ200.™

Because the ALQ200 has more of what it takes to get more done.

Take speed, for instance. With its 18- or 24-pin printhead, the ALQ200 prints excellent letter quality text twice as fast.

And the same is true for high

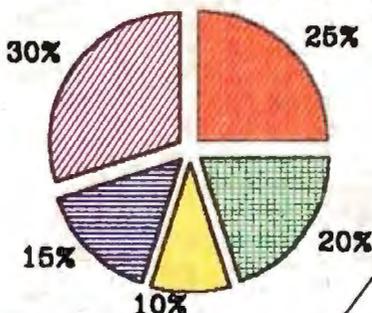
resolution graphics. Where, as you can see, we also have a distinct color advantage.

The ALQ200 even has what it takes to make people faster. Like automatic paper loading. A full-function, push-button control panel. And compatibility with all the leading PCs and software.

EAT A PRO.

Snap-in/out, interchangeable 18- and 24-pin printheads print 7 colors, including black.

MARKET SHARE BY COLOR



Top speed 240 cps for drafts, 100 cps for letter quality text.

As the chart above shows, red was the year's biggest selling color, commanding a 25% share of the market. Orange also performed brilliantly, earning a 25% share. The brightest surprise of all was green, at 20%, its share was double that of the previous year. As expected, both blue and yellow faded considerably in popularity.

ALPS ALQ200

Suggested retail price: \$595 for 18-pin, \$695 for 24-pin.

Push-button panel controls all printing functions without DIP switches or software commands.

Noise level 55 dBA.

You'll also find the ALQ200 especially compatible with busy offices. After all, it's about as solidly built as a printer can be. So it's quieter. And nearly impossible to overwork.

But what really beats all is that the ALQ200 costs about the same as the so-called "Pro."

For a free demonstration or more

information, call us at (800) 828-ALPS. In California, (800) 257-7872.

And see a real pro at work.

ALPS
AMERICA

IT'S TIME YOU SAW THE ALPS.

HypertExpert Systems

...something totally new from Knowledge Garden

HYPertext

Hypertext lets you link related concepts, logic or procedures. It adds a whole new dimension to written material like training manuals, help systems and reference works. Hypertext allows users to access information in a non-linear fashion by following a train of thought. Hypertext lets the reader control the level of detail and the type of information displayed. But that's just one side of the coin.

EXPERT SYSTEMS

The other key ingredient to real exchange of knowledge via the computer is control by the author. That's why integration of hypertext and expert systems is such a breakthrough—it lets communication take place between teacher and pupil, author and reader, expert and novice. It lets each side REACT to what the other says.

Announcing KnowledgePro™, a new development environment, from Knowledge Garden. It integrates **hypertext** with **expert systems** to create the world's first **knowledge processor**. KnowledgePro is unlike anything you have seen before.

KNOWLEDGE PROCESSOR

The age of packaged knowledge is upon us. PC's now have the power to manipulate, store and retrieve knowledge using KnowledgePro, a language for experts, and a tool for beginners. KnowledgePro is the first system to provide an effective, simple and aesthetic medium for the communication of knowledge on disk.

Big corporations can now construct expert systems for internal use quickly and without expensive AI training. Individuals can author knowledge bases for commercial or educational use.

KNOWLEDGEPRO

KnowledgePro is a totally new development environment created by Bev and Bill Thompson. It costs \$495 plus \$5 shipping and handling and runs on IBM PC, XT, AT or PS/2 with 512k memory. KnowledgePro is not copy-protected and there are no run-time fees. A working demonstration disk is available for \$30 with full credit towards purchase of KnowledgePro. Call today to order your copy.

A LANGUAGE FOR EXPERTS

KnowledgePro is for experts because it provides a wide variety of structures to work with. It has many advanced features, like inference, list processing, topics, procedural control and inheritance. You can write new procedures in other languages and interface to other programs. You can read DBASE III and LOTUS 123 data directly into the knowledge base.

A TOOL FOR BEGINNERS

KnowledgePro let's you communicate knowledge, easily and without spending weeks on the details. KnowledgePro handles the details for you. It provides easy access to colors, windows and mouse control. It's been called the BASIC of the 80's because anyone can get results quickly—and then grow into more sophisticated features at their own pace.

TO ORDER

Call 518-766-3000 (American Express, Visa, M/C accepted) or mail your **click check** today.

Knowledge Garden Inc.
473A Malden Bridge Rd.
Nassau, NY 12123

The run-time version of KnowledgePro is free on the electronic networks or \$15 from Knowledge Garden complete with useful example applications.



Another intelligent tool in the Knowledge Garden family of products.

Published by



IBM is a registered trademark of International Business Machines Inc. KnowledgePro is a trademark of Knowledge Garden Inc. DBASE III is a trademark of Ashton Tate. LOTUS 123 is a registered trademark of Lotus Development Corp. Photo: Tcherevkoff ©



High-Performance Graphics Boards

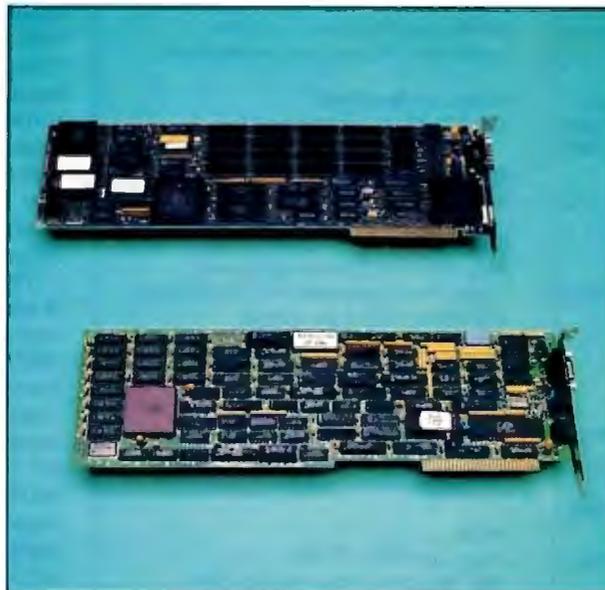
Bill Nicholls

Separate graphics processors provide high-speed, high-resolution displays

We can no longer expect the main system processor to adequately handle ever-more-complex applications and, at the same time, maintain high-performance graphics on displays with more and more pixels. To relieve the graphics bottleneck, two new high-performance graphics boards for IBM PC, AT, and compatible systems are now available: Vermont Microsystems' Image Manager 640 (VMI 640) and the Verticom 2Page Display (VTP) system. The VMI 640 uses the TI 34010 graphics processor chip, while the VTP incorporates the Intel 82786 graphics processor chip (see the text box "Graphics Coprocessors" on page 154).

Both boards emulate the CGA and provide their own high-resolution modes and custom drivers for a number of software products (see the box on page 152 for details). They also differ radically from each other in several ways. The VMI 640 is a medium-high-resolution (640 by 480 by 256 pixels) color board for MultiSync-type displays (an EGA monitor does not have the required bandwidth), particularly useful for CAD applications. The VTP is a high-resolution (1280 by 960 pixels) monochrome board, with a 19-inch monitor included.

To give you an idea of how these boards differ from current display controllers, let's compare a CGA display controller with the new designs. The first thing that jumps out at you (besides the prices—\$1695 for the VMI 640 and \$1295 for the VTP) is the amount of memory included on the new boards. The display on a CGA board has only 32K bytes of RAM. The VMI 640 board has 128K bytes of ROM (twice that of an AT), 140K bytes of RAM for the processor, and 300K bytes of RAM for the display.



The Image Manager 640 (top) and Verticom 2Page (bottom) graphics boards.

The VTP board has 512K bytes of RAM for the display and 8K bytes of ROM.

VMI 640

My VMI 640 full-length board arrived well protected with a 2-inch three-ring binder. The documentation is well organized and clear, has plenty of diagrams, makes no assumptions about what you know, and has a competent table of contents and index. It describes the installation process and gives detailed instructions. The board requires very few jumper adjustments, and I had no problem installing the VMI 640, which requires a long expansion slot in an IBM PC, XT, AT, or compatible computer. I was particularly happy to discover that

the VMI could operate in dual-monitor fashion with an existing display (i.e., you can use a standard graphics adapter—CGA, EGA, or Hercules—with the VMI in the same system simultaneously).

The VMI's CGA emulation is top-notch. It uses a custom VLSI chip to perform the emulation, and the CGA character set takes advantage of the display's 400 scan lines to replace the 8- by 8-pixel CGA font with an 8- by 16-pixel one. This is a CGA that you could work with all day without getting eyestrain. The VMI's CGA-emulation speed is faster than the IBM CGA board and is compatible with all the software I tested. (The VMI even ran in my Sanyo 885; that and the IBM CGA board were the only ones that would.)

The VMI 640 also has a well-designed PGL (Professional Graphics Language) software package and can emulate the IBM Professional Graphics Controller (PGC). This package includes a language manual and reference card, a special MS-DOS program that you can use to interactively write commands that are immediately executed on the screen, and C language bindings for professional software development.

The high-resolution performance of the VMI under Microsoft Windows varied from slow to glacial. Scroll times were two to three and a half times that in the CGA mode, and the delay increased

continued

Bill Nicholls received his B.S. in physics from Notre Dame University and is the owner of BGW Systems Inc. He can be contacted at BGW Systems Inc., 16714 Meridian S, Suite 200, Puyallup, WA 98373, or on BIX as "billn."

Image Manager 640

Company

Vermont Microsystems Inc.
11 Tigan St.
P.O. Box 236
Winooski, VT 05404
(802) 655-2860

Size

Standard XT full-length expansion card:
13 1/2 by 4 inches

Features

640- by 480- by 256-color resolution; screen refresh is 60 hertz noninterlaced, 30.48 kilohertz horizontal; 16-million-color palette; 300K-byte on-board graphics RAM arranged in 8 bit planes; uses the TI 34010 graphics processor running at 6 MHz with 128K bytes of processor ROM and 140K bytes of processor RAM; supports the complete set of PGL commands; emulates CGA, IBM PGC, VMI VM-8820, and Image Manager 1024. Support for applications software includes: Ansys, Anvil-1000MD, AutoCAD, CADKEY, CADvance, DataCAD 2 and 3, Design Board Professional, GM 1000, Personal Designer, Pro-Series, Redliner, TGRAF-05 and -07, Uniras Series, and VersaCAD. Board consumes 5 volts DC at 2 amps typical.

Hardware Required

IBM PC, XT, AT, RT, or true compatible

Software Required

MS-DOS 2.1 or higher

Documentation

Three-ring binder with two 5 1/2- by 8 1/2-inch typeset manuals: *Installation and Usage Guide*, 65 pages plus introduction, appendix, and index; and *Professional Graphics Language Version 2.0*, 170 pages plus appendix and index

Price

\$1695

Inquiry 889.

Verticom 2Page Display System

Company

Verticom
545 Weddell Dr.
Sunnyvale, CA 94089
(800) 433-5760
(408) 747-1222 in California

Size

Standard XT expansion card: 4 1/2 by
13 1/2 inches

Features

Monochrome display with 1280- by 960-pixel resolution; screen refresh is 64 Hz noninterlaced, with 63.65 KHz horizontal; 512K bytes of on-board graphics RAM; incorporates a 20-MHz Intel 82786 graphics coprocessor with 8K bytes of processor ROM; provides CGA emulation and a Microsoft InPort Device Interface. Support for applications software includes Microsoft Windows, GEM, AutoCAD ADI, Aldus PageMaker, and Ventura Publisher. Controller consumes 5 volts at 3 amps maximum.

Hardware Required

IBM PC, XT, AT, or compatible

Software Required

MS-DOS 2.1 or higher

Options

Programmer's Guide and System Toolkit, free if requested with purchase of VTP system; \$20 if purchased separately

Documentation

Two 5 1/2- by 8 1/2-inch spiral-bound manuals: *Operations Guide*, 61 pages plus appendix; *Programmers' Guide*, 107 pages plus appendix

Price

2Page controller: \$1295
With Verticom 2Page monochrome monitor: \$2395
Verticom 2Page monochrome monitor alone: \$1395

Inquiry 890.

chrome display was packaged face-down in a large, heavy cardboard box with molded plastic cushions on all sides. According to the documentation, the VTP is compatible with the IBM PC, XT, and AT, the Compaq Deskpro 286 and 386, and the Hewlett-Packard Vectra.

The documentation for this massive package consists of a slim spiral-bound book entitled *Operations Guide*, with scattered installation instructions and some README files on the driver disk. The 5 1/2- by 8 1/2-inch manual has a table of contents buried 9 pages deep, has no index, and was run off on a letter-quality printer with right-margin justification, which makes it difficult to read. The pages have large margins, few diagrams, and less than 80 worthwhile pages. Because of the manual's shortcomings, you'll need some technical knowledge to install this board.

The VTP has a number of annoying installation restrictions: You cannot use it with an EGA in the same system or with a Compaq monochrome/CGA board. The board creates an address restriction for software access (in the A0000-A03FF hexadecimal range), so if you try to access this area, the system will hang. You also have to set a few jumpers; fortunately, there is a clear jumper diagram in appendix A.

The manual's discussion of interrupts is confusing, mixing XT and AT interrupt structures and the mouse and CGA interrupts almost at random. The manual presents no clear solution for resolving conflicts between the interrupts and address ranges that the board requires and the interrupts and address ranges required by other system components. You cannot reconfigure the VTP to use other memory addresses. This is especially annoying because the Intel 82786 chip has the ability to locate those addresses anywhere in the bottom 4 megabytes of address space.

Another unnecessary restriction is the VTP's lack of support for monitors other than the VTP display (actually a Phillips model M19P114B monitor). You can program the Intel 82786 chip for a wide variety of monitors; this is an opportunity that Verticom missed.

A second slim volume, entitled *Programmer's Guide*, is an optional document for those who'd like to try programming the display directly. Only the hardest programmers should apply. In addition to the guide and the system tools disk, you need the full Intel documentation on the 82786, an assembler and linker, some experience with assembly language and with graphics, and a lot of patience to put a working program together. A Toolkit disk provided with the

with the speed of the system. The low performance was clearly linked to the beginning of each page, where a pause of almost a second occurred. A call to the company revealed that Windows places a ">>" character at the beginning of each page and that the symbol is not in the character set (Helvetica) that the board uses as a default. The company said that because of Windows' driver limitations, each time this symbol appears, the current character set is cleared, the set with this symbol is downloaded, the symbol is displayed, and the whole process is done again to reload the correct character set to

continue the display process. I let them know I thought they had a serious performance bug, and they promised to look for a solution.

I made several calls to the support people. While I couldn't permanently disguise the fact that I was a reviewer, the response was prompt and competent for simple as well as technical questions.

VTP

The VTP board and display arrived in two boxes. The board appears well made; it is fully packed with circuits and has no jumper wires visible. The 19-inch mono-

manual includes one example in assembly language that consists of almost nothing but Verticom-supplied macros and one-line comments. You get neither bindings nor information on how to drive the display from a higher-level language such as Pascal or C.

If you execute software that drives the screen in reverse video (black on white), the old scrolling method of blanking the screen will strobe annoying horizontal black bars about 1/2 inch in height on the display. This is not primarily a fault of the VTP, but the nature of the display makes the problem very obvious.

I tested Aldus PageMaker under Windows and found that the tutorial displayed very nicely. On closer inspection, I found that the fit-in-window display option made the type unreadable, but the actual-size choice exceeded the screen size for the two facing pages (even though the type was legible at close range). DESQview 2.0, however, would not boot up with the VTP display installed as the only display. The system froze, and I had to turn the power off and back on to get it to reboot.

In high resolution, the VTP display shows mixed CAD performance against the base CGA speed. Using the version 1.2 Windows driver supplied by Verticom, I achieved some interesting results. The speed was not impressive, running about one-half to one-third that of raw CGA. However, 9.6 times as many pixels were being updated on the screen, and the font legibility was very good.

A couple of service calls to Verticom gave me the impression that the general support level is good, but below that of VMI. A couple of times the support line was busy; when I finally got through, the person answering took my number and said that a support person would call back. The callbacks were delayed by various amounts of time, one taking more than a day. Based on the available documentation, it is likely that this support service will be busier than it should be.

Performance

I encountered a dilemma when I considered benchmarking the VTP and VMI graphics boards. Before this review, there was no set of benchmarks, standard or otherwise, for graphics displays. While I do not expect complete agreement on the benchmarks I developed, they are at least a starting point.

There are a number of reasons for the lack of graphics benchmarks. Until recently there have been only two classes of graphics controllers: too dumb (such as CGA), and too expensive (such as PGC). Since the great majority of us use only the former, benchmark results are dependent

Table 1: The benchmarks were run on (a) a 16-MHz 80386 system and (b) an 8-MHz 80286 system. The real-world benchmarks (c) were also run on the VMI and VTP boards in high-resolution modes. All times are in seconds.

(a) 80386 at 16 MHz

Test	IBM CGA	EGA CGA	VMI CGA	VTP CGA
Simple	16.48	16.2	15.82	16.14
Complex	35.83	38.62	33.3	35.42
Windows	29	39	28	28.5
AutoCAD				
Softwest	76	76	71	78
Test	37	37	34	37

(b) 80286 at 8 MHz

Test	IBM CGA	EGA CGA	VMI CGA	VTP CGA
Simple	26.34	26.58	26.8	26.44
Complex	51.91	54.87	48.89	52.18
Windows	52.5	54	51	52
AutoCAD				
Softwest	124	126	123	125
Test	59	60	58	59

(c) High-resolution mode

Test	80386 16 MHz		80286 8 MHz	
	VMI 640	VTP	VMI 640	VTP
Windows	107	100	127	136
AutoCAD				
Softwest	78	91	138	143
Test	36	50	61	78

on the host processor and whatever method of writing to the controller's memory the benchmark uses. In addition, the earlier (pre-single-chip) technology for graphics processors generated large and expensive display subsystems, restricting their use to a few critical applications.

After considerable head scratching, I decided on a matrix of tests that would cover multiple dimensions of the use of graphics. Since no end user buys a graphics processor except as part of a functioning system, the relevant point is how these boards work in a system. I decided that I should cover host processor dependence, resolution dependence, simple drawing tests, complex drawing tests, and real-world application tests.

To examine host processor dependence, I tested a variety of display controllers (CGA, EGA emulation of CGA, the VMI, and the VTP) in systems of different speeds. I ran the tests on a 16-megahertz ALR Access 386 with 512K bytes of 32-bit memory, 512K bytes of 16-bit extended memory, a 30-megabyte hard disk drive, and a 1.2-megabyte floppy disk drive (see table 1a). Then I ran them on an 8-MHz ALR Dart 286 with 1 megabyte of memory, a 40-megabyte hard disk drive, and a 1.2-megabyte flop-

py disk drive (see table 1b).

Simple drawing tests are those requiring a minimum of calculation to draw graphics shapes on the screen. These tests show the maximum sensitivity to graphics performance, as opposed to host computational speed. (These tests follow a set suggested by Jim Omura on BIX.)

Complex drawing tests are designed to reproduce real use of graphics devices, including windowing and complex shapes. The complex function tests use a modified version of Borland's Turbo Graphix Toolbox demo program.

Real-world application tests use software that places large demands on the graphics capability of the system. For this series of benchmarks, I tested Microsoft Windows version 1.03 and AutoCAD version 2.6 in typical use that demands graphics performance.

I executed the Windows test in Windows Write by scrolling an 80K-byte file from top to bottom. After Write displayed the first page, I began timing when I pressed the PageDown key, and I stopped when Write beeped at the end of the file. I used AutoCAD to display two fairly complex drawings: Softwest, a complete printed-circuit-board drawing (207K-

continued

Graphics Coprocessors

The TI 34010 chip is a general-purpose 32-bit microprocessor with special graphics support instructions (see "The TMS34010 Graphics System Processor" by Carrell R. Killebrew Jr. in the December 1986 BYTE). Its strengths are its great flexibility, customization via software, large memory-address range, and its ability to act as host as well as graphics processor. Its weaknesses are the requirement for minimum programming to drive the display, a fairly complex instruction set (with a long learning curve), and, as a result, the probability that each manu-

facturer's board will have a different software interface.

The Intel chip is a hardware coprocessor design with built-in graphics drawing capability that can be driven by calls with sets of parameters (see my "Inside the 82786 Graphics Chip" in the August 1987 BYTE). Its strengths include a simpler standard interface, built-in support for most basic graphics operations, and a flexible display-support capability. Its weaknesses are the requirements for host processor support and programming where the built-in functions cannot meet specific needs.

byte file), and Test, a simpler image (167K-byte file) with a lot of curves (a rainbow of colors drawn as a series of arcs). I began timing when I pressed the Return key after the filename and stopped after the drawing finished when AutoCAD prompted with Command on the bottom left of the display. I also ran these real-world tests on both boards in high-

resolution mode. See table 1c for the results.

Operations in high resolution (compare tables 1a and 1b with table 1c) were anywhere from slightly to dramatically slower than the equivalent CGA operations. This was a significant disappointment to me, as I had expected that the graphics processors would more than

make up for the work of updating extra pixels.

On reflection, I concluded that the responsibility for the lack of performance cannot be laid entirely at the board manufacturer's door. The essential cause of the performance problem is the lack of a well-defined and generally used graphics interface—other than, possibly, Microsoft Windows. Unfortunately, Microsoft designed Windows before graphics processors were available, and the results indicate that the interface defined by Windows drivers does not lend itself to efficient operation with graphics processors.

Thus, these graphics boards deliver on the higher resolution and flexibility that their processors can give, but they can't deliver on their performance promise with most current software. (Those programs whose designers have specifically incorporated code to make use of the processor's advanced features are the exceptions.) Future software based on a device-independent interface between the host processor and the graphics processor could dramatically improve both the graphics display and the system's performance. This could be especially true of a multitasking operating system that takes advantage of the support and memory

```

    graph TD
      A[Receiving Report (a)] --> B[Transmitted Invoice (b)]
      B --> C[Price, Qty, Part# Matched  
Invoice Stamped  
Coded (c)]
      C --> D[Check Register (e)]
      C --> E[Open Accounts Payable (e)]
      D --> F[General]
      E --> G[A/P Distribution]
      G --> H[Checks Printed & Signed]
      H --> A
  
```

LOOK!
It's Flow Charting™ II+!

The ultimate fast track tool—for internal auditors, public auditors, secretaries, engineers, managers and line leads. Performance power WITH A PLUS, for even faster and easier construction, editing and printing of flowcharts and org charts.

- Text auto centering
- Smart line mode
- Internal mouse driver
- 10 text fonts
- Ega support
- Comprehensive, friendly manual

Give your charts the PLUS for only \$229.* Contact your local software dealer—or call us.

PATTON & PATTON
Software Corporation

81 Great Oaks Blvd., San Jose, CA 95119
1-800/672-3470, ext. 897 California
1-800/538-8157, ext. 897 Outside California
408/629-5044 International
*plus shipping. In California add tax.

Excellence in charting the flow of ideas

that the graphics processor provides.

[Editor's note: *In evaluating the boards for this article, the author ran many more tests than we can show here. For the complete set of benchmark results, see the BIX conference graphic.disp/review.*]

Assets and Liabilities

The VMI 640 board comes from a manufacturer with a history of providing high-resolution graphics boards and software support for the CAD user. The experience shows. This board is well suited for CAD, CAE, or perhaps business and scientific graphics. It also performs well in a mixed-task environment because of the superior CGA emulation.

With the exception of the problem in the current Windows driver, the board's performance and the manufacturer's support are about all you could ask for. I'm particularly impressed with the board's ability to run in so many dual-monitor configurations. The only thing left to wish for is a lower price: \$1695 will restrict the sales of this board.

When the full Windows screen opens up in front of you the first time you use the VTP, the impact is considerable. I have to commend Verticom for supplying a very readable Windows font.

The VTP display is well suited to page layout; if you spend a significant amount of time at this, the VTP should provide sufficient productivity enhancement to justify the cost (\$2395). If you already have a large screen that can be driven by the controller, the cost of the controller alone (\$1295) is much easier to bear.

However, for the price Verticom is asking, the very least you should expect is comprehensive, carefully indexed, and accurate documentation. Verticom should also add the ability to configure the board for addresses other than A0000. Finally, Verticom should broaden the base of compatible software (to include DESQview, for example), improve the CGA emulation, and expand the number of supported monitors. ■

[Editor's note: *Source code (nonexecutable) listings of SIMPLCGA and CMPLXCGA, the simple and complex drawing benchmarks, respectively, are available on BIX, on BYTEnet, on disk, and in the Quarterly Listings Supplement. See "Program Listings" in the table of contents. Portions of CMPLXCGA based on Borland's Turbo Graphix Toolbox are used by permission from Borland International. To "find" source code in the Listings areas on BIX and BYTEnet, search by article title, author name, or issue date. Some archived files may contain numerous listings for a single article. A description of the file also accompanies each entry.*]

GCC's Personal Laserprinter

Donald Evan Crabb



The Personal Laserprinter from General Computer Corp. (GCC) is designed to compete with the Apple LaserWriter Plus in single-user desktop publishing. While some companies (e.g., QMS and Data-products) are trying to beat Apple with laser printers that offer greater performance yet are priced somewhat lower than the LaserWriter Plus (\$4000 and up), GCC hopes to beat Apple mostly with its price: Where the LaserWriter Plus lists for a hefty \$5799, the GCC Personal Laserprinter comes in at a trim \$2599.

Features and Description

The differences between the LaserWriter Plus and the Personal Laserprinter (PLP) are significant. The LaserWriter Plus is designed as a shared device to be accessed over an AppleTalk network. The PLP is a single-user device dedicated to a single Macintosh.

The LaserWriter Plus contains its own MC68000 CPU, RAM, and ROM, and a complete implementation of PostScript. The PLP has no CPU or memory and doesn't speak PostScript. It prints by accepting a compressed QuickDraw image sent to it by the Macintosh, while the LaserWriter Plus composes its own print image.

Communications between a Macintosh and a PLP take place through a SCSI connection. The actual imaging is by a semiconductor laser, similar to the one used in the LaserWriter Plus. The PLP's engine, produced by Ricoh, gives a resolution of 300 by 300 dots per inch and is rated at 6 pages per minute.

Like the Canon engine in the LaserWriter Plus, the Ricoh engine is a "write-black" design: Toner sticks to the imaging drum in places charged by the laser. Unlike the Canon engine, however, the PLP's Ricoh engine does not use a single printing cartridge that combines the toner and the imaging drum. Instead, it uses two separate snap-in cartridges for the drum and the toner.

The toner cartridge lasts about 1500 pages, while the imaging drum (OPC in PLP/Ricoh parlance) must be replaced about every 20,000 pages. The OPC drum's cleaning assembly must be replaced separately every 10,000 pages. These figures compare to a rated life of about 3000 pages for a Canon LaserWriter Plus cartridge.

The toner cartridges list for \$29, and the OPC cartridges cost \$199. The OPC cleaning assemblies cost \$99. A Canon LaserWriter Plus cartridge lists for about \$120, but it can be recharged with toner several times; the Ricoh toner cartridges cannot be recharged. In the long run, then, the PLP/Ricoh system costs more to use than a LaserWriter Plus/Canon system, given current costs for the different supplies.

The Ricoh engine has a theoretical durability advantage over the Canon engine: 180,000 lifetime pages versus 100,000. In practice, the LaserWriter Plus has proved to be a rock-solid printer that will last far beyond 100,000 images before requiring a major overhaul or replacement of the imaging system. The monthly rated duty cycle of both printers is 3000 pages; these figures can be safely exceeded, however.

Because of the printing method of the PLP, a hard disk drive is required to store the compressed QuickDraw files it will print. The PLP is also a memory-intensive device; it needs at least 1 megabyte of RAM for its printer-support software to spool the compressed QuickDraw files properly.

Bitstream Fonts

The PLP comes with two sets of Bitstream fonts that mimic the PostScript fonts used by the LaserWriter Plus. These fonts are mathematically defined in out-

continued

Personal Laserprinter

Type

Laser printer

Company

General Computer Corp.
580 Winter St.
Waltham, MA 02154
(617) 890-0880

Size

9 by 16 by 16½ inches (without paper tray); 38 pounds

Features

Ricoh print engine, rated at 6 ppm; 300-by-300-dpi resolution; set of six Bitstream font families; Personal Laserprinter Print Manager and system resource; high-quality and draft printing modes; SCSI address preset to 3, externally switchable; power requirements: 120 V or 240 V AC

Hardware Required

Macintosh Plus, SE, or II with at least 1 megabyte of RAM and a hard disk drive; SCSI cable and terminator

Software Required

Personal Laserprinter printing resource file and font disks

Options

SCSI cable: \$49
SCSI terminator: \$30
Set of seven additional Bitstream font families: \$299

Documentation

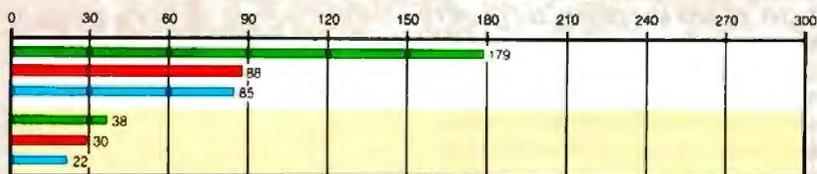
96-page spiral-bound manual; two addenda; on-line documentation (minimal) in Personal Laserprinter Print Manager

Price

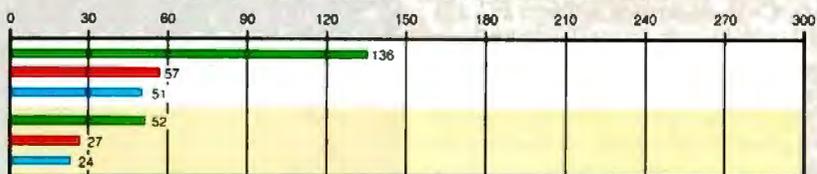
\$2599 (includes one OPC and toner cartridge; does not include SCSI cable or terminator)

Inquiry 891.

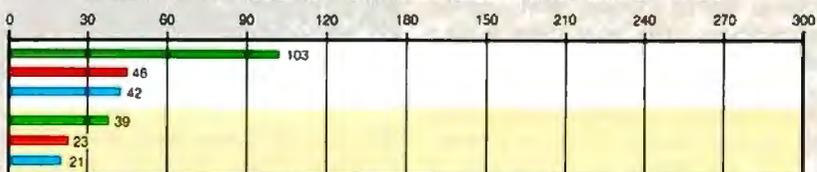
ONE PAGE MACWRITE TEXT



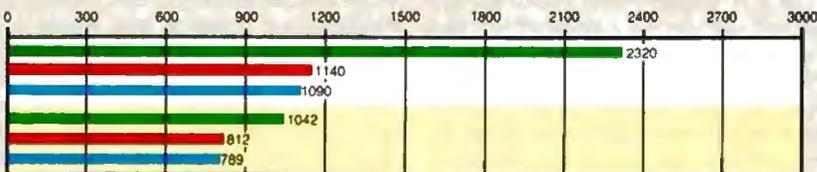
ONE FULL PAGE MACDRAW GRAPHICS



ONE FULL PAGE OF MIXED TEXT AND GRAPHICS



30 PAGES MACWRITE TEXT



- PERSONAL LASERPRINTER
- LASERWRITER PLUS
- MACINTOSH SE
- 2-MB MACINTOSH SE W/LEVCO PRODIGY
- 5-MB MACINTOSH II

All benchmarks were run with no RAM cache, System 4.1, Finder 5.5, MacWrite version 4.6, MacDraw version 1.9.5, and Courier font.

line form, like the PostScript fonts, so that they offer the same high-quality 300-dpi resolution, regardless of their point size.

Unlike the PostScript fonts that are stored in the LaserWriter Plus, the Bitstream fonts must be stored on your Mac's hard disk (because the PLP has no ROM or RAM), where they occupy about 1 megabyte of storage. The Bitstream fonts supplied with the PLP look like the LaserWriter Plus's Courier, Helvetica, Times, Symbol, Palatino, and Helvetica Narrow fonts. GCC offers a \$299 set of seven additional Bitstream font families.

The PLP connects to the Macintosh

Plus, the Macintosh SE, or the Macintosh II through the SCSI port. The SCSI address is preset to 3 at the factory, but an easy-to-set external push button allows a quick change. Setup took about 30 minutes, from opening the box to printing my first test page.

The complete PLP package includes the printer, one toner cartridge, one OPC assembly, three disks, the spiral-bound manual, two manual addenda, a warranty card, and a power cord. The printer lacks the needed SCSI cable and terminator, which are available from GCC for \$49 and \$30, respectively. GCC provides the usual 90-day warranty, but it does not offer any extended warranty coverage—a

disadvantage, since Apple offers the AppleCare extended warranty for the LaserWriter Plus.

Printing Software

The PLP includes its own printer software: the Personal Laserprinter Print Manager, the Personal Laserprinter 1.0 system resource, and the Bitstream fonts. You can install the Print Manager anywhere you like; I put mine in a special hard disk directory to keep track of all my PLP files. The Personal Laserprinter 1.0 system resource must be copied into the System Folder, so that the System and Chooser can access it. I also put all the

continued

It's just your basic quantum leap.



Microsoft[®] QuickBASIC 4.0 is no longer your basic BASIC. Now, because of a revolutionary breakthrough, you can run, test, debug, then continue running your program and see the results. Instantly. Which is why we call it "instant programming."

Other compilers make you wait while they compile your program at an unimpressive rate of 12,000 lines per minute. But Microsoft QuickBASIC 4.0 translates your program into executable code at a breathtaking 150,000 lines per minute. You get all the speed you can possibly use right when you need it. While you're developing your program.

And for the first time in BASIC, you'll find the most sophisticated debugging tools around. Like the freedom to change a running program on the fly. Without restarting. And you also get instant syntax checking, watch expressions, even runtime type checking.

Besides all these advances in the environment, Microsoft QuickBASIC 4.0 gives you a sophisticated collection of language extensions: records, recursion, huge arrays and true functions. There's even interlanguage calling that lets you call subroutines from other Microsoft languages.

And if you think all this means you might have to give up phenomenal execution speed, think again. Microsoft QuickBASIC 4.0 gives high performance executable code that's the fastest anywhere.

About the only thing that isn't more advanced in Microsoft QuickBASIC 4.0 is the price.

It's still just \$99. And it's still backed with a 30-day money back guarantee. Microsoft QuickBASIC 4.0.

To make a quantum leap in your programming, you need a quantum leap in your language.

Microsoft[®] QuickBASIC 4.0

For the name of your nearest Microsoft dealer, call (800) 541-1261. Dept. A43.
Microsoft is a registered trademark of Microsoft Corporation. Offer valid in the 50 United States only.

Circle 171 on Reader Service Card (DEALERS: 172)

The Mac II's processing speed helped close the gap on the LaserWriter Plus's advantage, but it wasn't enough to make up for the lack of a CPU and RAM in the PLP.

Bitstream fonts into my PLP directory.

If you already have LaserWriter Plus fonts installed, the DA/Font Mover will replace some of those fonts with PLP fonts that have the same name. This is inconvenient if you want to alternate between a PLP and a LaserWriter Plus, since you'll always get the Bitstream screen version of those fonts when you are editing a file. Of course, during printing, the LaserWriter Plus will print with its own built-in PostScript fonts, so the inconvenience is not a serious one.

Because GCC had to provide a print-management utility for the PLP, the company decided to add some options that you don't find in the Apple LaserWriter Plus print dialog boxes. These additional options include the ability to spool files to disk for later printing (not a true print spooler that returns control to your Macintosh earlier than straight-through printing); a limited letter-kerning capability; draft printing (similar to the ugly Imagewriter draft mode); the ability to process bit-map images with smoothing; and a preview option.

Print previewing is by far the most useful option. By building a print-spool file, the print manager's previewer lets you see the final Macintosh page in as close an approximation to WYSIWYG (what you see is what you get) as your Mac screen allows. I only wish I could add this preview feature to Apple's standard LaserWriter Plus print dialog box.

Like many other GCC products, the PLP comes with very good documentation. Its 96 pages are broken up into four chapters on setting up the printer, installing software and printing, using the printer, and maintenance and troubleshooting. Each section is well written, but the opening chapter on installation and setup suffers from poor illustrations. Two addenda update the changes made in the PLP software since its beta release.

Performance

There is no getting around it—the PLP is a slow printer. To test performance, I

compared the times the two printers took to print four different documents: a one-page MacWrite 4.6 file, consisting of the string "The Quick Brown Fox Jumped Over The Lazy Dog" repeated; a one-page MacDraw 1.9.5 file (four images of a custom-designed business card); a 30-page MacWrite 4.6 file (30 pages of the one-page MacWrite example); and a page combining text and graphics.

For each printer, I ran the four tests on three systems: a 1-megabyte Macintosh SE, a 2-megabyte Mac SE with a Levco Prodigy SE accelerator board installed, and a 5-megabyte Mac II (see the graph on page 156).

Even with the 5-megabyte Macintosh II, the PLP's times were slower than the slowest LaserWriter Plus/Macintosh combination, except for the time required to print a full page of MacDraw graphics. The processing speed of the Mac II helped close the gap dramatically on the LaserWriter Plus's advantage, but it wasn't enough to make up for the lack of a CPU and RAM in the PLP. In short, the ways in which GCC has chosen to cut costs in the PLP made an obvious difference in printing speed in the tests I conducted.

Software Compatibility

GCC provides an extensive list of software that will not work with the PLP: Great Plains Accounting 4.10, Layered's Insight 1.02, Software Ventures' Microphone 1.0, OverVUE 2.1a from ProVue, Aldus PageMaker 2.0 (although Aldus offers a free upgrade, 2.0a, that will print on the PLP), Apple's AppleLink 2.0, Red Ryder 10.0, Maitreya Design's mini-WRITER, and VersaTerm-PRO.

GCC also provides a list of software that works with the PLP, although with some problems: Telos' Business Filevision; Cricket Draw; Odesta's Double Helix; Microsoft's Chart, Excel, File, Filemaker Plus, Word 3.01, Works, and PowerPoint; Ann Arbor Software's FullPaint; Apple's HyperCard, MacPaint, MPW, and MacWrite; Lotus's Jazz; Think Technologies' Lightspeed C and Pascal; MindWork Software's MindWrite; Living Videotext's More; Blyth Software's Omnis 3 Plus; Broderbund's Print Shop; and Silicon Beach Software's SuperPaint.

The release notes with the printer detail the problems with printing and the processes required to make each of these packages print with the PLP. I tried all the workarounds and found that they act just as GCC says they do.

In addition to these programs, there are programs that will work with the PLP but, because they rely heavily on the abilities of PostScript, will produce

Imagewriter-quality results at best. These packages include Cricket Draw, Adobe Illustrator, and Quark XPress.

By comparison, GCC's list of software that works without problems is smaller: Acius's 4th Dimension, Symmetry's Acta, Cricket Graph, Ashton-Tate's dBASE Mac, Apple's MacDraw, MacTerminal, and MacProject, Paragon Courseware's QUED/M, Orange Micro's Ragtime, Letraset's Ready-Set-Go, Data Tailor's Trapeze, and T/Maker's WriteNow.

When a software package and the PLP work together, either seamlessly or through a special workaround, the output quality is generally high. It is at least as good as any LaserWriter Plus output of the same document, and in many cases, the PLP graphics looks slightly crisper and the text a bit blacker. Because of differences in the positioning of QuickDraw- versus PostScript-generated graphics, most PLP output is not aligned quite the same as equivalent LaserWriter Plus output.

Recommendations

The PLP is not the universal answer to Macintosh owners who need a high-quality laser page printer but who don't want to part with more than \$4000.

Freelance writers or text-oriented consultants, for example, may find that the PLP is a big win. The output of the PLP is about equivalent to the LaserWriter Plus or to the other 300-dpi Macintosh laser printers on the market. If you can get by without PostScript (many users can't), and if you already own a faster Macintosh (accelerated Mac Plus, Mac SE, or Mac II), then you're likely to find that the PLP is a wonderful printer at an affordable price.

On the other hand, if you are heavily dependent on accurate PostScript output, like many desktop publishing users, graphics designers, engineers, and others, then the Bitstream fonts and QuickDraw graphics of the PLP do not provide the flexibility and quality of PostScript (although, for some applications, they are close).

The PLP is also not a good laser-printing solution for offices that want to share printers, since it is a SCSI device that must be assigned to a single Mac. Its lack of AppleTalk support is a major limitation for those users who need to share computer resources within work groups.

Finally, this is one very slow printer. Because (unlike the LaserWriter Plus) it has no CPU or RAM to speed page processing, its printing speed is largely dependent on the computing bottlenecks of the Mac that drives it. The speed problem is compounded by the printer's memory

needs. Although the machine can work with a 1-megabyte Mac Plus, I often got Out of Memory messages when I tried to print long documents containing text and graphics.

In fact, when I tried to print a single copy of this review in its unedited form (a 12-page Microsoft Word 3.01 file) on a 5-megabyte Mac II, the PLP print manager ran out of memory because I had set a 3-megabyte RAM cache. I ran into this out-of-memory problem most often with Microsoft Word 3.01 and Excel 1.03.

For the small business owner, consultant, or manager in a larger corporation who needs an inexpensive laser printer for his or her Macintosh, the PLP can be very attractive. For my own needs, I can't afford to give up 100 percent PostScript compatibility or waste time dealing with software workarounds when printing, so I'll pass on the PLP. ■

Donald Evan Crabb (Department of Computer Science, University of Chicago, Ryerson Hall 260, 1100 East 58th St., Chicago IL 60637) is the director of instructional laboratories for the computer science department of the University of Chicago and is a lecturer in the department and the college.

VIEWS FROM BIX: PostScript vs. Non-PostScript Printers

macintosh/reviews #25, from Tom Hedges.

A general comment on non-PostScript laser printers: I think this is a bad mistake, on the part of both GCC and others (even Apple, according to persistent rumors). Granted, Adobe may be charging too much for its implementations, but the coming clones should inject some needed competition to that market. The advent of PostScript has given the personal computer industry a very powerful, resolution-independent way to output text, line graphics and even high-quality scanned gray-scale images (on the phototypesetters). The Laser-Writer provides a very accurate proofing device for professional desktop publishing and a final output device for many others.

The problem that comes from the release of significant numbers of non-PostScript printers is that software developers will be forced back to the Apple QuickDraw standard in order to be compatible and will not be able to take full advantage of the superior abilities of the PostScript

output devices. This is particularly true in the gray-scale scanned-image-output area, where Letraset and my firm, Fractal Software, along with others, are just now starting to provide good support for gray-scale image output. With the price of the RIP hardware coming quickly down and the royalties for PostScript under competitive pressure, it seems a very shortsighted move to "expand" the laser printer market for the Mac in the direction of the IBM-compatible world, namely toward "dumb" laser printers.

macintosh/reviews #28, from Chris Crawford.

Tom Hedges made a strong case against the dumb laser printers, and in general I tend to be sympathetic to such arguments. But the cost difference between the PostScript printers and the PLP is gigantic; we're talking a factor of two here! I simply could not have afforded a laser printer at the prices that the PostScript printers now sell for. And while a PostScript printer is faster and can do more things than the PLP, I find that the PLP does everything that I want it to do, quite well. I especially like the notion that additional fonts move into the system gracefully.

The Complete 68000 C Compiler

The UniWare™ 68000 C Cross Compiler generates fully optimized code for your ROMable applications. It supports:

- * 68000
- * 68010
- * 68020
- * 68008
- * 68012
- * 68881

You won't find a more complete package — the UniWare 68000 C Compiler comes with a relocating macro assembler, type-checking linker, librarian, and all the utilities you need to put your program into ROM. And it's just \$995 under MS-DOS. Also available under UNIX.

CALL TODAY

(312) 971-8170

SOFTWARE DEVELOPMENT SYSTEMS, INC.
3110 Woodcreek Drive
Downers Grove, IL 60515

The Complete Z80 C Compiler

The UniWare™ Z80 C Cross Compiler generates fully optimized code for your ROMable applications. It supports:

- * Zilog Z80
- * Zilog Z180
- * Hitachi HD64180

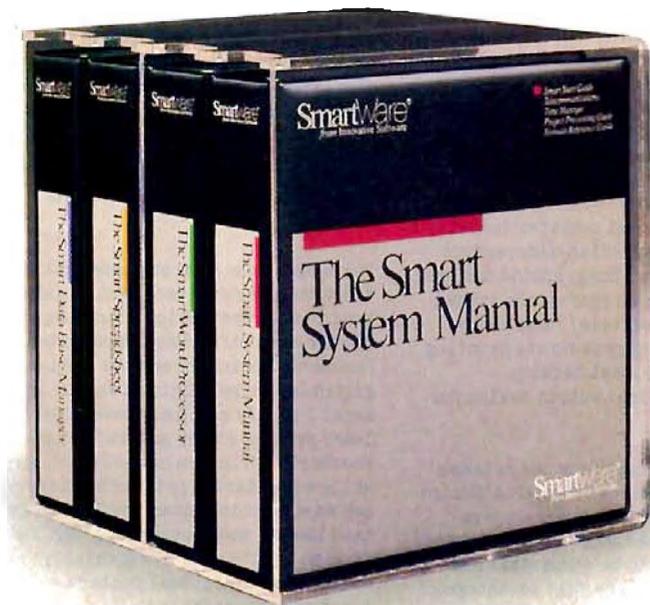
You won't find a more complete package — the UniWare Z80 C Compiler comes with a relocating macro assembler, type-checking linker, librarian, and all the utilities you need to put your program into ROM. And it's just \$995 under MS-DOS. Also available under UNIX.

CALL TODAY

(312) 971-8170

SOFTWARE DEVELOPMENT SYSTEMS, INC.
3110 Woodcreek Drive
Downers Grove, IL 60515

To some people, the



“For sheer power, ease of use, speed, and flexibility, you would be hard-pressed to find a more capable

product, especially if you need advanced features. It works just as well with a half-dozen spreadsheets simultaneously as it does with one.”

—InfoWorld

Whether you're just getting started as a lone computer user, or you're the Manager of Information Systems supporting thousands of PC users, discover easy-to-use applications your office won't outgrow. Single user and Multi-user software for DOS, LANs, UNIX or XENIX systems: Word Processing, Spreadsheet & Graphics, Database Management and Communications. For additional information, including a Free Smart Demo, simply return the reply card or call toll-free (800)331-1763 (in Kansas, Alaska or Canada call (913) 492-3800).

difference is obvious.

PC
MAGAZINE
EDITOR'S
CHOICE

“Integrated systems have come a long way, and Smart has...the widest array of powerful features...strong points include intelligent data sharing and good file security, intuitive ease of use, a powerful programming language, and consistently good performance... Smart can fill the bill for a total, integrated software system.”

—PC Magazine



SmartWare[®]
When you want to do more than
one thing with a computer.



QNX vs. OS/2 UNIX

QNX: Bend it, shape it, any way you want it.

ARCHITECTURE If the micro world were not so varied, QNX would not be so successful. After all, it is the operating system which enhances or limits the potential capabilities of applications. QNX owes its success (over 30,000 systems sold since 1982) to the tremendous power and flexibility provided by its modular architecture.

Based on message-passing, QNX is radically more innovative than UNIX or OS/2. Written by a small team of dedicated designers, it provides a fully integrated multi-user, multi-tasking, networked operating system in a lean 148K. By comparison, both OS/2 and UNIX, written by many hands, are huge and cumbersome. Both are examples of a monolithic operating system design fashionable over 20 years ago.

MULTI-USER OS/2 is multi-tasking but NOT multi-user. For OS/2, this inherent deficiency is a serious handicap for ter-

minimal and remote access. QNX is both multi-tasking AND multi-user, allowing up to 16 terminals and modems to connect to any computer.

INTEGRATED NETWORKING Neither UNIX nor OS/2 can provide integrated networking. With truly distributed processing and resource sharing, QNX makes all resources (processors, disks, printers and modems anywhere on the network) available to any user. Systems may be single computers, or, by simply adding micros without changes to user software, they can grow to large transparent multi-processor environments. QNX is the mainframe you build micro by micro.

PC's, AT's and PS/2's OS/2 and UNIX severely restrict hardware that can be used: you must replace all your PC's with AT's. In contrast, QNX runs superbly on PC's and literally soars on AT's and PS/2's. You can

run your unmodified QNX applications on any mix of machines, either standalone or in a QNX local area network, in real mode on PC's or in protected mode on AT's. Only QNX lets you run multi-user/multi-tasking with networking on all classes of machines.

REAL TIME QNX real-time performance leaves both OS/2 and UNIX wallowing at the gate. In fact, QNX is in use at thousands of real-time sites, right now.

DOS SUPPORT QNX allows you to run PC-DOS applications as single-user tasks, for both PC's and AT's in real or protected mode. With OS/2, 128K of the DOS memory is consumed to enable this facility. Within QNX protected mode, a full 640K can be used for PC-DOS.

ANY WAY YOU WANT IT QNX has the power and flexibility you need. Call for details and a demo disk.

THE ONLY MULTI-USER, MULTI-TASKING, NETWORKING, REAL-TIME OPERATING SYSTEM FOR THE IBM PC, AT, PS/2, THE HP VECTRA, AND COMPATIBLES.

Multi-User	10 (16) serial terminals per PC (AT).	C Compiler	Standard Kernighan and Ritchie.
Multi-Tasking	40 (64) tasks per PC (AT).	Flexibility	Single PC, networked PC's, single PC with terminals, networked PC's with terminals. No central servers. Full sharing of disks, devices and CPU's.
Networking	2.5 Megabit token ring. 255 PC's and/or AT's per network. 10,000 tasks per network. Thousands of users per network.	PC-DOS	PC-DOS runs as a QNX task.
Real Time	2,800 task switches/sec (AT).	Cost	From US \$450. Runtime pricing available.
Message Passing	Fast intertask communication between tasks on any machine.		

For further information or a free demonstration diskette, please telephone (613) 591-0931.

Quantum Software Systems Ltd. • Kanata South Business Park • 175 Terrence Matthews Crescent • Kanata, Ontario, Canada • K2M 1W8

UNIX is a registered trademark of AT & T Bell Labs. IBM, PC, AT, XT and PS/2, PC-DOS and OS/2 are trademarks of International Business Machines. HP and Vectra are registered trademarks of Hewlett-Packard Company.

Circle 225 on Reader Service Card



Allegro CommonLISP

Ernest R. Tello

A complete microcomputer implementation of Common LISP

Allegro CommonLISP version 1.0 (\$600) is an interactive programming environment for the Apple Macintosh based on the Common LISP standard as defined in Guy L. Steele's book *Common LISP: The Language*.

Allegro CL was produced jointly by Coral Software Corp. of Cambridge, Massachusetts, and Franz Inc. of Berkeley, California. It is a complete Common LISP running on a microcomputer, and for this reason it should be a good delivery environment for Common LISP programs from larger machines.

The implementation consists of an incremental compiler, an EMACS-style editor, a debugger, an object-oriented programming system called Object LISP, and Macintosh interface tools for creating windows, menus, and dialog boxes. Allegro CL has a pseudomultitasking system that lets you edit code while programs are compiling or executing in the background. The garbage collector is a mark/compact/forward collector that implements virtual memory by loading functions into memory only as they are needed. The garbage collector is invoked automatically when either the Macintosh operating system or LISP needs more memory.

Allegro CL comes on two double-sided 800K-byte floppy disks. The minimal hardware required to run the system is a Macintosh Plus, SE, or II with 1 megabyte of RAM and 1.6 megabytes of disk storage; it can support up to 8 megabytes of RAM. The manual recommends 2 megabytes of memory and a hard disk drive. This is good advice; I found that the system does not run very well with only 1 megabyte of memory.

Good Environment

Allegro CL provides an interactive menu system that lets you edit and debug without leaving the LISP environment. The main menu bar in Allegro CL has the following command options: File, Edit, Eval, Tools, and Windows. These menu

items give you access to the editor, the compiler, the debugger, and other tools. The Windows menu option lets you easily cycle through the windows open on the screen.

The Listener is a special window on the screen through which you type commands and get responses. The Listener behaves exactly like an interpreter, although in this case it is based on incremental compilation. Allegro CL automatically compiles any new function definitions. (You can turn off this feature by setting the `*compile-definitions*` variable to nil.)

The Eval menu has options for evaluating either a selected expression or the entire editing buffer. The Eval menu also includes an option that lets you save compiled code in a file by specifying the names of the source file and the destination file for the compiled code.

Two modes are available for the evaluation of LISP expressions: one that conforms exactly to the Common LISP standard, and one that is faster but does not support the debugging functions `evalhook` and `applyhook`. You select the latter by setting the `*fast-eval*` variable to true.

The full-screen window-oriented editor in Allegro CL is called FRED, an acronym for "FRED Resembles EMACS Deliberately." FRED is an EMACS-style editor that allows multiple windows and the use of a mouse. The advantage of using an EMACS-style editor is that you can customize it to suit your needs. For example, you can add macros for commonly executed key sequences as commands to the Edit menu. Each individual editor window can have a separate package or Common LISP name space associated with it. One chapter of the

User's Manual is devoted to documenting how to customize the editor.

Because of the scarcity of auxiliary keys on the standard Mac keyboard, it is not easy to implement an EMACS-style editor on this machine. Allegro CL handles the problem by using the Option key as a Meta key and the Clover key and Shift-Clover key for Control and Command, respectively. The editor also supports more recent Mac keyboards that include a separate Control key. In addition, the Macintosh Clipboard has been integrated with the EMACS kill-ring. Any time text is moved to the Clipboard, it is also automatically moved to the top of the kill-ring, and vice versa.

The Tools menu has options for debugging, such as a window-based inspector, backtrace, stepper, and trace facility. The inspector lets you browse about in data structures, examining and modifying them. Allegro CL implements the inspector as a window-oriented utility that can be invoked in three ways. First, you can select the Inspect option on the Tools menu. Second, when within the FRED editor, you can use the key command Control-X Control-I; this causes the current LISP expression to be inspected. The third way of invoking the inspector is directly from the LISP listener by calling the `inspect` function and supplying it with an argument. So, for example, `(inspect *inference-engine*)` would open an inspector window on the inference-engine class.

Allegro CL also supports a typical LISP backtrace facility as a dialogue window. The backtrace window pops open whenever the listener enters a break-loop. This can happen either when an error occurs or when a programmer calls

continued

Ernest R. Tello (1518 West Cliff Dr., Santa Cruz, CA 95060) is director of research and development at Integral Systems.

Allegro CommonLISP 1.0**Type**

Common LISP programming language

Companies

Coral Software Corp.
P.O. Box 307
Cambridge, MA 02142
(617) 547-2662

Franz Inc.

1995 University Ave.
Berkeley, CA 94704
(415) 548-3600

Format

Two 800K-byte 3½-inch floppy disks

Language

LISP

Computer

Macintosh Plus, SE, or II with 1 megabyte of RAM and 1.6 megabytes of disk storage; 2 megabytes of RAM and a hard disk drive are recommended

Software Required

Macintosh system version 2.1 and Finder 5.5 or higher

Documentation

Common LISP: The Language;
Common LISP: The Index; 200-page *User's Manual* describing implementation details

Price

\$600

Inquiry 883.

a break deliberately (for example, by selecting the *Backtrace* option on the Tools menu). Two tables appear in the backtrace dialogue window. The table at the top displays the functions on the stack awaiting return values. Preceding the name of each function is the address of the function's stack frame in hexadecimal. The lower table displays the values of the functions listed above. Currently, the backtrace does not show the names of lexical values.

The compiler uses tail recursion to minimize stack space. Tail recursion is an optimization used when an iterative process is described recursively. This means that only the most recent iteration of a loop appears in the stack history of a backtrace window. When debugging, you will want to turn off this optimization by setting the **nx-tailcalls** variable to nil; then there will be no tail-recursion optimization, and all the function calls will be found in the backtrace call history.

A trace function is implemented in accordance with the Common LISP standard and also extends to the Object LISP system. You attach the trace function to a particular function so that tracing occurs for each call to that function. In the case of method functions that are defined for different classes, you can trace each of the versions of the function separately by sending the trace message to a specific object and telling it which method to trace.

Allegro CL implements a form of pseudomultitasking that allows editing and various other operations to be done while LISP programs are compiling or executing. For this reason, the Macintosh watch cursor is not used in this environment. However, some tasks in Allegro CL (e.g., garbage collection and event processing such as menu selection) are noninterruptible. This means that during these tasks other operations, such as LISP evaluation, are halted.

Object LISP

Object LISP is an interesting and full implementation of object-oriented programming for Common LISP, but it suffers from two handicaps: There is little experience in its use, and the Common LISP community is standardizing on the CLOS (Common LISP Object System) standard. (The manufacturers say they will replace Object LISP with CLOS when the specification of CLOS is complete.) While CLOS incorporates some features of Object LISP, it is closer to the approaches taken by Xerox CommonLoops and Symbolics New Flavors.

However, Object LISP is an interesting way to implement objects in Common LISP. I particularly like the way it places classes and instances on the same level. It has always seemed artificial to be able to create objects only as instances of already existing classes. In Object LISP, you create instances the same way you create classes, so it is perfectly legal to create an object that is neither a class nor an instance of a class. This is ideal for applications where the problem is to determine what something is, such as a disease or a malfunction. Once it is determined, the object can be assigned to the class, and further processing can be driven by the methods and variables it has now inherited.

Another good feature of Object LISP is that objects can be modified "on the fly," while programs are running. I would like Object LISP to be included with Allegro CL even when CLOS becomes available.

Unfortunately, while making the switch from Object LISP to CLOS won't be difficult, it won't be transparent, either. Also, the manual cautions the pro-

grammer that portions of code that need to run efficiently should not be written in Object LISP. It is unfortunate that the developers never got around to optimizing their implementation of Object LISP.

Interface Tools

Allegro CL provides interface tools for building Macintosh menus, windows, and dialog boxes. Menus and windows in the current implementation of Allegro CL are implemented on top of Object LISP by means of the menu and window classes. A window is a subclass of the stream class. Every menu item in a menu object has five characteristics: the title, the keyboard equivalent (if any), the font style, check mark or no check mark, and enabled or disabled. An entire menu bar for an application in Allegro CL is simply a list of menu objects. The menubar function returns a list of the menus currently active in the menu bar. You can easily change the menu bar at any time by using the *set-menubar* function, which can be assigned to any LISP expression that returns a list or sublist.

Different types of windows are implemented not as different subclasses of the window class, but as different alternatives to the *:window-type* option of the window class itself. There are seven different window types: *document*, *document-with-grow*, *document-with-zoom*, *double-edge-box*, *single-edge-box*, *shadow-edge-box*, and *tool*.

A dialog box is a special kind of window that contains various messages and options that are sensitive to mouse clicks. Both the dialogs themselves and the items they contain, such as buttons, check boxes, radio buttons, static text, editable text, and tables, are created as instances of their own object classes. Since the dialog class inherits from the window class, dialogs can do anything ordinary windows can do.

Event Handling and Graphics

Allegro CL typically handles events initiated by a user automatically as a background task. For applications that need to handle user events explicitly, a variety of event-handling methods are available to programmers. For example, you can specify the response of window objects to certain types of events or to all events directed at them; you can specify a hook procedure that gets the first chance to process any event; or you can disable all background processing of events and handle them with a special event loop. Typically, programming languages on the Macintosh support only the last and most difficult type of event handling. With a system like Allegro CL, however, the first type often suffices.

Allegro CL Benchmarks

Jean-Denis Muys-Vasovic

I ran the Gabriel benchmarks on a Macintosh II with 5 megabytes of RAM, a 68881 floating-point coprocessor, and an Apple 20SC hard disk drive. Table A shows the results, along with the values for the VAX 750-CL and the Symbolics 3600 from Richard P. Gabriel's book *Performance and Evaluation of LISP Systems* (Cambridge, MA: MIT Press, 1985). Every benchmark ran without any modification, with the exception of the Puzzle benchmark. Puzzle has a variable named *d*. Since Allegro has a system variable with the same name, I renamed *d* to *dd* in Puzzle.

Common LISP has a `declare` statement that gives compile-time information to the compiler. A `declare` statement can be associated with every block of code: the scope of a function, of a loop, of a lambda expression, and so on. Allegro CL has two flavors of the `declare` statement: type declarations and optimizing declarations.

Type declarations tell the compiler that one or more variables will hold a known type of data—for example, a numeric index. This allows the compiler to generate specialized and more efficient code. Recall that variables in LISP can hold any value: numerical, symbolic, string, and so on.

With optimizing declarations, you can then tell the compiler to optimize the compiled code for safety, space, or speed. You write something like: `(declare (optimize (safety n1) (space n2) (speed n3)))`, where $n1$, $n2$, and $n3$ are integers between 0 and 3. The integer 0 indicates not to optimize in a particular way, and the integer 3 means to optimize as much as possible in that direction. Safety controls the ability to handle errors and interrupt the code, space controls the memory used, and speed controls how fast the code runs.

The first column in table A shows the times for the benchmarks without optimization. The second column shows the times with the optimization statement `(declare (optimize (safety 0) (space 0) (speed 3)))` added to each definition. I did not include any type declaration because this would have involved some semi-intelligent process of code and would not have been a fair comparison. In columns where two values

Table A: The first column gives the times for the Gabriel benchmarks run under normal conditions. The second column gives times for these same tests optimized for speed. Values for the VAX 750-CL and Symbolics 3600 are those published in Richard P. Gabriel's book *Performance and Evaluation of LISP Systems*. A detailed description of the benchmarks can also be found in this book.

Test	Allegro CL (normal)	Allegro CL (optimized)	VAX 750-CL	Symbolics 3600
Tak	1.40	0.70	0.61	2.69
Stak	16.05	14.97	6.21	2.58
Ctak	4.40	3.433	13.86	7.65
Takl	15.03	6.65	12.35	6.44
Takr	1.47	0.92	4.39	0.06
Boyer	35.15	22.083	69.38/79.30	11.99
Browse	62.06/3.17	51.58/3.25	195.11/164.05	30.80
Destructive	8.93	7.600	11.30	3.03
Traverse-init	35.35	18.57	35.44	8.62
Traverse	131.08	49.08	217.21	49.95
Deriv	27.22/3.25	26.16/3.12	24.50/49.63	5.12
Dderiv	27.00/2.98	26.10/3.00	32.90/45.80	5.24
Div2-iter	5.22	3.267	14.32/24.85	1.85
Div2-rec	5.27	2.617	9.07	2.89
Fft	61.22/2.95	60.00/2.97	131.59/101.84	4.75
Puzzle	72.62	64.85	231.79	13.89
Triangle	899.85	826.37	1021.35	151.70
Fprint	9.17	8.983	6.08	2.60
Fread	2.93	3.167	11.21	4.60
Tprint	30.02	29.25	4.11	4.89
Frpoly2rxyz1	0.02	0.02	0.06	0.00
Frpoly2r2	0.02	0.02	0.06	0.00
Frpoly2r3	0.02	0.02	0.06	0.00
Frpoly5rxyz1	0.17	0.13	0.37	0.05
Frpoly5r2	0.25	0.25	0.16	0.19
Frpoly5r3	0.2	0.17	0.48	0.05
Frpoly10rxyz1	1.57	1.17	3.38	0.49
Frpoly10r2	2.67	2.27	7.25	2.89
Frpoly10r3	1.92	1.50	4.69	0.54
Frpoly15rxyz1	10.22	7.57	21.51	3.45
Frpoly15r2	20.55	17.97	57.00/51.82	22.35
Frpoly15r3	12.22	9.63	31.05/26.80	3.84

are separated by a slash, adding the two numbers gives the total time; the second number indicates how much of that total time was spent in garbage collection.

On the whole, Allegro is very fast. Its only weak point is the speed of the text display `Tprint`. This is a drawback of the graphics-only aspect of the Macintosh. Allegro CL is nearly always faster, and sometimes much faster, than the VAX 750-CL. It is slower than the Symbolics 3600, but seldom by a factor of more than 2.

[Editor's note: Source code (nonexecutable) listings for the Gabriel bench-

marks are available on BIX, on BYTENet, on disk, and in the *Quarterly Listings Supplement*. See "Program Listings" in the table of contents. To "find" source code in the Listings areas on BIX and BYTENet, search by article title, author, or issue date. Some archived files may contain numerous listings for a single article. A description of the file also accompanies each entry.]

Jean-Denis Muys-Vasovic can be contacted at 6 Sentier Valette, F-95100 Argenteuil, France, or on BIX as "jedivasovic."

Allegro CL implements graphics support through a set of functions that provide an interface to the Macintosh QuickDraw package. So far, the routines completely support only Macs with the 64K-byte ROMs. To use more recent QuickDraw features, you must write low-level trap routines. Allegro CL currently provides two basic kinds of graphics functions: those that must be performed within some window object, and those that can be used globally without reference to the window system.

One important advantage of the Al-

legro CL graphics routines over the comparable Pascal QuickDraw functions described in *Inside Macintosh* is that Allegro CL's routines are written to take full advantage of the optional argument capability of Common LISP. This means that, in cases where operations have to be performed for all the objects on the screen at a given time, functions can simply be applied to the list that keeps track of all current screen objects.

You can have text drawn in a window by designating the window as an output stream. The text is displayed starting at

the current pen position, and its appearance is determined by the window's current font, size, and mode.

Low-Level ROM Access

Most programmers will be able to do everything they need with Allegro's high-level Macintosh routines. However, Allegro CL provides a means for making direct calls to the Macintosh ROM. The main purpose of this low-level access is for using traps not provided in the higher-level interface and, if necessary, for optimizing those that are provided. Low-level traps that can be called from Allegro CL include both those that handle arguments on the stack and those that handle them using registers. This low-level interface must be used with care, since it is very easy to crash the system while using it.

Making low-level calls requires an understanding of how memory is partitioned in Allegro CL. The basic division is between the two types of data, Macintosh resource data and LISP structure data. These two types of data are stored in the Application heap and the LISP heap, respectively. The Mac Application heap is needed in this context primarily for storing data used for communicating with the Mac ROM. Before any data can be passed to the ROM, it first has to be put in the format used either by the Application heap or the stack.

Allegro CL also provides a set of functions and macros that let LISP programs manipulate data stored in Pascal record formats—the main format used by the Macintosh Operating System. You can use these functions to access and manipulate Macintosh resources and data structures created at run time, such as window setups and text-edit records. The functions supported include `defrecord`, which defines new record types, `make-record`, which creates new records, and `dispose-record`, which deallocates records. Various other functions access, copy, and manipulate record data.

For documentation of generic Common LISP functions and variables, the standard texts *Common LISP: The Language* by Guy L. Steele and *Common LISP: The Index* by Rosemary Simpson are also shipped with the product. Implementation specifics are covered in a *User's Manual* that consists of about 200 pages of text divided into 13 chapters and four appendixes. Programmers are expected to refer to the standard texts for documentation of portable Common LISP behavior and functions.

Benchmarks

Although the manufacturers claim that Allegro CL will run on a Macintosh with just 1 megabyte and no hard disk drive, I

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 MAGAZINE

SUBSCRIBER SERVICE
P.O. Box 6821
PISCATAWAY, NJ 08854



Personal REXX

Namir Clement Shammass

don't think anyone should consider using that configuration. The reason stems partly from the sheer size of Common LISP and partly from the fact that Allegro CL uses a virtual-memory architecture, which results in a lot of disk activity.

I tried running the Gabriel benchmarks on a Macintosh SE with 1 megabyte of RAM. Although it ran, garbage collections and disk accesses were so frequent that it was clear why the manufacturers recommend using a 2-megabyte machine. Most users doing serious artificial intelligence work with this system will want to run it on a Macintosh II with 2 megabytes or more of RAM.

Because I was running so close to the memory limits, I did not think it fair to benchmark Allegro CL on my machine. However, Jean-Denis Muys-Vasovic ran the suite of Gabriel benchmarks on a Macintosh II with 5 megabytes of memory (see the text box "Allegro CL Benchmarks" by Jean-Denis Muys-Vasovic).

What's Missing?

Unlike many state-of-the-art LISP systems today, Allegro CL does not provide complete on-line documentation. There is no on-line tutorial here, either. The written documentation, though excellent in many respects, lacks an index of topics and a concise summary of functions present in the system that are not part of Common LISP. To look up a given function, you have to go to the chapter it should be in and hunt for it.

Also missing is a way of packaging applications for stand-alone delivery. According to the company, a stand-alone application generator, as well as a foreign-language interface to C, Pascal, and assembly language, are in the works.

Allegro CL is a very well crafted programming system, but I regret that the CLOS system standard, the object-oriented extension to Common LISP, has not yet been finalized. The object-oriented aspect of this implementation is extremely important, since the user environment is built on it.

The definitive implementation of the Allegro CL environment will be present when CLOS replaces Object LISP as the object-oriented extension and when the application generator and the foreign-language interface are included. However, since Allegro CL adheres to the Common LISP standard, the base of Common LISP programs can be migrated from minicomputers to the microcomputer world. Also, the benchmarks show that, when used with a machine like the Macintosh II, Allegro CL is clearly a system on which substantial development efforts can be conducted. ■

Personal REXX 1.6 (\$125) from Mansfield Software Group implements a subset of VM/CMS REXX on the IBM PC, with some extensions to tap into DOS. REXX is an interpretive, mainframe programming language similar to PL/I but easier to learn. Personal REXX also contains additional functions specifically for the IBM PC. (The original REXX was created by Michael Cowlishaw of IBM's United Kingdom Scientific Center.)

As a programming language, Personal REXX supports structured coding, an external stack, and global variables, and it provides various clauses, constructs, and looping features. It lacks the math functions and working memory necessary to be a useful general-purpose language, but its parsing and environmental-interfacing capabilities make it a powerful language for batch programming. For a summary of its capabilities, see table 1.

Personal REXX requires an IBM PC, XT, AT, PS/2, or compatible with at least 256K bytes of RAM and one disk drive, running MS-DOS or PC-DOS 2.0 or higher. It occupies from 115K to 140K bytes of memory, depending on the size of the internal-storage area (ISA), which may range from 10K to 40K bytes. The default ISA size is 30K bytes; you can change it with the command SET RXISA=*mm*. Personal REXX also supports the Expanded Memory Specification (EMS). I tested Personal REXX on a 6-megahertz IBM PC AT running under PC-DOS 3.1 with 512K bytes of RAM, 1.5 megabytes on an AST Advantage! card, and a 6-MHz 80287 coprocessor chip.

The language comes on one 5¼-inch floppy disk that contains sample programs, several utilities, the interrupt manager, and the interpreter. The interrupt manager is memory-resident and must be loaded before you invoke the interpreter. REXX.EXE contains the Personal REXX interpreter, which is loaded into memory from DOS at the REXX command; appending the /R command directive makes most of the interpreter memory-resident. RX.EXE invokes the memory-resident version of the language. Adding the /U option to the RX command will unload REXX.EXE from memory while it invokes RX.EXE.

Data Types and Variables

REXX supports various structured-coding facilities while keeping data typ-

ing simple. It uses characters to support two basic data types—strings and numbers—and makes no explicit distinction between integers and reals. Variable names are not case-sensitive and don't have fixed data types associated with them. Thus, a variable that stores a numeric value one time may be reused to store a string of characters another time, and vice versa.

There are three classes of variables: simple symbols, compound symbols, and stems. Simple symbols are synonymous with simple variables. Compound symbols are similar to arrays and use a period in the identifier's name. Stems are identifiers that end with a period and are considered the "parents" of compound variables.

For example, *Total.* is a stem, while *Total.Sum* and *Total.SumSquares* are compound symbols that stem from *Total.* This is not merely an aesthetic relationship; REXX lets you write the clause *Total. = 0* to assign zeros to all those compound symbols that start with *Total.* Thus, you can collectively initialize compound symbols without using an explicit loop. Compound symbols may contain more than one stem. For example, *Cell.I.J* is a two-dimensional compound symbol; *Cell* is one stem, *I* the other.

REXX supports a string-based, indirect-access scheme with compound symbols not commonly available in other languages. For example,

```
X = "Sum"
Total.Sum = 10;
Total.Sum2 = Total.X
```

The first statement assigns the string constant "Sum" to the scalar *X*; the second assigns 10 to the compound symbol *Total.Sum*. In the third statement, REXX first interprets *Total.X* as *Total.Sum*, since *X* has been assigned the value "Sum." Consequently, REXX assigns the value 10 to the compound symbol *Total.Sum2*.

Stacks and Global Variables

REXX uses an external stack, or queue, onto which its programs can put data items. The words *stack* and *queue* refer to the same structure; the difference between the two lies in how the structure is used. The PUSH instruction sends data

continued

onto a last-in first-out (LIFO) stack, while the QUEUE instruction sends data onto a FIFO queue. The PULL instruction serves to read data from the stack or queue.

In other words, you have one "pile" of data items. If you PUSH data, it goes on the top of the pile; in this case, the pile is called a stack. If you QUEUE data, it goes on the bottom of the pile; in this case, the pile is called a queue. In either case, when you access the data with PULL, it comes off the top. There is no way to access data from the bottom of the pile.

In Personal REXX, you must install the stack and specify its size (between 1K and 62K bytes) using the stack-manager utility that comes with it. The external stack also lets you increase the size of the type-ahead buffer from the standard 15 keystrokes to a maximum of 159.

A REXX utility also maintains external global variables that are static and accessible to different programs. These global variables divide into three classes, based on their lifetimes: *Simple* global variables remain in memory until you power down or reboot the system; *session* global variables are retained for the life of a session, which can span several reboots; and *permanent* global variables are available permanently. Session and permanent global variables are stored in the DOS files SESSION.GLV and LASTING.GLV (always located at the root directory of the current drive), re-

spectively. To start a new session, you must erase the SESSION.GLV file. REXX provides commands to transfer data among the various global variables and both local variables and the external stack.

The GLOBALV SET *var_name value* command defines a simple global variable and assigns it a value. Similarly, the GLOBALV SETS and GLOBALV SETP commands set session and permanent global variables, respectively. The GLOBALV PUT and GLOBALV GET commands provide duplication of the global variables and their contents between REXX programs and the memory area for global variables. You can also group global variables.

Clauses, Constructs, and Loops

REXX programs consist of various kinds of clauses: null clauses, labels (used to define procedures, functions, and error-trapping code), assignments, instructions, and commands. You may place multiple clauses on one line, but they must be delimited by semicolons.

REXX provides a collection of math, string, comparative, and logical operators. It supports the four basic numerical operations plus raising to a power, integer division, and remainder. Double bars are used to concatenate strings. The logical AND, OR, XOR, and NOT operators are also available. There are two sets of comparative operators: one for normal comparisons (in which strings may be padded

with trailing blanks), and the other for strict comparisons (in which strings must be exactly the same). For example, a normal comparison of (' '=') yields a 1, for true, but a strict comparison, (' '=='), returns a 0, for false.

A number of instructions exist to control numeric accuracy and display format. For example, the NUMERIC FORM [SCIENTIFIC | ENGINEERING] specifies scientific or engineering format for displayed numbers. Also, NUMERIC DIGITS *expr* specifies the arithmetic precision to *expr* significant digits. You can assign the number of digits you want to ignore during a numeric comparison with the instruction NUMERIC FUZZ *expr*.

There are two decision-making constructs: the IF...THEN...ELSE and SELECT statements. If you put the THEN and ELSE clauses on the same line, you must precede the ELSE keyword with a semicolon. If the THEN and ELSE clauses contain multiple statements, you must enclose them in a DO...END block. While this resembles Pascal's BEGIN...END, it is actually a single-iteration DO loop in REXX. You can't have ELSE-IF components in an IF statement, although nested IF statements are supported. However, you can obtain the effect of one or more ELSEIFs with the SELECT statement.

The SELECT construct doesn't contain a switch expression with its accompanying case lists. Rather, the SELECT

Table 1: A list of the capabilities and functionalities of Personal REXX.

Interpreter	Yes	Exit a loop	Yes
Support visual environment	No	Multiline user-defined routines	
Built-in editor	No	Functions	Yes
Data types	Numeric and string	Procedures	Yes
Need to declare scalar variables	No	Recursive	Yes
Need to declare nonscalar variables	No		
Support external stack	Yes	Predefined functions	
Support external static global variables	Yes	Basic string manipulation	Yes
		Extended character-based word manipulation	Yes
Decision-making constructs		Math functions	No
IF statements		Data-representation conversion	Yes
IF...THEN	Yes	Date/time functions	Yes
IF...THEN...ELSE	Yes	PC hardware-information query functions	Yes
Multiline IF...THEN...ELSE	Yes	DOS access functions	Yes
ELSEIF	No	PC hardware-access functions	Yes
SELECT	Yes	Windows	Yes (library)
Use switch variable	No		
OTHERWISE clause	Yes	Text-file I/O	
		Sequential, variable-length line I/O	Yes
DO loops		Sequential character I/O	Yes
One-iteration loop	Yes	Random-access, variable-length line I/O	No
Fixed iteration loop with no control variable	Yes	Random-access character I/O	Yes
Open loop	Yes		
Fixed iteration loop with a control variable	Yes	Error trapping	Yes
Step option	Yes	Resume execution of offending lines after error	No
FOR fixed number of times	Yes		
WHILE test	Yes	Tracing capabilities	Yes
UNTIL test	Yes	Interactive tracing	Yes
Cycle in a loop	Yes		

keyword is followed directly with one or more WHEN clauses, each containing a complete logical expression. The THEN keyword separates the logical expression from the outcome statement (with multiple statements enclosed in the single-iteration DO...END loop here also). SELECT also has an optional OTHERWISE clause that acts as a catch-all. For example,

```
SELECT
WHEN x = 1 THEN
DO
statements
END
WHEN x > 1 THEN
DO
statements
END
OTHERWISE
DO
statements
END
END /* SELECT */
```

REXX supports three forms of the DO loop: single-iteration (DO statements END), repetitive, and conditional. The repetitive loop may indicate the specific number of iterations, the keyword FOREVER (to loop continuously), or a loop-control variable, var = first TO last [BY step] [FOR count]. The conditional loop contains either WHILE logical expression or UNTIL logical expression. Repetitive and conditional clauses can coexist in a single DO loop.

DO loops end with the END keyword and an optional end-of-loop name. The ITERATE instruction is used to cycle the innermost DO loop. ITERATE has an unusual ability: You can skip the remaining portion of one or more inner DO loops and cycle back to an outer DO loop, so that any intervening inner loops are bypassed. You specify an end-of-loop name on the ITERATE instruction to cycle to the END statement of the outer loop (which also contains the end-of-loop name); then the outer loop continues if it has more iterations to perform. To my knowledge, the only other programming language with this ability is Ada. You can also exit a DO loop altogether with the LEAVE instruction.

Environmental Issues

Console I/O in REXX is simple but flexible. The SAY instruction displays items on the screen; you can list multiple items delimited by spaces after the SAY keyword, which always issues a carriage return. For keyboard input, you can follow the PULL instruction with a list of input variables, and you can use PULL with the PARSE instruction.

The combined PARSE PULL command lets you control input assignment. For example, PARSE UPPER PULL translates the

input characters to uppercase. In addition, PARSE can store input in several variables with or without an input template. For example, PARSE PULL hours ":" minutes ":" seconds takes a string from the keyboard input, such as 12:22:50, and assigns 12 to hours, 22 to minutes, and 50 to seconds.

PARSE is not limited to keyboard input, however. It can work with other program components, such as variables, the program's arguments, source code lines, and input-file lines. This instruction can parse the contents of a variable (using a data template), extract information, and store it in other variables. For example, if the variable name contains the string "Ada Augusta Byron," then the statement PARSE VAR name first 4 middle 12 last assigns "Ada" to first, "Augusta" to middle, and "Byron" to last.

One highlight of this language is its ability to interact with its environment. Typically, the environment for Personal REXX is DOS. However, in place of DOS, you can invoke the language from Mansfield Software's editor, KEDIT, and make it REXX's environment.

The interface between REXX and its environment is not at all casual. The environment is such an integral part of the language that any program instruction the interpreter doesn't recognize is considered to be a command and is passed to the environment. To avoid being limited to its "parent" environment, REXX supports the ADDRESS instruction, which lets you direct commands to other environments.

REXX also has an INTERPRET instruction that enables the interpreter to read a character string as instruction code during run time. This is a very powerful mechanism for user-modified or self-modifying programs.

Functions and Procedures

Function and procedure declarations begin with a label name (which ends with a colon), followed by the PROCEDURE keyword. If the function or procedure needs to access global variables, an EXPOSE variable_list clause follows the keyword. The called routine can alter the values of exposed variables; any parameters are declared on the line following the PROCEDURE line.

Procedures are CALLED with their optional parameters delimited by spaces; they issue a RETURN to the calling routine without any returned value. Functions, on the other hand, are CALLED with their optional parameters enclosed in parentheses; they issue a RETURN expression to the calling routine, with a value in the predefined variable, RESULT.

In a REXX program, functions and procedures follow the main program

Personal REXX 1.60

Type

Interpretive programming language

Company

Mansfield Software Group Inc.
P.O. Box 532
Storrs, CT 06268
(203) 429-8402

Format

One 5¼-inch floppy disk

Language

C language

Hardware Required

IBM PC, XT, AT, PS/2, or compatible with at least 256K bytes of memory (640K bytes recommended) and one disk drive

Software Required

MS-DOS or PC-DOS 2.0 or higher

Documentation

210-page *Personal REXX User's Guide*; *The REXX Language: A Practical Approach to Programming* by Michael Cowlishaw (Prentice-Hall, 1985)

Price

\$125

Inquiry 864.

body, which must end with an EXIT statement. Like procedures and functions, the main program can define a list of parameters (REXX calls them arguments) delimited by spaces. However, these arguments receive their values from the input typed at the DOS command level. If more arguments are supplied than are declared in the main program or routine, the last-declared argument inherits any extras. REXX's predefined string-manipulation functions let you detect and extract each of the extra arguments.

The language also provides a collection of built-in functions, most of which fall into the following categories: string manipulations, conversions among different numeric representations, file I/O, time and date queries, and queries about arguments. Notably absent, however, are math functions, such as logarithms, trigonometric functions, and square-root calculations.

The most impressive functions are the ones for string manipulation. They resemble those of BASIC or Pascal, but they pay special attention to character-based words. Spaces in a character string are considered to be word delimiters. The word-related functions deal with word

continued

position and word count, as opposed to character position and character count. You can extract words from a string, count the words in a string, and obtain the position of a word in a string.

For example, to extract the third word in the string *Name*, you would use the function `WORD(Name,3)`. Similarly, to delete four words from the string *Days* starting with the second word, you would use the function `DELWORD(Days,2,4)`. In other words, you don't have to know the exact character position of the word or the length of the extracted or deleted strings. The REXX functions do the work.

Personal REXX also provides functions for tapping into the hardware and the operating system. The hardware-information routines return data such as the genre of the IBM PC (including the new PS/2 models), the number of serial and parallel ports, the date of the installed ROM, the amount of RAM, and the number of floppy disk drives.

The DOS function group performs operations such as changing directory or drive, returning the current directory path, getting a directory of files, returning the volume label, creating or deleting a directory, and returning the value of a DOS environment parameter.

The hardware-access group contains routines that manipulate the screen cursor, the screen, and the display attributes. Other routines in this group perform PEEKs and POKEs and port I/O.

A fourth group includes miscellaneous routines that perform data conversion, return the amount of EMS memory available, convert a string to uppercase or lowercase, and return the stack status. The `RXWINDOW` library contains a set of window functions that let you open and close a window, display the borders, perform I/O, define or remove an input field, and set the attributes of an entire window or portions of it.

REXX supports file I/O using text lines or characters. The `CHARS(filename)` and `LINES(filename)` functions return a 1 (i.e., true) if there are more characters or lines, respectively, to be read from the file. Thus, REXX provides two forms of the logical `EOF()` function common in BASIC and Pascal.

The functions `CHAROUT` and `LINEOUT` write characters and lines, respectively, out to file. Likewise, you can use `CHARIN` and `LINEIN` to read characters and lines, respectively. REXX automatically opens files the first time you attempt to read from or write to them.

Personal REXX deviates from the mainframe version by not supporting random access of variable-length lines, since PC-DOS does not support such a file-access scheme. However, while perform-

ing character I/O, you can specify the starting location of the I/O task. This is REXX's mechanism for supporting random character access.

Tracing and Trapping

REXX also offers flexible tracing capabilities. Using tracing directives, you can trace all clauses (A), commands (C), errors (E), failures (F), results (R), intermediate results (I), and labels (L). Personal REXX can also redirect the trace output to the printer.

Personal REXX also supports interactive tracing, during which the interpreter executes a clause and then pauses to wait for your command. You can respond by pressing Enter, to resume execution, or by typing = to re-execute the last clause; any other response goes to the interpreter for immediate execution. While tracing, REXX displays various symbols at the beginning of each line to indicate the nature of the item shown on that line (e.g., result, intermediate result, or label).

The language provides two general error-trapping mechanisms via the `SIGNAL` instruction. In the first, `SIGNAL` directs the program flow to a label that is either a string constant or an expression (whose value specifies the target label). The predefined variable `SIGL` returns the offending line of source code.

The second mechanism tackles predefined types of fatal errors by using `SIGNAL [ON | OFF] condition`. Some error examples are `SYNTAX`, which occurs when REXX detects a syntax error; `NO-VALUE`, which occurs when an uninitialized variable is used to evaluate an expression; and `FAILURE`, which occurs when a command passed by REXX to its environment fails.

Error trapping doesn't contain any program-resumption mechanism, so you can't simply resume executing a troubled program. This is acceptable since most REXX programs are batch programs, and a malfunctioning batch file can cause unexpected damage.

Testing Personal REXX

I generated Personal REXX programs to run the `BYTE` Floating Point, Disk Write, and Disk Read benchmarks on my system. I loaded the REXX programs and interpreter from a RAM disk. For comparison, I also ran the same tests in `BASICA 3.10` on the same machine.

The Disk Write benchmark timings were almost identical (47 seconds for Personal REXX and 46 seconds for `BASICA` to write a 64K-byte sequential text file to a blank, formatted floppy disk). However, the Disk Read timings differed significantly: `BASICA` required only 23 seconds to read a 64K-byte se-

quential text file, while Personal REXX needed 90 seconds. I can't find any reason for this difference in performance.

Performance on the Floating Point benchmark (performing 10,000 iterations of a double-precision multiplication and division test) also varied considerably: 176 seconds for Personal REXX and only 79 seconds for `BASICA`. This difference is more easily explained: Personal REXX doesn't use the 80287 to enhance its slower interpreter.

I was unable to run the Sieve benchmark because I ran out of ISA memory. The Sieve contains a very large array, and Personal REXX's 40K-byte maximum for both program and variables was not enough.

[Editor's note: `FLOATPT.REX`, `WRITE.REX`, and `READ.REX` contain the code used for the benchmarks. `ROOT.REX` is a REXX program that solves for the root of a nonlinear equation. It provides an example of the `INTERPRET` instruction and lets you key in the function's expression (as well as a guess at the root) at run time. These four programs are available in Personal REXX 1.6 source code for the IBM PC and compatibles on `BIX`, on `BYTEnet`, on disk, and in the *Quarterly Listings Supplement*. See "Program Listings" in the table of contents. To "find" source code in the Listings areas on `BIX` and `BYTEnet`, search by article title, author, or issue date. Some archived files may contain numerous listings for a single article. A description of the file also accompanies each entry.]

Capability-Oriented

As a general-purpose language, Personal REXX is limited by the size of its 40K-byte working memory and the absence of math functions. It is also a fairly slow interpreter overall. However, its strength lies in its capabilities, not its speed. Its DOS interface, hardware-access functions, and ability to address various environments, along with its parsing, word-manipulation, and string-manipulation functions, make Personal REXX a very powerful batch language. ■

BIBLIOGRAPHY

- Cowlshaw, M. *The REXX Language: A Practical Approach to Programming*. Englewood Cliffs, NJ: Prentice-Hall, 1985.
O'Hara, R., and D. Gomberg. *Modern Programming Using REXX*. Englewood Cliffs, NJ: Prentice-Hall, 1985.

Namir Clement Shammass (4814 Mill Park Court, Glen Allen, VA 23060) is a freelance writer and columnist for several microcomputing magazines. He can be reached on BIX as "nshammass."

REVIEW: PERSONAL REXX

VIEWS FROM BIX:
PERSONAL REXX

other.langs/reviews #4, from Paul Hoffman.

There are over 100,000 PCs connected to IBM mainframes, and probably at least 75,000 are running CMS (Conversational Monitor System). The fact that Personal REXX is so close to REXX under CMS means that these users can now control their PCs in a fashion almost identical to how they control their mainframes. With more and more people using CMS, learning about how to use a very basic CMS tool like REXX is very valuable. Personal REXX is an excellent way to do so. It also lets you write scripts/macros/batch files on one machine and easily convert them to run on the other.

other.langs/reviews #7, from Salvatore Ricciardi.

The review fails to mention that REXX is IBM's SAA (Systems Application Architecture) committed command interpreter. Certainly this merits a note. The main advantage of Personal REXX is its use as a replacement for Batch and as a programmatic interface to KEDIT. I don't believe it is meant to be a replacement for BASIC. While the language features are there, perhaps it should be reviewed in the context of a command interpreter that has a good set of language features.

other.langs/reviews #12, from Mark Guzdial.

The product doesn't impress me from this review. I have more capability from the Unix Shell or the public domain shells for the PC, so the language description makes the product sound rather weak. But I can understand the argument that this is a great environment for developing scripts to use on CMS. That would impress me more and give me an idea of the real value of the product.

other.langs/reviews #13, from Cheyenne Wills.

From a language viewpoint, REXX is a very nice command language (if you are from the Unix world, read "shell language"). It just so happens that you can use the same language for your editor macros, or anything else that has been set up to interface with it. Having REXX on the PC means that I can replace all my .BAT files with a "real" language. (IBM also markets a subset of REXX for the PC. It is included with the VM BOND product.) By the way, what I use REXX for mostly is not command scripts, but editor macros.

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. 90 and 200 Watt models available.

PC Editor's
MAGAZINE Choice



Cuesta Systems Corporation
3440 Roberto Court
San Luis Obispo, CA 93401

Made with pride in the U.S.A.
805/541-4160 TLX-4949381 CUESTA
Dealer, VAR, & OEM inquiries invited

Now there's a smart way to connect more than one printer

Forget those dumb A/B boxes and those expensive switching devices.

Now you can connect up to six parallel printers to your computer and let your programs do the switching intelligently for only \$119.

SmartPorts automatically sends

your output to the correct printer.

You just add a simple code to your program or printer setup string.

Or, select a printer from a pop-up window utility that's included.

SmartPorts recognizes the code and makes the switch.

So, call now and use your Visa, MasterCard or AmerEx. It's smart!



Now Only \$119

1-800-368-7737

(Anywhere in the United States or Canada)

SmartPorts

Dresselhaus 8560 Vineyard Avenue, Suite 405, Rancho Cucamonga, CA 91730
An intelligent software-controlled printer switching device



COMPUTER WAREHOUSE

CALL TOLL FREE **1-800-528-1054**

FREE FEDERAL EXPRESS
Air Express Shipping
See Details Below

LOWEST PRICES
FAST DELIVERY

HARDWARE

PRINTERS

Alos All Models Call	
Brother All Models Call	
Citizen MSP-40 \$285	
MSP-45 \$415	
MSP-50 \$355	
MSP-55 \$455	
Premier 35 \$445	
Tribute 224 \$605	
I20 D \$140	
Citizen 180D \$160	
Citizen 15E \$320	
Diablo 635 \$735	
Dyonics 150 \$299	

EPSON

All Printer Models Call	
Hewlett-Packard LaserJet II \$1829	
NEC P2200 \$335	
850 \$1539	
860+ \$1950	
3550 \$729	
8810, 8850 \$1059	
P8 \$425	
P7 \$610	
P9 \$1035	

OKIDATA

All Printer Models Call	
Panasonic 1091 Model 2 \$180	
1060 Model 2 \$165	
9082 I \$295	
1524 \$535	
1592 \$385	
1595 \$429	
3131 \$249	
3151 \$390	
Laser Call	

STAR MICRONICS

All Printer Models Call	
Toshiba 321 SL \$499	
3415L \$665	
351 Model II \$899	
Laser Printer Call	

DISKETTES

Maxell MD2 (Qty 100) \$82.50	
M2S \$65	
Sony DS/OD (Qty 100) \$69	

MONITORS

Amdak All Monitors Call	
NEC Multisync II \$549	
Multisync Plus \$875	
Multisync XL \$2005	
Princeton Graphics All Models Call	
Sony Multiscan w/cable \$665	
Zenith 1490 FTM \$625	
Other Models Call	

VIDEO TERMINALS

Qume 101 Plus Green \$315	
101 Plus Amber \$315	
Wyse 30 \$285	
50 \$399	
75 \$555	
Wyse 85 \$425	

MODEMS

HAYES

All Modems Call	
Prometheus 2400B w/Soft \$120	
Other Models Call	
US Robotics Courier 2400 \$299	
Password 1200 \$149	

DISKETTES

Iomega Bernoulli 10 meg \$865	
Bernoulli 20 meg \$1260	
Bernoulli 40 meg \$1605	
Bernoulli Beta Internal \$909	
Bernoulli Beta External \$1645	
Teac AT 1 2 Meg Drive \$100	
XT 1/2 Height Drive \$85	

SEAGATE

20 meg w/Western I/O \$290	
Other Models Call	

BOARDS

AST Six Pack Plus \$115	
Hot Shot \$330	
Other Models Call	
ATI EGA Wonder \$185	
VGA \$279	
CSSL Awesome \$375	
Hercules Color Card \$145	
Graphic Card & Graphic Card + \$175	
Above Board PC 1010 \$210	
Intel Above Board PS/PC (1110) \$239	
Above Board AT (4020) \$315	
Above Board PS/AT (4120) \$345	
NEC Multisync Graphic Board Call	
Orchid Tiny Turbo 286 \$265	
Turbo EGA \$449	
Paradise Five Pak \$99	
Autowitch 350 \$135	
Autowitch 480 \$150	
VGA+ \$239	
VGA Professional \$355	

Plus Development

Plus Hard Card 20 & 40 Megabyte Call	
Quadram Quad EGA+ \$275	
Tec Mar Graphics Master \$389	
Captain No Memory \$119	
EGA Master \$235	
Vidoo-7 Vega Deluxe & VGA Call	

COMPUTERS

AST Model 80 \$1370	
AST Model 120 \$2059	
AST Model 140 \$2400	
NEC Multispeed \$1415	
NEC Multispeed EL \$1615	
Toshiba T1000 \$810	
T3120 \$3175	
T-1100 Superwist \$1649	
T-3100 \$2799	
Zenith Call	

KEYBOARDS

KB5151 \$145	
KB5153 \$235	
KR101 \$99	

\$389

MIT SYSTEMS Turbo PC/XT
256 Memory, One 360K Brand Name Floppy Drive + 135 Watt Power Supply, Slidin Case, AT Style Keyboard + 4-10 MHz Clock Speed (Keyboard Selectable) 8 Expansion Slots

Turbo PC/XT w/640K & 1 Drive \$415	
Turbo PC/XT w/640K & 2 Drives \$485	
Turbo PC/XT w/640K \$725	
1 Drive & 20 MG \$935	
PC/AT 10 MHz w/512K \$989	
1.2 Floppy Drive \$1510	
PC/AT 10 MHz w/1024K \$699	
1.2 Floppy Drive \$89	
PC/AT 10 MHz w/1024K \$279	
1 Floppy, 40 MG \$145	
MonGraphics Card with Parallel Printer Port \$38	
Color Card w/Parallel Printer Port \$65	
Amber Monitor (TTL) \$99	
Amber Monitor w/Swivel Tilt \$279	
Color Monitor (RGB) \$145	
EGA+ Card \$38	
I/O Card (Serial/Parallel) \$39	
I/O Card (Serial/Clock Calendar) \$89	
Enhanced Keyboard \$69	
AT Multi I/O Card \$55	
XT Multi I/O Card \$55	

SOFTWARE

IBM PC and 100% Compatibles

TRAINING

Flight Simulator \$27	
PC Logo \$69	
Typing Instructor \$27	
Typing Tutor IV \$27	
MS Learning DOS \$27	

LANGUAGES

C Compiler (Microsoft) \$247	
Fortran Compiler (Microsoft) \$245	
Macro Assembler (Microsoft) \$83	
Pascal Compiler (Microsoft) \$165	
Quick Basic 4.0 \$53	
Turbo Jumbo Pack \$159	
Turbo Pascal w/8087 & BCD \$53	
Turbo C \$83	
Turbo Basic \$53	
Turbo Prolog \$53	

PROJECT MANAGEMENT

Harvard Total Project Manager II \$289	
Microsoft Project \$288	
Super Project Plus \$269	
Timeline 2.0 Call	

COMMUNICATIONS

CompuServe Starter Kit \$19	
Crosstalk XVI \$88	
MS Access \$137	
Mirror II \$33	
Remote \$88	
Smartcom III \$155	

INTEGRATIVE SOFTWARE

Enable 2.0 \$359	
Framework II \$395	
Smart Software System 3.1 Call	
Symphony \$439	
Ability \$92	

GRAPHICS

Logi Mouse Call	
Logi Buss Mouse w/paint \$89	
Newsmaster \$48	
In-A-Vision \$259	
Microsoft Buss Mouse 1.0 Call	
Microsoft Chart 3.0 \$249	
Microsoft Serial Mouse 1.0 Call	
Newsroom \$30	
PC Buss Plus Mouse w/Paint \$99	
PFS: First Publisher Call	
IMSI Mouse w/Dr Halo II \$92	
PC Mouse w/Paint \$89	
Printmaster \$29	
Signmaster \$132	
Turbo Graphix Tool Box \$38	

WORD PROCESSORS

Word Perfect Executive \$103	
Leading Edge W/P w/Spell & Mail Call	
Turbo Lightening \$55	
Microsoft Word 4.0 \$185	
Multimate Advantage II \$245	
Wordstar w/Tutor \$162	
Wordstar Pro Pack 4.0 \$205	
PFS: Professional Write \$89	

Word Perfect (Ver.4.2) \$195
Wordstar 2000 + 3.0 Call

SPREADSHEETS

Lotus 1-2-3 Call	
Multiplan 3.0 \$108	
Twyn \$32	
VP Planner Plus \$82	

Supercalc 4 \$269

MONEY MANAGEMENT

Dollars & Sense w/Forecast \$92	
Tobias Managing Your Money Call	

UTILITIES

MS Windows \$55	
Copy II PC \$19	
1 DIR Plus \$46	
Fastback \$76	
Norton Utilities 4.0 \$48	
Printworks \$36	
Sidkick (Unprotected) \$45	
Sideways 3.1 Call	
Superkey \$53	
Xtra \$25	
SOZ \$45	
Brooklyn Bridge \$69	

DATA BASE MANAGEMENT

Clipper \$375	
Drase III Plus \$379	
Extended Report Writer \$175	
KnowledgeMan II PromoPack \$285	
Quickcode Plus \$138	
QuickReport \$138	
Reflex \$78	
DB-XL \$80	
PFS: Professional File \$112	

R:Base 5000 System V \$415

Many other titles available.

Circle 66 on Reader Service Card for MS DOS Products.
(All others: 67)

COMPUTER WAREHOUSE

To Place an Order: 1-800-528-1054
To Follow-up on an Order: 602-944-1037

8804 N. 23rd Ave.
Phoenix, Arizona 85021

Order Line Hours:
Mon-Fri 7:00 a.m.-6:00 p.m.
Saturday 9:00-1:00
Order Processing:
10:00 a.m.-3:00 p.m. Mon-Fri

* No Charge for VISA and MasterCard * You Pay the Ground Shipping - We Pay the Air * Ground Shipping & Handling \$6.00 * Free Air applies ONLY to orders up to 10 lbs. & Over \$50 * All products carry a manufacturer's warranty. All Guarantees, rebates, train period privileges & promotional programs are handled by the manufacturer only. * NO APO, FPO, or international orders, please * Call before submitting PO Numbers * Personal and Company Checks Will Delay Shipping 3 weeks * Prices, Terms & Availability Subject to Change Without Notice * Add 5% for COD Orders * We Do Not Guarantee Machine Compatibility





@Liberty and the Baler

Paul Schauble and Rick Cook

These spreadsheet compilers are among the first of their kind

A spreadsheet compiler lets a programmer turn a spreadsheet into a tamperproof, stand-alone program. It automatically produces a compiled version of the spreadsheet that runs faster and takes less memory than the interpreted version, while producing exactly the same results.

The first generation of spreadsheet compilers makes a bold claim—that you can take a Lotus 1-2-3 spreadsheet and speed up its execution while hiding formula information from users. You can let other people benefit from your work without giving away your secrets.

The two Lotus 1-2-3 compilers we tested, @Liberty—pronounced “At Liberty”—(\$99.95) from SoftLogic Solutions and the Baler version 3.27 (\$495) from Brubaker Software, only partially meet these goals. While spreadsheets compiled with these products give the same computational results as a Lotus 1-2-3 spreadsheet, neither of them is really Lotus command set-compatible. Many spreadsheets will have to be rewritten before compiling with either of these products. Neither compiler is suitable for the casual Lotus user; both assume that the programmer is thoroughly familiar with MS-DOS and Lotus 1-2-3.

The Tests

We tested each of the compilers on six different spreadsheets. Three of these—Savage, Recalc, and Scroll—are used frequently in BYTE. The other three were selected from our previous projects.

We ran the tests on a Multitech 900, an 80286-based AT clone running MS-DOS 3.2 with a 6-MHz clock speed and no floating-point unit (FPU). In addition, the compiled programs were run on a standard IBM PC with and without an 8087 FPU. We used Lotus 1-2-3 version 1A for all comparisons.

@Liberty

@Liberty comes with one manual for the spreadsheet programmer and 10 copies of

the run-time manual for executing compiled spreadsheets. Under the program's license, you cannot copy any part of the package, so distributing the compiled spreadsheets requires buying one copy of @Liberty for each 10 users.

The typeset manual adequately covers the features of @Liberty, and it is easy to understand. The preparer's manual is written at a fairly high level and assumes the reader is quite familiar with both Lotus and general computer-operating techniques.

The run-time manual (packaged separately) lacks installation instructions, and so cannot stand alone. This is unfortunate, since it could have been written for a less-experienced operator.

Because of these documentation limits, the compiled spreadsheets need to be operated by a knowledgeable person. You can't simply put one on a disk, mail it out to all your field offices, and expect untrained users to get it up and running.

We tested a version of @Liberty identified only as the “initial version.” @Liberty consists of a separate compiler and run-time modules. It requires an IBM PC-compatible machine using PC-DOS or MS-DOS 2.0 or higher with a monochrome, CGA, EGA, VGA, or Hercules video card and display. The graphing features will not operate on a standard monochrome monitor.

@Liberty automatically senses and uses an 80x87 FPU when present. Memory requirements depend on the spreadsheet being processed. The compiler operates on any machine with 384K bytes of RAM, enough to support Lotus itself. The run-time module executes most moderate-size (1000- to 2000-cell) spreadsheets on a 384K-byte machine.

@Liberty processes spreadsheets in

the Lotus 1-2-3 version 1A format. It claims to process spreadsheets from Lotus 1-2-3 version 2, as long as they do not use commands unique to version 2.

The biggest weakness of @Liberty is its minimalist approach to spreadsheet programming. The run-time package does not support a number of Lotus 1-2-3 commands, including RANGE, COPY, MOVE, DATA, and most of the Worksheet submenu. The documentation claims these commands are used only for designing a spreadsheet. Unfortunately, this isn't quite true; these commands are often used in macros.

To alleviate this problem, @Liberty provides many additional macro commands (e.g., BORDERS ON/OFF, BEEP, and HOME ON/OFF). This helps, but these commands are not supported by Lotus. This makes it impossible to move a spreadsheet directly from Lotus to the compiler. Rather than creating and testing a spreadsheet in Lotus and then compiling it, you end up using Lotus as a specialized text editor.

@Liberty doesn't always tell you when a spreadsheet will not run because of missing commands. Some spreadsheets compile nicely, but they bomb on execution.

These limitations showed up in our tests. Two of our sample spreadsheets compiled without error, but failed to run. It is possible to rewrite the macros using @Liberty's extra commands, but this requires major changes. It generally is not possible to make a version of one of these

continued

Paul Schauble is a computer consultant doing business as The Second Ring. He can be reached at 5316 West Port au Prince, Glendale, AZ 85306, or on BIX as “pls.” Rick Cook is a freelance writer specializing in computers and high technology. He can be reached at 3820 West Flynn, Phoenix, AZ 85019, or on BIX as “rcook.”

Table 1: The timings (in seconds) for the spreadsheet tests using @Liberty and the Baler. File sizes are in bytes.

	Savage	Recalc	Scroll	Savage error
Lotus				
AT clone	39	2	39	-2.0e-08
PC w/o 8087	127	5.6	121	
PC w/ 8087*	127	5.6	121	
@Liberty				
Compile time	16	33	33	
Compile size	33,391	75,787	75,787	
AT clone	47	2	81	-1.00e-06
PC w/o 8087	166	2.3	282	
PC w/ 8087	12	2	N/A	
Baler version 3.27				
Compile time	656	520	520	
Compile size	42,661	63,573	63,573	
AT clone	17	1	16	-3.56e-09
PC w/o 8087	163	10.8	173	
PC w/ 8087	9.3	4	N/A	

N/A = Not applicable; an 8087 does not affect scroll operations.

* = Lotus 1-2-3 version 1A does not support an FPU.

spreadsheets that works in both Lotus and @Liberty. We did not convert these spreadsheets for this review.

The Savage, Recalc, and Scroll spreadsheets converted and executed without error, but none contained any macros. On Savage and Recalc, the precision of the calculations was very good. In all three cases, the final results from @Liberty matched those from Lotus.

Although a compiled program usually executes faster than an interpreted one, @Liberty's spreadsheets were considerably slower than the Lotus originals (see table 1). Execution times without an FPU were about 20 percent to 30 percent longer than the spreadsheets run with Lotus. However, the compiled spreadsheets were about 15 percent smaller than their Lotus counterparts. [Editor's note: *Soft-Logic Solutions claims that it is possible to create @Liberty spreadsheets that run faster, slower, or the same as their Lotus counterparts. The individual operations in @Liberty are slightly slower than Lotus; but where Lotus recalculates all cells in a spreadsheet, @Liberty recalculates only those cells whose values are affected by a previous calculation.*]

One feature of @Liberty, notably absent in Lotus, is control over screen colors. The @Liberty run-time package has commands to separately change foreground and background colors for the data and command areas on the screen; however, the commands are present only in the run-time package, so the programmer cannot select colors. Once set, colors will not be saved with the spreadsheet and must be reset manually each time you load the spreadsheet.

The Baler

The Baler comes on three floppy disks in an IBM-size three-ring vinyl binder and cardboard slipcase. There is only one copy of the program and manual in the package, but the license agreement lets you make unlimited copies of the run-time software, and the compiled spreadsheets may be distributed without royalty or limitations. Unfortunately, this privilege does not extend to the manual, so the programmer has no documentation to include with the compiled spreadsheets. Brubaker Software would do well to produce a separate, copyable manual for the run-time package.

The manual assumes the reader is experienced with both Lotus and MS-DOS. Even so, it leaves too much unsaid. While the Baler's commands are much closer to Lotus's than @Liberty's, there are still important differences; for example, the Baler does not support deleting rows and columns from a spreadsheet. These differences are not adequately explained, particularly for the file-handling commands, and the sparse index makes it difficult to find information.

We reviewed the Baler version 3.27. It requires a 512K-byte IBM PC or full compatible running MS-DOS version 2.0 or higher. The Baler does not support any form of graphics and operates only in text mode on any monitor. The memory requirement for the compiled program depends on the size of the spreadsheet. A small spreadsheet (less than 500 cells) executes on a 384K-byte machine. A hard disk drive is a practical requirement: You need to have on-line the spreadsheet, the Baler itself, QuickBASIC, the Baler run-

time library, the QuickBASIC run-time library, the linker, and Lotus. You could run from floppy disks, but an edit/compile/test cycle would have you changing disks four times.

The company says the compiler processes spreadsheets from Lotus 1-2-3 versions 1A, 2, and 2.01. It also claims the compiler can process spreadsheet files from Symphony and VP-Planner, provided that they do not use features unique to those programs.

The Baler supports an 80x87 FPU if selected on compilation. If a spreadsheet is compiled without an FPU switch, it will not use an FPU, even if one is present. If a spreadsheet is compiled for an FPU, it will use the FPU if present and emulate it if absent. However, to use an FPU, the spreadsheet must be compiled on a machine with an FPU.

Unlike @Liberty, the Baler is not complete as delivered. It generates BASIC code for Microsoft QuickBASIC version 3.0 and requires that QuickBASIC be installed with it. The Baler's installation instructions do not cover QuickBASIC.

We discovered it is possible to have QuickBASIC installed and working but not usable with the Baler. The problem is that when the Baler does its translation, it creates a batch file that has QuickBASIC calls in it and then executes this file. For this to work, QuickBASIC has to be in the same directory as the Baler or it has to be findable via the "path" variable. When we first tested the Baler, we had QuickBASIC in a directory by itself so the Baler couldn't find it. This requirement is not stated in the Baler documentation, but an experienced programmer should be able to resolve these problems quickly.

The BASIC code is specific to the Baler and probably could not be adapted to other uses. Spreadsheet execution uses the QuickBASIC run-time library and follows those conventions.

One convention the Baler does not follow is the MS-DOS convention for handling path names. Under MS-DOS, a filename by itself is assumed to refer to a file in the current directory. Thus, `bale filename` would compile the spreadsheet in the current directory.

But the Baler doesn't work that way. Instead, it remembers the path name from its last invocation and uses that path. This may help the novice user, but it is guaranteed to confuse anyone familiar with MS-DOS conventions.

Like @Liberty, the Baler also has a set color feature. A configuration file that is used by both the compiler and compiled spreadsheets determines screen colors. The configuration file is distributed with the compiled spreadsheet, so the pro-

grammar has control over colors on the screen.

Running @Liberty simply compiles a spreadsheet, whereas running the Baler brings up a configuration menu that allows removal of Lotus error checking, overriding formulas, adding format commands, specifying Range Protect, invoking the Data commands, and using the data-interchange format (DIF) facility. Removing these features makes the compiled spreadsheet smaller and perhaps more secure. Brubaker Software claims that removing Lotus error checking also reduces run times, but we found no significant differences.

The Baler has a menu-activated audit feature that produces reports that cross-reference and document the spreadsheet. While not a substitute for testing, it helps locate problems in a large spreadsheet and serves as a permanent reference.

The Baler's execution speed was excellent. Run times averaged about half that of Lotus and down to 40 percent of the run times from @Liberty. The price for this speed is very slow compile times. Compiling a spreadsheet with the Baler (our tests left Lotus error checking on) takes from 15 to 40 times longer than @Liberty: Most of the time was spent in the Baler itself; the QuickBASIC compile and link times were relatively insignificant—1 minute out of a 10-minute compile cycle.

The Baler implements much more of the Lotus command set than @Liberty; for example, it implements the COPY, MOVE, and RANGE functions, but @Liberty does not. The only major omission is the graphics facility. In keeping with the style of the manual, the only mention of this omission is buried in an appendix. Unique commands are also provided, mostly for additional display formats that do not affect spreadsheet operation. The compiled spreadsheet has the format commands, Range Protect and Unprotect, the Data menu, and the ability to read DIF files. Despite this, there were still problems with our test spreadsheets.

Of the test spreadsheets, Savage and Recalc compiled and executed without error. Precision of calculation was excellent; the results matched Lotus to more than seven significant digits.

But error checking was a problem. We used the Savage spreadsheet to test error handling on all three products. With Lotus and @Liberty, specifying an invalid starting value resulted in a spreadsheet full of error values, as first the invalid value and then the error propagated through the chain of formulas.

We ran this test through the Baler both with and without Lotus error checking enabled. With error checking, the first

	@Liberty	Baler version 3.27
Type	Spreadsheet compiler	Spreadsheet compiler
Company	SoftLogic Solutions 1 Perimeter Rd. Manchester, NH 03101 (603) 627-9900	Brubaker Software 8625 North County Line Rd. E Lafayette, IN 47905 (317) 564-2584
Format	One 5¼-inch floppy disk	Three 5¼-inch floppy disks
Computer	IBM PC or compatible with 384K bytes of RAM and MS-DOS 2.0 or higher with monochrome, CGA, EGA, VGA, or Hercules video card and display	IBM PC or compatible with 512K bytes of RAM; MS-DOS 2.0 or higher and QuickBASIC 3.0
Documentation	100-page programmer's reference and ten 36-page user's manuals	A single 130-page manual for both programmer and user
Price	\$99.95	\$495 including QuickBASIC
	Inquiry 892.	Inquiry 893.

formula using the incorrect value was not recalculated and kept its value. The rest of the formulas in the chain used this value in their calculations. Without error checking, the first formula returned a completely erroneous value that was then used by all the other formulas. The result was a spreadsheet filled with incorrect values with no indication of an error. Although no similar problems were seen in the other tests, this did not inspire our confidence in the product.

One of our test spreadsheets failed to compile. One of the cells contained the formula @NPV(B122,D69...D69). The compiler converted the range D69...D69 to a single-cell reference D69; then it complained that the @NPV function required a range specification. This is obviously a bug rather than a deliberate design decision.

Our second test spreadsheet compiled and executed with only minor changes to its macros. The Baler normally saves spreadsheet data in a different file than the spreadsheet itself. The macros that automatically saved the spreadsheet needed to have the embedded filenames changed. Although we did not do so, we could have changed the macros to execute either in Lotus or in the Baler.

Another test spreadsheet required the same change of filenames but then crashed. This spreadsheet used the Lotus /FILE COMBINE COPY NAMED command to extract data from a disk file. The Baler was unable to locate the named range;

again, this is a bug rather than a deliberate design feature.

The Savage, Recalc, and Scroll spreadsheets from both compilers were executed on an IBM PC with and without an 80x87 FPU.

The First of Their Kind

These spreadsheet compilers are among the first of their kind. As might be expected of first-generation products, they have serious problems. Neither @Liberty nor the Baler can be expected to reasonably compile a spreadsheet of any complexity. In most cases, the spreadsheet will have to be redone for the limitations of the chosen compiler, and the result will not run in Lotus or in the other compiler. This makes it difficult to construct and debug a spreadsheet with Lotus and then compile and distribute it. The changes required demand a new test cycle.

Unless you really need to distribute a spreadsheet in a form that keeps users from fiddling with the formulas, you are probably better off distributing uncompiled Lotus 1-2-3 spreadsheets or waiting for a more developed spreadsheet compiler.

A good second-generation spreadsheet compiler should completely duplicate the command set and execution characteristics of the spreadsheet program, except for the minimum necessary changes a compiler requires. Ideally, the spread-

continued

sheet program would have a development mode that would exactly duplicate the effects of the compiler.

With this combination, a spreadsheet that has been developed and tested with the interactive spreadsheet program could be compiled and distributed without modifications or the need for re-testing. Not only would the compiler have most of the characteristics of the interactive program, but the interactive program would have some of the characteristics of

the compiler. Experience with other languages indicates this happens only when the compiler and interpreter come from the same company.

In the meantime, it is important to use @Liberty and the Baler cautiously when you need to hide the information contained in a spreadsheet. A user can run the compiled spreadsheet but can neither modify it nor see the hidden formulas or tables. A compiled spreadsheet can produce a publicly available result

with a secret mechanism.

Another advantage is cost. You can distribute compiled spreadsheets without having to purchase a copy of Lotus for each user. Even when you are limited to 10 spreadsheets per copy of the program, as with @Liberty, this adds up to a considerable savings.

However, unless a present need is overwhelming, we recommend waiting for the next generation of spreadsheet compilers to appear. ■

Microsoft's Bookshelf

Rusel DeMaria

We may be on the threshold of an era when such things become commonplace, but for now, a reference source like Microsoft's Bookshelf represents a remarkable advance in computer information technology. Bookshelf is arguably the first general-purpose application for CD-ROM. Bookshelf's CD-ROM contains the complete text of 10 major reference works, as well as a sophisticated memory-resident user interface designed to locate and retrieve information.

The references on the Bookshelf CD-ROM (I tested version 1.00) are: *The American Heritage Dictionary*, *The World Almanac and Book of Facts 1987*, *Bartlett's Familiar Quotations*, *The Chicago Manual of Style*, *Roget's II: Electronic Thesaurus*, *U.S. ZIP Code Directory*; Houghton-Mifflin Spelling Verifier and Corrector, Forms and Letters, Houghton-Mifflin Usage Alert, and *Business Information Sources* (compiled by the Regents of the University of California).

Since most of its resources are available in book form, you might well wonder what makes Bookshelf such a superior reference source. For starters, Bookshelf's fast search features and its ability to cut and paste directly from CD-ROM to various personal-computer word processors reduce research time dramatically. For example, *The World Almanac and Book of Facts 1987* is nearly 1000 pages of tightly compressed text. Imagine searching such a book for every reference to the city of San Francisco; the task could easily take days. With Bookshelf, you can locate, read, and even transfer passages in a matter of minutes; it took

me about 20 minutes to locate and read every reference to San Francisco in *The World Almanac and Book of Facts 1987*.

You can execute Bookshelf either as a stand-alone application or as a terminate-and-stay-resident (TSR) program. When operating Bookshelf as a TSR, you can call it up from within other applications.

Bookshelf fully supports several major word processors, including Microsoft Word (I tested version 3.1), PC-Write version 2.71, WordPerfect 4.2, Multi-Mate Advantage (version 1), IBM DisplayWrite III, Volkswriter 3, XyWrite III and III Plus, and WordStar 4. It also recognizes Lotus 1-2-3 and Multiplan, but it does not perform automatic lookup and replacement or paste into these applications. Other word processors and text editors may allow a limited interface. For instance, in tests with programs not specifically supported (a beta copy of Borland's Sprint and Broderbund's MemoryMate), I found that lookup and cut-and-paste functions worked very well, but automatic text replacement was disabled in the spelling corrector and thesaurus.

Installing and Learning

To use Bookshelf, you need an IBM PC-compatible computer, MS-DOS or PC-DOS 3.1 or higher, a CD-ROM drive, and the MS-DOS CD-ROM extensions (device drivers generally supplied with the CD-ROM drive that allow your PC to operate the CD-ROM drive as though it were a single, large disk drive). I tested Bookshelf on an 8-MHz AT with 640K bytes of memory, a 30-megabyte hard disk drive, a 1.2-megabyte floppy

disk drive, a 360K-byte floppy disk drive, and an Amdek LaserDrive 1.

Before installing Bookshelf, you must install the CD-ROM drive and its driver software. You then execute the Setup program, which presents questions about your equipment and uses your responses to complete installation of the software and modification of the AUTOEXEC.BAT file on your floppy disk or hard disk (whichever you boot from). The full set of programs uses about 600K bytes of disk space. To load Bookshelf as a TSR, simply enter books from the PC-DOS prompt; to run the program in stand-alone mode, enter books /s.

Once installed, the CD-ROM drivers add about 13K bytes to your system's environment space used by the CONFIG.SYS file. Microsoft's CD-ROM extension driver adds another 28K bytes, and the Books program uses another 135K bytes when residing in memory; thus, Bookshelf requires at least 176K bytes of free RAM. If you want to run any worthwhile applications with Bookshelf installed as a TSR, you'll probably need a 512K-byte machine. Although Bookshelf is tolerant of some other TSR programs (e.g., you can use it with SuperKey if you follow instructions given in a READ.ME file on the Bookshelf CD), Microsoft recommends using Bookshelf without other TSRs. If you discover a conflict while running Bookshelf in TSR mode, you can remove the program from memory using the Unload command.

The documentation consists of a short reference and installation guide and a quick-reference pamphlet to commands. The Learn program on the CD takes you through an excellent guided tour of the program and its capabilities. Finally, there is on-line help available through either context-sensitive help screens or a help index.

Using Bookshelf

Bookshelf uses the type of interface popularized by Apple's Macintosh: pull-down menus and dialog boxes with buttons and text entry fields. Bookshelf

works with the Microsoft Mouse as well as the PC Mouse from Mouse Systems, but you can also use the program from the keyboard.

When running Bookshelf as a TSR, you call it up by pressing Alt-Left Shift, which causes the Bookshelf menu bar to appear at the top of the screen. At this point, you can hit the first letter of any menu item (e.g., T for thesaurus), or you can use the Alt key in combination with a letter key to implement a search or open a particular dialog box.

For example, if you press Alt-Left Shift, then immediately press Alt-T, the thesaurus opens and searches for synonyms of any word at the current cursor location (the cursor can be either inside the word or just past it). This allows you to type a word and then immediately check its spelling or look for synonyms or a definition.

Moving around within dialog boxes, which are common to most references, is awkward if you're using the keyboard. The Tab key moves from one text entry field or button to the next. The space bar executes the current button, but the Return key executes the default selection (the default selection's button is surrounded by a double bar). I often found myself pressing the Return key out of habit when I should have pressed the space bar. (You don't have these problems if you use a mouse.)

Bookshelf also uses Macintosh-like scroll bars to handle tables that are longer or wider than a single screen. Although the keyboard works well for scrolling up and down a long table (using the PageUp and PageDown keys), it is sluggish when you scroll across a table wider than one screen. However, you can quickly hide individual columns of any table to bring off-screen columns into view. Additionally, you can lock titles on long tables so that column header information is always displayed as you scroll through the data. (This feature works automatically unless you turn it off from the Options menu.)

The zoom features make Bookshelf operate a little like a hypertext document. [Editor's Note: For a description of hypertext, see William Hershey's review of *Guide in the October 1987 BYTE*.] If you find a reference to a subject in an index or a table of contents, zooming lets you go to the chapter, subheading, or paragraph levels, or directly to the text of that entry. Some searches reveal only the chapter, the subhead, or the first lines of particular results, and you can go to the full text by pressing Return, or you can use Zoom In to move down one level. Some entries contain cross-references; others contain footnotes. Special commands under the Options menu let you view these supple-

mentary texts and, in the case of cross-referenced material, to return to the original text immediately.

You can copy up to 50 lines of text at a time into Bookshelf's clipboard; for long passages, you can copy the first 50 lines, then append to the clipboard for as much data as you need. Finally, you can paste the entire contents of the clipboard into your word processor.

Whenever you discover an important passage, table, or other text that you'll want to refer to again, Bookshelf lets you create bookmarks. You add a descriptive title to each bookmark, and later, when you want to return to that point, you simply choose View Bookmark (Alt-O) from the Options menu and select the particular bookmark's name. Since Bookshelf stores bookmarks on your hard disk or floppy disk, the number of bookmarks you can create is limited by the amount of free disk space you have.

The References

Using Bookshelf's thesaurus, you can locate synonyms for a word in text or a word that you enter into the thesaurus's dialog box. You can also perform multiple searches and cross-reference the results of a search (i.e., search for a synonym to a synonym). If you're using a Bookshelf-compatible word processor, you can automatically replace the original word on your screen with the selected synonym.

Bookshelf's *American Heritage Dictionary* contains the definitions and origins of over 200,000 words. Its limited phonetic spelling checker is useful on occasion, but I would not rely on it in place of Bookshelf's separate spelling verifier. On the other hand, the wealth of words and their definitions makes this an extremely useful dictionary. For example, "rise" has 35 distinct definitions, many with sample sentences, as well as a set of synonyms and their definitions.

The dictionary's search capabilities are impressive. I searched for all definitions that contained both the words "scientific" and "mathematical," and within about 10 seconds, the program presented four entries: "engineering," "index," "operations research," and "parameter." In contrast, a search for definitions containing either "scientific" or "mathematical" took about 27 seconds but located 210 entries.

The dictionary also features a biography and geography section. Each entry is brief; for example, the biographical entry for Nikola Tesla reads: "Tesla, Nikola. 1856-1943. Croatian-born Amer. electrical engineer, physicist, and inventor."

The Houghton-Mifflin Spelling Verifier and Corrector can check the spelling

Bookshelf version 1.00

Type

Multifaceted reference and lookup tool on CD-ROM

Company

Microsoft Corp.
16011 Northeast 36th Way
P.O. Box 97017
Redmond, WA 98073-9717
(206) 882-8080

Format

One CD-ROM (High Sierra format)

Hardware Required

IBM PC or compatible; if Bookshelf is used as a TSR, it requires a minimum of 512K bytes of memory for a hard disk drive system (640K bytes for floppy disk drive systems and 256K bytes if used stand-alone); Microsoft Mouse or PC Mouse recommended

Software Required

MS-DOS or PC-DOS 3.1 or higher; CD-ROM drive with MS-DOS CD-ROM extensions; compatible word processor (recommended). CD-ROM drive supported by Microsoft CD-ROM extension software; drives supported include Hitachi 1502S/1503S, Sony CDU-100, and Amdek LaserDrive-1.

Documentation

Short reference and installation guide; quick-reference pamphlet; on-disk tutorial program Learn; help screens

Price

Disk alone: \$295
Bundled with Amdek LaserDrive, MS-DOS CD-ROM extensions, and controller card: \$1285

Inquiry 894.

of an individual word or an entire screen of text. If it finds a word it doesn't recognize, it offers you the opportunity to search for alternative spellings, look up another word or spelling, add the word to a user dictionary (so that it can be identified in the future), ignore the word, replace it, or cancel the search. (It does not bypass additional occurrences of ignored words encountered during the same search, however.)

The spelling verifier is phonetically based (e.g., it will find "psychotic" from "sikotic"), but it isn't perfect. I asked it to look up the misspelled word "cronic"; it found "ironic." When I instructed it to seek more alternatives, it found "conic" and finally, on the third try, "chronic." By contrast, Microsoft Word 3.1 on the

continued

Macintosh found "chronic" the first time but failed the "sikitic-psychotic" test.

Bookshelf's Usage Alert tool checks the proper usage of words and phrases. For instance, you may be unsure whether you should use "effect" or "affect" in a particular sentence. Usage Alert determines whether an individual word (or an entire screen of text) has usage rules associated with it. The usage rules displayed are brief definitions. (For example, *principle* is defined as "rule, law" and *principal* as "chief, money.") You also can suppress certain words or phrases so that they will not be flagged during a Usage Alert scan.

The Chicago Manual of Style is a well-known reference for English language usage. As a Bookshelf reference, it offers almost instantaneous access to the rules governing good writing. For example, if you have a question regarding punctuation within parentheses, you can search for entries containing "punctuation" and "parentheses." You might want to narrow the search to only paragraphs that contain references to "punctuation" and "parentheses," or further narrow it to refer to "question marks" and "parentheses." Searches of this type usually yield results in less than 10 seconds.

The World Almanac and Book of Facts 1987 is a massive compendium of information ranging from who won the 1985 Academy Awards to a complete list of U.S. senators, imports and exports from each state, and many other interesting facts and statistics. With the *Almanac*, the capabilities of Bookshelf make the search possibilities virtually endless.

Not all words can be the target of search operations. You cannot search for numbers other than four-digit years (e.g., 1987); nor can you use wild cards, so you have to design searches exactly. The good news is that you can put several search criteria on one line (for OR operations; the string to request a search for California or Michigan might read California, CA, Michigan, MI), and you can have up to three levels of AND operators. If you want to search for information containing references to California and cotton, you would place "California" on one text-entry line of the dialog box and "cotton" on another.

With over 22,500 quotations in *Bartlett's Familiar Quotations*, you should never be at a loss for someone else's words. You can search by author or by subject matter and construct complex searches on multiple criteria. A search for entries containing references to "crime" or "money" and "politics" came up with one entry from Aristotle and another from Will Rogers.

The *Business Information Sources* ref-

erence contains a compendium of business resources, including periodicals and books, government agencies, specific market-oriented groups, and other information for business users. A search for references to "advertising" and "television" revealed seven entries, which included books about television advertising as well as statistical articles.

You use the ZIP code locator to look up five-digit ZIP codes for standard postal addresses. You can either enter addresses into the ZIP code locator's dialog box or place the cursor after the state in a standard two-line address so that when you call up Bookshelf, it reads the address directly from your word-processing document. (It also will paste the complete address back into your document when it has located the ZIP code.)

Although the ZIP code locator even supports post office boxes, it isn't fool-proof. In one test, it failed to recognize an address as valid, and in another it returned the wrong ZIP code for a post office box in New York City. The problem in both these cases was that the official *U.S. ZIP Code Directory* contains more than one listing for these addresses, but the program did not return a message to that effect. In all other tests, however, it returned the proper ZIP codes in under 5 seconds.

If you've ever wondered how to phrase a difficult letter or set up a financial form, then you should appreciate Bookshelf's Forms and Letters reference. Divided into four categories (Business Forms, Business Letters, Business Outlines and Checklists, and Personal Forms), the Forms and Letters reference is full of useful information and practical templates. There are financial forms

(e.g., financial statements, cash disbursements, and expense tracking); business letters of all kinds (with helpful hints); special outlines for marketing plans, pricing, and other business applications; and several personal finance forms as well. The Forms and Letters' Transfer Forms option will transfer an entire form directly to a fully supported word processor. Even if you're using an application that Bookshelf does not support, copy and paste procedures often work. As a last resort, you can copy the form to the clipboard, then save the clipboard to an ASCII file.

Let Your Fingers Do the Walking

Bookshelf's few flaws do not detract from its overall value as a reference. About the only thing missing is an encyclopedia.

There is no question that Bookshelf puts at your fingertips a library of information that won't simply sit on the shelf. It's so easy to find and extract what you want that Bookshelf invites usage in ways that ordinary books do not.

One of the greatest pleasures Bookshelf offers is the opportunity to browse through reference works any time the mood strikes. Finding useful information is aided by powerful search features, but it is also aided by the convenience of a computer interface that can often lead to serendipitous discoveries. For professional writers, students, business people, and anyone who likes to have lots of information, Bookshelf is more than a reference; it is an opportunity. ■

Rusel DeMaria is a freelance writer. He can be contacted at 109 Akea Place, Kula, HI 96790.

MGMStation CAD

Rusel DeMaria

MGMStation CAD version 2.09II, from Micro CAD/CAM Inc., is a powerful two-dimensional drafting program that runs on most Macintoshes (512K Mac, Mac XL, Mac Plus, Mac SE and Mac II) and costs \$799. MGMStation CAD is not a simple, freehand sketch application, nor is it MacDraw. This program produces high-precision drawings to be used in machining and industrial design. Its floating-point accuracy and finely tuned user interface also allow it to be used by professional draftsmen, architects, or

electrical engineers.

Billed as "Professional CAD for the Mac," Micro Graphics Manufacturing Station CAD (or MGMS, for short) offers a wide variety of drafting tools in the form of menus and icons. In addition to the basic tools of the trade (e.g., points, lines, arcs, and fillets), MGMS can create and manipulate symbol libraries, create groups from individual drawing entities, calculate and draw dimension statements, use built-in plotter support,

continued

When Your Computer Sends An S.O.S. It Can Cost You Plenty.

- SECTOR NOT FOUND
- FILE ALLOCATION TABLE BAD
- DISK ERROR READING FAT
- DISK NOT READY
- INVALID DRIVE SPECIFICATION
- DATA ERROR
- GENERAL FAILURE
- ERROR READING
- WRITE FAULT
- BAD SECTOR
- NON-SYSTEM DISK OR DISK ERROR
- READ FAULT
- BAD DATA
- ABORT, RETRY, IGNORE
- PLUS HUNDREDS MORE !!!

**A revolutionary, new way
You can successfully attack
The costliest problem
In business computing today.**

No matter what they say, every one of these messages usually means: data loss due to hard disk failure. Part of your business is suddenly missing-in-action. So you call technical support. Pay for unnecessary repair or replacement. Pay overtime attempting to recover or reconstruct as much of your scrambled information as possible. Spend your valuable time soothing customers' ruffled feathers because one of your computers is "down." Again.

Think about it a moment: how much have these disguised hard disk error messages already cost you in unrecoverable data, time and torture?

Now for the shocker: your average business user sees these disguised hard disk failures many times each year! But it doesn't have to be that way anymore ...

The good news is:

Disk Technician™ and Disk Technician+™ Automated AI Software Systems **virtually eliminate these DOS error messages by eliminating the hard disk problems that cause them.** Both are designed to work with IBM PC, XT, AT and true clones

Disk Technician™ is preventive maintenance software that repairs and maintains hard disks by predicting and correcting failures before and after they happen — without removing programs and data!

Can you imagine the time, torture and money you will save yourself? Your department? Your company? Plenty.

There is simply no other program that can deliver what Disk Technician™ does. Over 7 years' painstaking R&D were needed to bring this revolutionary system to you.

It's easy to use: requires absolutely no technical skills and less than 60 seconds of operator time daily. It runs automatically and unattended. Anyone who can press ENTER can use it. Easily. Read our reviews.

The Power of Disk Technician™

Disk Technician™ predicts, detects, repairs and recovers hard disk data problems on the most fundamental level possible: *that of the single occurrence, single bit soft error.*

This unique ability is used as an early warning mechanism that allows Disk Technician™ to accurately predict which areas of the hard disk will eventually cause problems — *problems unknown to you until it is too late.*

Only Disk Technician™ is able to find and correct marginal areas before they affect your valuable data. And your bottom line.

Disk Technician™ keeps a history in its database of failure patterns it detects. The astounding accuracy of Disk Technician™ and the long-term reliability of your hard disks depend on decisions reached by its artificial intelligence (AI) considering data gathered from previous tests it has performed on your system.

**Million-dollar mainframe reliability
For PCs?**

Disk Technician™ uses special proprietary write and read testing to identify marginal bits and/or continual dynamic changes. Then, comparing current test results with its database of previous failure patterns, Disk Technician™ AI makes an early warning decision as to whether or not these errors will cause data loss.

The power of Disk Technician™ daily testing, AI, precision accuracy and history database virtually assures million dollar mainframe reliability for PCs.

All this and "glitch" protection, too?

SafePark™ memory resident software program (included!) works with all of your programs all of the time to prevent destruction of your data from static electricity, turning power on-and-off, brownouts, surges and spikes. When these "glitches" occur they can write garbage into anything the disk heads happen to be located over — sometimes wiping out an entire disk!

After 7 seconds (user adjustable between 1 - 15 seconds) of hard disk inactivity, SafePark™ automatically moves the heads over a "safe zone" created by Disk Technician™. Once the heads have been moved — which will almost always be the case — and a power glitch occurs, any damage will be confined to the safe zone: *protecting your valuable data and programs.*

If reliability, cost and downtime are important to you — daily use of Disk Technician™ is a must. Because the time to prevent disaster is before it happens!

**Choose your hard disk
Reliability assurance:**



Choose Disk Technician™ for hard disks up to 32 megs with MFM controllers. \$99.95



Choose Disk Technician+™ for hard disks over 32 megs, logical or partitioned drives, or RLL controllers. \$129.95

The following new features have been added to both Disk Technician™ and Disk Technician+™. For complete feature and technical specifications, just call or write us.

- NEW!** Built-in, non-destructive (no need to remove your programs or data) low-level formatter for AT-type systems, with adjustable interleaving to maximize system speed.
- NEW!** Will print a complete, permanent record of each test, or store in file — your choice.

- NEW!** Built-in low-level formatter with adjustable interleaving for AT and XT-type machines.
- NEW!** Hardware Service/Repair section in expanded Technical Users Manual.
- NEW!** Runs on either A or B floppy drives.
- NEW!** Retains or ignores hard disk manufacturers' bad track data — your choice. Can add bad tracks or sectors at any time, non-destructively (no need to remove your programs or data), without reformatting.
- Works with 2 physical hard disk drives on a single system. Can be reset to operate on a new machine or hard disk by calling the factory.
- Even works on finicky 1.2 megabyte AT-type floppy disk drives.
- Quikstall™ installation guide and 60 Second Instruction Manual™ get you going fast and are all you will need to run Disk Technician™.

Press Reviews:

New York Times: "Disk Technician seems like a product every owner of a hard disk should seriously consider buying and using daily for preventive maintenance. Think of it as dental floss for your computer."

Tokyo PC Newsletter: "Hard disks are basically temperamental little beasts that must be tended to regularly. Otherwise, poof goes the data! Disk Technician does the same thing for hard disk preventive maintenance and protection that General Chuck Yeager did for aircraft flying: A radical expansion of the possible. These boys from Prime Solutions are breakin' some new ground here."

PC Magazine: "Prime Solutions claims its Disk Technician can prevent hard disk errors, repair even left-for-dead hard disks, and recover lost data — all automatically and without any technical skills on your part. Sound too good to be true? I thought so, too. But after witnessing a few minor miracles and a major miracle or two, I'm a believer. This \$99 software may be the best investment you could ever make."

John C. Dvorak: "If you're one of those souls who are plagued by hard disk problems, then take a look at Disk Technician from Prime Solutions."

New York Law Journal: "Be prepared for an experience. The software is childishly simple to install and start. Prime Solutions says it takes 60 seconds. It certainly doesn't take longer. But then ... oh, boy!"

EVALUATION COPIES & FACTORY REBATES
available to volume users through participating dealers, call now for details!
ORDER NOW from your participating Disk Technician™ Dealer or factory direct!
— Visa, Mastercard, Eurocard accepted —
800 847 5000 or 619 274 5000

PRIME SOLUTIONS INC.™
We Make Technology Easy And Affordable™
1940 Garnet Avenue • San Diego, CA 92109
Telephone: 619 274 5000 Technical Support: 619 272 4000

MGMStation CAD version 2.09II**Type**

CAD program

Company

Micro CAD/CAM Inc.
5900 Sepulveda Blvd. #340
Van Nuys, CA 91411
(818) 376-0008

Format

Three 400K-byte 3½-inch floppy disks: one system disk with installation program and device drivers and two master disks with MGMS CAD application; key disk is required

Implementation Language

Macintosh Programmers' Workshop
Pascal

Computer

512K Mac (with two disk drives), Mac XL, Mac Plus, Mac SE, or Mac II

Software Required

System 3.2; Finder 5.3 or higher

Output Devices

Supports Imagewriter and LaserWriter printers and Houston DMP series, Hewlett-Packard and compatibles, Graftek, Gould, and Apple Color pen plotters and Roland plotters

Documentation

Micro Graphic Manufacturing Station,
145 pages

Price

\$799 for CAD package with plotter drivers and Geometry Analysis module (calculates area, perimeter, moment of inertia, etc.)

Options

IGES module: \$500
MGMS CAD/CAM: \$7000

Inquiry 895.

and more. I evaluated MGMS on a Mac II with 2 megabytes of RAM and an NEC MultiSync color monitor.

User Interface

MGMS's user interface is one of its more controversial features. Although it departs from some traditional Mac procedures, given the context of precision drawing, it is both logical and easy to use. Many commands are used for the exact placement of points, lines, arcs, and

other entities and often require some keyboard input or several mouse clicks to identify exact locations. This method of manipulation does not resemble the typical MacDraw point-and-drag operations.

One variation on the Mac interface is MGMS's use of icons. The usual pull-down menus are present, but along the left side of the screen are 11 icons; each icon represents a submenu of graphic functions. Though this system differs from the traditional Mac interface, it allows many commands to be accessed from one screen without excessive submenu levels.

Another variation is MGMS's implementation of user prompts. A typical Mac application prompts you for an action using a dialog box that has a message and option buttons. MGMS blanks the menu bar and places a message there with your options. Rather than using a mouse, you type the first character of the option performing the selected action, or type the requested information (text or digits) and hit the Return or Enter key. For example, when selecting Quit from the File menu, MGMS prompts Save the document before exit? •Yes• •No•; typing n causes MGMS to discard the file and return you to the desktop.

Many menu choices set the program into a specific mode of operation. For instance, choosing Delete allows you to delete specific entities from a drawing. You delete by clicking on a particular line, curve, or shape. You stay in delete mode until you leave it by using one of MGMS's convenience features—the "mouse escape." To escape any ongoing mode, you just move the mouse to the left-hand row of icons, aborting the current action. When working with MGMS, this mouse-escape technique becomes second nature.

Pull-down menus control general features of the program: The File menu controls file operations, printing, and plotting; the Zoom menu controls various zoom options; and the Group menu controls group operations. The General menu allows you to undo certain commands and modify the grid and drawing sizes, as well as repaint all the elements of a drawing, or only the actual drawing group itself (leaving out dimensions, labels, and hatching). The Hatch menu selects various hatch-and-fill patterns (a future version will allow you to select color on the Mac II). The Text menu selects the labeling mode. The Library menu handles specific library functions, and the Calc menu summons an on-screen calculator.

MGMS handles measurements in both the English and metric systems. When entering feet and inches, you can enter a

value—for example, 10 feet, 6 inches—as 10f 6; as total inches (126); as decimal feet (10.5f); or as a fraction (10 1/2f). You can enter a measurement in meters or feet at any time by entering the appropriate letter (i.e., 5m would represent 5 meters). Usable coordinate systems include polar coordinates (by angles), Cartesian coordinates (x and y), or user-defined grid coordinates.

Construction Icons

The 11 icon menus used in the actual construction of drawings are Point, Line, Arc, Fillet, Sect(ion), Spline, Rotate, Mirror, Dimen(sion), Types (lines), and Delete. Within each menu are several choices used in creating precision drawings.

MGMS excels at precision drawing. Many options allow exact placement of objects, lines, arcs, and other details. Under the Point menu, there are options for setting an absolute point; incrementing the position of an existing point; choosing a new or an existing point; and finding the midpoint/vector point, a point on an existing arc, a polar increment point, a point on the grid, or any free point. The Line menu includes automatic creation and exact placement of parallel lines; and lines perpendicular to other lines, arcs, free lines, and so on.

You can create all kinds of arcs and circles from existing points in a drawing: from exact center, radius or angle dimensions entered at the keyboard, or in several other ways. In addition, the Fillet menu offers easy ways to create a fillet (an arc that forms part of an imaginary circle and is tangent to two objects) between lines, lines and arcs, two arcs, from arc to point, and tangent between two arcs or tangent between an arc and a point. Another option, Fillet All Corners, lets you create fillets on all corners of a figure in one continuous operation.

The Sect(ion) menu enables you to resection lines and arcs and trim intersecting lines and arcs. This menu also includes chamfering (connecting two nonparallel lines by another straight line—similar to filleting, but with straight lines instead of arcs).

The Spline menu contains options that create shapes, curves, and contour offsets. You can, for instance, use a prepared file of Cartesian coordinates (perhaps originally generated from a spreadsheet or database) to define a complex curve, or you can enter up to 80 coordinate pairs from the keyboard. The program then creates a smooth curve between the starting and ending coordinates, using the intermediary points as guides. These coordinates approximate the use of a spline in manually drawn

continued



The \$19.95 High-Performance C Compiler

Mix Software presents Power C . . . Our new cost-efficient alternative to high-priced C compilers. Now you can create high-performance programs without spending all your hard-earned money. But price isn't the only reason to choose Power C over the competition.

Compare the performance. Power C's integrated Make saves you time and effort by automatically managing your large programming projects. And with Power C, your programs can be as large as available memory. As for speed, the performance chart speaks for itself. Power C executes most of the benchmarks faster. And Power C creates smaller EXE files, out-performing the competition.

Compare the functions. With over 400 functions, the Power C library is vastly superior. Our library is a superset of Microsoft C and Turbo C. Plus, we've added an extensive set of graphics functions for drawing lines, boxes circles, pie charts, and more.

Compare the portability. Power C supports the latest features of the proposed ANSI C standard. Plus, Power C is compatible with both Microsoft C and Turbo C. All of which makes it easier to move programs to and from Power C.

Compare the documentation. Our competition assumes that you're already a C wizard. We don't. Power C includes a step-by-step tutorial and sample programs with every function. With our complete documentation, programming in C couldn't be easier.

Power C is factors less expensive. And the source code to our function library is available at a fraction of their price.

	Power C	MS C	Turbo C
1) fib*	23.8	47.0	26.4
2) sieve*	27.6	40.2	25.5
3) tdbl*	3.5	9.0	9.6
4) diskio*	13.5	14.2	14.3
5) report**	11.0	86.3	60.7
6) drystone**	36.6	38.2	31.8
Compile/Link	73.9	187.6	81.4
EXE File Size	25120	29008	27184

C Compiler	Power C	MS C	Turbo C
C Compiler	\$19.95	\$450.00	\$99.95
Library Source Code Option	\$10.00	N/A	\$150.00
Total Cost with Source	\$29.95	N/A	\$249.95

Benchmarks from Dr. Dobb's Journal* & Computer Language**. First four programs test 1) function calling, 2) loops/integer math 3) floating point math, & 4) disk I/O. Programs 5 & 6 simulate typical applications. Tests compiled from command line using Make supplied with each compiler. Tests run on 8 MHz AT with medium model of Power C 1.0, MS (Microsoft) C 4.0, & Turbo C 1.0.



Technical Specifications

Power C includes: Power C compiler with integrated Make, Power C linker, Power C Libraries, Power C book, and support for...

- ✓ ANSI standard
- ✓ IEEE floating point
- ✓ 8087/80287 coprocessor
- ✓ auto-sensing of 8087/80287
- ✓ automatic register variables
- ✓ mixed model (near & far pointers)
- ✓ CGA, EGA, & Hercules graphics

Options are...

- ✓ Library source code
- ✓ BCD business math

Order Power C now by calling our toll free number or mail the coupon to Mix Software, 1132 Commerce Drive, Richardson, TX 75081.

1-800-523-9520

For technical support and for orders inside Texas call: 1-214-783-6001

Minimum System Requirements:

MSDOS or PCDOS 2.0 or later, 256K memory, 2 floppy drives or hard drive recommended, Runs on IBM PC, XT, AT, and compatibles, and IBM PS/2 model 25, 30, 50, 60, or 80.

60 day money back guarantee

Name _____
 Street _____
 City _____
 State _____ Zip _____
 Telephone _____

Paying by: Check Money Order
 MC/Visa# _____ Exp. _____

Computer Name _____ Disk Size _____
 5¼" 3½"

Product(s) (Not Copy Protected)

Power C (\$19.95) \$ _____
 Library Source Code (\$10) \$ _____
(includes an assembler)

BCD Business Math (\$10) \$ _____

Texas Residents add 8% Sales Tax \$ _____
 Add Shipping (\$5 USA - \$20 Foreign) \$ _____
 Total amount of your order \$ _____

Power C is a trademark of Mix Software.
 Microsoft C is a registered trademark of Microsoft Corporation.
 Turbo C is a registered trademark of Borland International. B

Circle 185 on Reader Service Card

MGM works on a standard Macintosh screen. However, it works better on a large screen display because more data in a large design is visible.

curves. The Spline menu also has commands for creating contour offsets for both open and closed figures. You can create inside or outside offsets after you've selected the distance. In effect, the contour offsets create an outline of any shape in the drawing.

The Shapes option, found under the Spline menu, allows you to select predefined shapes, such as rectangle, round rectangle, hexagon/polygon, slot, and D-hole. For each shape, you enter the appropriate dimensions from the keyboard, and the program creates the shape at the current point in the drawing.

The Rotate menu is similarly versatile, letting you rotate and duplicate defined groups in various ways, such as to specific points on the drawing or to a point indicated with the mouse. You also can click and drag groups to a new location or assign them to a new coordinate location entered from the keyboard.

Mirroring allows you to create mirror images around the x or the y axis or around a sloping x or y axis. You can choose to include or exclude hatching in the mirrored image.

Dimensions let you mark the two points of a dimension line, then mark where the line should be drawn. You can select different hash marks for the dimension lines from a special Install program that's run separately. You also can nest dimension lines or run them together in one long, subdivided line. The only drawback to dimensioning applies to architects: The vertical dimension statement cannot be placed along the edge of the object or rotated at angles; it always displays horizontally inside the dimension line. Other than that, MGMS offers instant and effortless dimensioning.

Organizing the Data

You can zoom a drawing by setting a new scale or by outlining a portion of the drawing using Cursor Zoom. You can use Cursor Zoom many times to blow up specific details of the drawing, returning instantly to the full picture using the

Original View command or typing Command-B (one of the useful keyboard-equivalent commands for selections in the menu bar).

MGMS works on a standard Mac screen. However, it works better on a large screen display such as Megagraphic Images' MegaScreen because more data in a large drawing is readily accessible; on a smaller screen, you spend a lot of time scrolling about the drawing. At first, I found the lack of keyboard equivalents in the left-hand icon menus to be annoying. Constant scrolling of the mouse to the left side of a large screen was cumbersome, but setting the mouse-tracking speed to a higher rate in the Control Panel solved the problem.

Grouping is accomplished in one of two ways: by clicking on individual entities or by defining a region with the mouse. Although MGMS does not have true layering, you can treat groups as layers since you can hide or display any defined group at any time. As an example, you might have a plumbing layout defined as one group in a house plan. By hiding or displaying that group, you could effectively work within different "layers." The disadvantage to this, however, is that in order to make alterations, you have to ungroup the plumbing group, alter it, and then regroup it.

You can define any group as a symbol in a symbol library. Libraries can contain up to 56 symbols, but you can have unlimited numbers of libraries. You can pick any symbol from the libraries, rotate or scale it, then paste it into a drawing at whatever point you choose. Then, if necessary, you can ungroup the symbol, modify it, delete it, or manipulate it using normal group commands.

For more complex effects, you can even load an existing drawing over the current one. You also can import MacDraw (or compatible) documents or export in PICT format via the Clipboard.

You label drawings in the text mode. Labeling is versatile, allowing various types of text displays and labels. You can enter comments, labels, balloons, or tables of entries. Text size can be modified as a percentage of the total drawing, but only two fonts are available: Monaco and a special Symbol font. Also, text cannot be rotated. You can, however, choose different types of pointers, select the exact position at which the text should point, and modify the position and size of text labels as needed.

Documentation and Add-On Modules

MGMS comes with a fairly basic manual and tutorial that—considering its size and complexity—is remarkably easy to learn. However, the learning time required

varies depending on how much prior CAD experience a user has.

This is not a package for casual graphics applications. Its real strength is its fine precision. Some experimentation is necessary to achieve fluidity with the program. Experienced users of both AutoCAD and MGMS will like the latter's accuracy of object placement and speed of drawing construction. MGMS's user interface makes designing easier with MGMS than with AutoCAD.

MGMS has a few add-on modules available from Micro CAD/CAM or from third-party vendors. For those people needing full CAD/CAM capabilities, MGMS is ideal because it is often marketed with the Manufacturing Design Systems CAM program (called MGMS CAD/CAM) for accurate manufacturing applications. It costs \$7000, but this includes installation and training, and MGMS CAD/CAM uses the Mac and a serial connection to drive manufacturing equipment, quite unlike the situation where buying a software product and reading a manual will suffice. Another company, Compu-Arch, offers three symbol libraries: architectural symbols (for \$195), electronic and electrical drafting symbols (\$195), and interior design symbols (\$195). Micro CAD/CAM also offers an Initial Graphics Exchange Specification (IGES) module for \$500.

A Geometry Analysis program also is included with MGMS but, according to the manufacturer, it will eventually be an optional add-on module. The program can determine the area, perimeter, moment of inertia, and center of gravity of a contour or figure. Results can be saved to a file if required.

CAD for the Professional

MGMS is a powerful and versatile CAD program for the Macintosh whose user interface is designed to achieve precision drawings; it may not appeal to people who like to point, click, and drag everything. At times, the precision features may inhibit free-form creativity, but for those who need precise results, that may be a small price to pay. In some cases, it makes sense to do the more free-form work in MacDraw, then import the results to MGMS for further refinement.

Although some Mac users have criticized the user interface's departure from the Mac standard, I think it serves its purpose well. It takes getting used to, but once you pass the learning curve, it provides a great deal of utility, and it lets users accomplish goals in record time. ■

Rusel DeMaria is a freelance writer. He can be contacted at 109 Akea Place, Kula, HI 96790.



THE IMPROVED VGA

Extending across barriers of graphics incompatibilities, **ATI** introduces a VGA improved performance card – **VIP**. **VIP** delivers the IBM PS/2 VGA standard to IBM PC/XT/AT and Model/30 users, providing an upgrade path to the outstanding world of VGA graphics.

Totally compatible with the **ATI EGA WONDER**, users have the unique ability to display EGA, Color/Graphics and Hercules software on monochrome, RGB and EGA monitors.

- Compatible to IBM Video Graphics Array (VGA). All 17 modes.
- Runs EGA/CGA/Hercules & 132 column software on IBM PS/2 Analog¹. Multisync, EGA, RGB, TTL monochrome, PC Portable, Compaq Portable² monitors.
- Softsense automatic mode switching.
- Automatic analog monitor detection.
- High resolution 800 x 560 graphics for Multisync monitors with drivers supplied for Windows, Gem, Ventura, Autocad.



Call today at (416) 756-0711 for more information.

¹ 132 Columns not available on IBM PS/2 Analog Monitors

² Compaq via optional Compaq Expansion Module

Trademarks: IBM, PS/2, Model 30, VIDEO GRAPHICS ARRAY, VGA, EGA, CGA, MDA - International Business Machines Corp.; HERCULES - Hercules Computer Technologies Inc.; Multisync - NEC Home Electronics Corp.; COMPAQ - Compaq Computer Corp.; WINDOWS - Microsoft Inc.; GEM - Digital Research Inc.; VENTURA - Xerox Corp.; AUTOCAD - Autodesk Inc.



Technology you can Trust

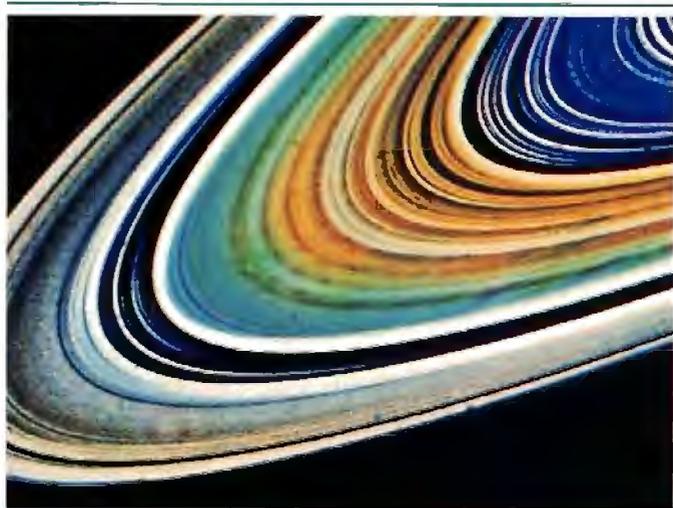


CONNECT MAINFRAME TAPE DRIVES TO YOUR PC!

Whether your tape data comes from millions of miles away by satellite or from just down the hall in accounting, our "TAPE CONNECTION" can read and write 1/2" 9-track magnetic tapes using your PC! Over 500 million reels of magnetic tape are in use by most mainframe and minicomputer systems. For more than 25 years, 1/2" 9-track tape has been the standard worldwide for storing and retrieving large data files. Why not let your PC and our tape system assist you in using the vast resources of the tape data world?

Supporting 800 NRZI, 1600 PE and 6250 GCR, our file transfer software processes labeled or unlabeled tapes from most computer systems, including IBM OS/DOS, DEC/VAX, UNISYS, Honeywell, Burroughs, NCR, and HP. Large multivolume tape reels can be transferred to disk at rates up to 5 MB/minute! Backup and restore capabilities work well with Novell networks for IBM XT/AT. With our Tape Data Extraction software, you can read packed fields, select and extract specific records and fields, such as payroll or personnel data, tax structure statistics, department records, as well as import data into LOTUS 123. You'll find so many applications for your particular business. You could even use your PC to read and display NASA's Voyager II mission data tapes, such as this highly enhanced image of Saturn's rings recorded from a distance of 8.9 million kilometers (from the tape library shown above).

We have years of experience with IBM mainframes using magnetic tape, so we're qualified to assist you in implementing and supporting your application. Since 1981, we have supplied thousands of conversion systems throughout the world, including most of the *Fortune 500*



companies. Our customer support personnel are available to answer your questions, free of charge. Our high volume allows us to offer low prices on Anritsu, Cipher, Kennedy and Qualstar equipment. Systems come complete and ready to use with controller card, cables, software and drive. Ranging from \$2995 to \$8995, we have a system for you, so call us today!

Dealer and volume discounts available.

"JOIN" FLAGENG for vendor support on BIX!

**FLAGSTAFF
ENGINEERING**

1120 Kaibab • Flagstaff, Arizona 86001 • 602-779-3341
Compusol-Europe • 12 Rue Rosenwald • 75015 Paris
Tel 530.07.37 • Telex 205431F

Circle 93 on Reader Service Card (DEALERS: 94)



A Writer's Tools

Jerry Pournelle

Editors, spelling checkers, and CD-ROMs: searching for the perfect system

I'm back at Chaos Manor after many adventures. *Prince of Mercenaries* is finished—well, there's still the exciting final chapter to do, but that's plotted, and action scenes are easy to write—and ought to be out from Baen Books sometime in 1988. I spent a couple of weeks in Silicon Valley, mostly working on the book, but I also got to Hackers 3.0—the third edition of the Hackers' Conference—and some press conferences. When I got back to Chaos Manor, the place was, of course, filled with stuff, so it's hard to see where I should begin.

Text-Editor Blues

I wrote *Prince of Mercenaries* with Symantec's Q&A Write. This is one of those programs I have to call infuriatingly excellent. I've written about it before, and normally I wouldn't use so much space on one program, but the problems are illustrative. Let me explain.

First, Q&A Write is, in the main, extraordinarily easy to use. The documentation is spotty, varying from pretty good to positively harmful. I'm beginning to think that no text editor can have really good documentation. Still, the help screens really are nice, and most of the instructions are quite intuitive.

Symantec has thoughtfully built in the old WordStar commands—Control-G deletes a character, Control-T deletes a word, Control-F jumps forward a word, and so on—as well as the more “modern” commands, like Control-right arrow to jump forward a word.

Q&A Write also has a very good macro capability. Thus, if you grew up on Electric Pencil, you can redefine Control-Y to be “delete to end of line” and Control-U to be “delete entire line.” Indeed, you can key nearly any multistroke sequence to be accomplished by a single command. Good macro capability is essential in a text editor.

Second, it has a quite sophisticated search-and-replace facility. For example,

you can search for all italic characters and replace them with underlines in one operation. You can even convert all italic *cats* into boldface **dogs** if you've a mind to.

As it happens, some of the early chapters of *Prince of Mercenaries* had been written on old Zeke the Z80 using CP/M WRITE, which defines underlining by enclosing the text to be underlined in underbar characters, thus. I developed a macro that would search for the first underbar character, delete it, mark the text as italic until it came to the next underbar, delete that, and go find the next set.

This worked fine until it found the very last phrase marked by underbars, after which it did strange things. Eventually, I discovered that Q&A Write didn't stop searching and replacing when it reached the end of the text. Instead, it wrapped back to the beginning and started over.

“Intolerable,” I muttered. Spelunking through the manual, I found that if I pressed PageDown after I entered the search and replace command mode, I could tell the editor to stop searching at the end of the text. I could even make that the default. If you press the Help key (F1) when in search and replace mode, you'll learn things not discussed in the manual. There are pages of options. Score more points for Symantec.

I ran into at least a dozen things like that, poorly documented or even undocumented features, until I began to believe there wasn't anything that program couldn't do. Then came time to print.

Paging, Paging

My old text editor, CP/M WRITE, doesn't bother with pages. You just type in what you want. If you want to force a page break at a particular point, you in-

sert a formfeed character. WordStar does much the same thing with its .pa command. This method is clean, neat, and intuitive.

Q&A Write tries to be “what you see is what you get,” or “WYSIWYG,” which means that it not only shows you the page breaks, but all the blank lines at the top and the bottom of the page. This is annoying if you're trying to write a column. I don't need to see an electronic analogue of paper.

The page breaks can be eliminated, though, if you tell Q&A Write that your page length is zero. This seems a bit odd, but it does work, and it's what I used when I wrote *Prince of Mercenaries*; and after all, when you're writing letters it really is nice to see the page breaks, so that additional capability is a bonus.

I stored my manuscript as one-chapter files. Q&A Write is a “text in memory” editor, meaning that there's a finite length to the size of a document you can work on. Some people object to that, but it's all right by me. I'd as soon break my work into chapter-size chunks.

However, when I print the stuff, I like to have a different header on each chapter, so that if I'm thumbing through the printed text and find an error, it's easy to see from the header which chapter I'm in. I tend to use a single running header related to the title, then the chapter number, so that *Prince of Mercenaries* would have headings like “Prince-1” and “Prince-2.”

Alas, Q&A Write won't let you put headers on a pageless document. WRITE accepts dot commands: you say .lh Prince-2 (beginning the line with the .lh, of course), and from that point on, every page has a left header of “Prince-2” until you put a different .lh command

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.

in the text stream. Similarly, you can have variable footers if you like. Not with Q&A Write. Unless your document has been saved with a finite page length, the program won't accept headers or footers at all.

Well, I thought, all right, I'll tell each chapter it now has 66-line pages, and then I'll add my headers. This was a bit of work I hadn't expected to have to do, but it's easier than rewriting the book with some other word processor, which is what I'd probably have had to do, since I don't have a program that converts Q&A Write files to WordPerfect or WordStar.

Before I went to all that work, though, I thought I'd experiment a bit; and that's just as well, since I'd have been wasting my time.

In Memoriam

Nearly every text editor I've used has been a "text in memory" editor: it works only on files it can hold in memory, and it can't create a file larger than the memory space it has to work with. As I said above, some people hate this, but it has never bothered me.

The advantage of "memory only" processing is speed. The disadvantage is that if you want to do a global search and replace, you have to do it for every one of your files. (This is enough of a disadvantage that I've sometimes concatenated WRITE files into one big WordMaster file, done the global replacements, then broken the text back into chapter-size files.)

It's not a problem for printing, at least not with CP/M WRITE, which has provisions for linking files: at the end of the file, you simply put / FILENAME.EXT as the last line (where the filename you give is the filename for the next chapter), and when you go to print, the linked files are automatically read in and printed.

There was once a version of WRITE that actually used the linkages to control search and replace as well, but that got lost in a later version. It would be a great advantage if you could optionally do search and replace through linked files, but it's not vital. Clearly, though, "text in memory" editors simply *must* allow print linkages. This seems so obvious, I never thought about how Q&A Write would handle long documents until I was ready to print *Prince of Mercenaries*.

I found out soon enough. The program solves the problem by ignoring it.

That is: Q&A Write has a provision for linking files. You merely insert a command of the form JOIN *filename*, which has about the same effect as WRITE's LINK in that, when you're printing, as the program comes to the JOIN command, it reads in the referenced file and prints it.

Alas, it doesn't do that very well, because it ignores the new file's header. The header you put on the very first page of your document will be the header you get for the rest of it.

In fact, JOIN ignores the formatting saved with the file and reformats the incoming file to conform with the formatting (e.g., margins, page length, single- or double-spaced) of the file that contains the JOIN. That's all right, but it wouldn't give me a different header for each chapter. Whatever header I started printing with would be what I'd keep.

There is another way. Instead of JOIN, you can use the Q&A Write QUEUE *filename* command. This one treats the new file as a separate document and thus preserves the header and footer (and formatting) you put on it when you saved it. Since all the chapters were saved as pageless documents, I'd have had to call up each one and change those formats, then save the document again. That might have been worth doing—but JOIN begins the *page numbers* all over again each time that it calls in a document. That wasn't precisely what I wanted either.

No WYSIWYG

It took me about 3 frustrating hours to discover all this. I decided to go with the JOIN system. That is, I created a document that contained a title page, followed by *JOIN PRINCE1.QW*, the page-break command, *JOIN PRINCE2.QW*, page break, and so on, all through the 20-odd chapters. This was pretty tedious, but at least I'd get consecutive page numbers from beginning to end. Publishers like that. . .

Halfway through that process I had an idea. Since I want to create my documents in the "pageless" mode—that is, give the program a page length of zero—but I also want them to have headers, suppose I tell the program that the page has, not zero length, but a very long length, say, 99,999 lines? That way I'd get a header, but no page breaks. It was a good idea, too; but Q&A Write won't accept page lengths longer than about 200 or so. Back to zero page lengths. Tediously, I created the JOIN document.

Now, of course, I wanted to print my book double-spaced. Fine. Tell the Q&A Write program that. It accepts the command—and does nothing with it. It will print a document double-spaced, all right, but it doesn't show the double-spaced page breaks.

It doesn't even tell how many pages the document will be: it continues to act as if you were going to print single-spaced. Since one of the options in Q&A Write is to print from page X to page Y, it is a little odd to tell it to print from page 1 to

page 7 in order to produce 13 pages of double-spaced text.

When I called Symantec about that, I was told that Q&A Write wasn't intended as an editor to create books. It's mostly meant for business correspondence. I told them I bet there are quite a few people out there who have to create a long document once in a while.

Font Support

If that weren't bad enough, Q&A Write likes to boast of its ability to handle type fonts, and, indeed, it does that in a fairly simple way. I have the Z font for my Hewlett-Packard LaserJet Plus, and it's wonderful, with three sizes each of Times Roman and Helvetica, plus some others. Normally, telling the LaserJet Plus about its fonts is a black art, but Q&A Write does this automatically and can change fonts within a line.

This sounded great, and I wanted to use the feature to write fancy letters with several fonts. Alas, if you tell Q&A Write to print your document in Times Roman of the same point size as Courier 10-pitch (the LaserJet Plus default), it does that nicely, but the page breaks and line-end breaks have zero relationship to what you see on the screen. Formatting the text neatly is nearly impossible.

It's no good trying to use one typeface for your letterhead and another for the body of the letter, either. Sure, Q&A Write will print both fonts on one page, but you'll waste a lot of paper trying to figure out *where* on the page the text will be. There's just no relationship between what you see on the screen and what comes out on paper.

Also, if you have numbers in the text, the columns don't line up. Neither do the tabs. I was using Q&A Write to create my expense reports (it has a primitive calculation routine built in), but I found I had to do them in Courier rather than in Helvetica or Times Roman.

In fairness, Q&A Write is a character editor, intended to run with monochrome screens as well as with machines that support graphics. It's not supposed to show you different fonts on the screen. On the other hand, if you've got graphics capability, you probably ought to have an editor that makes use of it.

Certainly, I want an editor that understands the font metrics well enough to show me, if not the fonts themselves, at least the line and page lengths I'll get when I print. I suppose some business tasks don't require that capability, although offhand I can't think of too many. Any reports that involve forms or tabular columns of numbers will need better WYSIWYG than Q&A Write has.

continued

Paradox: the top-rated relational database manager in the world

Source: Software Digest*	Software Digest Rating	Overall Evaluation	Program Name	Version Tested	Ease of Learning	Ease of Use	Error Handling	Performance	Versatility	Memory Requirement	Price
☆☆☆☆	8.7	Paradox	1.1	■	■	■	■	■	■	512K	\$495
☆☆☆☆	8.2	XDB	1.10	■	■	■	■	■	■	320K	\$750
☆☆☆	7.6	PowerBase	2.3	■	■	■	■	■	■	384K	\$349
☆☆☆	7.0	Open Access II	2.0	■	■	■	■	■	■	256K	\$395
☆☆☆	7.0	DataEase	2.5/2	■	■	■	■	■	■	384K	\$600
☆☆	6.6	dBASE III PLUS	1.1	■	■	■	■	■	■	384K	\$695
☆☆	6.4	R:BASE System V	1.1	■	■	■	■	■	■	512K	\$700

RATINGS KEY
(On a scale of 0 to 10)
Overall Evaluation
 ☆☆☆☆ 9.0 or higher
 ☆☆☆ 8.0 - 8.9
 ☆☆☆ 7.0 - 7.9
 ☆☆ 6.0 - 6.9
 ☆ 5.0 - 5.9
All Other Ratings
 ■ 7.0 - 9.9
 ■ 5.0 - 6.9
 ■ UNDER 5.0

Paradox® is once again the top-rated program, with the latest version scoring even higher than last year's top score.** (Software Digest's 1987 Ratings Report is an independent comparative ratings report for selecting IBM PC business software. Ratings Report tests were done by the prestigious National Software Testing Laboratory, Philadelphia, Pennsylvania.)

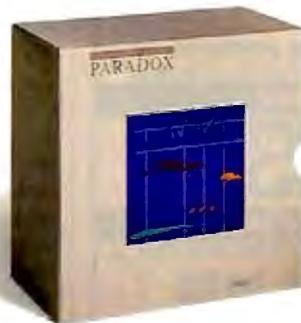
The Ratings Report message is crystal clear: there is no better relational database manager than Paradox. NSTL tested 12 different programs and amongst other results, discovered that Paradox is 3 times faster than dBASE® and 6 times faster than R:BASE® on a two-file join with subtotals test.†

Paradox combines ease of use with power and sophistication

Even if you're a beginner, Paradox is the only relational database manager that you can take out of the box and begin using right away. Because Paradox employs state-of-the-art artificial intelligence technology, it does almost everything for you—except take itself out of the box.

“ Paradox 2.0 will do for the LAN what the spreadsheet did for the PC

David Schulman,
Bendix Aerospace ”



Special Offer!

We're making a Special Offer on all three versions of Paradox. Mail proof of purchase, dated between Sept. 15, 1987 and Dec. 15, 1987 and your signed registration form for any of the three, and we'll mail you a \$100.00 rebate.** It's that simple!

- Paradox 1.1, suggested retail, \$495.00
- Paradox 2.0, suggested retail, \$725.00 (each copy of Paradox 2.0 supports one user on a network)
- Paradox Network Pack, suggested retail, \$995.00 (each network pack supports up to 6 users on a network)

60-Day Money-Back Guarantee†

PARADOX

by Ansa

A Borland Company

For a brochure
or the dealer
nearest you, call
(800) 543-7543

System Requirements for Single User:

- DOS 2.0 or higher
- IBM® PS/2 and PC, Compaq® PC families and other 100% compatibles
- 512K RAM
- Two disk drives. 3½-inch and 5¼-inch supported
- Compatible monochrome, color, or EGA monitor with adapter

*Reprinted with permission by Software Digest from its July 1987 Report covering 12 relational database programs.

†Test was designed and executed by NSTL. A 1,000-record file and a 10,000-record file were joined. A short test file from the 1,000-record file and a numeric field from the 10,000-record file were selected using the 1,000-record file address. The short test file was processed and sorted in ascending order. The numeric field was displayed for each group, and the results output to a roll printer. Test times from the last keyboard on the command sequence until return of program control were recorded and averaged.

**Rebate request must be received by Borland no later than February 15, 1988. Mail to: Paradox Rebate Department, Borland International, 4345 Scotts Valley Drive, Scotts Valley, CA 95066.

††90 days from purchase. This product does not perform in accordance with our claims, call our customer service department, and we will arrange a refund. Paradox is a registered trademark of Ansa Software. Ansa is a Borland International Company. Other brand and product names are trademarks or registered trademarks of their respective holders. Copyright ©1987 Borland International. D-11474

PARADOX

24-PIN

QUALITY AT 9-PIN PRICES!

NLQ LPRINTER[®] 324c

High volume 24-pin color printing is now in your price range. If you're considering 24-pin printers from NEC, IBM, Epson, Toshiba, Alps, Fujitsu or any 9-pin wide carriage printer, then the NLQ 324c is the printer you've been waiting for!

FEATURES:

- 300 cps draft/100 cps NLQ
- 24-pin color graphics/text
- Bi-directional tractor w/paper parking
- 8 K buffer w/32K option
- * Available with the Printers Plus 2-YEAR REPLACEMENT GUARANTEE! Call for details!



LIST PRICE: \$1195
INTRODUCTORY PRICE:

\$499*

INCLUDES IBM CABLE!

NLQ LPRINTER is a trademark of Printers Plus, Inc., Vienna, VA. This is not a liquidation or imitation product. Please call and we will gladly explain the difference between this product and any other product with any similarity.

CHOOSE FROM THE WORLD'S LARGEST SELECTION OF PRINTERS!

We guarantee to match the lowest in-stock prices in this publication! And guess what! WE DO GUARANTEE COMPATIBILITY! Call about the unique Printers Plus Guarantee!

PRINTERS

ALPS	NEC
BROTHER	NLQ [®]
CIE	OKIDATA
CITIZEN	PANASONIC
C.ITOH	PRIMAGES
DIABLO	SILVER REED
EPSON	STAR
FUJITSU	TOSHIBA

LASERS

APPLE	KYOCERA
AST	NEC
CANON	OASYS
CIE	OKIDATA
C. ITOH	PANASONIC
CORDATA	PCPI
EPSON	QMS
H-P	QUME
IBM	

Our expert R & D Department continuously monitors the latest printers on the market. IF YOU DON'T SEE IT, CALL!

GREAT PRICES WITH A GUARANTEE TO MATCH

PRINTERS PLUS

THE NATION'S ONLY COMPUTER PRINTER SPECIALISTS

HOURS (EST):
MON-THUR:
10 AM - 6 PM
FRIDAY:
10 AM - 5 PM



(703) 734-0236

WE'LL CREDIT COST OF LONG DISTANCE TELEPHONE CALL WITH ANY PRINTER PURCHASE.

PRINTERS PLUS, INC.
8486-C TYCO RD.
TYSONS CORNER, VA 22180

This offer good only through mail order division. Visit our 7 retail showrooms for best local prices. 15% restocking fee applies to all returned or refused merchandise.

Finally, it's inexcusable that the program won't tell me how many pages I'll get if I double-space.

So: here I am with a text editor that's awfully good for text creation. It's about the most transparent editor I've found so far. It doesn't get in the way, the macro capability is good, and there are plenty of built-in commands. It's fast and has the ability to export my text into ASCII files that can be sent into BYTE's Atex system or otherwise put on the wire.

The only trouble is that it can't print a simple double-spaced manuscript of 300 or more pages. Clearly, I was better off with WordStar.

Now What?

I drifted away from WordPerfect largely because of its complexity compared to Q&A Write. Now I discover Q&A Write isn't going to do the job. I'll always want a paper copy of my books. More than that, Jim Baen, my editor at Baen Books, is spoiled: he likes the way the book looks in Times Roman with *real italics*.

I suppose I can live with Q&A Write's limits. It is certainly the easiest to use, really the best in its price range, and maybe they'll make some fixes.

However, I'll be trying several more editors in the next few months. WordPerfect is certainly a contender. It's perhaps more complicated than I need, but what the heck, it does seem to do the job—and unlike Q&A Write, the WordPerfect format is known to a number of desktop-publishing programs that can format my books *exactly* the way I want them.

Another possibility is Microsoft Word 4.0, which people I respect tell me is wonderful. I got to looking at it today, and I still cannot find any references on how to delete a word, delete to the end of the line, or delete an entire line, without taking your hands off the keyboard. As far as I can see, you have to mark the word (either with the arrow keys or the mouse), then hit the Delete key. That gets in the way of creative writing, and I won't do it.

I want to have delete word, delete line, and delete to the end of the line as single Control-key keystrokes. Spelunking through the Microsoft Word 4.0 manual reveals the flat statement that you can build macros to do all this. It doesn't tell me how, but I think I see the light. Given that I can do that, I find a great deal to like about Microsoft Word 4.0; and it will certainly support my LaserJet Plus Z cartridge, since that one was developed for use with Microsoft Word.

The "stylesheets" features are also appealing; Microsoft Word lets you keep files of various formats and insert them

continued

THE PROGRAMMER'S SHOP

helps save time, money, and cut frustrations. Compare, evaluate, and find products.

FREE Innovative Software Technology Details

Since 1983, we've kept microcomputer developers abreast of software development trends. Our specialists help you with information about products that raise your productivity and enrich your programming environment. Now you can receive a special packet covering one of the 7 important approaches to productivity enhancement. PLUS a Free series of articles from our newsletter, "The Programmer's Letter," discussing this important subject. Specify Translators, Cross Compilers, 386 Native Mode Development, Prototyping Software, Object-Oriented Programming, Visual Programming, or Windowing Environments.

Call TODAY and choose your packet

386 Development Tools

386 Assembler/Linker	PC	\$ 389
386 Debug - by Phar Lap	PC	\$ 129
386/DOS Extender	PC	\$ 919
DESQview PS/2	PC	\$ 109
F771 -EM - by Lahey	MS	Call
High C - by Metaware	PC	Call
OS/286 & 386 by AI Architects	PC	Call

All Languages

APT - Active Prolog Tutor - build applications interactively	PC	\$ 49
ARITY Prolog - full, 4 Meg		
Interpreter - debug, C, ASM	PC	\$ 229
COMPILER/Interpreter-EXE	PC	\$ 569
Cogent Prolog Compiler	MS	\$ 179
MicroProlog Prof. Comp./Interp.	MS	\$ 439
PC Scheme LISP - by TI	PC	\$ 85
Star Sapphire	MS	\$ 429
TransLISP - learn fast	MS	\$ 79
TransLISP PLUS	MS	\$ 149
TURBO PROLOG by Borland	PC	\$ 69
Others: IQ LISP (\$239), IQC LISP (\$269)		

Basic

BAS_C - economy	MS	\$ 179
BAS_PAS - economy	MS	\$ 135
Basic Development Tools	PC	\$ 89
db/Lib	MS	\$ 119
Exim Toolkit - full	PC	\$ 45
Finally - by Komputerwerks	PC	\$ 85
Inside Track	PC	\$ 49
Mach 2 by MicroHelp	PC	\$ 55
NetWorks by Exim	PC	\$ 89
QBase - screens	MS	\$ 79
QuickBASIC	PC	\$ 69
Quick Pak-by Crescent Software	PC	\$ 59
Quick-Tools by BC Associates	PC	\$ 109
Stay-Res	PC	\$ 59
True Basic	PC	\$ 79
Turbo BASIC - by Borland	PC	\$ 69
Turbo BASIC Database Toolbox	MS	\$ 69

FEATURES

Windows/386 by Microsoft-multitask standard DOS applications in separate 640K segments and access expanded memory. Toggle, run simultaneously, or foreground only PC \$ 149

Alslys ADA - DoD certified, version 3 for AT. Optimizing Runtime Executive, Multi-Library environment, informative error messages. PC, List: \$2995

Note: All prices subject to change without notice. Mention this ad. Some prices are specials. Ask about COD and POs. Formats: 3" laptop now available, plus 200 others. UPS surface shipping add \$3 item

Circle 218 on Reader Service Card

INNOVATIVE DEVELOPERS!

Request a FREE "Innovative Software Technology" Packet. Compare key products in areas like Translators, Cross Compilers, Prototyping, 386 Native Mode Development, Object-Oriented Programming, and more

Get a FREE "Screen-Oriented C Libraries" Demo Disk for 3 competing products

* Consider how the products at the right can help you program creatively. Call one of our Tech Reps today

Order before January 31, 1988 and mention "BY188" for these SPECIAL PRICES:

	List	Normal	SPECIAL
386-DOS Extender	\$995	\$899	\$839
ACTOR - prototype fast	\$495	\$419	CALL
CLEAR by Clear Software	\$ 99	\$ 89	\$ 79
FLASHUP with toolkit	\$138	\$124	\$109
Interactive Easy Flow	\$150	\$125	\$109
SHOW-PARTNER-FX	\$350	\$328	\$299
Smalltalk/V	\$100	\$ 85	\$ 75

RECENT DISCOVERY

SQL - SQL for Btrieve callable from BASIC, C, and Pascal or for interactive query. Computed fields, specify sort order, manipulate composite records from joined files. No royalties. MS \$459

C Language-Compilers

AZTEC C86 - Commercial	PC	\$499
C86 PLUS - by CI	MS	\$359
Datalight Optimum - C	MS	\$ 99
Lattice C - from Lattice	MS	\$269
Microsoft C 5.0- Codeview	MS	\$275
Microsoft Quick C	MS	\$ 69
Rex - C/86 standalone ROM	MS	\$695
Turbo C by Borland	PC	\$ 69

C Libraries-Files

BFree by Soft Focus	MS	\$ 69
CBTREE - Source, no royalties	MS	\$ 99
cree by Faircom - no royalties	MS	\$315
ctree - report generation	PC	\$239
dB2C Toolkit V2.0	MS	\$249
dbQUERY - ad hoc, SQL-based	MS	Call
dbVISTA - Object only	MS	Call
Source - Single user	MS	Call
dbx - translator	MS	\$299

C-Screens, Windows, Graphics

C Worthy Interface Library	PC	\$249
Curses by Aspen Scientific	PC	\$109
dBASE Graphics for C	PC	\$ 69
ESSENTIAL GRAPHICS - fast	PC	\$185
FontWINDOW PLUS	PC	\$229
Graphic C - new color version	PC	\$279
Greenleaf Data Windows	PC	\$155
w/source	PC	\$269
Terminal Mapping System	PC	\$279
TurboWINDOW/C - for Turbo C	PC	\$ 79
View Manager - by Blaise	PC	\$199
Windows for C - fast	PC	\$149
Windows for Data - validation	PC	\$239
Vitamin C - screen I/O	PC	\$159
VC Screen	PC	\$ 79
ZView - screen generator	MS	\$129

Atari ST & Amiga

We carry full lines of Manx & Lattice.

DBASE Language

Clipper compiler	PC	\$399
dBASE II	MS	\$329
dBBase III Plus	PC	\$429

Call for a catalog, literature, and solid value

800-421-8006

THE PROGRAMMER'S SHOP™
Your complete source for software services and answers

5-B Pond Park Road, Hingham, MA 02043
Mass: 800-442-8070 or 617-740-2510 11/87

RECENT DISCOVERY

Instant-C/16M - Addresses up to 16M for program and data. Incremental compilation makes development faster than Turbo C (compile and relink XLISP in 4 secs vs 24). 286/386 only. PC, List: \$895

DBASE Language Cont.

Clipper compiler	PC	\$399
dBASE II	MS	\$329
dBBase III Plus	PC	\$429
dBASE III LANPack	PC	\$649
DBX1 Interpreter by Word Tech	PC	\$109
FoxBASE+ Dev. - V2.0	MS	\$289
Quicksilver by Word Tech	PC	\$499

DBASE Support

dAnalyst	PC	\$ 89
dBBase Tools for C	PC	\$ 65
dBrief with Brief	PC	Call
dBBC III by Lattice	MS	\$169
Documentor - dFlow superset	MS	\$229
Genifer by Bytel-code generator	MS	\$279
QuickCode III Plus	MS	\$239
R&R Report Writer	MS	\$139
Seek-It - Query-by-example	PC	\$ 79
Silver Comm Library	MS	\$139
Tom Rettig's Library	PC	\$ 79
UI Programmer - user interfaces	PC	\$249

DataBase & File Management

CQL	PC	\$ 359
DataFlex by Data Access	PC	\$ 899
DataFlex multiuser	PC	\$1149
Magic PC	PC	\$ 699
Paradox - original	PC	\$ 369
Paradox V2.0	PC	\$ 469
Revelation by Cosmos	PC	\$ 779

Multilanguage Support

BTRIEVE ISAM	MS	\$185
BTRIEVE.N-multiuser	MS	\$455
GSS Graphics Dev't Toolkit	PC	\$375
HALO Development Package	MS	\$389
Graphics	PS	\$209
Help/Control - on line help	PC	\$ 99
Hoops Graphics Library	PC	\$549
Instant Programmer's Help	MS	\$ 79
Informix 4GL-application builder	PC	\$789
Informix SQL - ANSI standard	PC	\$639
NET-TOOLS - NET-BIOS	PC	\$129
Opt Tech Sort - sort, merge	MS	\$ 99
Norton Guides	PC	\$ 75
Panel Plus	MS	\$395
Pfinish - by Phoenix	MS	\$229
Report Option - for Xtrieve	MS	\$109
Screen Sculptor	PC	\$ 89
SSP/PC - 145+ math routines	PC	\$269
Synergy - create user interfaces	MS	\$375
Xtrieve - organize database	MS	\$199
ZAPCommunications - VT 100	PC	\$ 89

Even More Power & Flexibility BRIEF 2.0



BRIEF easily conforms to your editing preferences and style, ensuring you are truly comfortable and productive.

Straight from the box, BRIEF is as much editor as most people will ever need — thanks to features like the real Undo, flexible windowing, and unlimited file size.

But BRIEF's hidden power is in its exclusive macro language. Customize BRIEF to include the commands and features YOU desire. It's fast and easy.

Users and industry press alike unanimously praise BRIEF. "Recommended." — Jerry Pournelle, Byte 12/86.

Now BRIEF 2.0 adds:

- Basic Features**
- Setup Program for easy installation and configuration. (Requires no macro knowledge).
 - Increased speed for sophisticated operations like Undo and Regular Expression Search.
 - All new documentation WITH tutorial on the Macro Language.
 - Command line editing (move cursor, add & delete characters, specify parameters).
 - Expanded Regular Expressions, with matching over line boundaries.
 - More block types, with marking by character, line or column.
 - Reconfigurable indenting for C files (supports most indenting styles).
 - Enhanced large display support, including wider displays.
 - Optional borderless windows.

- Windows
- Multi-level Undo
- Edit many files at once.
- File size limited only by disk space.
- Automatic language sensitive indentation.
- EGA and Hercules Plus 43-line support
- Compile & find errors within BRIEF.

Try BRIEF (\$195) for 30 days — If not satisfied get a full refund.

If you already own BRIEF, call for update info.

CALL 800-821-2492

In MA 617-337-6963

Solution Systems

541 Main Street, Suite 410B
So. Weymouth, MA 02190

And much, much more!

Requires an IBM PC, AT or compatible with 192K.

CHAOS MANOR

into documents at need. One stylesheet is for letters, another for the opening page of a chapter, another for regular pages, and so on. The Word manual explicitly tells me I can change my "running heads" any time I want to, provided that the new running head is the first paragraph on the page and marked as a header, so I'll be able to print chapters the way I like. All in all, Microsoft Word 4.0 looks very tempting.

I have also promised John Hild, president of XyQuest, that I'll try XyWrite III Plus, which can't possibly be as good as some of my professional colleagues tell me it is. Or maybe it can be.

XyWrite has become something of a standard within the publishing industry. While it's not yet standard practice to submit books on disk, that day is getting closer; and all the publishers I know will accept XyWrite files that have embedded ASCII commands. The way this works, to mark a passage as italic, you use some scheme like <ITALIC>this will appear in italics<ROMAN>; which is fairly easy to do using XyWrite macros.

According to Frank Romano, who is publisher of *TypeWorld* and a spokesperson for the publishing industry, so long as you use a consistent scheme and your text is in ASCII, publishers will be able to translate it.

XyWrite is faster than the dickens, and the only reason I didn't use it in the first place was that version 2.0 would not work with SideKick. XyWrite III Plus has been tamed down so that you can use it with your favorite memory-resident programs.

Finally, there's good old WordStar 4.0 and a new edition of WordStar 2000.

Those are the main candidates. They all swear they are trustworthy, loyal, friendly, thrifty, and very, very fast. Certainly, they'll all do 300-page double-spaced manuscripts with consecutive page numbers and different headers at the top of each chapter.

What Do You Want, Anyway?

When I first started writing with computers, I was so thrilled about not having to retype manuscripts in order to revise and edit, I didn't care what else the computer could do for me. Now, after more than 10 years of this, I have a few higher expectations.

We professional writers are, after all, businesspeople. Our needs in text editors aren't all that different from anyone else's. Most of us don't need a lot of bells and whistles on our editors; but what we do need, we need badly; and our first requirement is that the editor be as nearly invisible as it can be.

I, for one, don't need to see status

continued

PowerStation™

A Complete VT220 / VT240 Work Station Upgrade for the IBM PC/XT/AT and PS/2



"You'll never know you are not using a real DEC terminal unless you take advantage of the many extended features."

- | | |
|--|-------|
| PowerStation™ 240
VT240 style keyboard and ZSTEM VT240 Emulation Software. | \$435 |
| ZSTEM pc™ - VT240 Emulator Emulation Software only. | \$295 |
| VT240/241 Emulation software with all the features of ZSTEM VT220 plus ZSTEM 4014 and REGIS graphics | |
| PowerStation™ 220
VT220 style keyboard and ZSTEM VT220 emulation Software. | \$289 |
| ZSTEMpc™-VT220 Emulator Emulation Software only. | \$150 |
| All the features of ZSTEM VT1100 plus 8-bit mode, downloadable fonts, user defined keys, full national/multi-national modes. Extended macros-/script language. True 132 columns on Hercules, VGAs, Super EGAs, and standard EGAs using the EGAmate option. 128 columns on CGAs. 43 line support on EGAs Enhanced keyboard support. Ungermann Bass Net/One support. | |

- | | |
|--|------|
| EGAmate™
Daughterboard option for 132 columns on most standard EGA adaptors. | \$39 |
| PS220/2
Keyboard adaptor cable for PS200 on PS/2 systems. | \$19 |
| ZSTEMpc™-4014 Emulator
Use with ZSTEM VT100, VT220, or stand-alone. Interactive zoom and pan. Save/recall images from disk. Keypad, mouse, digitizer, printer, plotter, and TIFF support. 4100 color and line style color mapping 640 x 400 and 640 x 480 on some adaptor/monitors. | \$99 |
| ZSTEMpc™-VT1100 Emulator
High performance COLOR VT100. True double high/wide, smooth scrolling ISO and attribute mapped color XMODEM and KERMIT, softkey/MAC-RDS. DOS access. | \$99 |

KEA Systems Ltd.

#412 - 2150 West Broadway, Vancouver, B.C. Canada V6K 4L9
Support (604) 732-7411 TELEX 04-352848 VCR FAX (604) 732-0715
Order Desk (800) 863-8702 Toll Free
30 day money back guarantee MC/VISA

Aztec C

*Power to go the distance...
Whatever that distance might be*



From real time embedded applications to comprehensive commercial applications on Macintosh, IBM PC, Amiga, Atari, and others, Aztec C has earned a well-deserved reputation as an innovative, tough to beat, rock-solid C development system.

But don't just take our word for it—try it yourself. We know that the best way to understand what puts you ahead with Aztec C is to use it. That's why Aztec C

systems purchased directly from Manx come with a 30-day, no questions asked, satisfaction guarantee. Call for yours today.

We can also send you information that details the special features and options of Aztec C. Plus information on support software, extended technical support options, and all of the services and specialized support that you may need when you're pushing your software to the limits and... beyond.

MS-DOS Hosted ROM Development Systems

Host + Target: \$750 Additional Targets: \$500

Targets:

- 6502 family
- 8080-8085-Z80-Z180-64180
- 8088-8086-80186-80286/8087-80287
- 68000-68010-68020/68881

Components:

- C compiler for host and target
- Assembler for host and target
- linker and librarian
- Unix utilities make, diff, grep
- Unix vi editor
- debugger
- download support

Features:

- Complete development system
- Fast development times
- Prototype and debug non-specific code under MS-DOS
- Compilers produce modifiable assembler output, support inline assembly, and will link with assembly modules
- Support for INTEL hex, S record, and other formats
- source for UNIX run time library
- processor dependent features
- source for startup

Aztec C Micro Systems

Aztec C is available for most micro-computers in three configurations: The Professional; The Developer; and The Commercial system. All systems are upgradable.

Aztec C68k/Am Amiga
source debugger—optional

Aztec C68k/Mac ... Macintosh
MPW and MAC II support

Aztec C86 MS-DOS
source debugger • CP/M libraries

The following have special pricing and configurations. Call for details.

Aztec C68k/At Atari ST

Aztec C80 CP/M-80

Aztec C65 Apple II & II GS

Standard System \$199

- C compiler
- Macro Assembler
- overlay linker with librarian
- debugger
- UNIX and other libraries
- utilities

Developer System \$299

- all Standard System features
- UNIX utilities make, diff, grep
- UNIX vi editor

Commercial System \$499

- all Developer features
- source for run time libraries
- one year of updates

MANX

C.O.D., VISA, MasterCard, American Express, wire (domestic and international), and terms are available. One and two day delivery available for all domestic and most international destinations

Circle 151 on Reader Service Card

Manx Software Systems
One Industrial Way
Eatontown, NJ 07724

Aztec C is available on a thirty-day money back guarantee. Call now and find out why over 50,000 users give Aztec C one of the highest user-satisfaction ratings in the industry.

Call 1-800-221-0440

In NJ or outside the USA,
call 201-542-2121

Telex: 4995812 Fax 201-542-8386

DEBUGGING SWAT TEAM

Order Eco-C88 Rel. 4.0 New Modeling Compiler
and get C-more at no extra charge!

Seek and Correct

You already know that fast compilation does not mean fast program development. Backing up for bogus error messages and removing the bugs takes time. Eco-C88's "Seek and Correct" three-way error checking finds even the most elusive bugs, clearing the path for swift program development.

Double Barrel Error Checking

Eco-C88 nails **syntax errors** cold and tells you about the error in plain English. And there's no avalanche of false error messages, either. Other compilers can generate up to four times the number of error messages actually present; they leave it up to you to guess which ones are real. You'll be more productive with Eco-C88 because there is no guess work.

Eco-C88 provides ten levels of **semantic error** checking. You can select from almost no checking to the fussiest you've ever seen. Eco-C88's "picky flag" finds subtle errors that slip by other compilers.

Eco-C88 also features:

- All data types, plus ANSI Enhancements
- Robust library, including many new ANSI functions
- CED editor with online function help, split windows, compile-edit-link capability
- New, expanded manual with sample programs for the library functions

C-more Source Code Debugger

Finally, if a really nasty bug persists, put C-more, our source code debugger, to work. With C-more you can watch your program as it executes, single-step it, set simple or conditional breakpoints, test complex expressions, use variables as indexes into other variables, initialize and trace variables, examine CPU registers, display results with printf()-type options and much more. C-more can help you track down bugs in minutes rather than days.

The price for Eco-C88 is \$99.95. And, for a limited time, we'll give you our C-more debugger at no extra charge.

Ecosoft Inc.

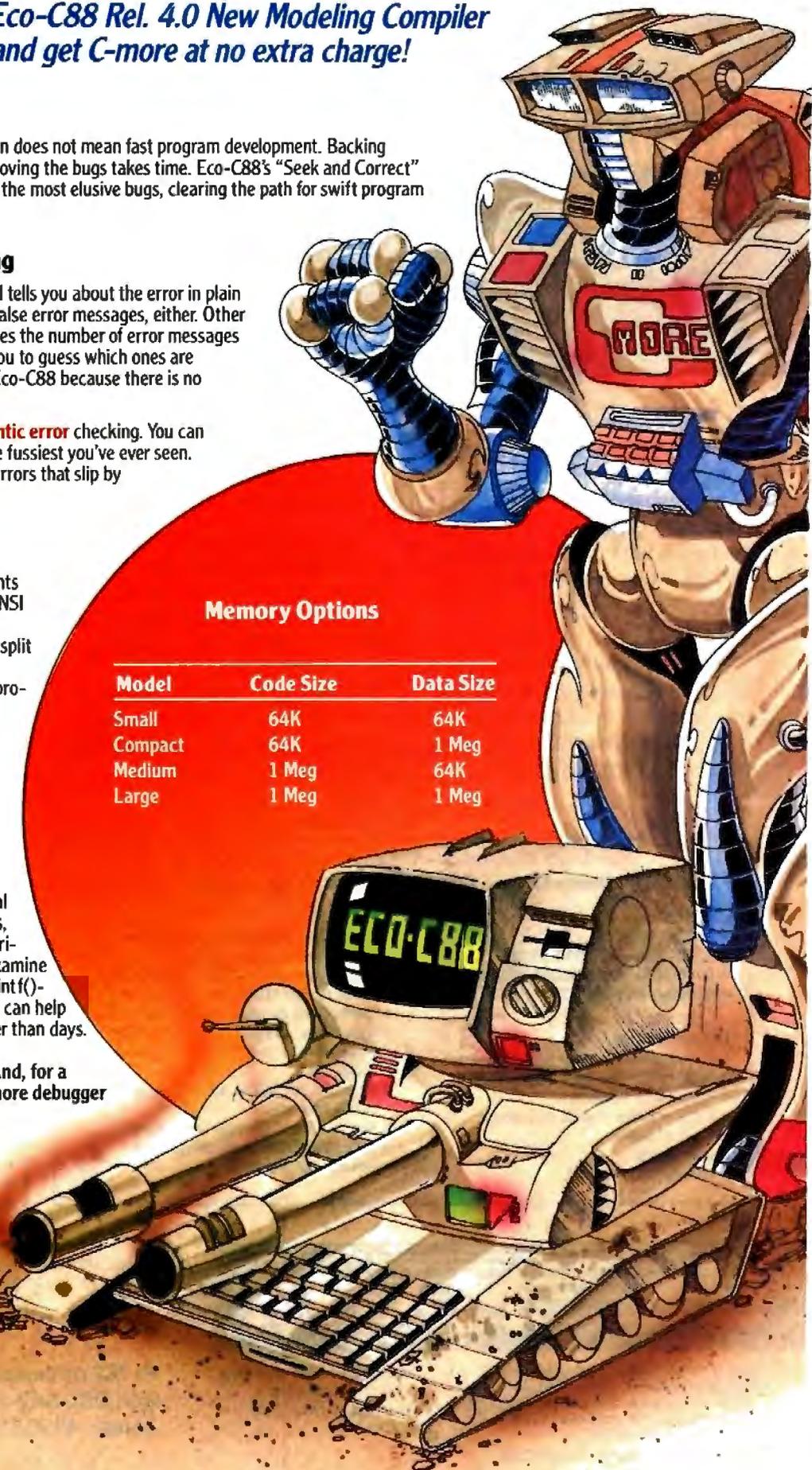
6413 N. College Ave.
Indianapolis, IN 46220

(317) 255-6476 (Tech Info)
(800) 952-0472 (Orders)

Circle 87 on Reader Service Card

Memory Options

Model	Code Size	Data Size
Small	64K	64K
Compact	64K	1 Meg
Medium	1 Meg	64K
Large	1 Meg	1 Meg



CHAOS MANOR

lines, rulers, help lines, or anything else on my screen; what I want to see there is my text, and the more of it, the better. For reasons I have never understood, editor designers almost never provide a toggle that lets you simply blank out all the helpful information and fill the screen with what you've written and nothing else. I don't know why.

When you're creating text, you don't need a lot of fancy commands. If you write the way I do, with trial sentences and words and suchlike, you will want the ability to do selective deletions cleanly and easily. Of course, you want your paragraphs to reformat as you insert and delete. Also, you want to be able to vary the margins to suit the job at hand, and you want an easy way to get word and line counts. Mostly, though, you want something you can feel comfortable with.

As a businessman, I write a lot of letters, and while most are only a single page, some are longer. It would be nice if my program would, somehow, generate letterhead from normal paper so that I don't have to put letterhead into the laser printer every time I want to send correspondence. It would also be nice if it were easy to call up a "letter format" form to take care of margins and such. Finally, some kind of attached card-file system to keep track of the correspondence would be helpful.

All that, though, can't compensate if the editor can't do the primary task of producing manuscripts in the format that editors like.

As I've been writing this (in Q&A Write; this goes in electronically, so the print problems don't apply, and I won't meet deadlines if I change text editors tonight), I've been checking the Microsoft Word 4.0 manual; so far, I haven't thought of anything it doesn't claim to be able to do. That's certainly the next program to try.

Spelling Checkers

I recall stories of some famous advertising people who insisted that their staff use the products they advertised. If you have the Arrow shirt account, you wear Arrow shirts. Drink Schweppes. Etc. I don't care much about the advertisers, but I sure wish the people who design user software were forced to use it. In particular, I think anyone who publishes a text editor and doesn't use it to create that editor's documents ought to be shot.

It's the same with spelling checkers. Sometimes I can't believe the people who design them actually use them at all.

Take my situation. I write for a living. It's important that my manuscripts be as near perfect as possible. Since Robert

continued

Born with 100 years experience



OKIDATA® 1200 and 2400 BPS Modems

To most people our name says reliable PC printers. But the fact is, we've been in telecommunications for over 100 years.

And our new PC modems are all you'd expect from that experience. With all the right diagnostics for a clear signal over "noisy" lines,

Hayes® compatibility, and a 5-year warranty.

The Okitel™ 1200 and 2400 modems.

The only modems born with a century of experience.

See your OKIDATA dealer. Or call 1-800-OKIDATA for the dealer nearest you.

Registered Trademarks: OKIDATA, Oki America, Inc., Marque déposée de Oki America, Inc. Hayes, Hayes Microcomputer Products Inc. Trademarks: Okitel, Oki Electric Industry Company, Ltd., PC Digest, National Software Testing Laboratories, Inc. Rated #1 by PC Digest August 1987 issue covering 1200 bps modems.

OKIDATA®
an OKI AMERICA company

LAHEY SETS NEW FORTRAN STANDARDS

LAHEY PERSONAL FORTRAN 77 - The full ANSI 77 Standard and Debugger for \$95.00.

F77L - The benchmark for the competition.
"EDITOR'S CHOICE"

PC Magazine

"...the most robust compiler tested."

Micro/Systems Journal

"...the ultimate fully-blown ANSI FORTRAN 77...
a fantastic product."

PC Australia

F77L-EM - Breaks the DOS 640K program barrier with extended memory. The most powerful PC FORTRAN available.

FORTRAN TOOLS: Profiler, Mathematical Functions Library, Overlay Linker, Utility Libraries, Widows Library, Toolkit.

The difficult decision is not from whom you should buy your PC FORTRAN, but which Lahey compiler you should purchase.

Call us today to discuss your
PC FORTRAN needs.

**FOR INFORMATION OR TO ORDER:
1-800-548-4778**

30-Day Money-Back Satisfaction Guarantee
Lahey Computer Systems, Inc., Box 6091,
Incline Village, NV 89450
Tel: 702-831-2500 TLX: 9102401256

Lahey
Computer Systems, Inc.

Heinlein once solemnly informed me that I was a terribul spellur, you may imagine my relief when the first really good spelling checkers came out.

Alas, the first few were better than many of those that followed.

A decent spelling-checker program needs at least three dictionaries. First is the Main dictionary. This one is saved in a special algorithmic format to make searches faster. It's often impossible to insert or delete words from the Main dictionary.

Second is the Update dictionary. This is the one that gets things missed by the Main dictionary. Words like your own name, lots of plurals, favorite slang expressions, and so on; words you're likely to use in any kind of document.

Third are specialized dictionaries. As a science fiction novelist, for example, I have alien characters with odd names, like Chowpeenuk and Harpanet. I certainly don't want those in the Update dictionary or anywhere else that will be searched when I'm not working on the particular book that employs those names. I thus need, in a word, a Special dictionary.

I can make a good case for there being yet a fourth dictionary, but I won't bother. My point is that I don't want to look at the same dictionaries every time; and of the three dictionaries I use, at least two will have been created by me.

So far, so good. My quarrel with most spelling checkers is that even if they allow me to invoke several optional dictionaries, they make it very difficult to create them.

The exception to this is The Word Plus from Wayne Holder, which offers you one-keystroke commands to put a word into the Update (press *U*) or the Special (press *S*) dictionary. The words are then automatically put in the proper place in the appropriate dictionary file. Since that program first came out in the 1970s, you'd think later program designers would have made theirs at least as good as Holder's used to be, but most didn't bother.

Worse, Oasis now sells a version of The Word Plus that doesn't work that way. Naturally, that's the version Syman-tec bought. Sigh. On the other hand, Microsoft Word 4.0 clearly uses the old version of The Word Plus and *does* support Update and Special dictionaries.

Microsoft Bookshelf

I knew CD-ROMs were the wave of the future the first time I ever heard of them. I got an Amdek CD-ROM reader as soon as it came out. The Amdek engine is made by Hitachi, and Amdek ships it as a class act, with cables and instructions

carefully packaged so that it takes no time to set it up. Of course, once I had a CD-ROM reader, there wasn't much to do with it—*Grolier's Encyclopedia* is interesting to experiment with, but it's not something I use much.

On the other hand, given that Microsoft sponsored the CD-ROM conferences, it was pretty clear that Microsoft would be one of the first companies to bring out a spectacular application of CD-ROM technology; and they did. Microsoft Bookshelf is a preview of the future.

What Microsoft did was put *The American Heritage Dictionary*, *Roget's Thesaurus*, *The World Almanac and Book of Facts*, *Bartlett's Familiar Quotations*, *The Chicago Manual of Style*, the *Houghton Mifflin Spelling Verifier* (a book of forms and letters that will be very useful to small businesspeople), the *U.S. ZIP Code Directory*, the *Houghton Mifflin Usage Alert*, and *Business Information Sources*, along with their indexes, on a single CD-ROM disk.

They then made an interface that's pretty easy to work with. Naturally, it's geared to work best with Microsoft Word 4.0, but so what? I tried it with WordStar, XyWrite, and WordPerfect, and it works fine with all of them. However, it will *not* work with Q&A Write or the current DESQview.

The interfacing isn't perfect. Some of the early beta-test versions were bloody awful. The release version is pretty good. The control software is generally RAM-resident, though you can use Bookshelf as a stand-alone program. When you invoke it, there's a command line at the top faintly reminiscent of Digital Research's GEM.

If you've called up the thesaurus, for example, the program will offer to look up the word that happens to be under the cursor (if you're merely in DOS, that will be the prompt, which the thesaurus is unlikely to find). If you want it to look up a different word, you type that in. Bookshelf shows you the synonyms and offers to substitute one of them. All this works quite smoothly.

The interface with the other books is similar. There are also browse features. When you use it in document mode, you've got the option of cutting stuff out of the books and pasting it into your work. Generally, it's pretty easy to do that.

What's important isn't that there are a few glitches and frustrations in the user interface: it's that, glitches and all, it's a heck of a lot easier to use all those references as part of Microsoft Bookshelf than it is to get up, go find the printed copy of the book, and use it manually. Most pro-

fessional writers—at least the ones I know—own copies of almost every one of these books, but they seldom use the things because it's just too much trouble. No longer.

When word processors first came out, I was far too lazy to do without one, and as far as I know, I wrote the first book—certainly the first science fiction book—ever done on a microcomputer. Back then, I said that pretty soon all books would be written with the little beasts; and while there are exceptions (I know some writers who still use foolscap and pens they dip in ink), that's a prediction that has effectively come true.

I'll make another: in 10 years (probably fewer), all professional writers will have CD-ROM readers, and if they don't have Microsoft Bookshelf, it will be only because someone has brought out an even more complete set of writers' tools on CD-ROM; and unlike the shelves of reference books we all keep but don't use enough, the CD-ROM references will be used every day.

More Writing Tools

When I went off into hiding to write, I needed something to put *Zelda the Zenith Z-248* on, so I hared off to hardware stores. By sheer good luck, I ran into a desk made by Foremost Furniture (502 Middle St., Archbold, OH 43502). Their Model 4530, of simulated wood on fiberboard, is one of the best computer desks I've seen yet, and it costs only about \$50 retail.

It's large and has a pull-out keyboard drawer. That drawer is big enough for the keyboard and has a raised level for a mouse; under the raised level is a separate drawer big enough for labels, disks, small tools, and other stuff. There's also a matching hutch. This desk and a stand to hold stuff you're copying from can make a real difference in productivity.

While I was at Spring COMDEX, I bought The Winner, a dual-level computer table manufactured by Hubbard Furniture (P.O. Box 104, Northbrook, IL 60065). This is a stand of good design, better looking than Foremost's desk and a bit smaller. It's good, too, and their catalog is definitely worth writing for.

The right furniture can make a real difference in work habits.

QuickBASIC 4.0

Microsoft has done it again. QuickBASIC 3.0 wasn't bad, but some of it was kludged up and rushed out in order to match features in Borland's Turbo BASIC. It was probably a mistake for Microsoft to do that. In any event, QuickBASIC 4.0 is new from the ground up, with features that are truly stunning.

To begin with, it's got records; that is, data structures that contain several data types. String data must, naturally, be declared as fixed-length (as all strings are in Pascal); once you've done that, QuickBASIC 4.0 records work just about the way Pascal records do. As a result, the dreaded FIELD statement is no longer needed. It still exists, but that's largely to retain compatibility with programs written for earlier versions.

Unlike version 3.0, which had a separate compiler for programs to be run on machines with a math chip, 4.0 is unified; there's a conversion program to read your old Microsoft binary-number files, but all mathematical operations are now done in IEEE standard format. You don't have to have a math chip in your machine to compile, but if you do have one, 4.0 will use it automatically.

I think the most impressive feature is the debugger. When you interrupt a program, you are automatically in the appropriate section of the source code. You can cause the assembly language instructions associated with that code to come on-screen. You can also revise the source code and restart the program from where it left off without recompiling the whole thing. The debugger is little short of amazing.

I haven't had QuickBASIC 4.0 very long, but I think I'm in love. This is what BASIC ought to be.

Hackers 3.0

The annual Hackers' Conference has become a bit more sedate, but it remains the most interesting computer conference of the year, at least for me. It's hard to come up with specifics. I spend most of my time talking with small groups, rather than listening to the presentations, and the main result is mutual stimulation of ideas. Mostly, I guess, it's the excitement; this is one of the last places where people aren't ashamed to say they love these little machines.

This year, there were lots of buttons:

MS-DOS & OS/2
Just Say No

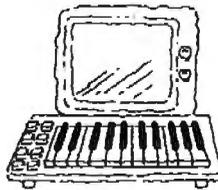
There was also a slogan:

PS/2: Yesterday's Hardware, Today
OS/2: Yesterday's Software, Tomorrow
to which I added

OS/2 Extended:
Today's Software Real Soon Now

And, of course, there was a strong mixture of Unix enthusiasts. I must say
continued

Now you can play Assembler in the key of C. risC™ from IMSI™



Sometimes you've just got to write in Assembler. It's tedious. But it makes the machine perform.

When you're used to writing in a friendlier and easier language like C, working in Assembler is a little like working in Greek. But now, there is a better way to write Assembler code. Add unbelievable speed to program development. And make programs easier to maintain. It's called risC.

risC transposes for you. Fast. risC is the first portable, C-like, object-oriented, High-level Assembly Language (HAL). It includes features of object-oriented high-level languages like Smalltalk, Objective C, LISP and PROLOG.

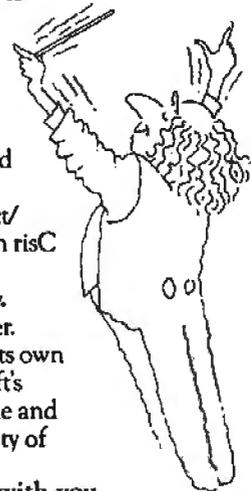
You write in a C-like syntax, and risC transposes to Assembler. At Assembler speeds. With tight Assembler precision.

Your objects will work in concert. With risC, your program costs will go down, because you can create objects and operators to go with them. And risC contains a complete object-oriented messaging kernel (source code included) which allows risC objects (.EXE files) to pass messages back and forth.

Add your own personal touch. You can tailor the language to your own personal style. risC's flexible syntax allows you to create customized compilers thanks to its language extension capabilities ("packages"). risC keeps "packages" in compiled form for speedy compilation times. Your development process will go faster than ever before.

Your program development costs will be reduced even more because risC allows you to specify the exact Assembler code generated by each object/operator combination. Producing .ASM files with risC variable names and comments intact.

risC helps you identify when you're off key. You'll have better applications. Faster and cheaper. Because risC allows debugging two ways: under its own source code debugger, DBG, and under Microsoft's CodeView. To bring down your development time and costs even more, risC interfaces with a large variety of existing .OBJ library routines.



It's easy to take with you. Unlike Assembler, risC creates portable programs. So you can easily port your applications to other current and future machine architectures.

risC is a sophisticated programming tool. risC has compiler options allowing you to interface with many different C and Pascal compilers and with different 8086 models—'NEAR', 'FAR', and 'INTERRUPT'. So if you're a serious programmer, you'll find risC is a serious programming tool. It's just easier.

Microsoft and CodeView are registered trademarks of Microsoft Corporation

Order today. And play Assembler in the key of risC.

Only \$79.95, with a 30-day, money-back guarantee. In CA add 6% sales tax
To order risC, just call IMSI at (415) 454-7101, or call toll-free, 1-800-222-4723. (In CA call 1-800-562-4723). If you prefer, return this coupon with your credit card #, or a check for \$79.95 to IMSI, 1299 4th Street, San Rafael, CA 94901. Please add \$3.00 shipping and handling.

Name _____ Title _____
Firm _____
Address _____
City _____ State _____ Zip _____
 Visa® MasterCard® _____ exp. date _____
Signature _____



UNIX is a trademark of AT & T Bell Laboratories.

SORD Wins Hands Down



M680UX Series

- ★ Operable with UNIX™
- ★ Astonishing speed: use of 32-bit Motorola 68020 CPU
- ★ Easy expansion: VME bus architecture

Also available on OEM basis.



SORD®

Software & hardware
— Quality through technological innovation —

SORD COMPUTER CORPORATION
20-7, Masago 5-chome, Chiba-shi, Chiba 260, Japan
TEL (0472)79-2671 TLX 3722484 SORDC J FAX (0472)77-6696
New York: (212)759-0140

that as I watch the OS/2 story unfold, I do begin to wonder: if Unix is ever made stable enough to be put in ROM, so that you don't need a guru to maintain the system, there's less and less reason why it won't catch on. I think of little that OS/2 promises that you can't do with Unix; and now that American Management Systems has actually developed the long-mythical user-friendly Unix shell, who knows?

However, Unix isn't going anywhere without a major backer. The obvious major backer is AT&T, a company with deep pockets, brilliant engineers and designers, and a monopolist's attitude toward marketing. Think how different the world would have been if, a few years ago, AT&T had bought Apple Computer for its marketing savvy.

At one meeting, someone wryly observed that if AT&T would copy-protect System V Unix, within 6 months it would be so widespread that nothing would be able to stop it.

Actually, I suppose the most probable outcome is that a year after OS/2 comes out, there will be as many OS/2 users as Unix users, after which both will continue in parallel and without actually competing, Unix growing slowly, and OS/2 charging ahead; but while that's the most probable event, it's by no means inevitable. After all, the main objection to Unix was that it's too big and too slow—and that applies just as strongly to OS/2.

The main excitement at Hackers 3.0 was hypertext. Hypertext is an idea that Ted Nelson expressed many years ago in, among other places, his book *Computer Lib: You Can and Must Understand Computers Now!*: the idea that document storage needn't be linear, that you can and should be able to jump from one relevant idea to another by ideas and relevance; and that small computers can store ideas in ways that make that easy.

The implementation of hypertext is under the control of Project Xanadu, with most of the work being done by Roger Gregory in his spare time. This project is very probably the library system of the future; the only thing stopping its completion is money. If you've got a spare 10 bucks, there are an awful lot worse things you can do than send the money to Project Xanadu (Xanadu Corp., 2438 Newhall St., San Jose, CA 95128).

Meanwhile, the closest thing to hypertext is HyperCard for the Macintosh. Since everyone else has already written about HyperCard, I don't have to. Interestingly, Apple, the company that seems so quick to complain about "look and feel," had a presentation about HyperCard in which, oddly enough, Ted Nel-

continued

New! Hire a Pro for Your New Turbo 4.0

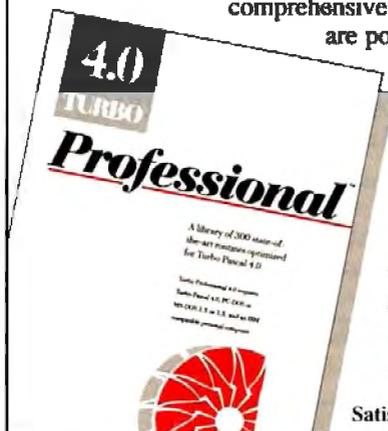
Turn on the power of Turbo PROFESSIONAL 4.0, a library of more than 300 state-of-the-art routines optimized for Turbo Pascal 4.0. You'll have professional quality programs finished faster and easier.

Turbo PROFESSIONAL 4.0 includes complete source code, comprehensive documentation and demo programs that are powerful and useful. The routines include:

- Pop-up resident routines
- BCD arithmetic
- Virtual windows and menus
- EMS and extended memory access
- Long strings, large arrays, macros, and much more.

Turbo PROFESSIONAL is only \$99.
Call toll free for credit card orders.
1-800-538-8157 extension 830
1-800-672-3470 extension 830 in CA

Satisfaction Guaranteed or your money back within 30 days.



Turbo Pascal 4.0 is required. Registered owners of Turbo Professional by Sunny Hill Software may upgrade for \$30. Include your serial number.

For other information call 408-438-8608, 9 AM to 5 PM PST. Shipping & taxes prepaid for US and Canadian customers, others please add \$6 per item.



TurboPower Software 3109 Scotts Valley Dr., Suite 122 Scotts Valley, CA 95066



Scanning electron micrograph of red blood cells

SOME PEOPLE ASK LIFE & DEATH QUESTIONS WITH OUR MICROPROCESSOR DEVELOPMENT TOOLS.

What you see above isn't the late-night vision of an overworked design engineer

Rather, it's blood—ready to be computer assayed at the touch of a button in a hospital operating room—on a new blood gas analyzer that works twice as fast as ever before. All to save time, money, error—and lives.

This breakthrough for anesthesiologists was created by NOVA Biomedical. And made possible by AVOCET, acclaimed as the best source for professional-quality assemblers, simulator/debuggers and cross-compilers for microprocessor and microcontroller software development.

Let Avocet turn your PC or VAX into a fast, powerful, integrated development system in 48 hours, even overnight.

Avocet can help you turn more good ideas into more real products in less time.

Just call us now and we'll get you up and running with what EDN calls "the most flexible, easy-to-use, high-speed development tools"—everything you need to turn your computer into a sophisticated personal development system.

All at a modest price. From a single source. Backed by the reassurance of a technical hotline. So friendly, knowledgeable, immediate-response support is as close as your phone.

Start with the industry standard: Avocet AVMAC™ Assemblers.

The latest AVMAC Version 2.0 offers you lightning-fast assembly. Plus, enhanced compatibility with Intel, Hitachi, Motorola & other chipmakers. Each AVMAC package comes complete with our AVLINK™ linker, AVLIB™ librarian, AVREF™ cross-reference generator and 200+ pg. User's Guide—all the tools you'll want and need.

Multiply your productivity with NEW Avocet C™

Introducing Avocet C—professional-quality optimizing cross compilers for the Z80, 64180, 8096, 8051 and more.

Avocet C gives you quick compilation and compact, fast-running object code. And yes, it supports the full C language, including many ANSI extensions.

Of course, Avocet C is also compatible with our AVMAC assemblers. So you can drop into assembly language when you need to work magic at the bits-and-bytes level.

Test with the best: AVSIM™ Simulator/Debuggers.

NOVA™ Biomedical design engineers rate AVSIM "Number One" for checking programs—quickly and reliably.

AVSIM test target μP μC code right on your PC, with no special hardware. It can't be crashed by program bugs. And the full-screen display gives you instant visual access to the entire CPU: flags, registers, memory, I/O ports and on-chip peripherals. Highly-rated by EDN, "only AVSIM is sophisticated enough to let you set unlimited breakpoints and traps."



Target Microprocessor Families Supported

1802/1805	68000/68010	COP400
6502/65C02	68020	HD64180
6801/6301	8048/8041	NEC 7500
6804	8051/8052	TMS-32010
6805/6305	8085	TMS-32020
6809	8096	Z8
68HC11	F8 3870	Z80

Host Operating Systems

CP/M	DOS	PC Xenix	VAX Unix
AVMAC Macro Assemblers			from \$349
AVSIM Simulator/Debuggers			from \$379

Call now about new Avocet C Cross Compilers from \$895

CALL TOLL-FREE
800-448-8500*

to order, inquire about other development tools or receive our latest microprocessor development tool catalog

Try before you buy.

Order your AVMAC assembler and AVSIM simulator/debugger today and we'll include a special demo kit for both. Try the demo for 30 days. If you're not satisfied for any reason, return unopened products for a full refund, less the \$35 demo, documentation kit which is yours to keep.

Avocet Systems. With our development tools, the diagnosis for your project is a smooth finish—on time and on budget.

Avocet Systems, Inc., 120 Union Street
P.O. Box 490AM, Rockport, Maine 04856

*Outside U.S. and in ME, call (207) 236-9055

TLX: 467210 AVOCET CI FAX: (207) 236-6713

Avocet delivers all the tools you need in 48 hours or less. Ask about our NEW Cross-Compilers, our AVFROM™ and AVPAL™ programmers, our 8051 in-circuit emulator, development boards, the AVPA51™ cross-compiler—and AVKIT™, the total Unix toolbox for DOS, including the incomparable VI editor.

© 1987 Avocet Systems, Inc. All rights reserved. VAX is a trademark of DEC. Unix is a trademark of AT&T. Xenix is a trademark of Microsoft. CP/M is a trademark of Digital Research.

AVOCET
SYSTEMS, INC.™

THE SOURCE FOR QUALITY PERSONAL μP DEVELOPMENT TOOLS.

Circle 304 on Reader Service Card for inquiries in the U.S. and Canada. (Outside North America: 305)

son's name never appeared (although the Apple spokeswoman who gave the presentation said that would be fixed Real Soon Now).

HyperCard really is a neat hack, a software breakthrough that deserves its popularity.

Fire Power

By far the most popular game at Hackers 3.0 was Fire Power, a new Amiga game from MicroIllusion. This is a joystick-controlled arcade-type game involving tanks. It can be played solitaire against

the computer, on a split screen with a live opponent, or through a modem against a live opponent.

The graphics are stunning. There are still a few bugs on interface control. When you blow up buildings—which you do often—they collapse to rubble. No matter how careful you are at driving your tank, you can get it stuck; sometimes stuck so that it's impossible to retrieve. There's no game command to release you. You have to restart the game.

The map is complex, the action is fast, and everyone liked the game. It was fasci-

nating to watch two pacifists yelling like savages as they blew each other's buildings away.

At Hackers 3.0 I played Fire Power awhile, after which someone asked me if I had reconsidered my opinion of the Amiga's multitasking operating system. It seemed a fair remark. However, when I got home and loaded my own copy of Fire Power, I managed to get a system crash and guru meditation (Commodore's miserable excuse for humor in error messages) within 5 minutes.

Since that time, I've seen the guru several times. The game will be going along fine, when two of the automated helicopters will somehow stick together, or one of the tanks gets blocked in a strange way; then the screen goes blank, and out comes the guru.

I don't know if I have a broken copy of the game; at Hackers 3.0 the game was played all weekend, and if there was ever a crash, I didn't see it.

Even with the crashes, this is one of the best arcade games I've ever played. I sure like blowing up my friends.

Ancient Art of War at Sea

I mentioned this one before, but it's just too good to pass off with one line.

Broderbund named this to be reminiscent of their Ancient Art of War, but, in fact, it's not about ancient times: it's the age of fighting sail, and about the best game of that period I have ever seen. There are some limits I wish it didn't have—for example, fleets can have at most three ships in them, so you can't really play out Trafalgar—but for sheer realism, this beats the competition all hollow.

There's a strategic level, in which you give long-range orders to little artificial symbols; and a combat level, in which really neat graphic representations of sailing ships "tack" and "wear ship" and generally react the way you'd expect.

There are six different opponents, from a crazy Viking who makes no plans at all, to Lord Nelson who will probably beat you every time. In addition to the 10 or so preset scenarios, there's a game-building kit that lets you set up your own maps, allocate fleets to yourself and your enemies, and choose your opponent.

I do wish they'd work on the user interface, and there's one serious bug involving captured ships—if you capture an enemy and there's another enemy fleet close behind, the next fight will be between your crippled prize and the new enemy. They'll win, after which your next fight will be against their newly recaptured ship, and so on, until you wish you could scuttle the darned thing and get

continued

"Developing my application in C would have taken 6 months to a year, but in Actor it took 2 months."
—Brian Fenske, Boeing Commercial Airplane Company

**"To C
or not
to C..."**



Actually, you don't have to make the choice. Once C was ideal for all PC programming. But it has been complicated by windowing and graphical interfaces. Now windows development with C is difficult, time-consuming and error-prone. You need a new language that simplifies windows programming. Introducing Actor®.

Actor is the first interactive object-oriented language made for commercial development. Its powerful browsers, inspectors and debuggers give you more insight into a windowing environment than C ever will. But your C work is not lost. C libraries can be linked to Actor. Plus, its procedural syntax is easy for C programmers to learn.

Actor comes with windowing classes built in. Customize Actor's classes to create stand-alone windowing applications. And objects give you another layer of independence for a smooth transition to OS/2 and Presentation Manager. It's the quickest and easiest way to write a windowing program.

"You can write Windows programs much faster with Actor than with C or assembly language."
—PC Magazine, June 9, 1987

T e c h S p e c s

- Runs with Microsoft Windows 1.04, 2.0 and 386. Extended memory under 2.0 and 386.
- Pure, single-inheritance object-oriented language, incrementally compiled.
- Dynamic linking to C, Pascal, Assembler, or Fortran libraries. Pass data in C structures.
- Pascal and C-like syntax.
- Programming tools: Browser, Inspector, Debugger, File Editor.
- Full access to MS-Windows systems calls, multitasking, and DDE.
- Fast device-independent graphics: lines, shapes, icons, cursors, bitmaps, metafiles, Turtle graphics, sample control language using YACC.
- 150 classes, 1500 functions, fully extensible.

- Window styles: tiled, overlapping, popup, child, edit, dialogs. Controls: list boxes, scroll bars, buttons, check boxes.
- Data structures: stacks, arrays, queues, lists, dictionaries, sets, sorting, hashing, intervals.
- AI support: frames, symbols, dictionaries, lists, symbolic programming, functional arguments. Parsing and lexical analysis YACC compatible.
- String manipulation: substring, concat, append, insert, remove, search.
- 643-page manual includes tutorial and reference.
- No license fees. Generates stand-alone applications.
- Fastest interactive OOL available.
- Fast incremental garbage collector.

**New
Release
Version 1.1**

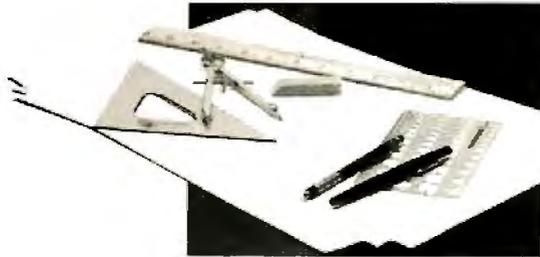
Actor \$495 • Academic price \$99 • Academic site license \$99 • Manuals for site license \$35 • New! Language Extension \$99 • Shipping \$5 US, \$25 Int'l

**The Whitewater Group
Technology Innovation Center
906 University Place, Evanston, Illinois 60201
(312) 491-2370**

Actor is a registered trademark of The Whitewater Group, Inc.

AutoSketch™

A Resource to Draw Upon



To get any job done, you need the right tools. Ideally, they should be extensions of your talents, freeing you to do what you do best. And speed, precision, flexibility, and consistency are always top priorities, no matter what the job.

If communicating with drawings is part of your job, AutoSketch should be one of your resources.

AutoSketch from Autodesk, the developers of AutoCAD,® is the precision drawing tool for professional use. It's fast, powerful, and simple to learn. The price is right, too.

With AutoSketch and your personal computer, you'll enter the world of computer-aided drawing with ease. You may never have designed with a PC before, and you may think it's bound to be complicated and time-consuming. Surprise! With AutoSketch, you'll probably be up and running in about an hour.

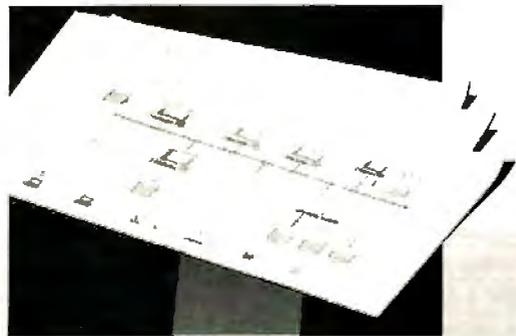
Despite its ease of use, AutoSketch is a full-function, object-oriented CAD program. Pull-down menus and dialog boxes help you each step of the way. With a click of the mouse, you can draw, then copy, mirror, or move objects, even create symbol libraries. AutoSketch automatically updates measurements whenever you stretch, scale, or rotate dimensioned objects. It even keeps track of everything you do, so that you can delete and restore parts of your drawing as easily as you change your mind, using successive undo or redo commands.



We know you'll be impressed with the professional results. So will your clients and colleagues.

AutoSketch runs on the IBM PC/XT/AT and compatible systems with a minimum of 512K RAM and either color or monochrome display. The standard version is yours for just \$79.95. If your PC has an 8087 or 80287 math coprocessor, this version operates about three times faster. The speed-enhanced version for \$99.95, requiring the coprocessor, is three times faster still.

Call 800-445-5415 for the name of the AutoSketch Dealer nearest you or more information on supported peripherals. To order direct with a credit card, call 800-223-2521.





Integrand's new Chassis/System is not another IBM mechanical and electrical clone. An entirely fresh packaging design approach has been taken using modular construction. At present, over 40 optional stock modules allow you to customize our standard chassis to nearly any requirement. Integrand offers high quality, advanced design hardware along with applications and technical support *all at prices competitive with imports*. Why settle for less?

Rack & Desk PC/AT Chassis

Rack & Desk Models

Accepts PC, XT, AT Motherboards and Passive Backplanes

Doesn't Look Like IBM

Rugged, Modular Construction

Excellent Air Flow & Cooling

Optional Card Cage Fan

Designed to meet FCC

204 Watt Supply, UL Recognized

145W & 85W also available

Reasonably Priced



Call or write for descriptive brochure and prices:
8620 Roosevelt Ave. • Visalia, CA 93291
209/651-1203
TELEX 5106012830 (INTEGRAND UD)
EZLINK 62926572

We accept BankAmericard/VISA and MasterCard

IBM, PC, XT, AT trademarks of International Business Machines. Drives and computer boards not included.

CHAOS MANOR

Items Discussed

Ancient Art of War at Sea .. \$44.95	(206) 882-8080
Broderbund Software	(800) 426-9400
17 Paul Dr.	Inquiry 936.
San Rafael, CA 94903	
(415) 492-3200	
Inquiry 934.	
Fire Power	\$24.95
MicroIllusion	
17408 Chatsworth St.	
Granada Hills, CA 91344	
(818) 360-3715	
(800) 522-2041	
Inquiry 935.	
Microsoft Bookshelf	\$295
Microsoft Word 4.0	\$450
QuickBASIC 4.0	\$99
Microsoft	
16011 Northeast 36th Way	
P.O. Box 97017	
Redmond, WA 98073-9717	
Q&A Write	\$199
Symantec	
10201 Torre Ave.	
Cupertino, CA 95014	
(408) 253-9600	
Inquiry 937.	
The Word Plus	\$150
Oasis Systems	
2765 Reynard Ave.	
San Diego, CA 92103	
(619) 453-5711	
Inquiry 938.	

the whole thing over with.

Forget the bugs, though. You'll love this game. Recommended.

Winding Down

I'm out of space, and I haven't talked about half the stuff here. There's Electrohome's new 19-inch multiple-sync monitor that will handle everything from PGA to CGA and comes with an optional box that will let you connect it to cable to be your television set. This thing is great. Next month, I'll try to do it justice.

I also have received Office Publisher, a new desktop-publishing package that's really simple to use. I'm no expert on desktop publishing, but I like this package. The documents actually explain how to do things.

There are new video boards from Orchid and Zenith. Both support a wide variety of video outputs, from CGA to VGA, and thus are designed to work with multiple-sync monitors like the Electrohome. I find EGA color good enough—text on the EGA is crisp and readable—but PGA is even better.

EGA is the business standard now (although there are probably more monochrome monitors in the business world), but it will be a short-lived standard, largely because of some technical design flaws in the EGA chip set (and besides, EGA doesn't have square pixels). If I were buying a monitor, I wouldn't even consider one that didn't support multiple-sync frequencies.

The Atari Mega ST is a 4-megabyte machine with more bang for the buck

than anything I've seen. More and more, I am beginning to believe that the Atari ST really is the machine for the rest of us: it's fast, reliable, inexpensive, and getting a lot of software. In Europe, the Atari is considered a serious business machine. I don't see why it can't be here.

The book of the month is John Dos Passos' *Midcentury*. I picked up a copy in a library sale, so the edition I have is long out of print, but I'm sure there are still some around.

There are three computer books of the month. Two of them are by Dan Shafer: *Turbo Prolog Primer* and *Advanced Turbo Prolog Programming*, both published in 1987 by Howard W. Sams. The other book is by Khin Maung Yin, *Using Turbo Prolog* (Que Books, 1987). You'll want them all. If I had to pick one single recommendation for people who want to try to keep up with the computer revolution, I'd say, "Get and learn Turbo Prolog." Declarative languages like Prolog will be the wave of the future.

All in all, a good month. Now, if you'll excuse me, I'll get back to Fire Power. Who cares about the silly guru? ■

Jerry Pournelle welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. 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. You can also contact him on BIX as "jerrypp."

UNLEASH YOUR 80386!

Your 80386-based PC runs at least twice as fast as your old AT. This is good, but not great. The products described below will unleash the true potential of your 80386, giving you 4 to 16 times the power of your old AT. These new MicroWay products include a family of 80386 native code compilers and the mW1167 numeric coprocessor.

Examples of the increases in capacity and performance include:

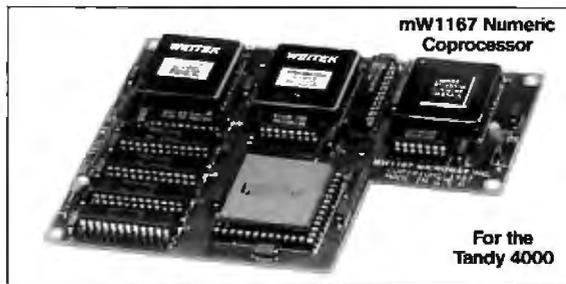
- Programs compiled with MicroWay

NDP Fortran-386 execute 2 to 8 times faster than those compiled with existing 16-bit Fortrans. NDP Fortran-386 can also address up to 4 gigabytes of memory instead of the standard 640 kbytes. MicroWay's NDP compilers and the programs they generate run on MS-DOS or Unix V.

- NDP Fortran-386 generates code for the 80287, 80387 or MicroWay's mW1167. The mW1167 has a floating point throughput exceeding 2.5 mega-

flops, which is 4 to 5 times the throughput of an 80387 and is comparable to the speed achieved by the VAX 8600.

Equally important, whichever MicroWay product you choose, you can be assured of the same excellent pre- and post-sales support that has made MicroWay the world leader in PC numerics and high performance PC upgrades. For more information, please call the Technical Support Department at **617-746-7341**



MicroWay® 80386 Support

MicroWay 80386 Compilers

NDP Fortran-386 and NDP C-386 are globally optimizing 80386 native code compilers that support a number of Numeric Data Processors, including the 80287, 80387 and mW1167. They generate mainframe quality optimized code and are syntactically and operationally compatible to the Berkeley 4.2 Unix f77 and PCC compilers. MS-DOS specific extensions have been added where necessary to make it easy to port programs written with Microsoft C or Fortran and R/M Fortran.

The compilers are presently available in two formats: MicroPort Unix 5.3 or MS-DOS as extended by the Phar Lap Tools. MicroWay will port them to other 80386 operating systems such as OS/2 as the need arises and as 80386 versions become available.

The key to addressing more than 640 kbytes is the use of 32-bit integers to address arrays. NDP Fortran-386 generates 32-bit code which executes 3 to 8 times faster than the current generation of 16-bit compilers. There are three elements each of which contributes a factor of 2 to this speed increase: very efficient use of 80386 registers to store 32-bit entities, the use of inline 32-bit arithmetic instead of library calls, and a doubling in the effective utilization of the system data bus.

An example of the benefit of excellent code is a 32-bit matrix multiply. In this benchmark an NDP Fortran-386 program is run against the same program compiled with a 16-bit Fortran. Both programs were run on the same 80386 system. However, the 32-bit code ran 7.5 times faster than the 16-bit code, and 58.5 times faster than the 16-bit code executing on an IBM PC.

NDP Fortran-386™\$595
NDP C-386™\$595

MicroWay Numerics

The mW1167™ is a MicroWay designed high speed numeric coprocessor that works with the 80386. It plugs into a 121 pin "Weitek" socket that is actually a super set of the 80387. This socket is available on a number of motherboards and accelerators including the AT&T 6386, Tandy 4000 and MicroWay Number Smasher 386 (Jan. '88). It combines the 64-bit Weitek 1163/64 floating point multiplier/adder with a Weitek/Intel designed "glue chip". The mW1167™ runs at 3.6 MegaWhetstones (compiled with NDP Fortran-386) which is a factor of 16 faster than an AT and 3 to 5 times faster than an 80387\$1495

Monoputer™ - The INMOS T800-20 Transputer is a 32-bit computer on a chip that features a built-in floating point coprocessor. The T800 can be used to build arbitrarily large parallel processing machines. The Monoputer comes with either the 20 MHz T800 or the T414 (a T800 without the NDP) and includes 2 megabytes of processor memory. Four or more Transputers can be easily linked together to form a Quadputer. A single T800 is comparable in speed with an mW1167-equipped 80386. The compilers to drive one or more Monoputers include Occam, C, Fortran, Pascal and Prolog.

Monoputer T414-20¹\$1495
Monoputer T800-20¹\$1995
Biputer™ T800/T414²\$4995
Quadputer™ T414-20²\$6995

¹Includes Occam ²Includes TDS

80287 ACCELERATORS

287Turbo-10\$450
287Turbo-12\$550
287TurboPlus-12\$629

80386 Multi-User Solutions

AT8™ - This intelligent serial controller is designed to handle 8 users (16 with two boards) in a Xenix or Unix environment with as little as 3% degradation in speed. It has been tested and approved by Compaq, Intel, NCR, Zenith, and the Department of Defense for use in high performance 80286 and 80386 Xenix or Unix based multi-user systems\$1299

MicroPort Unix 5.3 is a port of the new Unix 5.3 to the 80386. MicroWay NDP-386 compilers currently run on this version of UNIX.

MicroPort Unix 5.3from \$399

PC-MOS-386™ is an 80386 operating environment that turns an AT with an AT8 into an MS-DOS multi-user system. The system makes it possible to run applications such as Lotus 1-2-3 on terminals. The operating system also has a Phar Lap compatibility mode that runs programs developed with the Phar Lap versions of MicroWay's compilersfrom \$199

Phar Lap™ created the first tools that make it possible to develop 80386 applications which run under MS-DOS yet take advantage of the full power of the 80386. These include an 80386 monitor/loader that runs the 80386 in protected linear address mode, an assembler, linker and debugger. These tools are required for the MS-DOS version of the MicroWay NDP Compilers. Phar Lap Tools\$399

MATH COPROCESSORS

80387-16 16 MHz\$495
80287-10 10 MHz\$349
80287-8 8 MHz\$259
80287-6 6 MHz\$179
8087-2 8 MHz\$154
8087 5 MHz\$99

MicroWay

The World Leader in PC Numerics

P.O. Box 79, Kingston, Mass. 02364 USA (617) 746-7341
32 High St., Kingston-Upon-Thames, U.K., 01-541-5466

LIST OURS	
GREENLEAF DATA WINDOWS	225 155
W/SOURCE CODE	395 259
IYACC FORMAKER	495 449
IYACC JAM	750 679
MICROSOFT WINDOWS	99 65
MS WINDOWS DEVELOPMENT KIT	500 309
PANEL	295 215
PANEL PLUS	495 395
PANEL/QC (QUICK C)	129 95
PANEL/TC (TURBO C)	129 95
QUICKSCREEN	195 175
SCREEN ACE	195 159
SCREENSTAR W/SOURCE	198 155
VIEW MANAGER	275 199
WITAMIN C	225 159
W/SOURCE CODE	99 79
WINDOWS FOR C	195 149
WINDOWS FOR DATA	295 235
ZVIEW	245 169

TRANSLATORS	
BAS_C (ECONOMY)	199 169
BAS_C (COMMERCIAL)	375 319
BAS_PAS (ECONOMY)	149 125
BAS_PAS (COMMERCIAL)	280 239
BASTOC	495 399
BASTOC (BASICA VERSION)	795 639
DB2C	299 CALL
DBX TRANSLATOR	350 299
RTC PLUS	225 289
TURBO TO C	495 449

ADDITIONAL LANGUAGES/PRODUCTS	
ACTOR	495 419
CARBON COPY PLUS	NEW 195 139
DAN BRICKLIN'S DEMO PROGRAM	75 59
DAN BRICKLIN'S DEMO TUTORIAL	50 45
HS/FORTH	395 359
JANUS/ADA C PACK	95 89
LATTICE RPG II COMPILER	750 629
MASTER FORTH	125 115
MKS AWK	75 69
MKS TOOLKIT	139 115
NORTON GUIDES	100 65
PC FORTH	150 109
PERSONAL REXX	125 99
PL_86	750 629
PRO-C	399 379
SAPIENS V8	300 269
SET: SCIL	349 319
SOFTSCREEN HELP	195 149
THE WEINER SHELL	199 179

BLAISE	
ASYNCH MANAGER (C/PASCAL)	175 135
C TOOLS PLUS/S.0	129 99

LIST OURS	
EXEC	95 79
LIGHT TOOLS FOR DATALIGHT C	100 79
PASCAL TOOLS/TOOLS 2	175 135
TURBO ASYNCH PLUS	129 99
TURBO C TOOLS	129 99
TURBO POWER TOOLS PLUS	129 99
VIEW MANAGER (C/PASCAL)	275 199

HARDWARE PRODUCTS	
AMDEK 722 MONITOR	750 499
AMDEK 730 MONITOR	899 569
AST ADVANTAGE PREMIUM W/512K	495 319
AST RAMPAGE! 286 W/512K	545 349
HERCULES GRAPHICS CARD PLUS	299 195
HERCULES IN COLOR CARD	499 329
IRMA 2	1195 779
ORCHID TURBO EGA	749 495
ORCHID TURBO PGA	1495 1099
VEGA DELUXE	379 259

BORLAND	
TURBO BASIC COMPILER	100 65
DATABASE TOOLBOX	100 65
EDITOR TOOLBOX	100 65
TELECOM TOOLBOX	100 65
TURBO C COMPILER	100 65
TURBO PASCAL	NEW V. 4.0 100 65
TURBO PASCAL DEV. LIB.	NEW 289 289
TURBO TUTOR	70 45
NUMERICAL METHODS TOOLBOX	100 65
DATABASE TOOLBOX	100 65
EDITOR TOOLBOX	100 65
GAMEWORKS TOOLBOX	100 65
GRAPHIX TOOLBOX	100 65
TURBO PROLOG COMPILER	100 65
TURBO PROLOG TOOLBOX	100 65

GREENLEAF	
GREENLEAF C SAMPLER	SPECIAL 100 69
GREENLEAF COMM LIBRARY	185 125
GREENLEAF DATA WINDOWS	225 155
W/SOURCE CODE	395 289
GREENLEAF FUNCTIONS	185 125

LATTICE	
LATTICE C	500 265
W/SOURCE CODE	900 495
C CROSS REFERENCE GENERATOR	50 39
C-FOOD SMORGASBORD	150 95
W/SOURCE CODE	300 179
C-SPRITE	175 119
CURSES SCREEN MANAGER	125 89

LIST OURS	
CVUE W/SOURCE CODE	250 199
DBC III	250 169
DBC III/II W/SOURCE CODE	500 359
DBC III PLUS	750 595
W/SOURCE CODE	1500 1185
LMK	195 139
LSE	125 99
RPG II DEVELOPER SYSTEM	1400 1119
RPG II COMPILER	750 629
RPG II SEU	250 199
RPG II SORT/MERGE	230 199
RPG II SCREEN DESIGN AID	350 300
SECRETDISK	120 89
SIDETALK	120 89
SSP/PC	350 289
TEXT MANAGEMENT UTILITIES	120 89

LIFEBOAT	
ADVANTAGE 386 C	895 799
ADVANTAGE 386 PASCAL	895 799
ADVANTAGE C++	495 475
ADVANTAGE DISASM.	295 249
ADVANTAGE GRAPHICS	250 225
ADVANTAGE LINK	395 359
ADVANTAGE MAKE	125 99
ADVANTAGE VCMIS	379 329
PANEL	295 215
PANEL PLUS	495 395
QUICKSCREEN	195 175
RUN-C THE C INTERPRETER	120 89
RUN-C PROFESSIONAL	250 155
TIMESLICER	295 265
W/SOURCE CODE	1000 895

MICROSOFT	
MS BASIC COMPILER (XENIX)	695 419
MS BASIC INTERPRETER (XENIX)	350 209
MS C COMPILER	450 269
MS COBOL COMPILER	700 439
FOR XENIX	995 609
MS FORTRAN	450 289
FOR XENIX	695 419
MS LEARNING DOS	50 39
MS LISP	250 155
MS MACRO ASSEMBLER	REBATE 150 95
MS MOUSE BUS VERSION	175 119
MS MOUSE SERIAL VERSION	195 125
MS MUMATH	300 185
MS PASCAL COMPILER	300 185
FOR XENIX	695 419
MS QUICK BASIC	REBATE 99 65
MS QUICK C	REBATE 99 65
MS SORT	195 125
MS WINDOWS	99 65
MS WINDOWS DEVELOPMENT KIT	500 309
MS WINDOWS-386	195 135

LIST OURS	
PHOENIX	
C/PAC (P/FORCE, PRE-C)	SPECIAL 495 CALL
PASM86	195 109
PDISK	145 99
P/FANTASY PAC	995 599
P/FINISH	395 209
P/FIX86PLUS	395 209
P/FORCE	395 209
P/FORCE++	395 209
P/LINK86PLUS	495 275
P/MAKER	125 79
P/MATE	195 109
PRE-C	295 155
PTCL	195 109

POLYTRON	
POLYBOOST	80 69
POLYDESK III	99 75
ADD-ONS	CALL CALL
POLYLIBRARIAN	99 85
POLYMAKE	149 125
POLYSHELL	149 125
POLYTRON C BEAUTIFIER	49 15
POLYTRON C LIBRARY I	99 75
POLYXREF	219 185
PVCS CORPORATE	395 329
PVCS PERSONAL	149 125

XENIX/UNIX PRODUCTS	
MICROPORT & SCO PRODUCTS	CALL CALL
ADVANTAGE C++	695 CALL
BTRIEVE	595 465
C-TEPP	499 379
INFORMIX	125 115
KORN SHELL	CALL CALL
MICROSOFT LANGUAGES	CALL CALL
PANEL PLUS	795 675
QUICK SHELL	395 359
REAL TOOLS	149 89
RM/COBOL	1250 949
RM/FORTRAN	750 549
SCO MULTIVIEW (286)	385 319
SCO MULTIVIEW (386)	485 399
TURBO SORT	995 895

AMIGA PRODUCTS	
AZTEC COMMERCIAL	499 449
AZTEC DEVELOPERS	299 269
C-TEPP	98 79
DBMAN	150 119
LATTICE AMIGA DOS COMPILER	200 159
LATTICE PRO AMIGA C COMPILER	375 299
MODULA II REG	90 75
MODULA II DEV	150 125
TRUE BASIC	100 79

A New Year's Celebration in Paradise

VM/386

Turns your 386 PC into Many PCs, Multitask Your DOS Programs—Quickly and Easily. VM/386 is a control program for 386 Computers that creates Virtual Machines, like separate PCs, each running its own task simultaneously. Virtual Machines are protected from one another. A crash in one will not crash the others.

Run a different DOS, CONFIG.SYS, AUTOEXEC.BAT, memory resident program and application in each Virtual Machine.

Run any DOS application and memory-resident program including EMS applications, without modifications.

Recalculate a 1-2-3 spreadsheet, sort a dBASE III file and receive your E-mail—all at the same time.

Run EGA applications perfectly in foreground and background. **List: \$195 Special Price \$119**

ADVANTAGE Disassembler

A memory-resident program, ADVANTAGE Disassembler gives programmers the ability to disassemble executable files (.exe and .com files) to produce comprehensive, well-documented assembly language source code. Provides immediate feedback as you work, storing results in tables on disk. Final output is ready for MS assembler. Supports 8086/186/286 code and 8087/80287 coprocessors.

List \$295 Special Price \$249



Microport System V/386

Get multi-user, multi-tasking performance today with your 80386 PC and Microport's UNIX System V Release 3, the real UNIX developed by AT&T and Intel and enhanced and extended by Microport. System V/386 delivers almost unlimited speed and power. Runs in protected mode and supports four gigabytes and an unlimited number of users.

Complete System List \$799 Special Price \$679



Terms and Policies
 • We honor MC, VISA, AMERICAN EXPRESS
 • No charge on credit or C.O.D. Prepayment by check. New York State residents add applicable sales tax. Shipping and handling \$3.00 per item, sent UPS ground. Rush service available, prevailing rates.
 • Programmer's Paradise will match any current nationally advertised price for the product listed in this ad.
 • Prices and Policies subject to change without notice.
 • Hours 9AM EST — 7PM EST
 • *Ask for details. Some manufacturers will not allow returns once deal seals are broken.
 • Corporate Buyers — Call for special discounts and benefits!

1-800-445-7899
In NY: 914-332-4548

Customer Service:
914-332-0869
 International Orders:
914-332-4548
 Telex: 510-601-7602

Microsoft Rebate

Buy a combination of these new, fast and complete Microsoft language products—QuickC, QuickBASIC and Macro Assembler—and get a check for up to \$50. For programmers who hate to wait, QuickBASIC is ideal because it eliminates the time-consuming compile step. For more sophisticated programming, choose QuickC for fast and easy compilation and prototyping. When you really need control, choose Macro Assembler. The Code View debugger, an integral part of the Masm system, lets you test and debug your Microsoft QuickBASIC, QuickC and Macro Assembler programs all at the same time.

Microsoft
 All three List \$348 Ours \$225/after rebate \$175
 Any two List CALL Ours CALL

Greenleaf C Sampler

3-in-1 oil for your C programs. Interrupt communications, windows, menus and more in a big new library. Device independent, logical attributes, unlimited logical windows. Keyboard input includes function and other keys. Clear examples to help you get started. Drives comm ports up to 9600 baud, with XMODEM included, using the most powerful system available. Also includes pull down menus that are easy to use. Available for Quick C and Turbo C. Free source code with purchase by Feb. 15th. **List \$95 Special Price \$69**



PI Editor

Imagine editing multiple files in multiple resizable windows; invoking your compiler and seeing your errors highlighted with error messages; using advanced features like undo, macros, regular expressions, and "Find All" to speed your development process. PI—feature packed, lightning fast, fully configurable. The ultimate editing environment.

List: \$195 Special Price \$149



Programmer's Paradise

A Division of Hudson Technologies, Inc.
 42 River Street, Tarrytown, NY 10591



BYTE

is Number One

...again!

MRI's Fall syndicated research results have confirmed its Spring results. Among *BYTE's* closest competitors studied, specifically *PC Magazine* and *PC World*, *BYTE* remains the winner in key target markets:

Largest Reach

Target Market	Number of BYTE Readers
Among Total Adults:	1,619,000
Fortune 500	328,000
Middle Management	141,000
Small Companies (less than 50 employees)	427,000
Medium Companies (50-999 employees)	177,000
Large Companies (1000+ employees)	446,000
Engineering Job Function	582,000
Influence Purchase of PCs/EDP/Communications	597,000
Use a PC at place of business	1,032,000
Use a Mac at place of business	95,000
Among Professional/Managerial/Technical:	1,244,000
Fortune 500	318,000
Middle Management	138,000
Engineering Job Function	546,000
Small Companies (less than 50 employees)	339,000
Medium Companies (50-999 employees)	146,000
Large Companies (1000+ employees)	427,000
Use a PC at place of business	937,000
Use a Mac at place of business	93,000

Source: Mediemark Research, Inc.
Fall 1987

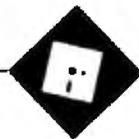
BYTE

It's indispensable.



Lowest 4-C CPM

Target Market	BYTE's 4-C CPM
Among Total Adults:	\$ 6.90
Fortune 500	34.05
Middle Management	79.22
Small Companies (less than 50 employees)	26.16
Medium Companies (50-999 employees)	63.11
Large Companies (1000+ employees)	25.04
Engineering Job Function	19.19
Influence Purchase of PCs at business	23.17
Influence Purchase of:	
PCs/EDP	21.56
PCs/EDP/Communications	18.71
PCs/EDP/Communications/Word Processing	18.62
Use a PC at place of business	10.82
Use a Mac at place of business	117.58
Among Professional/Managerial/Technical:	\$ 8.98
Fortune 500	35.13
Middle Management	80.94
Engineering Job Function	20.46
Small Companies (less than 50 employees)	32.95
Medium Companies (50-999 employees)	76.51
Large Companies (1000+ employees)	26.16
Influence the Purchase of:	
PCs at business	23.97
PCs/EDP	22.66
PCs/EDP/Communications	20.53
PCs/EDP/Communications/Word Processing	20.38
Use a PC at place of business	11.92
Use a Mac at place of business	120.11



Real-World Answers

Ezra Shapiro

Reflex Plus, PhoneNet, and a TOPS network solve some practical dilemmas

I started out the month trying to solve a simple problem that shouldn't have been a problem. I needed to build a name-and-address database, then merge it into both form letters and mailing labels. I had little time to complete the project, so I had to get up and running quickly.

Because I wanted to use some downloadable Adobe fonts on my QMS laser printer, I decided to work on the Macintosh. I also think it's easier to construct data-entry forms on the Mac than it is on the IBM PC. Two solid votes for the Mac. I went to work.

My first attempt was with Microsoft Works. It's incredibly easy to use, and you can merge fields from the database module into documents created with the word processor. What could possibly be easier? Well, because Works is supposedly geared to the entry-level user, it's missing a few features. In this case, I was chagrined to learn that it lacks any sort of blank-line control; if I had a null field for a person's corporate title, there was no way I could avoid a blank line in the middle of my address block. Scratch Works.

"OK," I thought. "I'll use the database in Works, then dump out a tab-delimited text file that I'll merge into big, powerful Microsoft Word 3.01. That's a serious word processor. This should turn out to be a cinch."

Hah. Though Word has some impressive mail-merge features, like a minimal macro language with `if...endif` constructions for printing optional fields and punctuation marks, its blank-line control is only half-implemented. Word can squelch blank lines, but only if they're the result of nonprinting instructions or comments. Once again, I faced a gaping hole if somebody didn't have a corporate title. Scratch Word.

The next try was with FileMaker Plus, which has great facilities for designing both data-entry and report forms. It even has an option to "slide" fields up and to the left if it encounters any that are

empty. "This should work," I said, "and it's more elegant than merging into a word processor."

So I set about building a form-letter matrix with FileMaker Plus, figuring that the "slide up" command would take care of my blank lines. That it did, but I fiddled for 3 hours and never got the line spacing to look decent. Scratch FileMaker Plus.

At this point, with deadlines looming, the power supply in my Mac Plus went up in a puff of acrid smoke. I hauled it off to the shop and put in a call for a rental Macintosh SE. All told, I lost a day and a half. During those 36 hours without a Mac, I piled up the manuals for all the other Mac databases I have in my collection and started reading.

I find Double Helix extremely convoluted; it's about as easy for me to get data out of Double Helix as it is to get baggage out of United Airlines (the only airline that has lost my luggage on a flight between San Francisco and Los Angeles). Though the documentation indicated that I could *probably* create a report form that would accomplish my mail merge, I didn't have the time to fuss with anything but 100 percent certainty. Scratch Double Helix.

Two hours with the documentation of Omnis 3 Plus convinced me that I was looking at one of the most unreadable manuals ever written. I couldn't begin to determine if it could do the job. (I later learned from an Omnis guru that it could, in fact, handle my merge, but I'd already given up.) Scratch Omnis 3 Plus.

I never got around to looking at either 4th Dimension or dBASE Mac; I ended my search with Borland's Reflex for the Mac. I had liked the product (called Interlace before it was acquired by Borland)

when I'd tried it more than a year ago. I felt fairly sure that I could get it running in the limited time I had remaining.

The documentation was worse than I remembered, with massive tutorials and little com-

mand reference, but I uncovered a feature called "variable height text," which takes an area in a report and pulls up any data lower on the page to fill gaps left by null fields. It sounded like a winner.

When the SE rental unit arrived, I began designing my project with Reflex. I created both a flat database file structure and a data-entry form in less than 10 minutes. Using the Clipboard, I cut the text of my letter out of Word and pasted it into a "label" area on my Reflex report form. I wrote a formula for a variable-height address block and positioned it over the letter. Done.

I had a database and a form-letter matrix within Reflex that spat out printed mailers as fast as I could feed paper into my laser printer. There was only one minor annoyance: Reflex won't let you have more than one text attribute in any defined region of a report, so I had to edit the letter to eliminate any italic and bold-face phrases.

In the middle of all this, Borland announced an update package called Reflex Plus. Since the company promised a new, shrink-wrapped copy of Reflex Plus to any journalist who attended the announcement shindig, I headed south to Santa Clara with software lust in my heart. When I returned to San Francisco, bearing an uncomfortably large box in a bright red tote bag, I rushed to the SE, plugged in the new disks, and replaced Reflex for the Mac with Reflex Plus.

continued

Ezra Shapiro is a consulting editor for BYTE. Contact him at P. O. Box 146069, San Francisco, CA 94114, or on BIX as "ezra." Because of the volume of mail he receives, Ezra, regretfully, cannot respond to each inquiry.

Reactions to Reflex Plus

Reflex Plus is the first product packaged as part of Borland's Professional Series. Documentation is no longer a cheaply printed paperback book; you get a fat loose-leaf binder in a striking black-and-red slipcase. The manual has been completely rewritten. Introductory, tutorial, and reference materials are neatly broken out into discernible sections. The topics are ordered logically and treated exhaustively; this is light-years ahead of the old Interlace documentation. The index is lengthy and thorough, and I liked using it.

The basic Interlace/Reflex engine is still familiar, but some features have been added and some commands have been moved around. You first enter a list of field names in a "database overview" window. Next, you go back through the list and declare field types and select "key fields." (Because Reflex indexes its data files, you must have a unique key—made up of one or more fields—in every record.)

Reflex follows a very relational model; you can set up links between data files on a one-to-one, one-to-many, or many-to-many basis. Linking is accomplished by simply drawing a line on-screen in the overview window from one field name to another. There's no need to establish an overall data library or collection; Reflex databases exist as separate files on disk, even if they're connected.

It's best to set up relationships at the outset, as Reflex demands that the linked fields be empty, but it's no big deal to add fields and links to existing databases later on, though you may have to export some data from one structure to another.

Reflex for the Mac allows multiple report forms but only one data-entry system. Reflex Plus stores both input and output forms as separate files, so you can have as many of each as you need. Forms are designed on a standard Macintosh page grid; you move objects around with the mouse.

Calculated fields in entry and report forms make use of a wide selection of formula functions, and Reflex Plus employs a device, called a "repeating collection," that lets you display intricate relationships on any form.

The best news is that once you get the hang of Reflex Plus (which should take no longer than an hour or two), you can do amazing things with it. Unless you need full programmability, network support, absolute control of the user interface, and/or "choice" fields that let you enter data by selecting from a list of pre-defined alternatives, Reflex Plus is an ideal program.

The relational features will enable me to take my mailing list and convert it into

Items Discussed

PhoneNet ... \$59.95 per connection
Farallon Computing
2150 Kittredge St.
Berkeley, CA 94074
(415) 849-2331
Inquiry 939.

Reflex Plus\$279
Borland International
4585 Scotts Valley Dr.
Scotts Valley, CA 95066
(408) 438-8400
Inquiry 940.

TOPS/DOS (MS-DOS).....\$189
TOPS for the Macintosh\$189
TOPS FlashCard
(PC AppleTalk card).....\$239
TOPS
2560 9th St., Suite 220
Berkeley, CA 94710
(415) 549-5900
Inquiry 941.

a full-blown order-entry system when the time comes. Because every file is indexed, search speed on either the Mac Plus or the SE is quite acceptable. I like this program, even if the \$279 price tag for Reflex Plus is quite a jump from the \$99 for Reflex for the Mac.

As one of the few writers I know never to have been quoted in one of Borland's direct-response advertisements, I'm finally willing to say something favorable about a Borland product: Reflex Plus offers tremendous versatility in the management and display of data. Building complex, interrelated database structures is no longer a mysterious process available only to elite programmers; anyone with half a brain can make Reflex Plus perform magic tricks.

That said, I have one final comment. I could control blank lines with WordStar on a CP/M machine 5 years ago. I'm appalled that Microsoft missed this feature in its two Mac word processors. On the other hand, I was relieved to find databases that could handle what I consider to be text-management functions. Must the Mac be forever doomed to be called a lousy machine for word processing? Come on, let's get with it, you guys.

In Praise of TOPS

Networks used to make me nervous. I broke into a cold sweat when anyone mentioned token ring, file and record

locking, twisted-pair cabling, or any of the other buzzwords associated with the arcane science of networking.

There were two reasons for this phobia. First, I was worried that the increasing emphasis on local-area networks was a scheme cooked up by the Forces of Darkness to squelch the independent spirit of "personal" computing. Second, I saw the purely technical and mechanical aspects of hooking up a network as a way to spend uncounted hours on my hands and knees under my worktable, muttering curses as I struggled vainly to connect patently unconnectable devices.

Furthermore, I didn't believe I needed a network. There are no coworkers in my basement with whom I have to share my resources; it's just me, a bunch of computers, and a bunch of printers. And I have enough serial cables, null modems, and gender changers to hook the various machines together and shoot files around the room to my heart's content. Or so I thought.

Then I began to have these annoying little problems. I started a project that involved moving megabyte files between the Macintosh and the Tandon AT clone; even at high data transfer rates, this took a lot of time and tied up both machines. Next, software for the Tandon began arriving with PostScript printer drivers; how could I test this stuff without linking the Tandon to the QMS laser printer?

True, the QMS has connectors for both AppleTalk and a standard serial cable, but there's also a switch on the side of the printer that has to be set to tell it which port to use. I've neatly blockaded that side of the printer with the corpse of my old Compaq Portable, and I didn't want to have to rearrange the whole place just to get at the switch. Finally, I hit the limit on the Mac's 20-megabyte DataFrame and began eyeing the empty regions of the Tandon's 40-megabyte hard disk as a solution to my space woes, if only I could get to it.

So, with a sinking feeling in my stomach, I decided to try out the TOPS AppleTalk network. I was not happy about this, but there seemed to be no way out. I was so uncomfortable with the decision, in fact, that I put off installing the thing for nearly 2 weeks.

You've probably gotten the point by now. When I finally went to work, it took me all of 20 minutes to get TOPS running, and most of that time was spent taking apart the Tandon to install the AppleTalk card. I haven't read more than, oh, 25 pages of the manuals that come with the network, and everything has behaved wonderfully.

Files zip back and forth between the

continued

NOW YOU CAN HAVE THE MODEM YOU'VE ALWAYS WANTED AT A PRICE YOU NEVER DREAMED YOU COULD GET.

At Hayes we just found a way to make the best-selling PC modems in the world even better. We lowered their price. From now on our Smartmodem 2400,[™] Smartmodem 2400B,[™] Smartmodem 1200,[™] Smartmodem 1200B,[™] Smartmodem 1200C[™] and our new Smartmodem 1200A[™] will cost considerably less. Up to one-third less.*

So if you've always wanted a Hayes modem, external or internal, for an IBM[®] PC or compatible, IBM PC Convertible, Apple[®] Macintosh,[®] Apple II, or almost any other PC, now you don't have to settle for less. Just pay less.

Hayes[®]

SMARTMODEM 2400

 Hayes[®]

HS

AA

CD

OH

RD

SD

TR

MR

two computers like lightning (I can even run a program on one computer and edit a file on the other without any transfer at all), the Tandon now speaks to the laser printer on a polite basis, and I'm using the Tandon's disk to hold the overflow from the DataFrame. I'm beginning to consider myself a stupid jerk because I didn't do this any sooner.

TOPS stands for "transcendental operating system," but the T could just as easily indicate "transparent." It's sold as software for both the MS-DOS world and the Mac world, at \$189 per machine, and it will run with PC AppleTalk cards from TOPS, Apple, Hercules, Tandy, and anyone else who follows Apple's specs. (The Mac has AppleTalk built in, so you don't need an add-in board.)

For cabling, I had the choice of either Apple's kits (\$75 per machine) or PhoneNet from Farallon Computing (\$59.95 per machine). I went with PhoneNet; not only is it a little less expensive, but you can use standard RJ-11 modular cables to connect machines, or nab any two unused wires in your installed telephone cabling to go from room to room.

Software installation is automated on both the PC and the Mac (batch file on the PC side, self-contained program on

the Mac side). The PC software seems a bit more cumbersome to run than the Mac software, but it's not much more complex than any other similar DOS task—setting up a mouse, for example.

The central act in using TOPS is logging on to the network and "publishing volumes"; that is, declaring which drives or directories you're willing to make available to other computers on the network and assigning read/write or read-only status to your volumes. Once that's out of the way, you can access published files on any other station as if you were accessing files on an external drive connected to your machine.

TOPS keeps track of what's where. Mac files look like PC files when viewed from MS-DOS; PC files look like Mac files when viewed from the Mac. TOPS assigns valid filenames appropriate to the operating system. You can copy a file from one environment to the other and back again, and TOPS won't miss a beat. Even a netophobe like myself can handle it without much brainpower.

The salient point in all this, for me, is that TOPS is an ideal operating-system extension in any environment with more than one computer, even if there's only one user. It's vital if you've got a Macin-

tosh and a PC-type machine, but it also makes sense if you're using computers of the same species.

I've read scads of analyses of TOPS (and other low-cost networks) that grade it in comparison to larger, faster, multi-user networks. Not one of these analyses has looked at TOPS for teeny environments like mine. But it works, and it works spectacularly well, even if I don't have to tap its capabilities for password protection and AppleTalk zones.

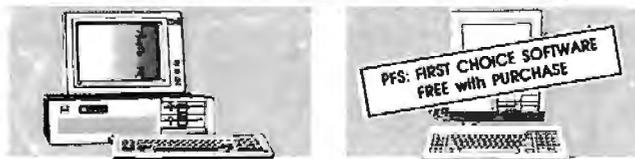
I do not have the facilities to simulate a multiuser network load; I can't say how many machines TOPS will support without performance degradation. For the simple kinds of operations a single user will perform, though, I concur with a comment in the TOPS manual: Loading a program or file from another computer's hard disk is about as fast as loading from an internal floppy disk on your machine. In other words, the decrease in speed is barely noticeable.

In about a month, TOPS has proven to be valuable for backup operations, storage, file transfer, and editing between operating systems. I'm becoming as addicted to it as I am to hard disks. I simply would not have two or more computers without a copy of TOPS for each. ■

Hardware Specials

- AMDEK 310A MONITOR
12-inch amber screen, IBM compatible ... \$129⁹⁵
- AMDEK 410 MONITOR
12-inch, choose amber or white screen ... \$139⁹⁵
- AMDEK COLOR 722 MONITOR
13-inch EGA, amber & green modes ... \$399⁹⁵
- AMIGA 500/1080 SYSTEM
512K computer & color monitor ... \$799⁹⁵
- AMIGA 512K UPGRADE
Expands 500 computer to 1MB RAM ... \$149⁹⁵
- AMIGA A1680 MODEM
300/1200 baud for Amiga computers ... \$109⁹⁵
- 20MB DISK ON A CARD
For XT and compatibles ... \$339⁹⁵
- COMMODORE 128D/1802C
Built-in drive & monitor ... \$629⁹⁵
- COMMODORE C2002 MONITOR
13-inch RGB color monitor ... \$249⁹⁵
- EPSON MONOCHROME CARD
For IBM and compatibles ... Special \$59⁹⁵
- INLAND SPQSPL PROTECTOR
6-outlet, surge, spike, EMI/RFI ... \$39⁹⁵
- MAGNAVOX 613/623 MONITOR
IBM compatible, green or amber ... \$99⁹⁵
- MAGNAVOX 8505 MONITOR
12-inch RGB/Composite, versatile ... \$199⁹⁵
- MAGNAVOX 8562 MONITOR
13-inch RGB, 80-column with cable ... \$279⁹⁵
- NOVATION PARROT MODEM
1200 baud, IBM software and cable ... \$89⁹⁵
- SEAGATE 20MB HARD DRIVE
Half-height with controller ... \$279⁹⁵
- SEAGATE 30MB HARD DRIVE
Half-height with controller ... \$319⁹⁵

J&R MUSIC WORLD



**Epson Equity 1-Plus
XT Compatible Turbo Computer**
•640K RAM •1 or 2 360K floppy drives
•4.77/10MHz turbo •Serial/parallel ports
•DOS 3.2 •GW BASIC •AT style keyboard
•Monitor & card not included

Single Floppy **\$729⁹⁵**
Dual Floppy **\$799⁹⁵**

**Epson "Apex"
PC Compatible Computer**
•512K RAM •RGB, composite and parallel ports
•Dual 360K floppy drives •4.77/8MHz turbo
•DOS 3.2 •GW-BASIC •Monitor not included

Sale Price **\$599⁹⁵** List \$999

Printer Specials

- BROTHER M1409 DOT MATRIX
180/45 cps. friction/tractor ... \$299⁹⁵
- COMMODORE MPS1000
Commodore and parallel, friction/tractor ... \$149⁹⁵
- SEIKOSHA SPI000VC MATRIX
Commodore interface ... \$159⁹⁵
- SEIKOSHA SPI80VC MATRIX
100 cps, Commodore interface ... \$149⁹⁵

Printer Specials

- AMARAY PS2 PRINTER STAND
Universal design with paper tray ... \$19⁹⁵
- EPSON EX800 HIGH SPEED
Dot matrix 300 cps. N10 mode ... \$419⁹⁵
- EPSON LQ1000 136-COLUMN
Dot matrix, 7X buffer, 180 cps ... \$539⁹⁵
- EPSON LX800 DOT MATRIX
180 cps. friction/tractor, N10 ... \$199⁹⁵

To Order Toll Free **800-221-8180** In New York, Alaska & Canada Call: (718) 417-3737

Dealer Inquiries Invited — Prices Effective Through January 31, 1987

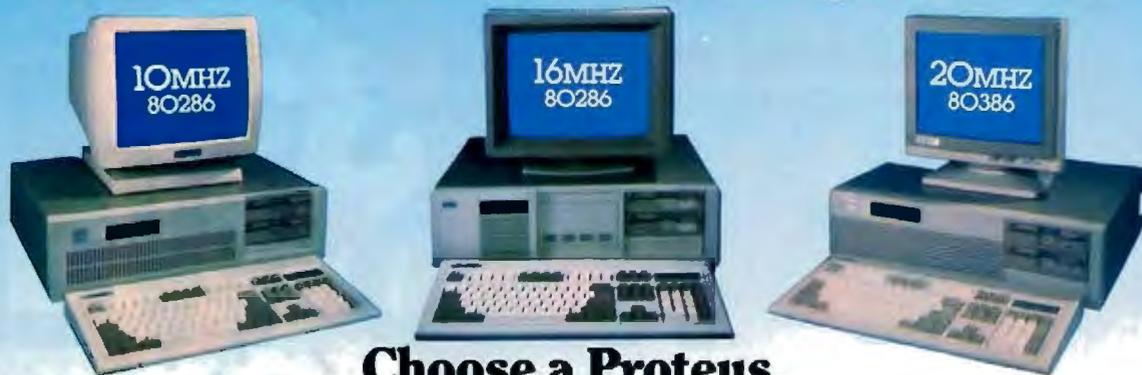
Floppy Disk & Software

- SONY 3.5-INCH FLOPPY DISKS
Double sided/density ... 10-Pack \$18⁹⁵
- FUJII 5.25-INCH FLOPPY DISKS
Double sided/density ... 10-Pack \$8⁹⁵
- CERTRON DD130 DISK CASE
Stores 130 5.25" disks with lock ... \$14⁹⁵
- CERTRON DD40 DISK CASE
Stores 40 3.5-inch disks ... \$8⁹⁵
- ASHTON-TATE "dBASE FOR MAC"
For Macintosh systems ... \$289⁹⁵
- ASHTON-TATE "dBASE III +"
For IBM ... \$389⁹⁵
- BRODERBUND "PRINT SHOP"
For IBM or Macintosh systems ... \$34⁹⁵
- CENTRAL POINT "COPY II BOARD"
For IBM systems ... \$29⁹⁵
- LIVING VIDEOTEX "MORE 1.1"
For Macintosh ... \$169⁹⁵
- MACE CORP. "UTILITIES"
For IBM systems ... \$59⁹⁵
- MICROSOFT "EXCEL"
Requires 1MB RAM & hard disk 1/1MB ... \$319⁹⁵
- MICROSOFT "WORD 3.1"
For Macintosh systems ... \$239⁹⁵
- MICROSOFT "WORKS"
Integrated software for IBM ... \$139⁹⁵
- NANTUKET "CLIPPER"
dBASE III+ compiler for IBM ... \$389⁹⁵
- SOFTWARE PUB "FIRST PUBLISHER"
For IBM ... \$64⁹⁵
- TIMEWORKS "DOS-RX"
Utilities package for IBM ... \$39⁹⁵
- WORD PERFECT VERSION 4.2
Word processing for IBM ... \$199⁹⁵

HOW TO ORDER BY MAIL: SEND MONEY ORDER, CERTIFIED OR CASHIER'S CHECK, MASTERCARD, VISA or AMEX (include card number, Interbank No., expiration date and signature.) TO: **J&R MUSIC WORLD, 59-50 QUEENS-MIDTOWN EXPRESSWAY, DEPARTMENT 8MO188, MASPETH, NY 11378** DO NOT SEND CASH. Personal and business checks must clear our Authorization Center before processing. \$25 MINIMUM ORDER. Shipping, Handling & Insurance Charge is 3% of Total Order with a \$3.95 minimum. (Canadian Orders Add 15% Shipping, with a \$9.95 minimum charge.) For shipments by air, please double these charges. SORRY, NO C.O.D.'s. NEW YORK RESIDENTS PLEASE ADD SALES TAX. ALL MERCHANDISE SHIPPED BRAND NEW, FACTORY FRESH, AND 100% GUARANTEED. WE ARE NOT RESPONSIBLE FOR ANY TYPOGRAPHICAL ERRORS.

59-50 Queens-Midtown Expressway, Maspeth, NY 11378

How to get a top quality, U.S. made IBM compatible without spending a bundle...



Choose a Proteus.

When you choose a Proteus, you get a lot more than just high performance at a low price. You get personal service that helps you custom tailor a system which is just right for your specific applications from our large stock of brand name hard disks, graphics boards monitors and other add-ons.

Easy Setup

When you get your new Proteus system you can have it up and running in no time. No need to spend hours, or even days, to get it to work. It comes with clearly written, easy to follow manuals, and on some models you even get built-in, ROM based, menu driven set-up, diagnostic, and utility software.

Money Back Guarantee

We're determined that you will be fully satisfied with your purchase. Use the system for a while, and if you don't like it, or any part, simply return it for a full refund - any time during the first thirty days.

15 Month Warranty

Everything you buy from us is backed by a full fifteen month warranty.

Service Wherever

and Whenever You Need It.

In the rare case that something goes wrong with your Proteus system while it is still under warranty, we provide free repair at your location during the crucial first two months. No need ever to pack it up and ship

it anywhere. If the unit has exceeded the warranty period, you can still get factory authorized service, on site, at reasonable rates.

Problems at 3 a.m.?

You may be able to solve them yourself with our unique 24-hour on-line interactive support system, which is always free of charge.

There are many reasons for owning a Proteus. The experts think so too.

In a recent AT compatible product comparison, *Infoworld* (4/87) stated "...for overall best machine in power, the Proteus 286 is the clear winner. It offered the best CPU and hard disk random read/write performance of any machines tested, is remarkably easy to set up, and boasts the best support around. We recommend it."

EDITOR'S CHOICE

"...There are so many nice aspects to Proteus and the company that makes it, there isn't room to cover them all."

Business Computer Digest (3/87)

PROTEUS SYSTEMS

MODELS	286E	286F	286GTX	386A	386I
INTEL CPU:	80286-10	80286-10	80286-12	80386	80386
CLOCK SPEED	8.10MHz	8.10MHz	6.12MHz	6.16MHz opt. 20MHz	6.16MHz opt. 20MHz
NORTON SI.	10.1	11.5	15.3	23.5 opt. 31.6	23.5 opt. 31.6
BASE MEMORY	1024K	1024K	1024K	1024K to 4MB	1024K to 16MB
WAIT STATES	ONE	ZERO	ZERO	ZERO	ZERO
KBD SELECT. SPEEDS	NO	YES	YES	YES	YES
CLOCK, CAL/BATTERY ONBD.	YES	YES	YES	YES	YES
COPROCESSOR SOCKET	80287	80287	80287	80287/287	80287
SERIAL PORTS	TWO	TWO	TWO	TWO	TWO
PARALLEL PORT	ONE	ONE	ONE	ONE	ONE
IO SLOTS	EIGHT	EIGHT	EIGHT	EIGHT	EIGHT
HARD DISK/FD CONTROLLER	YES	YES	YES	YES	YES
FLOPPY DISKS	1.2MB	1.2MB	1.2MB	1.2MB	YES
306K OR 35" FD CHOICE	YES	YES	YES	YES	YES
KEYBOARD TYPE	84-KEY	84-KEY	101 KEY	101 KEY	101-KEY
FREE CUSTOMER SITE SERVICE	YES	YES	YES	YES	YES
SYSTEM PRICE	\$1295	\$1495	\$1895	\$2395	\$2395
HARD DISKS: Seagate, Minicor, Prim starting \$79			MEMORY EXPANSION: from \$65		
MONITORS: High Res. Monochrome, Color, EGA from \$85			MODEMS: 300/1200/2400 from \$119		
ADD-ONS: EGA/CGA Memo Cards from \$79			Quantity discounts available. University and corporate P.O. accepted. Payment method: Charge card, prepayment. COD, terms upon approval. All prices, conditions, specs are subject to change. All trademarks registered.		

TO ORDER OR FOR INFORMATION CALL TOLL FREE 1-(800) 782-8387. ELECTRONIC CATALOG DIAL 201-288-8577 (1200B/8/N.)

*IN NJ (201) 288-8629 Telex 510-601-0960 877 Rt. 17, Airport 17 Center Hasbrouck Heights, NJ 07604

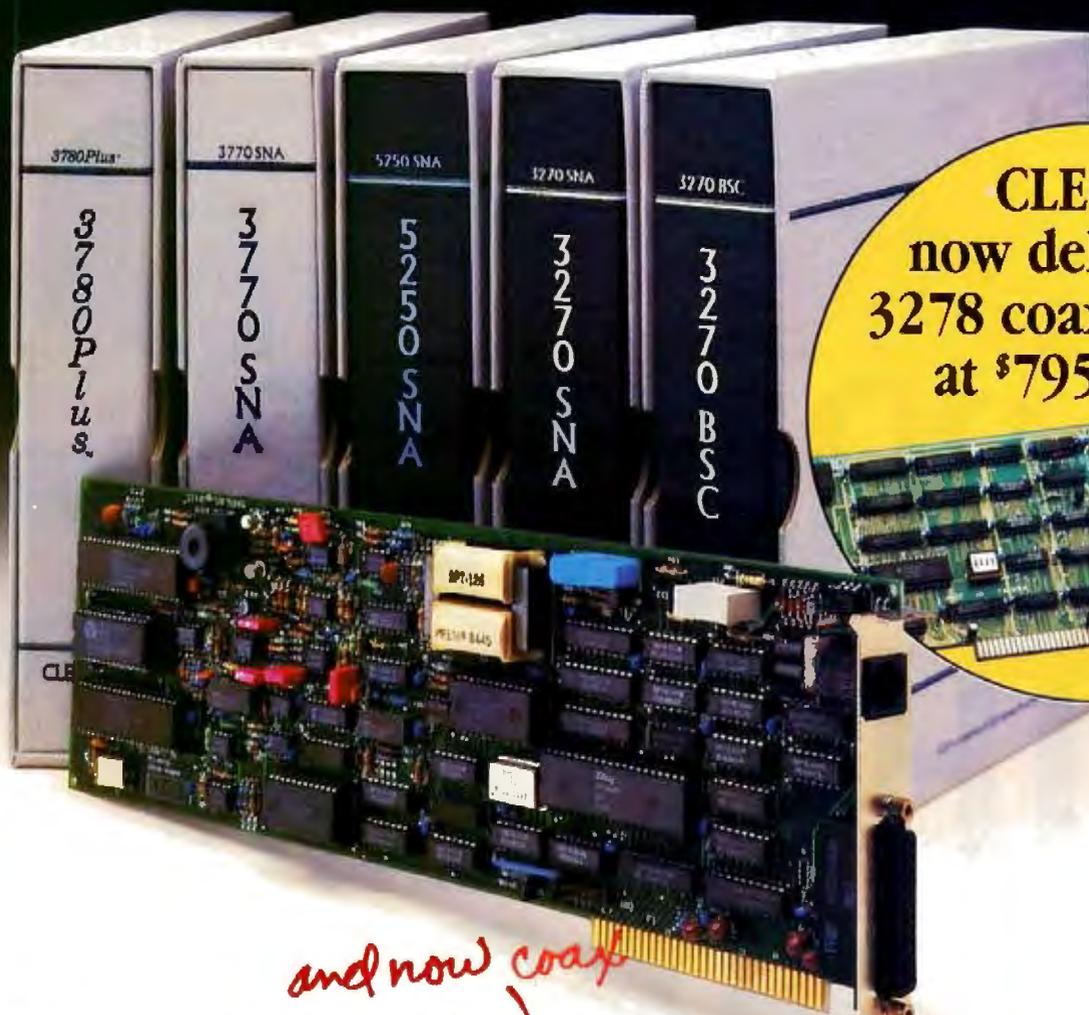
proteus[™]
The Intelligent Conclusion

© 2001 Warner Bros.
What is a Floppy? Register your name.

Jim
Need
by 7

**IF THIS WERE
NEW FLOPPY
YOU'D STILL
TO READ AL**





and now coax

CLEO is your SNA or BSC Gateway

Remote Sites Communication

Whatever your industry, your remote computers need to share information with your mainframe. Or, they need to exchange data with other remotes. In either case, you need a total solution at the remote sites. You need software, hardware interfaces and modems that all work together smoothly. You need CLEO!

CLEO software products allow micro-computers to communicate with mini-computers and mainframes, and to emulate their workstations. Since 1981, CLEO has provided remote communications between micros and mainframes for the automotive, insurance, medical and banking industries. Today over 66,000 CLEO users worldwide are running on all major brands of micro-processors. The greatest number of these users run CLEO software on IBM Personal Computers and NETBIOS LANs.

Complete Software/Hardware Package

Every CLEO package contains all the software and hardware accessories needed at the remote site. Your selected CLEO SNA or BSC software is packaged with 1) an internal modem card for dial-up applications, or 2) an interface card and cable for use with your existing modem. There's no waiting for non-CLEO add-ons. And, you get prompt, single-source service.



Package prices range from \$795.00 for most stand-alone packages, up to \$1,995.00 for the 32-user SNA gateway.

Call us today to discuss your application.

CLEO Software
1639 North Alpine Rd.
Rockford, IL 61107
Telex 703639
FAX 815/397-6535

Headquarters:
USA: 1-800/233-2536
Illinois: 1-800/422-2536
International: 815/397-8110

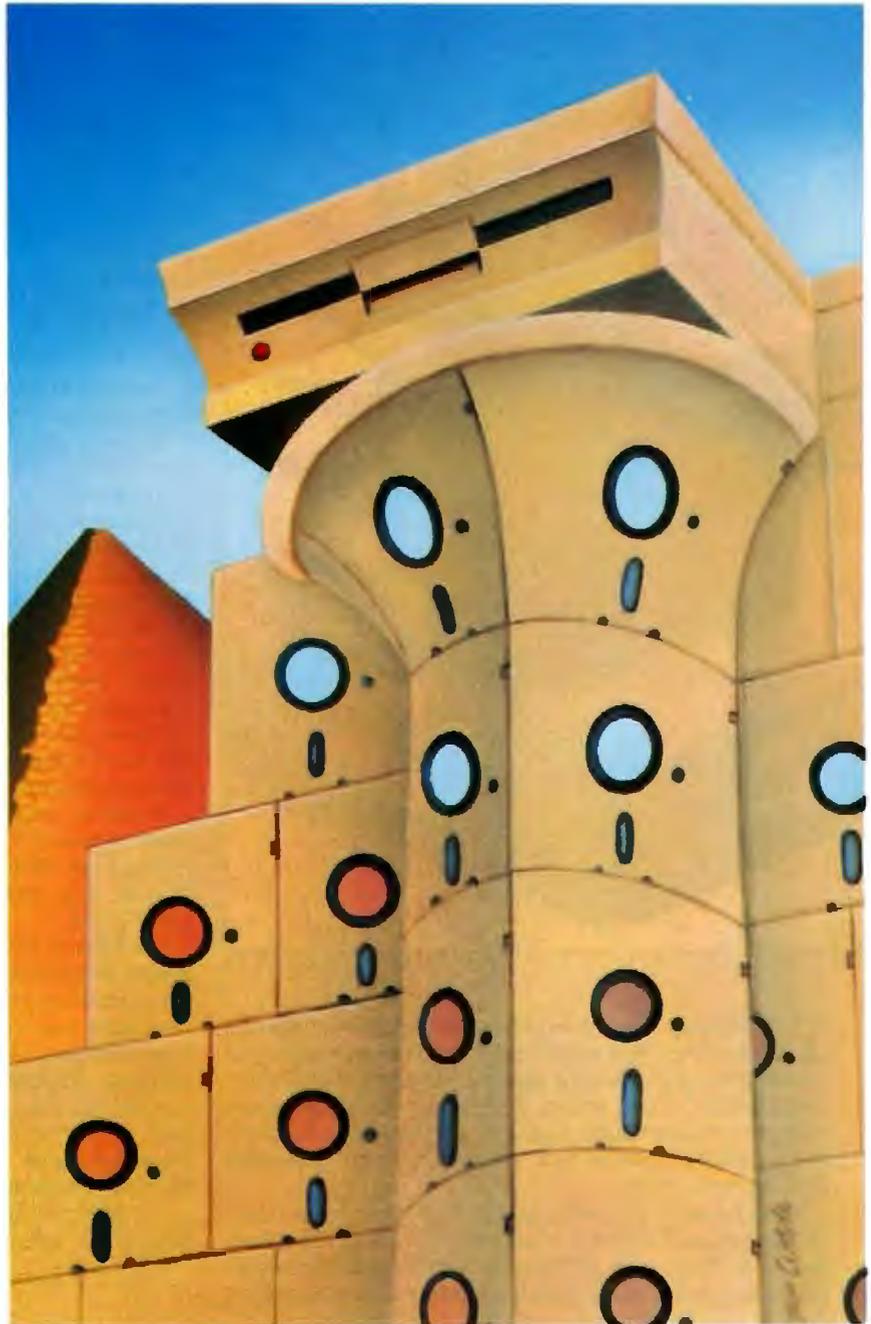
Sales and Distribution:
Benelux, Scandinavia: 31 (71) 899202
Canada, East: 800/361-3185
Canada, West: 800/361-1210
Canada, Montreal: 514/737-3631
Colombia, S.A.: 12875492
France: 146873366
Italy: (0331) 634 562
Mexico City: 203-0444

CLEO 

CLEO and 3780Plus are registered trademarks of CLEO Software. IBM is a registered trademark of International Business Machines Corporation.

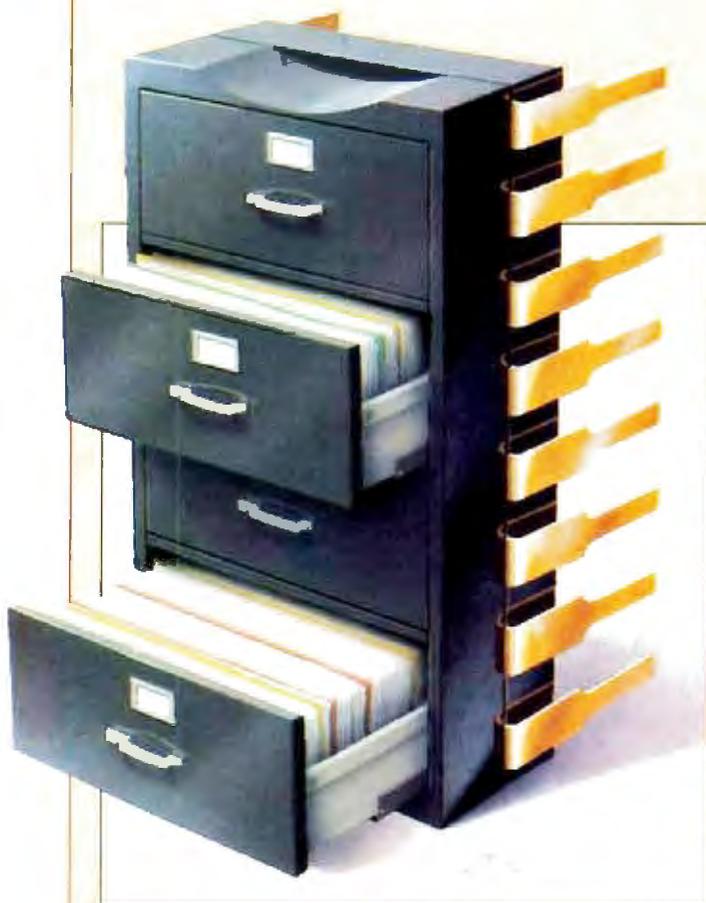
Managing Megabytes

- 215 **A Better Way to Compress Images**
by Michael F. Barnsley and Alan D. Sloan
- 225 **Managing Immense Storage**
by Theodor H. Nelson
- 243 **Fast Data Access**
by Jonathan Robie
- 255 **Achieving Mainframe Performance**
by Wink Saville
- 265 **Managing Megabytes Resource Guide**



Introduction

Managing Megabytes



The memory capacity of personal computers is undergoing another round of inflation, with the onset of 32-bit architectures and operating systems. New hard disks, video disks, and CD-ROM devices are bringing similar increases in the area of nonvolatile, high-speed storage. The megabyte has joined the kilobyte as a common coin for measuring memory and storage.

Unfortunately, you won't benefit fully from this increase in capacity until software is available that takes full advantage of it. To be sure, OS/2 in the 80x86 world and Multi-Finder and A/UX in the Macintosh world offer system-level

support for large memories. But the end user needs applications specifically designed to take advantage of the vast data sets, high-density graphics images, and voluminous text files that can live in megabyte storage systems.

The four articles in this section present some of the new techniques and design ideas for managing megabytes.

In "A Better Way to Compress Images," Michael F. Barnsley and Alan D. Sloan present a new technique for image processing, storage, and retrieval that yields compression ratios of 10,000 to 1. This is the first detailed exposition of the method outside of academic literature. The authors include a BASIC program so that interested readers can see the image-reconstruction part of the method at work.

Theodor H. Nelson, originator of the hypertext concept, presents a detailed explanation of the storage scheme for Project Xanadu. Xanadu is the first node of a proposed worldwide hypertext network. It uses a radical new system for storing the vast quantities of text, image, and other data that may be generated by entirely new categories of application programs and their users.

Database consultant Jonathan Robie explains why traditional personal-computer style database management systems are not adequate tools in the megabyte era. "Fast Data Access" is a good introduction to the next generation of DBMS tools.

"Achieving Mainframe Performance" by Wink Saville gives a programmer's view of the challenges and opportunities of working with large memories and storage devices. He cites some general principles and gives specific algorithms demonstrating how three common operations—displaying bit-image graphics, computing trigonometric functions, and sorting data—can be speeded up significantly by using the extra memory available. The author writes from experience: He spearheaded the development of a 2.4-gigabyte CD-ROM development system at Meridian Data Inc.

For further information on some of the topics presented in this section, refer to the Resource Guide on page 265.

—Ken Sheldon and George A. Stewart,
Technical Editors

A Better Way to Compress Images

Mathematics is providing a novel technique for achieving compression ratios of 10,000 to 1—and higher

Michael F. Barnsley and Alan D. Sloan

THE NATURAL WORLD is filled with intricate detail. Consider the geometry on the back of your hand: the pores, the fine lines, and the color variations. A camera can capture that detail and, at your leisure, you can study the photo to see things you never noticed before. Can personal computers be made to carry out similar functions of image storage and analysis? If so, then image compression will certainly play a central role.

The reason is that digitized images—images converted into bits for processing by a computer—demand large amounts of computer memory. For example, a high-detail gray-scale aerial photograph might be blown up to a 3½-foot square and then resolved to 300 by 300 pixels per square inch with 8 significant bits per pixel. Digitization at this level requires 130 megabytes of computer memory—too much for personal computers to handle.

For real-world images such as the aerial photo, current compression techniques can achieve ratios of between 2 to 1 and 10 to 1. By these methods, our photo would still require between 65 and 13 megabytes.

In this article, we describe some of the main ideas behind a new method for image compression using fractals. The method has yielded compression ratios in excess of 10,000 to 1 (bringing our aerial photo down to a manageable 13,000 bytes). The color pictures in figures 1 through 5 were encoded using the new technique; actual storage requirements for these images range from 100 to 2000 bytes.

A mathematics research team at the

Georgia Institute of Technology is developing the system, with funding provided by the Defense Advanced Research Projects Agency (DARPA) and the Georgia Tech Research Corporation (GTRC). Our description is necessarily simplified, but it will show you how a fractal image-compression scheme operates and how to use it to create exciting images.

Describing Natural Objects

Traditional computer graphics encodes images in terms of simple geometrical shapes: points, line segments, boxes, circles, and so on. More advanced systems use three-dimensional elements, such as spheres and cubes, and add color and shading to the description.

Graphics systems founded on traditional geometry are great for creating pictures of man-made objects, such as bricks, wheels, roads, buildings, and cogs. However, they don't work well at all when the problem is to encode a sunset, a tree, a lump of mud, or the intricate structure of a black spleenwort fern. Think about using a standard graphics system to encode a digitized picture of a cloud: You'd have to tell the computer the address and color attribute of each point in the cloud. But that's exactly what an uncompressed digitized image is—a long list of addresses and attributes.

To escape this difficulty, we need a richer library of geometrical shapes. These shapes need to be flexible and controllable so that they can be made to conform to clouds, mosses, feathers, leaves, and faces, not to mention waving sunflowers and glaring arctic wolves. Fractal

geometry provides just such a collection of shapes. For a hint of this, glance at the pictures in *The Fractal Geometry of Nature* by Benoit Mandelbrot, who coined the term *fractal* to describe objects that are very "fractured" (see references for additional books and articles). Some elementary fractal images accompany this article.

Using fractals to simulate landscapes and other natural effects is not new; it has been a primary practical application. For instance, through experimentation, you find that a certain fractal generates a pattern similar to tree bark. Later, when you want to render a tree, you put the tree-bark fractal to work.

What is new is the ability to start with an actual image and find the fractals that will imitate it to any desired degree of accuracy. Since our method includes a compact way of representing these fractals, we end up with a highly compressed data set for reconstructing the original image.

Overview of Fractal Compression

We start with a digitized image. Using image-processing techniques such as color separation, edge detection, spectrum analysis, and texture-variation analysis, we break up the image into segments. (Some of the same techniques

continued

Michael F. Barnsley and Alan D. Sloan are professors of mathematics at the Georgia Institute of Technology (Atlanta, GA 30332) and officers of Iterated Systems Inc. (1266 Holly Lane NE, Atlanta, GA 30329).



Figure 1: IFS-encoded color image of three-dimensional ferns (4 transformations, 100 bytes).



Figure 2: IFS-encoded color photo of Black Forest, color set adjusted to give winter tones (120 transformations, 2000 bytes).



Figure 3: IFS-encoded color photo of a Bolivian girl (120 transformations, 2000 bytes).

form the basis for the automatic coloring of black-and-white motion pictures.) A segment might be a fern, a leaf, a cloud, or a fence post. A segment can also be a more complex collection of pixels: A seascape, for example, may include spray, rock, and mist.

We then look up these segments in a library of fractals. The library doesn't contain literal fractals; that would require astronomical amounts of storage. Instead, our library contains relatively compact sets of numbers, called *iterated function system (IFS) codes*, that will reproduce the corresponding fractals. Furthermore, the library's cataloging system is such that images that look alike are close together: Nearby codes correspond to nearby fractals. This makes it feasible to set up automated procedures for searching the library to find fractals that approximate a given target image. A mathematical result known as the *Collage Theorem* (more on that later) guarantees that we can always find a suitable IFS code—and gives a method for doing so.

Once we have looked up all the segments in our library and found their IFS codes, we can throw away the original digitized image and keep the codes, achieving our compression ratio of 10,000 to 1—or even higher.

Iterated Function Systems

We start by explaining how a set of IFS codes can approximate a natural image.

IFS theory is an extension of classical geometry. It uses affine transformations, explained below, to express relations between parts of an image. Using only these relations, it defines and conveys intricate pictures. With IFS theory, we can describe a cloud as clearly as an architect can describe a house.

By studying the following sections,

you should be able to encode and decode fascinating black-and-white image segments, such as leaf skeletons, tree shadows, spirals, and thunderheads. You should also obtain an overview of how a fully automated fractal compression system operates.

Affine transformations can be described as combinations of rotations, scalings, and translations of the coordinate axes in *n*-dimensional space. An example in two dimensions is

$$W(x,y) = (\frac{1}{2}x + \frac{1}{4}y + 1, \frac{1}{4}x + \frac{1}{2}y + 2),$$

which can also be written in matrix form as

$$W \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} .5 & .25 \\ .25 & .5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 1 \\ 2 \end{bmatrix}.$$

This transformation moves the point (0,0) to (1,2) and moves (-1,0.5) to (0.625, 2). To confirm your understanding of the idea, you should work out where it moves the point (1,1). We denote this transformation by *W*; the notation *W(S)* denotes the subimage of *W* on a set of points *S*.

Now let's see what *W* does to a picture of a smiling face, *F*, lying on the *x,y* plane (see figure 6). The result is a new, squeezed face *W(F)*. The affine transformation has deformed and moved the face. Notice that the eyes in the transformed face *W(F)* are closer together than they are in *F*. We say that the transformation *W* is *contractive*: It always moves points closer together.

Another example of a contractive affine transformation is shown in figure 7. This time it acts on a leaf to produce a new, smaller leaf.

The general form for an affine transformation is



Figure 4: IFS-encoded color photo of the Monterey coast (60 transformations, 100 bytes).



Figure 5: IFS-encoded color image from A Cloud Study (30 transformations, 500 bytes).

$$W \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} e \\ f \end{bmatrix} \\ = \begin{bmatrix} ax+by+e \\ cx+dy+f \end{bmatrix},$$

where the coefficients $a, b, c, d, e,$ and f are real numbers.

If we know in advance the translations, rotations, and scalings that combine to produce W , we can generate coefficient values as follows:

$$a = r \cos \theta, b = -s \sin \phi, \\ c = r \sin \theta, d = s \cos \phi,$$

where r is the scaling factor on x, s is the scaling factor on y, θ is the angle of rotation on x, ϕ is the angle of rotation on y, e is the translation on $x,$ and f is the translation on $y.$

How can you find an affine transformation that produces a desired effect? Let's show how to find the affine transformation that takes the big leaf to the little leaf in figure 7. We wish to find the numbers $a, b, c, d, e,$ and f for which the transformation W has the property

$$W(\text{big leaf}) \approx \text{little leaf}.$$

Begin by introducing x and y coordinate axes, as already shown in the figure. Mark three points on the big leaf (we've chosen the leaf tip, a side spike, and the point where the stem joins the leaf) and determine their coordinates $(\alpha_1, \alpha_2), (\beta_1, \beta_2),$ and $(\gamma_1, \gamma_2).$ Mark the corresponding points on the little leaf and determine their coordinates $(\tilde{\alpha}_1, \tilde{\alpha}_2), (\tilde{\beta}_1, \tilde{\beta}_2),$ and $(\tilde{\gamma}_1, \tilde{\gamma}_2),$ respectively.

Determine values for the coefficients $a, b,$ and e by solving the three linear equations

$$\alpha_1 a + \alpha_2 b + e = \tilde{\alpha}_1, \quad (1)$$

$$\beta_1 a + \beta_2 b + e = \tilde{\beta}_1, \quad (2)$$

$$\gamma_1 a + \gamma_2 b + e = \tilde{\gamma}_1, \quad (3)$$

and find $c, d,$ and f in similar fashion from these equations:

$$\alpha_1 c + \alpha_2 d + f = \tilde{\alpha}_2, \quad (4)$$

$$\beta_1 c + \beta_2 d + f = \tilde{\beta}_2, \quad (5)$$

$$\gamma_1 c + \gamma_2 d + f = \tilde{\gamma}_2. \quad (6)$$

We recommend the use of an equation solver such as TK Solver Plus (Universal Technical Systems, Rockford, Illinois) or Eureka (Borland International, Scotts Valley, California) for finding the coefficient values. Doing it manually can be tedious.

Now that we know what a contractive *continued*

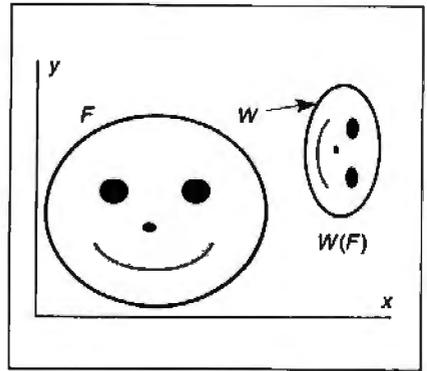


Figure 6: An affine transformation W moves the smiling face F to a new face $W(F).$ The transformation is called contractive because it moves points closer together.

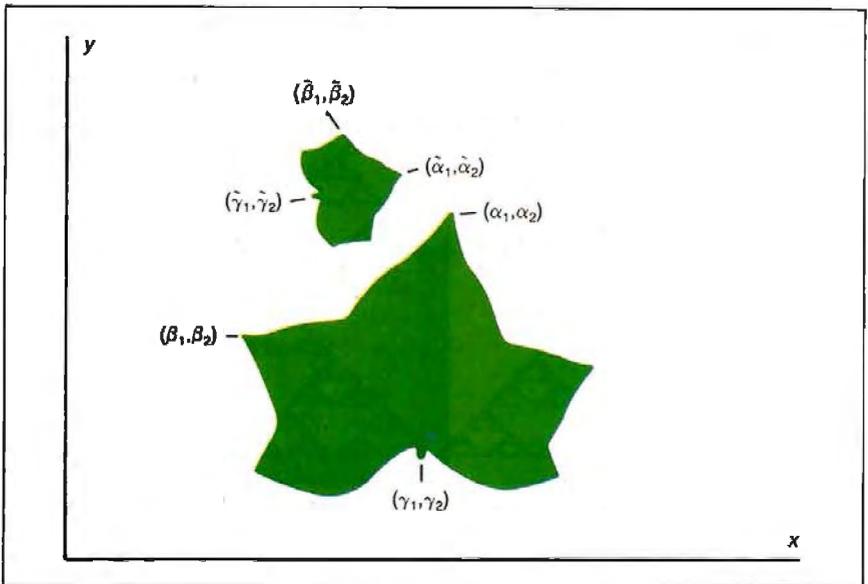


Figure 7: Two ivy leaves fix an affine transformation $W.$

Table 1: IFS codes for a Sierpiński triangle.

W	a	b	c	d	e	f	p
1	0.5	0	0	0.5	0	0	0.33
2	0.5	0	0	0.5	1	0	0.33
3	0.5	0	0	0.5	0.5	0.5	0.34

Table 3: IFS codes for a fern.

W	a	b	c	d	e	f	p
1	0	0	0	0.16	0	0	0.01
2	0.2	-0.26	0.23	0.22	0	1.6	0.07
3	-0.15	0.28	0.26	0.24	0	0.44	0.07
4	0.85	0.04	-0.04	0.85	0	1.6	0.85

Table 2: IFS codes for a square.

W	a	b	c	d	e	f	p
1	0.5	0	0	0.5	0	0	0.25
2	0.5	0	0	0.5	0.5	0	0.25
3	0.5	0	0	0.5	0	0.5	0.25
4	0.5	0	0	0.5	0.5	0.5	0.25

Table 4: IFS codes for fractal tree.

W	a	b	c	d	e	f	p
1	0	0	0	0.5	0	0	0.05
2	0.1	0	0	0.1	0	0.2	0.15
3	0.42	-0.42	0.42	0.42	0	0.2	0.4
4	0.42	0.42	-0.42	0.42	0	0.2	0.4

affine transformation is and how to find one that maps a source image onto a desired target image, we can describe an iterated function system. An IFS is a collection of contractive affine transformations. Here's an example of an IFS of three transformations:

$$W_1 \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0.5 & 0.0 \\ 0.0 & 0.5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \end{bmatrix},$$

$$W_2 \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0.5 & 0.0 \\ 0.0 & 0.5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix},$$

$$W_3 \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0.5 & 0.0 \\ 0.0 & 0.5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} .25 \\ .5 \end{bmatrix}.$$

Each transformation must also have an associated probability, p_i , determining its "importance" relative to the other trans-

formations. In the present case we might have p_1, p_2 , and p_3 . Notice that the probabilities must add up to 1. That is, $p_1 + p_2 + p_3 = 1$.

Of course, the above notation for an IFS is cumbersome. Table 1 expresses the same information in tabular form. Other examples of IFS codes are given in tables 2 through 4. Notice that an IFS can contain any number of affine transformations.

The Random Iteration Algorithm

Now let's see how to decode an arbitrary IFS code using the random iteration method. Remember that in general an IFS can contain any number, say m , of affine transformations, $W_1, W_2, W_3, \dots, W_m$, each with an associated probability. The following code summarizes the method:

- (i) Initialize: $x=0, y=0$.
- (ii) For $n=1$ to 2500, do steps (iii)-(vii).
- (iii) Choose k to be one of the numbers 1, 2, ..., m , with probability p_k .
- (iv) Apply the transformation W_k to the point (x,y) to obtain (\bar{x},\bar{y}) .
- (v) Set (x,y) equal to the new point: $x=\bar{x}, y=\bar{y}$.
- (vi) If $n > 10$, plot (x,y) .
- (vii) Loop.

Applying this procedure to the transformation in table 1 produces the figure shown in figure 8—a fractal known as the Sierpiński triangle. Increasing the number of iterations n adds points to the image. Figure 9 shows the result of the random iteration algorithm applied to the data in table 3, at several stages during the process. By increasing the scale factor used in plotting, you can zoom in on the image (see figure 10). The text box on page 221 contains a BASIC implementation of the method with additional comments on programming.

You may wonder why the first 10 points are not plotted (step (vi)). This is to give the randomly dancing point time to settle down on the image. It is like a soccer ball thrown onto a field of expert players: Until someone gains control of the ball, its motion is unpredictable, or at least is independent of the players' actions. But eventually a player gets the ball, and its motion then becomes a direct result of the skill of the players. The fact that our transformation is contractive guarantees that the "ball" will eventually get to one of the "players," and that it will stay under control after that.

How do we know that the random iter-

continued

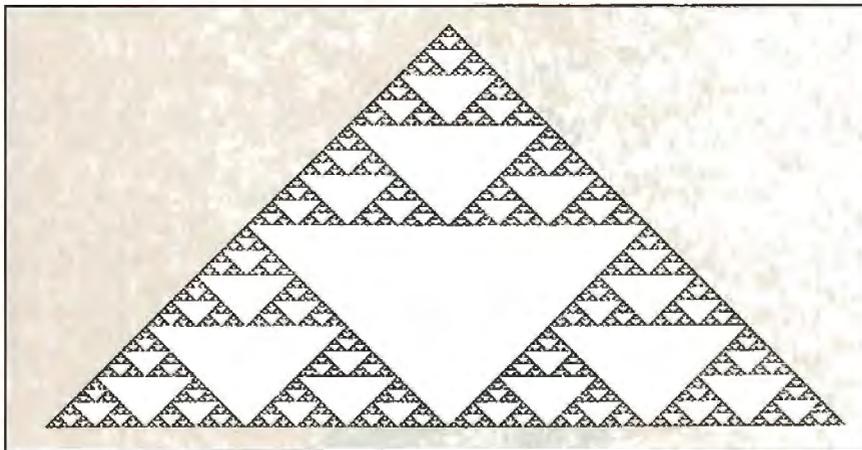


Figure 8: The result of applying the random iteration algorithm to the IFS code in table 1. It is called the Sierpiński triangle.

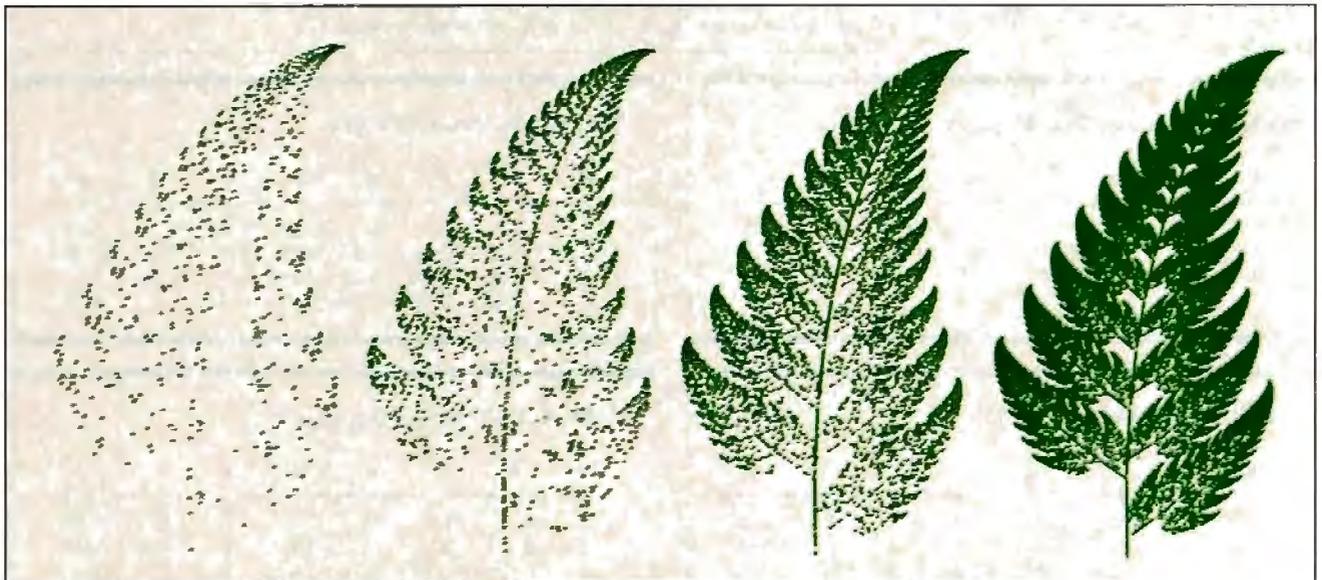


Figure 9: A fern appears when the random iteration algorithm is applied to the IFS code in table 3.

Silicon Specialties

1-800-354-7330

From As Low As

\$346

Call For Details and Other System Configurations



FEDERAL

FREE

AIR EXPRESS SHIPPING
You Pay the Ground
We Pay the Air



Up to 640K on Mother Board Brand Name Floppy Drives, 135 Watt Power Supply, Slide Case, AT Style Keyboard, 8-10 MHz Clock Speed, (Keyboard Selectable), 8 Expansion Slots.

Hardware

DISK DRIVES

Bernoulli Box	
10 Meg	\$ 865
20 Meg	1260
40 Meg	1605
Beta External	1645
Beta Internal	909
Segate 20 MG w/WD Controller	339

COMPUTERS

AST	
Model 80	\$1370
Model 120	2059
All Other Models	Call
NEC	
Multispeed	Call
Toshiba	
T-1000	\$ 810
T-1100 Supertwst	Call
T-3100	Call
T-3120	3175

PRINTERS

Alps	
All models	Call
Brother Printers	Call
Citizen Printers	Call
120D	\$ 169
180D	160
MSP 40	285
MSP 45	415
MSP 50	355
MSP 55	455
Other models	Call
Diablo	
D-25	469
635	759
Diconics	
150	299
Epson Printers	Call
Hewlett-Packard	

Laser Jet Series II	1829
NEC	
Silentwriter	1539
3510, 3550	729
P-6.P-7.P-9 Series	Call
8810, 8850	1045
Okidata Printers	Call
Panasonic	
10801 Model II	165
10911 Model II	180
1524	535
1595	429
Other Models	Call
Star Micronics	Call
Toshiba	
321/SL	Call
341E	669
351 Model II	1045

MONITORS

Amdek Monitors	Call
NEC	
Multisync II	\$ 549
Multisync Plus	Call
Other Models	Call
Princeton Graphics Monitors	Call
Princeton Ultrasync	489

MODEMS

Hayes	
All Models	Call
Prometheus	
1200B	\$ 109
Other Models	Call
US Robotics	
Password 1200	149
Courier 2400	335

BOARDS

AST	
Hot Spot	\$ 330
Six Pack Plus	139
Other Models	Call
ATI	
EGA Wonder	245
VGA	279
Hercules	
Color Card	145
Graphics Card Plus	175
Intel	
Above Board	Call
PC 1010	210
4020	315
Orchid	
EGA	565
Turbo EGA	449
Jet 386 Accelerator/AT	829
Tiny Turbo 286	399
Paradise	
5 Pack	99
Autoswitch	Call
Tecmar	
Captain (No Memory)	109
Graphics Master	409
Other Models	Call
Video-7	
VGA	288
Vega Deluxe	225

Software

SPREADSHEETS

Cambridge Analyst	\$ 55
HAL	104
Lotus 1-2-3 Ver 2.01	Call
MS Excell	Call
Multiplan	108
PFS Pro Plan	Call
Supercalc 4	269
Twin Classic 4.0	32
VP Planner	47

LANGUAGES

C Compiler (Microsoft)	\$ 219
Fortran Compiler (Microsoft)	245
Macro Assembler (Microsoft)	83
Ryan McFarlan Fortran	339
Ryan McFarlan Cobol	539
Pascal Compiler (Microsoft)	165
Quick Calc 4.0	55
Turbo C	53
Turbo Jumbo Pack	159
Turbo Pascal w/8087 & BCD	53

PROJECT MANAGEMENT

Harvard Total Project Manager II	\$ 289
Microsoft Project 4.0	268
Super Project Plus	269
Timeline 2.0	Call

INTEGRATIVE SOFTWARE

Ability	\$ 52
Enable 2.0	359
Framework II	395
MS Works	Call
PFS 1st Choice	65
Smart Software System	Call
Symphony	439

GRAPHICS/MICE

Chartmaster	\$199
Diagram Master	185
Generic CAD w/Dot Plot3.0	75
Harvard Graphics	185
IMSI Mouse w/Dr Halo II	92
In-A-Vision	259
Logimouse	66
Logimouse w/paint	85
Microsoft Buss Mouse 1.0	Call
Microsoft Chart 3.0	249
Microsoft Senal Mouse 1.0	Call
News Room	30
News Room Professional	65
PC Buss Plus Mouse (New Ver.) w/point	99
PC Mouse (New Ver.) w/point	89
Printmaster	29
Print Shop	32
Signmaster	132
Turbo Graphix Tool Box	38
Windows Draw!! w/clip art	159

DATA BASE MANAGEMENT

Clipper	\$ 368
dBase III Plus	379
DB-XL	79
Eureka	Call
Fox Base Plus 2.0	195
Genler	188
Nutshell	75
Paradox 2.0	379
PFS: Professional File	112
Q & A	189
Quickcode Plus	185
QuickReport	138
Revelation	449
R-Base 5000 System V	Call
Reflex	78
VP Expert	Call
VP Info	Call

ACCOUNTING

BPI - G/L, A/R, A/P, Payroll	Call
Computer Associates - G/L, A/R, A/P	\$379
DAC Easy Accounting	Call
One Write Plus	140
Timeslips	Call

ACCESSORIES

Copy II Option Board	\$ 75
Masterpiece	84
Masterpiece Plus	93
MousePad by MouseTrac	9
Summashetch 12x12 Tablet Plus	359

TRAINING

Flight Simulator	\$ 27
MS Learning DOS	27
PC Logo	69
Turbo Tutor II	23
Typing Instructor	27
Typing Tutor IV	27

WORD PROCESSORS

Microsoft Word 4.0	\$ 185
Multimate Advantage II	249
PFS Professional Write	89
Volkswriter 3	132
Volkswriter Deluxe Plus	59
Webster New World Writer	55
Webster Spell Checker	32
Webster Thesaurus	39
Word Perfect (Ver 4.2)	195
Word Perfect Executive	103
Word Perfect Library	54
Wordstar Pro Pack 4.0	233
Wordstar 2000 Plus 3.0	Call

DESKTOP PUBLISHING

Newsmaster	\$ 48
Pagemaker	449
PFS First Publisher	Call
Ventura Publishing	445

MONEY MANAGEMENT

Tobias Managing Your Money	Call
Dollars & Sense w/Forecast	\$ 92

No Charge for VISA and MasterCard
You Pay the Ground Shipping - We Pay the Air
Ground Shipping & Handling \$6.00
Free Air applies ONLY to orders up to 10 lbs. & Over \$50
All product carries a manufacturer's warranty. All
Guarantee rebates, trial period privileges & promotional
programs are honored by the manufacturer only

No APO FPO or international orders please
Call before submitting P.O.'s Ask for National Accounts
Personal and Company Checks Will Delay Shipping 3 weeks
Prices, Terms & Availability Subject to Change Without Notice
Add 5% for C.O.D. Orders
We Do Not Guarantee Machine Compatibility

Shipping Address:
8904 W 23rd Ave/UpPhone Anjona 85021
To place an Order: 1-800-354-7330
To follow up on an Order: (602) 944-2562
Order Line Hours: Mon-Fri: 7a m-6p m
Saturday 9a m-1p m
Order Processing Hours: (602) 944-1037
10a m-3p m, Mon-Fri



ation algorithm will produce the same image over and over again, independent of the particular sequence of random choices that are made? This remarkable result was first suggested by computer-graphical mathematics experiments and later given a rigorous theoretical foundation by Georgia Tech mathematician John Elton.

The Collage Theorem

Our next goal is to show a systematic method for finding the affine transformations that will produce an IFS encoding of a desired image. This is achieved with the help of the Collage Theorem.

To illustrate the method, we start from a picture of a filled-in square S in the x,y

plane, with its vertices at $(0,0)$, $(1,0)$, $(1,1)$, and $(0,1)$ (see figure 11). The objective is to choose a set of contractive affine transformations, in this case W_1, W_2, W_3, W_4 , so that S is approximated as well as possible by the union of the four sub-images $W_1(S) \cup W_2(S) \cup W_3(S) \cup W_4(S)$. Figure 11 shows, on the left, S together with four noncovering affine transformations of it; on the right, the affine transformations have been adjusted to make the union of the transformed images cover up the square.

To find the coefficients of these transformations, we use the method described earlier in the section on iterated function systems, leading to simultaneous equa-

tions 1 through 3 and 4 through 6. The values one finds in the present case are given in table 2. When the random iteration algorithm is applied to this IFS code, the square is regenerated.

The preceding example typifies the general situation: You need to find a set of affine transformations that shrink distances and that cause the target image to be approximated by the union of the affine transformations of the image. The Collage Theorem says that the more accurately the image is described in this way, the more accurately the transformations provide an IFS encoding of it.

Figure 12 provides another illustration of the Collage Theorem. At the bottom left is shown a polygonalized leaf boundary, together with four affine transformations of that boundary. The transformed leaves taken together do not form a very good approximation of the leaf; in consequence, the corresponding IFS image (bottom right), computed using the random iteration algorithm, does not look much like the original leaf image. However, as the collage is made more accurate (upper left), the decoded image (upper right) becomes more accurate.

So, there's a fundamental stability here. You don't have to get the IFS code exactly right in order to capture a good likeness of your original image. Moreover, the IFS code is robust: Small perturbations in the code will not result in unacceptable damage to the image. In each of the above examples, we have used four transformations to encode the image. However, any number can be used.

For example, the spiral image in figure 13 can be encoded with just two contractive affine transformations. See if you can find them. Then determine the IFS transformation coefficients and input them to the random iteration algorithm to get the spiral back again.



Figure 10: Successive zooms on pieces of an IFS-encoded fern.

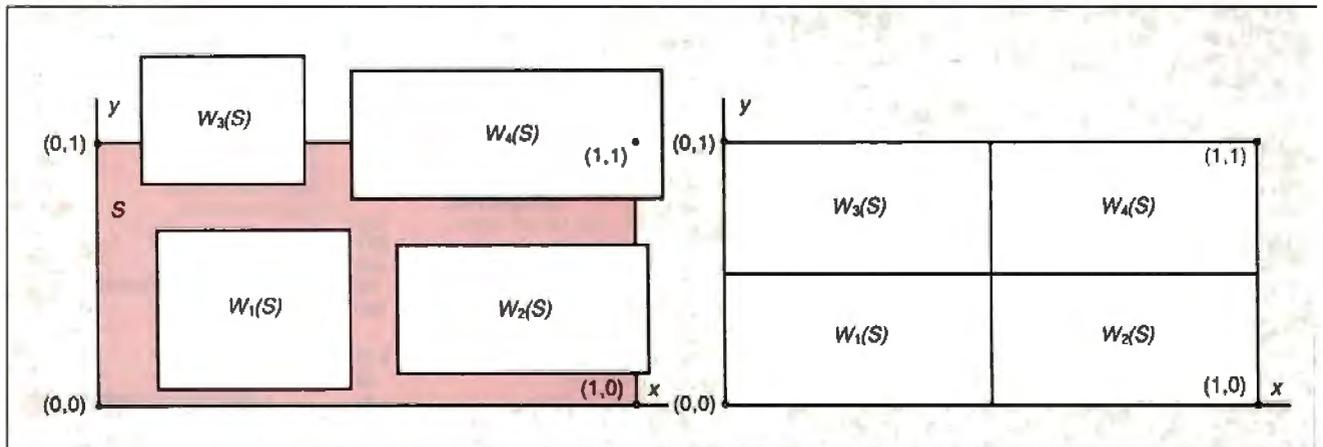


Figure 11: The collage theorem is used to encode a classical square S . The correct IFS code is obtained when the four affine transformations of S cover S , as shown on the right.

Assigning Probabilities

Once you have defined your transformations, you need to assign probabilities to them. Different choices of probabilities do not in general lead to different images, but they do affect the rate at which various regions or attributes of the image are

filled in. Let the affine transformations W_i corresponding to an image I be

$$W_i \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} a_i & b_i \\ c_i & d_i \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} e_i \\ f_i \end{bmatrix},$$

where $i = 1, 2, 3, \dots, n$. Then the

amount of time that the randomly dancing point should spend in the subimage W_i is approximately equal to

$$\frac{\text{area of } W_i}{\text{area of } I}$$

continued

IFS Decoding in BASIC

Listing A is a BASIC implementation of the random iteration algorithm. It includes the data for the Sierpinski triangle, but you can use it to process any IFS tables. In particular, you will want to try the data in tables 2, 3, and 4. Be sure to set the variable m correctly; it tells the program how many transformations are in the IFS.

It is also essential that the probabilities in $p()$ add up to 1. For speed, the transformations should be listed in descending order of probability: the highest probability transformation first, and the lowest probability last.

The program includes variables for rescaling and translating the origin to accommodate the range of the points being plotted to the limits of your screen. If the image is too wide, decrease $xscale$; if the points are too close horizontally, increase $xscale$. Adjust $yscale$ similarly to get a good vertical point spread. To move the image, adjust $xoffset$ and $yoffset$.

You can do these adjustments by trial and error: Run the program; interrupt it and change the offsets and scale factors; and run it again. Or, you can replace the plot command $pset$ with a command to print the values of x and y and run the program to get an exact idea of the range of points being plotted, so you can adjust the scale and offsets more precisely.

Another way to arrange the program is to have it read all the data— m , $a()$, $b()$, $c()$, $d()$, $e()$, $f()$, $p()$, $xscale$, $yscale$, $xoffset$, and $yoffset$ —from a disk file specified by the user. Instead of reading in the coefficients a , b , c , and d , you may want to read in angles θ and ϕ and scale factors r and s , and then calculate the coefficients.

The random iteration method is computation-intensive, so we recommend use of a compiler such as Microsoft's QuickBASIC or Borland's TurboBASIC. If your computer has a floating-point coprocessor and your compiler supports one, so much the better.

Listing A: A BASIC program demonstrating the use of the random iteration algorithm to reconstruct an IFS-compressed image.

```

10 'Allow for a maximum of 4 transformations in the IFS
20 DIM a(4), b(4), c(4), d(4), e(4), f(4), p(4)
30 '
40 'Transformation data, Sierpinski triangle
50 'First comes the number of transformations
60 'then the coefficients a through f and probability pk
70 'The values for pk should be in descending order.
80 DATA 3
90 DATA .5,0,0,.5,0,0,.34
100 DATA .5,0,0,.5,1,0,.33
110 DATA .5,0,0,.5,.5,.5,.33
120 '
130 'Read in the data
140 READ m
150 pt = 0 'Cumulative probability
160 FOR j = 1 TO m
170     READ a(j), b(j), c(j), d(j), e(j), f(j), pk
180     pt = pt + pk
190     p(j) = pt
200 NEXT j
210 '
220 'Set up for Graphics
230 SCREEN 3 'Select graphics screen
240 xscale = 350 'Map [0,1] onto [0,350]
250 yscale = 325 'Map [0,1] onto [0,325]
260 xoffset = 0
270 yoffset = 0 'Leave the y-origin
280 '
290 'Initialize x and y
300 x = 0
310 y = 0
320 '
330 'Do 2500 iterations
340 FOR n = 1 TO 2500
350     pk = RND
360     'The next line works for m<=4. It must be modified
370     'for values of m > 4.
380     IF pk <= p(1) THEN k = 1 ELSE IF pk <= p(2) THEN k = 2
           ELSE IF pk <= p(3) THEN k = 3 ELSE k = 4
390     newx = a(k) * x + b(k) * y + e(k)
400     newy = c(k) * x + d(k) * y + f(k)
410     x = newx
420     y = newy
430     'Use PRINT x,y instead of the PSET line
440     'to see the range of coordinates. Then fix
450     'xscale, yscale, xoffset, and yoffset
460     IF n > 10 THEN PSET (x * xscale + xoffset, y * yscale
           + yoffset)
470 NEXT n
480 '
490 LOCATE 24, 35
500 PRINT "Press any key to end.:"
510 WHILE INKEY$ = ""
520 WEND
530 '
540 'Return to text screen
550 SCREEN 0
560 END
    
```



Figure 12: *The Collage Theorem is applied to a leaf. The collage at lower left isn't much good, so the corresponding IFS image, shown at lower right, is a poor approximation. But as the collage improves, upper left, so does the IFS image.*

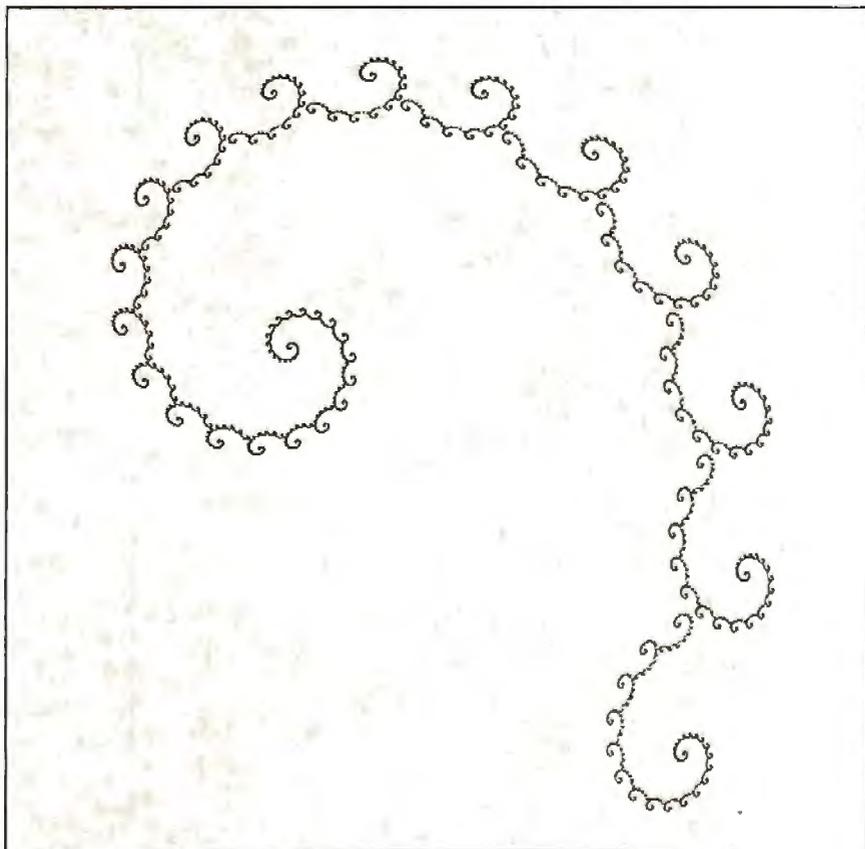


Figure 13: *Can you find the IFS codes for this spiral image? Only two transformations are needed.*

So long as $ad - cd$ is not 0, it is a standard calculus result that our ratio equals the determinant of the transformation matrix for W_i . So a good choice for the probability p_i is

$$\frac{a_i d_i - b_i c_i}{\sum_{i=1}^n |a_i d_i - b_i c_i|}$$

provided none of these numbers p_i comes out to be 0. A 0 value should be replaced by a very small positive value, such as 0.001, and the other probabilities correspondingly adjusted to keep the sum of all the probabilities equal to 1.

We now summarize the compression and decompression process: An input image is broken up into segments through image-processing techniques. These image components are looked up in the IFS library using the Collage Theorem, and their IFS codes are recorded. When the image is to be reconstructed, the IFS codes are input to the random iteration algorithm. The accuracy of the reconstructed image depends only on the tolerance setting used during the collage mapping stage.

Applications

For graphics applications, we use a more sophisticated procedure that allows full-color images to be encoded. Combinatorial searching algorithms can be used to automate the collage mapping stage. Figures 2, 3, and 4 were obtained using IFS theory at compression ratios in excess of 10,000 to 1. These images were based on photographs in recent issues of *National Geographic*. A full-sequence video animation, *A Cloud Study*, was shown at SIGGRAPH '87. This was encoded at a ratio exceeding 1,000,000 to 1 and can be transmitted in encoded form at video rates over ISDN lines (ISDN stands for integrated services digital network, a concept for integrated voice and data communications). A frame from the animation is shown in figure 5.

The IFS compression technique is computation-intensive in both the encoding and decoding phases. Computations for the color images were all carried out on Masscomp 5600 workstations (dual 68020-based systems) with Aurora graphics. Complex color images require about 100 hours each to encode and 30 minutes to decode on the Masscomp.

For practical applications, you need custom hardware that can speed the encoding and decoding process. An experimental prototype, the IFSIS (iterated function system-image synthesizer), decodes at the rate of several frames per second. The IFSIS device was produced from a cooperative effort between GTRC,

DARPA, Atlantic Aerospace Electronics Corporation, and Iterated Systems, and it was demonstrated on October 5, 1987, at the third annual meeting of the Applied and Computational Mathematics Program of DARPA. It can be connected to a personal computer through a serial port; the personal computer sends the IFS codes to the device, which responds by producing complex color images on a monitor.

The IFSIS is a proof of concept for faster devices with higher resolution. Once the higher-performance IFSIS devices are combined with ISDN telecommunication, full-color animation at video rates over phone lines will be a reality.

Another area for future application of IFS encoding is automatic image analysis. What's in a picture? Does it show a spotted sandpiper or a robin? The more complex the image or the more subtle the question, the harder it becomes for an algorithmic answer to be formulated. But here's the point: Whatever the answer, it will proceed faster if stable, compressed images are used. The reason for this is that image-recognition problems involve combinatorial searching, and searching times increase factorially with the size of the image file.

During the spring of 1987, Iterated Systems was incorporated to develop commercial applications of IFS image compression. It is exciting to see how an abstract field of mathematics research is leading to new technology with implications ranging from commercial and industrial work to personal computing. ■

ACKNOWLEDGMENTS

Figures 2 through 5 were encoded by graduate students François Malassenet, Laurie Reuter, and Arnaud Jacquin. All color images were produced in the Computergraphical Mathematics Laboratory at Georgia Institute of Technology and are copyright 1987, GTRC.

BIBLIOGRAPHY

- Barnsley, M. F. and S. Demko. "Iterated Function Systems and the Global Construction of Fractals." *The Proceedings of the Royal Society of London*, A399, 1985, pp. 243-275.
- Barnsley, M. F., V. Ervin, D. Hardin, and J. Lancaster. "Solution of an Inverse Problem for Fractals and Other Sets." *Proceedings of the National Academy of Science*, vol. 83, April 1985.
- Barnsley, M. F. *Fractals Everywhere*. Academic Press, 1988. Forthcoming.
- Elton, J. "An Ergodic Theorem for Iterated Maps." *Journal of Ergodic Theory and Dynamical Systems*. Forthcoming.
- Mandelbrot, B. *The Fractal Geometry of Nature*. San Francisco, CA: W. H. Freeman and Co., 1982.

Attention all FX80, FX100, JX, RX, & MX owners:
You already own half of a great printer

Improved version with elite



Now Only \$79.95

Now for \$79.95 you can own the rest. You see, today's new dot matrix printers offer a lot more features.

But now, a Dots-Perfect upgrade kit will make your printer work like the new models in minutes—at a fraction of their cost!

For example, with a Dots-Perfect the "dotty" look is gone! In its place is NLQ (Near Letter Quality), a feature that produces printed characters almost as sharp as a daisy wheel or laser printer.

NLQ: Like Having Two Printers

NLQ is not just "double striking." It's a completely redesigned letter form that reshapes each character. Characters are actually formed by four times the normal dot resolution.

And since NLQ can be switched on or off from the touch of a button, you can switch modes whenever you wish.

Installs In Minutes

You can install a Dots-Perfect in minutes with an ordinary screwdriver by following our easy-to-understand illustrated instructions.

All you need do is unplug the existing chips and replace them with a Dots-Perfect—that's all there is to it!

Doesn't Get In Your Way

Dots-Perfect is easy to operate because it actually becomes part of your printer.

It requires no software itself, so it

can be used with every software package.

And you control it from the printer's existing control panel buttons.

You can choose from over 160 printing modes like condensed, double-wide, italic, high-speed draft, or even combinations. All switched on and off at the touch of a button.

Samples shown actual size

NLQ abcdefghijklm
 Condensed Fine Print
Emphasized
Double-Wide
Italics Underline
 Or Hundreds of Combinations!

Dots-Perfect even has a unique panel button controlled buffer clear command.

I.B.M. Graphics

FX, JX and MX versions of Dots-Perfect will even permit switching from the standard Epson® character set to the IBM®Graphics Printer set, allowing you to print IBM screens exactly as they appear on your computer. All three versions have all Graftrax Plus™ features, even the MX version.

And, every Dots-Perfect is backed with a full year's warranty.

So, call now toll-free and use your Visa, MasterCard, or American Express card.

Don't replace your printer, upgrade it!

1-800-368-7737

(Anywhere in the United States or Canada)



8560 Vineyard Ave., Ste. 405, Rancho Cucamonga, CA 91730

(714) 945-5600

An upgrade kit for EPSON FX, JX, RX, & MX printers

You Never Regret A **WYSE** Decision



WYSEpc 286 SYSTEM

Intel 80286 Running AT 8 and **12.5 MHz**
 Phoenix Bios • 1.2 Meg Floppy Drive
 102-Key Enhanced PC - Style Key Board
 1 Meg of Parity Checked RAM
 Clock/Calendar with Battery Backup
 WYSEwindow system status display
 190 W Power Supply • GW-Basic 3.21
 1 Serial and 1 Parallel Port
 MS-DOS 3.21 and Users Guide
 20 Meg 65ms Hard Disk Drive

\$1,795

\$2,295

HERCULES COMPATIBLE MONO SYSTEM
 With WY-530 14inch Hi Res Amber Monitor

EGA COLOR SYSTEM
 With WY-640 Hi Res EGA MONITOR

\$3,750

\$4,250



WYSEpc 386 SYSTEM

Intel 80386 Running AT 8 and **16 MHz**
 Phoenix Bios • 1.2 Meg Floppy
 102-Key Enhanced PC - Style Keyboard
 1 Meg of 0 wait state static ram
 Clock/Calendar with Battery Backup
 WYSEwindow system status display
 1 Serial and 1 Parallel Port
 GW - Basic 3.21 • 220 W Power Supply
 MS-DOS 3.21 • **FREE PC - MOS/386**
 41 Meg 28ms Hard Disk Drive

OPTIONS

- 2nd Floppy Drive 5 1/4" 360K \$99
- 2nd Floppy Drive 3 1/2" 720K \$155
- 41Meg 28ms Hard Disk Drive \$210
- 1200 Baud Internal Modem w/Software \$99
- 2400 Baud Internal Modem w/Software \$199
- 12.5 MHz Speed Option \$450

- **NEC Multisync EGA Monitor \$99**
- 71 Meg 28 ms Hard Disk Drive \$450
- Math Co-Processor
- Extended Service Contract Available
- Other Options Available

THIRTY-DAY MONEY BACK GUARANTEE

You can return any B & W SYSTEMS, INC. computer system within thirty days of the date of shipment. Return the items like new with complete documentation, warranty cards and packing material. Return product cards and packing material. Return product must be labeled with a Return Merchandise Authorization (RMA) number and shipped prepaid and insured.

ONE YEAR LIMITED WARRANTY

We warranty our products to be free of defects in material and workmanship for a period of one year from the date of shipment. The Warranty covers the cost of all materials and labor.

- **WORLDWIDE SERVICE AND SUPPORT**
- **QUANTITY DISCOUNTS AVAILABLE**
- **No Extra Charge for Visa or Mastercard**

TO ORDER TOLL FREE

1-800-638-9628

For Information Call — (301) 963-5800

Visa • Master Card



7877 Cessna Ave
 Gaithersburg, MD
 20879

© B & W SYSTEMS, INC.

Trademarks: WYSE — trademark of WYSE Technology • MS-DOS & OS/2 — trademark of Microsoft Corporation • Hercules — trademark of Hercules Computer Technology • NEC — trademark of NEC Corporation • PC-MOS/386 — trade mark of Software Link. Specifications, configurations, and prices subject to change without notice. Copyright 1987 B & W SYSTEMS, INC.

Managing Immense Storage

Project Xanadu provides a model for the possible future of mass storage

Theodor H. Nelson

PROJECT XANADU IS a system designed to be the principal publishing utility of the future. It will provide for the deposit, delivery, and continual revision of linked electronic documents, servicing hundreds of millions of simultaneous users with hypertext, graphics, audio, movies, and hypermedia. Xanadu has been under continuous development for over 27 years and has been repeatedly redesigned as better methods were developed for achieving broader goals. (Xanadu is a trademark for hypertext and software products and services offered by Project Xanadu, San Antonio, Texas.)

The present system, Xanadu 87.1, is an operational file server program, intended to run in many computers of a network, that performs a full set of functions and that can be incrementally improved without major revision up to the full performance of the network. This article is an introduction to its principal concepts and indexing schemes.

I began what is now Project Xanadu in the fall of 1960 as a term project for a graduate course at Harvard on computers in the social sciences. During the 1960s, it evolved into a new set of data structures (see reference 1), then a single-user workstation (reference 2), and finally the idea grew to its present scope, detailed in my book *Literary Machines* (reference 3).

Through all this time, however, two main specifications remained the same: A user would be able to see and follow arbitrary links between pieces of non-sequential text and be able to intercompare different versions of documents, noting which parts were the same—a fea-

ture I believe to be necessary for office systems and other forms of interconnected writing (such as hypertext).

Project Xanadu has suffered from too much publicity. The project is well known, but not well understood. Its greatest aspiration, a universal instantaneous hypertext publishing network, has not been generally understood at the technical level and has created various false impressions. One publication, for example, referred to it as "a database-to-be the size of the world"—a very muddled description.

We at Project Xanadu have another great aspiration for the same software and underlying ideas: the organization and clarification of files on a small scale, cleaning up the clutter of computer files that now chokes both individuals and offices. People everywhere are drowning in little files with mysterious names whose origins and relationships are forgotten. We want to clear that up as well.

We believe we have a unifying technical solution to both problems.

A New Form of Storage

We have a model of storage that is rational yet radical: rational because it proposes to keep things orderly to a degree they could never be before; and radical because it requires a fundamental change in the way computers are programmed. Like other new paradigms, this presents an entirely new worldview, and it provokes various forms of confusion and anger.

Our generic name for this is "xanalological storage." Xanalological storage lets units be built from parts of other units and

linked together in various ways. I will explain this concept further and then present various technical details—such as the addressing system and its arithmetic, and the structure of links—by which we create the particular xanalological structure of the Xanadu system.

Often, apparently simple designs for data storage merely foist complexity on users, requiring many adaptations *outside* the design. Traditional computer storage is such a system; it pushes onto the user the problem of naming and keeping track of hundreds or thousands of files and their backup copies, and the relations between them. Existing systems encourage clutter; files with unknown contents are saved as a precaution, and the connections between things get lost and deteriorate.

What individual users and offices don't know they need is a system of storage that keeps track of the origins and variations of everything. Such a system would let a user see the origin of any part of a document, provide insight into its meaning in different contexts, and allow it to be used in new ways easily.

For example, consider a lawyer who uses variations of the same contract repeatedly. He will tell his secretary, "I want to give this client the modifications we did for Jones, but also the changes we

continued

Theodor H. Nelson (Project Xanadu, 8480 Fredericksburg, Suite 138, San Antonio, TX 78229) is the director of Project Xanadu and the inventor of the hypertext concept.

did for Smith." On the screen, he ought to be able to see each borrowed part highlighted in both old and new contexts. Without this, in today's offices, a good secretary must do what the system ought to do—keep track of the origins and interconnections of the material.

Traditional computer file structures have also generated many computer applications—and their problems—as we

now know them. Conventional files are streams of bits divided into blocks and given a name. Text systems began when someone decided to treat the sequence of bits as text characters, then set up controls for their revision. Database programs began when someone decided to treat individual blocks as units and divide them into named and addressable fields.

In this way, I would argue, our applica-

tions programs have become artificially divided into functions on the basis of how they are implemented. This keeps us misled into believing that such programs as "database" and "text" are divinely ordained, and leads us away from designing functions best suited to particular uses.

The alternative is a new module for maintaining storage in its real complexity, permitting you to understand the interrelation of all stored materials. Under this storage paradigm, you can ascertain the origin of every part of every document (in a way that will even save space in some environments), as well as make note (as if using a highlighting pen and sticky notes) of every interconnection and feature of interest. To distinguish materials stored in this way, I will avoid confusion by not using the word "file," since that is what conventionally stored units are called. I will use the term "document" for materials stored according to this new paradigm.

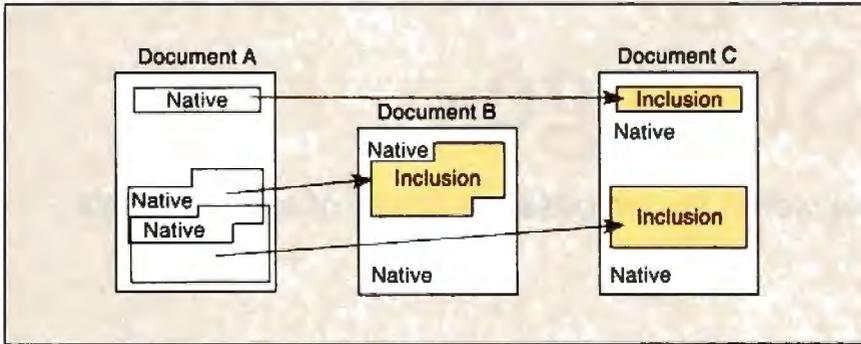


Figure 1: A Xanadu document can consist of native bytes, which originated with the document, and inclusions of native bytes from other documents.

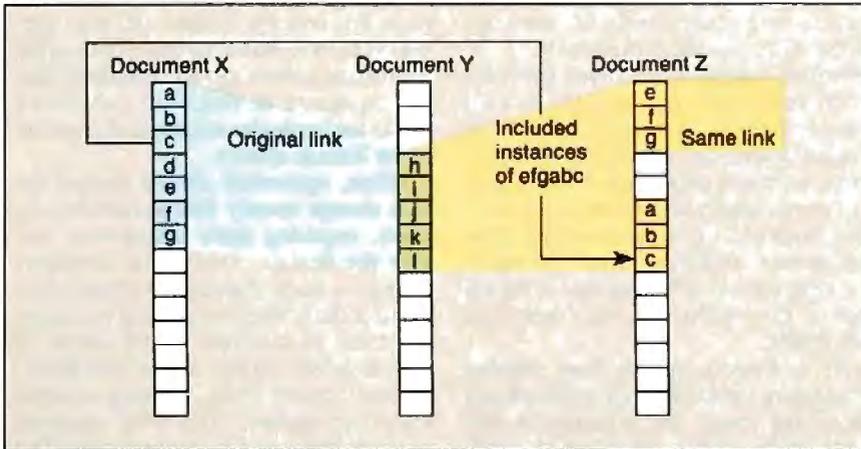


Figure 2: An example of linking: Some of the bytes of document X have been included into document Z. Since those bytes contain links to document Y, Z and Y are now linked.

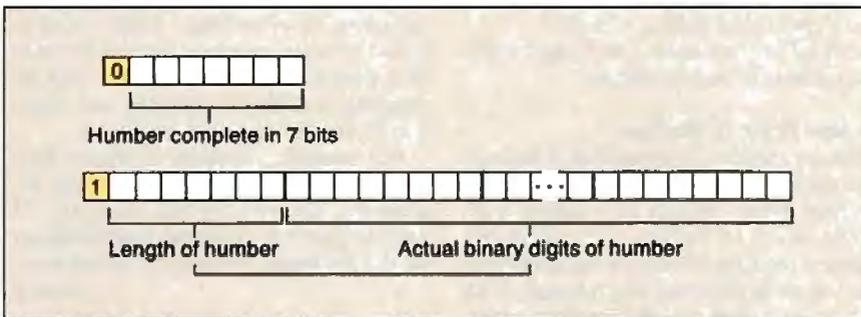


Figure 3: Humbers can be represented by 1 or more bytes. A 0 in the first bit signals that the number is complete in 1 byte. A 1 in the first bit means that the remaining bits of the first byte specify the length, in bytes, of the number, which can be a binary number up to 1016 bits long—an extremely long number.

Building Documents by Inclusion

In the Xanadu paradigm, a document consists of *native bytes*, which originated with the document, and *inclusions*, which are bytes native to other documents but also present by inclusion, or virtual copy, in this one (see figure 1). Conceptually, there is only one copy of every byte (though for both safety and implementation there are generally other copies). A byte is just as fully a part of a document in which it is included as it is part of the document to which it is native.

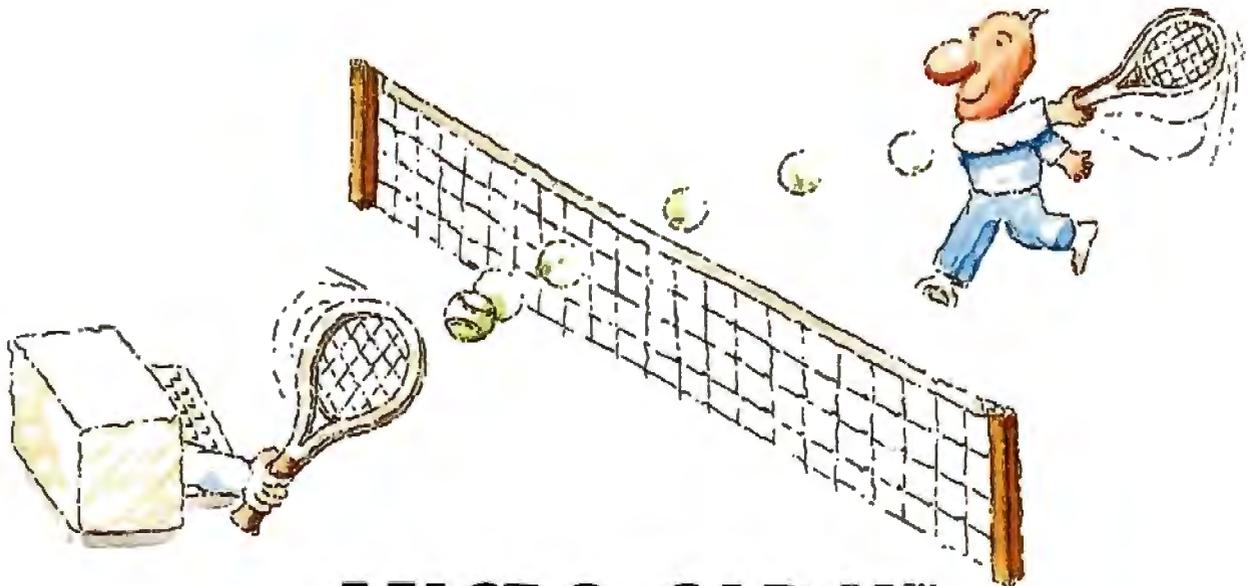
Thus, a document consists (first approximation) of native bytes and a structure of pointers (hidden and maintained by the storage system) for bringing instances of included bytes from other documents. By various system commands, you can ask where bytes came from, ask to see them in their original context, and so on.

At about this point some people—especially assembly language programmers who like to optimize systems for speed—invariably ask, "What about efficiency?" Well, at every stage in the development of system facilities, some people object to a lack of raw access. But keeping in mind that storage and computers are cheap, and people are expensive, then the real efficiency is *human* efficiency, and it is that efficiency we are trying to maximize.

Keeping Track

A truly efficient storage system needs a data structure that keeps track of arbitrary links between arbitrary portions of arbitrary documents. This is important for hypertext, for the marking and annotation of all kinds of data, and for search-

continued

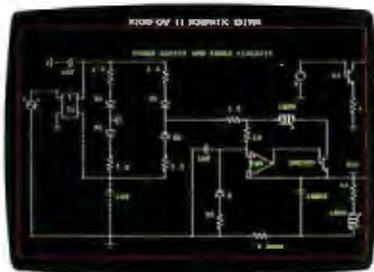


MICRO-CAP II.™

The CAE tool with fully interactive analog simulation for your PC.

Spectrum Software's MICRO-CAP II® is fast, powerful, and feature rich. This fully interactive, advanced electronic circuit analysis program helps engineers speed through analog problems right at their own PCs.

MICRO-CAP II, which is based on our original MICRO-CAP software, is a field-proven, second-generation program. But it's dramatically improved.



Schematic Editor

MICRO-CAP II has faster analysis routines. Better resolution and color. Larger libraries. All add up to a powerful, cost-effective CAE tool for your PC.

The program has a sophisticated integrated schematic editor with a pan capability. Just sketch and analyze. You can step



Transient Analysis

component values, and run worst-case scenarios—all interactively. And a 500-type* library of standard parts is at your fingertips for added flexibility.

MICRO-CAP II is available for IBM® PCs and Macintosh.™ The IBM version is CGA, EGA, and Hercules® compatible and costs only \$895 complete. An evaluation version is available for \$100. Call or write today for our free brochure and demo disk. We'd like to tell you more about analog solutions in the fast lane.

- Integrated schematic editor
- Fast analysis routines
- High-resolution graphic output
- Standard parts library of 500* types

*IBM versions only.

- Transient, AC, DC, and FFT routines
- Op-amp and switch models
- Spec-sheet-to model converter*
- Printer and plotter* hard copy



AC Analysis

spectrum

1021 S. Wolfe Road, Dept. E
Sunnyvale, CA 94087
(408) 738-4387

MICRO-CAP II is a registered trademark of Spectrum Software.
Macintosh is a trademark of McIntosh Laboratory, Inc. and is being used with express permission of its owner.
Hercules is a registered trademark of Hercules Computer Technology.
IBM is a registered trademark of International Business Machines, Inc.

ing on such links and markings.

In the Xanadu system, we do this by attaching links not to points in the data, but to the bytes themselves. Thus, a given link is present on every document in which any of the bytes (native or included) are linked to another document.

For example, in figure 2, some of the bytes of document X have been included in document Z. Since those particular bytes are linked to document Y, the same link now exists between Z and Y. This link will always exist between Z and Y until the last of those linked bytes from X is deleted from Z.

We have taken pains to generalize this linking system so that it can work seamlessly across all disk, computer, and net-

work boundaries as the world of computer storage becomes united. Our storage program is designed to be run in parallel on networks of an unlimited number of servers that respond essentially as a whole.

Link types are extensible, and any user can create new ones. Although primitive links are two-sided, one-sided links can be used; links can also be combined (like CAR and CDR in LISP) into structures of arbitrary richness.

Links can be searched for by type and by endpoints throughout the universe of data. Thus, we see the flat file with searchable links as potentially a universal data structure.

Since the "byte" parts of a file can be

instanced anywhere, and for different purposes, this method encourages using the link mechanism to represent those parts that are variable, arbitrary, and viewpoint-dependent. For example, paragraphs and text attributes such as underlining are represented by links; thus, each included instance of specific text material can easily be underlined and paragraphed differently.

The Numbering Problem

Our system must keep track of a very large number of items: an ever-growing network of serving units (computers, also called nodes or file servers) with no center; an ever-expanding system of documents, growing unpredictably; an ever-expanding number of authors and publishers, business users, scholars, and miscellaneous accounts; and an ever-proliferating system of versions of documents, some controlled by their originators and others not.

Keeping track of all this essentially means keeping track of a lot of numbers, some of them small and some very large. These internal numbers are used for counts and pointers, and for the overall scheme of where things are and how to get to them. We could, of course, treat the growing universe of documents (or "docuverse") as a large integer domain, sparsely occupied by assigned document addresses. However, this would mean unoccupied areas using up many, many precious bits.

In designing the structure, we faced the problem of how to specify a sprawling, rapidly and unpredictably growing docuverse in a tractable form, with an indexing scheme that could possibly grow very large and still be cogent and parsimonious on the small-scale integer manipulations within individual documents.

As an inspiration, we looked to the Dewey decimal system, which, while not perfect, doesn't waste a lot of space on empty characters. It led us to the concept of forking numbers—numbers that can be continually separated to make more numbers—which we have developed in an unusual way.

The solution to our numbering problem involves two concepts. The first is the use of compound numbers called *humburs*.

Humber stands for "humongous number," which can be represented by 1 or more bytes. The very first (or *completeness*) bit signals whether the number is complete in 1 byte. If this bit is unset (equal to 0), the remaining 7 bits hold the number itself (ranging from 0 to 127), and the entire number is stored in the 1 byte (see figure 3).

continued

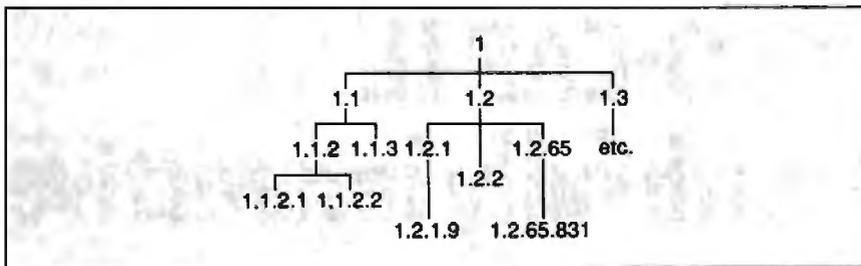


Figure 4: A small branching structure of simple tumbler.

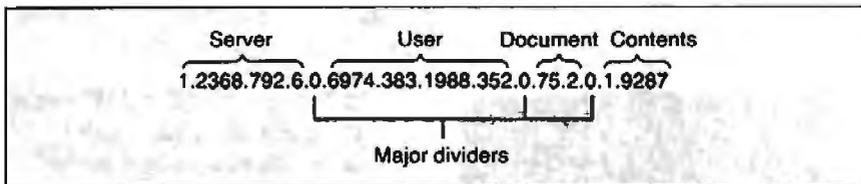


Figure 5: Xanadu address tumbler are divided into four fields: Server, User, Document, and Contents. Each field can be short or long depending on the complexity of the item being addressed, and the major divider ".0." is used to separate fields. The digit 1 in the first position of the Contents field indicates that this tumbler designates a byte; a 2 in the first position would indicate a link.

Table 1: Sample commands from Xanadu's FEBE protocol, in simplified form.

DELETEVSPAN (<i>doc, span</i>)	Deletes the span.
MAKELINK (<i>doc, from-spanset, to-spanset, type</i>)	Makes a link from one document to another.
FINDNUMFOFLINKSTOTHREE (<i>home-set, from-set, to-set, type</i>)	Returns the number of links of the specified type residing in the home-set between the specified sets.
FINDLINKSFROMTOTHREE (<i>home-set, from-set, to-set, type set</i>)	Finds all the links of the specified types connecting any bytes of specified sets, provided that those links reside in the home-set.
FINDDOCSCONTAINING (<i>spans</i>)	Returns a list of all documents containing any of the material specified by the span addresses.

Price Break!
PCDOS \$295. Source Code \$295.

WINDOWS FOR DATA®

MULTI-LEVEL MENU SYSTEM

NESTED POP-UP FORMS

SCROLLABLE REGION

CHOICE LIST

CLOCK

POP-UP WINDOW

RUNNING TOTALS

MESSAGE WINDOW

Cursor keys scroll, ENTER selects and ESC exits choice menu

No.	PRODUCT	DESCRIPTION	QUANTITY	PRICE	AMOUNT
1	0001	Windows for Data - All	1	1000.00	1000.00
2	0002	Windows for Data - Lattice	1	1000.00	1000.00
3	0003	Windows for Data - Microsoft	1	1000.00	1000.00
4	0004	Windows for Data - Turbo C	1	1000.00	1000.00
5	0005	Windows for Data - C	1	1000.00	1000.00
			Subtotal:	5000.00	
			Shipping:	0.00	
			TOTAL:	5000.00	
			Payment:	0.00	

Uncommon Screens

If you program in C, take a few moments to learn how Windows for Data can help you build a state-of-the-art user interface.

- ✓ Create and manage menus, data-entry forms, context-sensitive help, and text displays—all within windows.
- ✓ Provide a common user interface for programs that must run on different machines and operating systems.
- ✓ Build a better front end for any DBMS that has a C-language interface (most popular ones do).



FROM END TO BEGINNING

Windows for Data begins where other screen packages end, with special features like nested pop-up forms and menus, field entry from lists of choices, scrollable regions for the entry of variable numbers of line items, and an exclusive built-in debugging system.

NO WALLS

If you've been frustrated by the limitations of other screen utilities, don't be discouraged. You won't run into walls with Windows for Data. Our customers repeatedly tell us how they've used our system in ways we never imagined—but which we anticipated by designing Windows for Data for unprecedented adaptability. You will be amazed at what you can do with Windows for Data.

YOU ARE ALWAYS IN CHARGE

Control functions that you write and attach to fields and/or keys can read, compare, validate, and change the data values in all fields of the form. Upon entry or exit from any field, control functions can call up subsidiary forms and menus, change the active field, exit or abort the form, perform almost any task you can imagine.



OUR WINDOWS WILL OPEN DOORS

Our windows will open doors to new markets for your software. High-performance, source-code-compatible versions of Windows for Data are available for **PCDOS (OS/2 soon)**, **XENIX**, **UNIX**, and **VMS**. PCDOS versions are fully compatible with Microsoft Windows, Top-View, and DESQview. **No royalties.**

You owe it to yourself to try Windows for Data. If not satisfied, return for a full refund. To order, or for a **FREE DEMO**, call **(802) 848-7731 x 51**.

Telex: 510-601-4160 VCISOFT FAX 802-848-3502



Vermont Creative Software

21 Elm Ave., Richford, VT 05476

JANUARY 1988 • BYTE 229

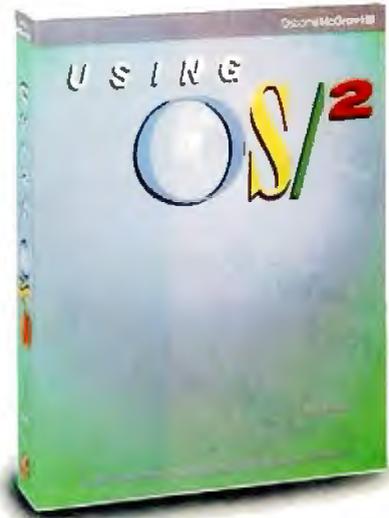
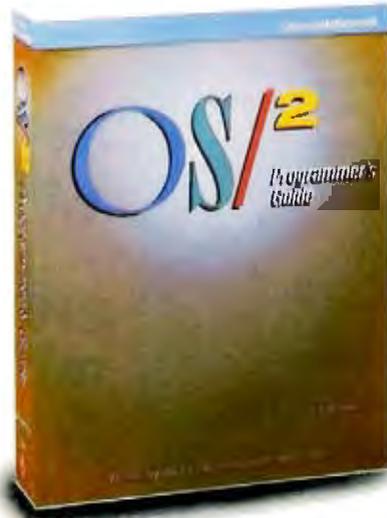
New From Osborne/McGraw-Hill

The OS/2™ Books by The OS/2™ Experts

According to Bill Gates "Ed Iacobucci was a key architect . . .

and made very important contributions. Ed is one of the few individuals who can explain the foundation that OS/2 will provide for the industry. . . what you will read here represents the real ideas behind the operating system and what can be done with it."

From the Foreword of
OS/2™ Programmer's Guide



OS/2™ Programmer's Guide

by Ed Iacobucci,
Leader of the IBM® OS/2 Design Team

Foreword by Bill Gates

Here are the techniques and insights on OS/2 version 1.0 that serious programmers need. Learn how and why the system works. Iacobucci discusses

- Dynamic linking and the system API
- Memory management in a protected environment
- OS/2 multi-tasking
- Advanced inter-process communications facilities
- The system I/O capabilities
- Session management, user interface, utilities, and more.

\$24.95, ISBN: 0-07-881300-X, 650 pages

Using OS/2™

by Kris Jamsa,
Author of the Bestseller
DOS: The Complete Reference

You'll get up to speed on OS/2 with Jamsa's expertise. This quick-paced guide covers fundamental to advanced concepts, illustrated with numerous examples and screen displays. You'll find details on

- Redirection of I/O
- System configuration
- Multi-tasking
- Similarities between DOS and OS/2
- A *complete* command reference with syntax charts that are unavailable elsewhere
- Tips for system configuration with analyses of configuration file entries

\$19.95, ISBN: 0-07-881306-9, 600 pages

Available at Fine Book Stores and Computer Stores Everywhere

Or Call Our Toll-Free Number **800-227-0900 (Outside California) 800-772-2531 (Inside California)**
(Use Your Visa or MasterCard)

Available in Canada through Village & Hyattsville, Ltd. Phone 254-07-1151



Osborne/McGraw-Hill
2600 Tenth Street
Berkeley, California 94710

Circle 196 on Reader Service Card

A completeness bit that is set (equal to 1) means that the remaining 7 bits of the first byte specify the length, in bytes, of the number. The largest 7-bit number (1111111) equals 127 (decimal), so the bytes that follow the first byte can carry a binary number up to 1016 bits (127×8) long, a number greater than 10^{300} , and larger than we will need very soon.

In this scheme, numbers occupy no more space than they need; they are short most of the time (when needed for small incrementation) and stretch out whenever needed, without any change in the generalized manipulation routines. There is little space overhead: the completeness bit, the first byte (if over 128), and no more than 7 bits in the length of the mantissa, if over 128.

Numbers are digits represented in the main addressing scheme of our system, which we call *tumblers*—a name chosen because the action of our system resembles that of the rotary mechanisms of a lock, which slide and increment independently with respect to each other.

Anatomy of a Tumbler

A tumbler consists of a series of integers, called "digits," that have no upper limit. The digits of the tumbler are separated by minor dividers, or points. Thus,

.373.
.675923.
.40.

are examples of tumbler digits.

One digit can become several by a forking or branching process. For instance, the digit

.2.

can branch into several more items, each of which is a successive daughter item placed "under" the digit:

.2.1.
.2.2.
.2.3.
.2.4.

Similarly, the sixth item under ".2.4." is

.2.4.6.,

and the 312th item under that is

.2.4.6.312.

The use of such numbers imposes a tree structure upon the address space of the system (although not upon material contained in the system). Figure 4 shows a small branching structure of simple tumblers.

The tumbler space is an accordion-like master address space, potentially very large, that provides for the notation of the complex relations between documents, their ancestors and progeny, their owners, their home locations on the network, and the expansion of the network itself.

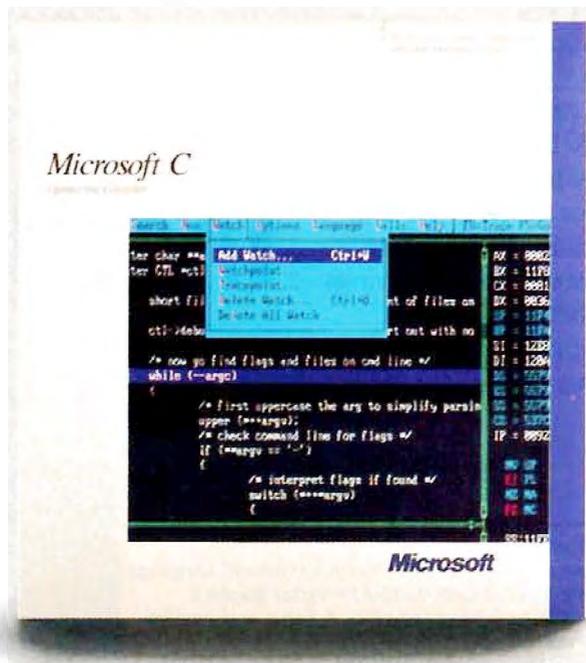
We have developed these basic mathematical ideas into the Xanadu system as follows: The digits in a tumbler are divided into fields, which are separated by the major divider ".0.", a kind of punctuation between the fields that also has certain useful mathematical properties.

As set up for the Xanadu system, the four major fields of tumblers are expandable indefinitely, with three major dividers between them. These fields are called Server, User, Document, and Contents. Tumblers may be shorter or longer depending on the complexity of the item being addressed, as shown in figure 5.

The Server is the node on which a document is stored, either a single physical device or a logical division that may be mapped to subdevices or collections of

continued

C5.0 has three features professional programmers can't live without.



GOOD

Wait no more. Because with the Acer LP-75, you get a laser printer that meets and even surpasses the standards set by the industry leaders.

Consider the LP-75's memory - 1.5 MB standard. Which means you print an A4 page of high resolution type, halftones and sophisticated graphics. All in one feed.

Fully emulating the HP LaserJet family, the Acer LP-75 takes all of the best selling software packages available. Among them, AutoCAD, Ventura and Page-Maker, along with countless other applications from over 500 software houses.

The extras - at no extra cost

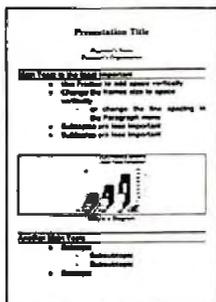
Unlike other laser printers the Acer LP-75 is also standard equipped with vector graphics capability for CAD, CAM and CAE applications which lets you preview complex drawings or schematics.

Font support includes nine resident fonts of popular faces

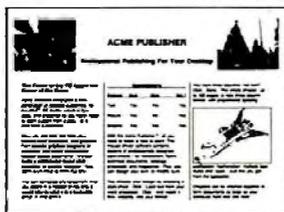
and a library of over 70 others in a choice of either cartridge or diskette.

A complete product line

At Acer Technologies our long-term commitment to research and development



With its full page of high resolution graphics, the Acer LP-75 makes complex merging of text and graphics a cinch.



has enabled us to build better, more affordable machines.

Desktop publishing hardware soon available includes an Acer Scanner, 19" high resolution

monitor and the Acer Mouse.

Software user support includes Acer Form developed as the ideal solution for professional documents and forms. And support drivers such as AutoCAD are available for professional users.

From printers to peripherals, data communication products to stand alone PCs and advanced multiuser systems, what we do best is provide complete and integrated solutions.

It's what we've been doing now for many years. And something we intend to keep on doing.

Acer. A name synonymous with quality, reliability, price performance and advanced technology. In short, value.

So check us out. Ask your nearest dealer about the Acer LP-75. And see how it can help you make a good impression in business.

IMPRESSIONS



E-001

Technical specifications

- 1.5MB RAM memory • HP LaserJet Printer Command Language compatible • Nine resident fonts standard • Vector graphics capability • 300x300 dpi full page graphics • Serial and parallel interface • 418mmx408mmx205mm(DxWxH)

HP LaserJet is a registered trademark of Hewlett Packard Corp. AutoCAD is registered trademark of Autodesk Corp. Ventura is registered trademark of Xerox Computer Services. PageMaker is registered trademark of Aldus Corp.

Acer Technologies Corporation

401 Charcot Avenue, San Jose, California 95131, USA.
Tel: 408-9220333. Fax: 408-9220176, 408-9220177.
Call toll-free (800) 7821155 (California only), (800) 5381542 for the name of the dealer nearest you.

Acer
A New Word For Value



devices in the future, all of which would branch within this first field.

The User field of the tumbler designates the owner of a document, which can also branch off within this field to indicate daughter accounts, departments, interests and projects, or areas of record-keeping.

A Document is the logical entity in which materials are stored. Within this field, subdivisions can branch off to represent different versions of the document, as shown in figure 4.

The final tumbler field specifies the individual contents and can represent either bytes or links. When this section of a tumbler address begins with a 1, the address is that of a byte. Thus

X.0.X.0.X.0.1.1

indicates the first byte of the document, and

X.0.X.0.X.0.1.9287

indicates the 9287th byte of the document.

Numbers with 1 as the first digit in the last field can, by interpretation, map sequential data other than simple bytes (e.g., a DNA sequence).

When the fourth section of a tumbler address begins with a 2, the address is that of a link. The number after the 2 indicates the number of the link. Thus,

X.0.X.0.X.0.2.352

indicates the 352nd link contained in this document.

In the future, numbers above 2 could be used in the first position of this field to indicate that the following digits are parts of nonsequential structures, such as a graphic image, a video frame, or a musical notation.

Two Types of Tumblers

Tumblers are used in two ways: They can refer to an *address* (a place tumbler, as discussed already), or to a *span* of the address space—a series of bytes and/or links, a series of documents, a tree structure in the address space, or even the entire docuverse.

A span is represented by two tumblers: an address tumbler and a *difference tumbler*. These tumblers are governed by different rules. To begin with, address tumblers are stable, referring to the same entity no matter how much additional material is added to the docuverse; they remain valid wherever you are.

A difference tumbler, on the other hand, is valid only in relationship to its tumbler address. Difference tumblers are

derived from two address tumblers in a process called *tumbler subtraction*. This involves the first object in a specified subtree (the subtrahend) and the first element *after* the specified subtree (the minuend), which is always "larger" (in the sequence of tumblers) than the subtrahend; the result is a difference tumbler representing the intended span.

The rules for tumbler subtraction are as follows: Place the subtrahend under the minuend; start at the left, and for every field that is the same in both tumblers, place a zero (maintaining the field

divider zeros as checkpoints, always in correspondence); when you encounter a difference in corresponding digits, subtract the integers in that position. (The result cannot be negative; this would mean the subtrahend was larger than the minuend, which is illegal.) All digits that follow are copied down from the top row.

For example, the span of addresses between the tumbler address

1.0.1.0.1.0.1.9287

continued

Speed.

Fast Execution Speed.

	Microsoft® C 4.0	Microsoft C 5.0
Sieve (25 iterations)	5.7	3.3
Loop	11.0	0.0*
Float	19.9	0.1
Dhrystone	22.8	19.1
Pointer	14.2	7.4

- New optimizations generate the fastest code:
 - Inline code generation. NEW!
 - Loop optimizations: NEW!
 - Loop invariant expression removal. NEW!
 - Automatic register allocation of variables. NEW!
 - Elimination of common sub expressions.
 - Improved constant folding and value propagation.
- Fine tune your programs for even greater speed:
 - Coding techniques for writing the fastest possible programs are included in the documentation. NEW!
 - Segment Allocation Control:
 - Group functions into the same segment to get faster NEAR calls. NEW!
 - Specify which segments receive variables to yield faster NEAR references. NEW!
 - Uses register variable declarations.
 - Mix memory models using NEAR, FAR & HUGE pointers.

*Time is negligible.

Microsoft C 5.0

Optimizing Compiler

CTX

THE BEST 14" MONITORS IN BOTH WORLDS



CGA

EGA

VGA [PS-2]

MULTI-SCAN/ANALOG

DUAL SCAN

GREEN/AMBER/WHITE

132 COLUMN

ALL WITH TWO-YEAR WARRANTY



U.S. HEADQUARTERS: CTX INTERNATIONAL, INC.
280 PASEO TESORO/WALNUT, CA 91789
TEL: (714) 595-6146 FAX: (714) 595-6293

EASTERN REGIONAL OFFICE

CONTINENTAL TECHNOLOGY, INC.
300 MCGAW DRIVE
EDISON, NEW JERSEY 08837
TEL: (201) 225-7377 FAX: (201) 225-6355

NEW ENGLAND AREA

MICRO-REP
141 BROOKS ST., SUITE NO. 1
BRIGHTON, MA 02135
TEL: (617) 254-1488 FAX: (617) 783-4877

FACTORY

CHUNTEX ELECTRONIC CO., LTD.
ROOM 401, NO. 50 SEC.1,
HSIN-SHENG S. RD.,
TAIPEI, TAIWAN, R.O.C.
TEL: (02) 3921171 FAX: (02) 3918780

and the earlier tumbler address

1.0.1.0.1.0.1.7156

is represented by the earlier address and the difference tumbler

0.0.0.0.0.0.0.2131.

This is the simplest kind of tumbler subtraction, in which the tumbler addresses have the same Server, User, and Document fields.

A more complex example of tumbler subtraction, in which a span covers two different users, would be:

1.0.234.0.45.0.1.334

1.0.112.0.17.0.1.977

0.0.122.0.45.0.1.334

It may help to think of tumbler subtraction as something like "step backward one chapter, three paragraphs, and two lines."

Tumbler addition involves the first element in a specified subtree (the augend) and a difference tumbler (the addend) representing the span; the result will represent the first element after the specified subtree.

The mechanics of tumbler addition are as follows: For every leading zero in the second row, the corresponding integer is copied down from the first row. When a nonzero digit is encountered in the second row, an addition between the two rows is performed for that field. All additional fields are copied down from the second row, as shown in the following examples:

1.0.1.0.1.0.1.7156 (first tumbler in tree)

0.0.0.0.0.0.0.2131 (difference tumbler)

1.0.1.0.1.0.1.9287 (first tumbler after end of tree)

1.0.112.0.17.0.1.977 (first tumbler in tree)

0.0.122.0.45.0.1.334 (difference tumbler)

1.0.234.0.45.0.1.334 (first tumbler after end of tree)

Let me stress that tumbler arithmetic as presented here has been contrived, like many other mathematical activities we need, rather than discovered.

Span addresses are necessary to specify what links point to and from, and to specify the domains to be searched for documents and links in the various user

requests to the system. Subtraction is the process needed to specify the spans, and addition is its inverse. This system has some interesting and helpful features. For example, it lets you refer to the entire docuverse simply by using a span whose difference tumbler has a 1 in the very first position.

A Matter of Protocols

Now that we have a scheme for referring to documents and the links between them, I'll explain how the system will handle these pieces. Xanadu has two

main sets of protocols, which dictate how the system behaves: FEBE (front end to back end) and BEBE (back end to back end).

All requests to the Xanadu system are made by applications programs through the FEBE protocol, which manipulates the addresses (and spans of addresses) necessary to find text and links and to follow them. The FEBE protocol also includes instructions for insertion in a document, deletion from a document, and rearrangements of unlimited size.

continued

Speed.

Fast Compilation. Fast Prototyping.

Microsoft C Version 5.0 includes QuickC™ which lets you edit, compile, debug, and execute in an integrated environment. It's ideal for prototyping.

- In-memory compilation at 10,000 lines/minute. NEW!
- Built-in editor with parentheses, bracket and brace matching.
- Use the integrated debugger to animate through your program, add watch variables and set dynamic breakpoints. NEW!
- MAKE file is automatically generated for you. Simply indicate the modules you want to use, then MAKE recompiles and links only those modules that have changed. NEW!
- Full C 5.0 compatibility:
 - Completely source and object code compatible.
 - Emits CodeView®-supported executables.
 - Identical compile/link command line switches.

Microsoft C 5.0

Optimizing Compiler

The Big Bang Theory.



In the beginning, there was power. When Wyse engineers set out to create a new PC family, criterion one was power with total compatibility: higher performance for industry standard software. Today's *and* tomorrow's.

The results are four uniquely upgradeable Modular Systems Architecture™ Wyse PCs that make up the most powerful PC family in the business.

At the top, the new WYSEpc 386 has one of the highest benchmark ratings yet for a personal computer. Our unique design achieves exceptional memory speed as well as processing speed for zero wait state performance on multiple operating systems. Such as MS-DOS®, OS/2™, and Xenix®. It delivers power to satisfy the insatiable.

And it's *only* the beginning. Our 8 MHz AT

WYSEpc 386 driving our VGA color monitor. Actual screen image.

compatible, 12.5 MHz professional desktop 286, and 12.5 MHz zero wait state 286 provide more power for every level of user.

Introducing SystemWyse™. Our PCs form the core of a comprehensive system for creating solutions. They link effortlessly with our terminals, monitors, and expansion modules in solutions of exceptional quality and value. And SystemWyse is backed by the company that makes more terminals than anyone but IBM.

SystemWyse. It's a power structure you can build on. **1-800-GET-WYSE**

WYSE

We make it better, or we just don't make it.

Circle 298 on Reader Service Card

Wyse® is a registered trademark of Wyse Technology. SystemWyse, WYSEpc 386, and Modular Systems Architecture are trademarks of Wyse Technology. Other trademarks/owners: MS-DOS, Xenix/Microsoft; OS/2, AT, IBM/International Business Machines.

Table 1 contains samples of FEBE commands. Note that these commands are not seen by the user but handled invisibly by programs in the user's front-end machine. Some of the commands as presently defined will return avalanches of material. Further refinement of the protocol will specify handshaking methods for controlling this.

The BEBE protocol, which is still undergoing definition, will connect nodes of the Xanadu network so as to meld the contents of separate Xanadu servers into a single unified space, where different nodes contain maps of the whole docuverse with varying degrees of detail.

Application Design

The interior design of applications for use with the Xanadu storage engine is very different from conventional application design, since so much is handled by the storage mechanism. All references to links and stored materials go through the FEBE protocol (even if the entire Xanadu module is bound into the program), and the programmer's design work becomes, to a large extent, the user interface.

Note that the application designer is no longer constrained by old categories of programs, since the Xanadu data structure provides a broad-spectrum representation method for word processing, databases, CAD/CAM, molecular modeling, seismographic data, bit-mapped graphics, image synthesis, and other functions, which can be combined in new ways. Software designers have not merely a license, but a mandate, to start from scratch, since (regrettably) no existing programs will work with our model of storage. But we believe that applications as presently implemented—balkanized, irreparably divided in function, and carved into zones of partial compatibility—have reached the limit of common sense and tolerability.

As when any higher-level function migrates to system software and language facilities, some programmers may feel that part of their creativity has been taken away. On the contrary, we believe that our system frees programmers for the truly creative work of designing interaction, visualization, and conceptual structure. Applications programmers are usually so busy with the impediments of storage and data-structure maintenance that they tend to sleight the more important subtleties of interaction and what I call "virtuality"—the conceptual structure and feel of a system. Now they can concentrate fully on these issues.

Implementation

The Xanadu storage engine described above presently exists in full prototype,

available via phone line for experimentation by serious developers. Its software mechanisms are proprietary and are presently covered by trade secret; we hope to publish them at a future date.

The present architecture is chiefly the work of Mark S. Miller and Roger Gregory, with myself, Stuart Greene, Eric Hill, and Roland King. The program is written in C under Unix. In the current version (August 1987), it compiles to about 135K bytes on the 68000 microprocessor. A local search space of 10 megabytes is desirable, though we expect that

to be reducible for personal and office applications. The resident protocol manager (required by applications programs) compiles to about 35K bytes.

[Editor's note: *The C source code for the Xanadu protocol handler for applications programs is available on BIX, on BYTEnet, on disk, and in the Quarterly Listings Supplement as the file XANADU.PRO. See "Program Listings" in the table of contents. To use the module, you will need a C compiler for the IBM PC, the Macintosh, or the Amiga. Serious ap-*

continued

And speed.

Fast Debugging.

Microsoft C Version 5.0 includes Microsoft CodeView, our source-level windowing debugger that lets you debug more quickly and thoroughly than ever before.

- Debug larger programs:
 - Debug through overlays created by the Microsoft overlay linker. NEW!
 - Expanded Memory Specification (EMS) support. NEW!
- Fast debugging through precise control of your program execution:
 - Access source level and symbolic debug information from your Microsoft C, FORTRAN, and Macro Assembler programs. NEW!
 - View your source code and assembly simultaneously.
 - Watch the value of variables change as you execute.
 - Set conditional breakpoints.
 - Animate or single step through your program.
- CodeView brings you as close as you've ever been to your hardware:
 - Swap between your code and output screens.
 - Watch your registers and flags change as your program executes.

All benchmarks run on an IBM® Personal System/2.*

MICROSOFT

For your free C 5.0 information packet, call:

(800) 426-9400.

In Washington State and Alaska, (206) 882-8088. In Canada (416) 673-7638. Microsoft, the Microsoft logo and CodeView are registered trademarks and QuickC is a trademark of Microsoft Corporation. IBM is a registered trademark and Personal System/2 is a trademark of International Business Machines Corporation.

**NOW
SHIPPING**

lications developers who have a program incorporating this module and wish to experiment with the Xanadu system can contact Roger Gregory at (408) 244-2643.]

We have dealt with a large-scale problem where clean design is vital—both inner simplicity and a clean interface to the outside world. We believe we have achieved this.

Our analysis indicates that as the number of documents and links grows, degradation of the performance of the system will, at best, be log-like and at worst, square root-like: a rate of deterioration that is greater at first, then leveling off. For instance, each time the number of links doubles, there should be only a slight degradation of performance.

Unfortunately, this analysis doesn't give us base rates to judge what performance we'll get on presently available machines, and we await these empirical figures with great interest.

The present design calls for the use of sequential computers. However, given our long-term goals and today's new hardware, we expect to introduce various types of parallelism to improve performance and make the system practical on the scale we intend.

Universal Hypertext Publishing

The grand ambition of the Xanadu system is not "a database the size of the world," but rather a repository publishing network for anybody's documents and contents, which users may combine and link to freely.

This will permit a new form of electronic publishing, entirely within the tradition of paper publishing but greatly streamlined: One need not ask permission to republish something, but simply place it in a document as an inclusion. The bytes will not be physically copied, but only included by reference.

Nothing will ever be misquoted or out of context, since the user can inquire as to the origins and native form of any quotation or other inclusion. Royalties will be automatically paid by a user whenever he or she draws out a byte from a published document. The permission procedures of conventional publishing are bypassed, with complete fairness to all parties. Blanket permission for inclusion and linkage must be granted contractually by a user when depositing a document for publication. Legal accountability for both links and text will be the responsibility of their owners. Private documents can be stored under the same system, but with

slightly different rules: A private document can include or link to published documents, but not vice versa.

Today's conventional databases will not satisfy the information needs of the noncomputing public, nor can they provide methods for publishing the ever-more-interconnected writings now being placed on electronic networks. It is our hope to bring the power of electronic access to the new and sweeping literary medium of hypertext, in all the forms that the mind can devise. ■

REFERENCES

1. Nelson, Theodor H. "A File Structure for the Complex, the Changing, and the Indeterminate." Proceedings of the 1965 ACM National Conference.
2. Nelson, Theodor H. "Replacing the Printed Word: A Complete Literary System." Proceedings of the 1980 IFIP World Computer Conference.
3. Nelson, Theodor H. *Literary Machines*. Project Xanadu, 1987.

BIBLIOGRAPHY

- Drexler, Eric. *Engines of Creation*. New York: Anchor/Doubleday, 1986.
- Rheingold, Howard. *Tools for Thought*. New York: Simon and Schuster, 1985.



WHOLE EARTH ELECTRONICS



WHOLE EARTH XT Turbo

Complete 20 MB System
Complete plug-in-and-use system

The Confident Compatible. Superb workmanship. Assembled in our Berkeley California plant and lab tested to ensure quality and compatibility! Each computer gets a 48-hour burn-in.

Other Great Prices

80286, complete, 10Mhz.....**979.**
 80286, complete, 10Mhz
 20MB HD.....**1395.**
 80286, complete, 10Mhz
 30MB HD.....**1495.**
 80286, complete, 10Mhz
 40MB HD.....**1595.**
 80386, base system, 16Mhz.....**1995.**
 80386, complete, 16Mhz,
 40MB HD.....**2895.**
 Cards.....**Lowest**
 Drives.....**Lowest**
 Plus Hardcard 20.....**559.**
 Everex 1200b modem.....**89.**
 Hayes compat. 2400b modem.....**179.**
 Everex 2400b external.....**209.**
 Star NP10.....**149.**
 NEC Multisync.....**529.**

849.

Free Freight

Features Include:

- Dual clock speed/keyboard switchable 4.77Mhz and 10Mhz • 640K RAM • 150 watt power supply • Eight expansion slots • Runs all MS-DOS programs • BRAND NEW (not refurbished) famous make 20MB hard drive and controller card • 360K famous make floppy drive • AT style 85 key keyboard w/LED status indicators • Monographics (Hercules compatible) card w/printer port • High resolution TTL amber screen monitor • System assembled and tested • FULL ONE YEAR LIMITED WARRANTY • 30-Day return for refund policy • FCC Class B approved

FOR MORE INFORMATION AND ORDERS CALL TOLL FREE:

1-800-323-8080

For CA calls or customer support: **415-653-7758**

WHOLE EARTH ELECTRONICS • 2990 7th Street • Berkeley, California 94710

Call for freight and COD information Errors subject to correction

All returned items must be in their original condition, with all manuals, warranty cards and packaging intact. Returned items must bear a Whole Earth Electronics Return Merchandise Authorization on the shipping label to receive a full credit, and must be shipped prepaid and insured. Please call Whole Earth Electronics for more information. **ABOUT OUR WARRANTY:** Whole Earth Electronics will repair or replace, at its option, any defective products or parts at no additional charge, provided that the customer returns the product, shipping prepaid, to Whole Earth Access.

THE NORTON UTILITIES

DATA RECOVERY
DISK MANAGEMENT

For the complete IBM PC family and compatibles

4.0

- "Don't compute without it." — New York Times. ■ "Highly recommended for business users." — Time-Life Access Newsletter.
- "Indispensable." — PC Magazine. ■ "Essential in day-to-day personal computing." — Personal Computing Magazine. ■ Three years voted "World Class" Best Utilities. — PC World. ■ "A pleasure to use." — PC Week.
- "You'll bless this disk." — Peter McWilliams/ The Personal Computer Book.



A life saver for your data.

THE NORTON UTILITIES



A life saver for your data.

ADVANCED EDITION

DATA RECOVERY
DISK MANAGEMENT

For the complete IBM PC family and compatibles

- All the features of the "Indispensable" Norton Utilities — the world's best-selling disk management package. ■ Loaded with significant new technical enhancements. ■ Includes a powerful new version of the remarkable *UnErase*™ data recovery feature. ■ A must for everyone who demands the most from their PCs.

Now it's not so lonely at the top.

At last.

After five long years alone at the top of the best-seller lists, the Norton Utilities™ is being challenged by another software package.

Which is no small feat, considering that Version 4.0 is selling even faster than its predecessors did.

Unfair competition.

Of course, in order to compete with the Utilities, this upstart new package first had to copy it.

It had to include the famous *UnErase*™ which has rescued the derrières of thousands of grateful PC users.

As well as the unique *File Info*, which lets you attach descriptions of up to 65 characters

to your files.

Not to mention the *Norton Integrator*, which lets you control everything from a single program and gives you on-line help for each function.

In fact, The Advanced Edition of the Norton Utilities includes every single one of the features, functions and enhancements that have made Version 4.0 so popular.

Right down to the user interface which, according to the *InfoWorld* Review Board makes the Advanced Edition "as easy to use as possible."

And that's not all.

The more the merrier. Because the Advanced Edition goes on to include a wish list

of brand new technical features and functions.

Like *Speed Disk*, for tightening up disk space and optimizing access.

And *Format Recover*, for unformatting your accidentally reformatted hard disk.

As well as a FAT Editor, a Partition Table Editor, a Directory Editor and access to absolute disk sectors.

All of which explains why *InfoWorld* called the Advanced Edition "a great program that has gotten even better."

We just call it good company.

Peter Norton
COMPUTING

Designed for the IBM® PC, PC-AT and DOS compatibles. Available at most software dealers, or direct from Peter Norton Computing, Inc., 2210 Wilshire Blvd. #186, Santa Monica, CA 90403. To order: 800-451-0303 Ext. 40 (VISA and MasterCard welcome). MCI Mail: PNCL. Fax 213-453-6398. © 1987 Peter Norton Computing.



Horowitz In Moscow The historic return! Music by Scarlatti, Mozart, Rachmaninov, Liszt, Chopin, Scriabin, Schumann, others. DG DIGITAL 125264

Handel, Water Music The English Concert/Pinnock. "Quite the best performance...now on the market."—*Gramophone* Archiv DIGITAL 115306

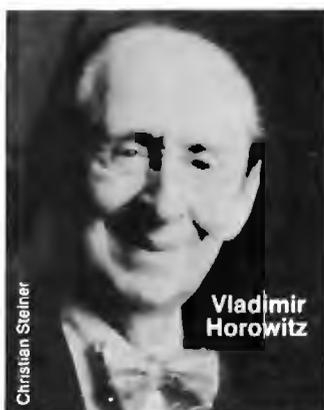
Holst, The Planets Montreal Symphony Orchestra/Dutoit. "[A] stunning performance...The best available on both LP and CD."—*Gramophone* London DIGITAL 115448

Andrew Lloyd Webber, Variations; more Julian Lloyd Webber, cello. London Philharmonic Orchestra/Maazel Philips DIGITAL 115473

Dvořák, Symphony No. 9 (New World) Chicago Symphony Orchestra/Solti. "The playing is superlatively good."—*Gramophone* London DIGITAL 115168



Sir Georg Solti



Christian Steiner

Vladimir Horowitz

Handel, Messiah (Highlights) Musica Sacra/Westenburg. *Hallelujah Chorus, I Know That My Redeemer Liveth*, more. RCA DIGITAL 153586

James Galway & The Chieftains: In Ireland *Danny Boy; When You And I Were Young, Maggie; Down By The Sally Gardens*; more. RCA DIGITAL 124344

Ravel, Daphnis et Chloé (Complete) Montreal Symphony/Dutoit. "An absolute dream performance."—*Stereo Review* London DIGITAL 115520



Mozart, Clarinet & Oboe Concertos Pay, basset clarinet; Piguet, oboe. Academy of Ancient Music/Hogwood. *L'Oiseau-Lyre* DIGITAL 115523

Brahms, Cello Sonatas Yo-Yo Ma, cello; Emanuel Ax, piano. "Distinguished...handsomely recorded."—*Stereo Review* RCA DIGITAL 154044

Richard Stoltzman: Begin Sweet World Title song, *Amazing Grace, Clouds, Abide With Me/Blue Monk*, more. RCA DIGITAL 150414

Mozart, Requiem Leipzig Radio Choir; Dresden State Orchestra/Schreier. "Exceptionally satisfying."—*High Fidelity* Philips DIGITAL 115039

Rimsky-Korsakov, Scheherazade Vienna Philharmonic/Previn. "A fresh and spacious reading."—*Gramophone* Philips DIGITAL 115415

Pops In Love The Boston Pops/Williams. *Clair de lune, Gymnopédies* Nos. 1 & 2, *Albinoni Adagio, Fantasia On Greensleeves, Pachelbel Canon*, more. Philips DIGITAL 125230

Galway & Yamashita: Italian Serenade Flute & guitar works by Paganini, Cimarosa, Giuliani, Rossini & Bazzini. RCA DIGITAL 173824

Horowitz In London Recorded live! Schumann, *Kinder-scenen; Chopin, Polonaise-Fantaisie & Ballade No. 1*; more. RCA DIGITAL 162507

Mozart, The Piano Quartets Beaux Arts Trio; Bruno Giuranna, viola. "Absolutely indispensable."—*Stereo Review* Philips DIGITAL 115271

Wagner, Orchestral Highlights From The Ring Vienna Philharmonic/Solti. *Ride Of The Valkyries*, more. London DIGITAL 115426

The Canadian Brass: High, Bright, Light & Clear Air On The G String, *Masterpiece Theatre Theme*, others. RCA DIGITAL 144529

Pops In Space John Williams leads The Boston Pops in music from *Star Wars, Close Encounters, Superman*, more. Philips DIGITAL 105392

Pachelbel, Canon in D Also includes other works by Pachelbel & Fasch. Maurice André, trumpet; Pailard Chamber Orchestra. RCA 133877

Gershwin, Rhapsody In Blue; An American In Paris; Concerto Pittsburgh Symphony/Previn (pianist & conductor). Philips DIGITAL 115437

Vivaldi, The Four Seasons The English Concert/Pinnock. "The finest recording of [it] I've heard."—*High Fidelity* Archiv DIGITAL 115356

Sousa, Stars & Stripes Forever Philip Jones Ensemble. Plus *Semper Fidelis*, *Washington Post*, more. London DIGITAL 115051



James Galway

Michael Feinstein: Remember Irving Berlin standards include title song, *Alexander's Ragtime Band, Puttin' On The Ritz*, more. Elektra 153947

Tchaikovsky, Symphony No. 6 (Pathétique) Chicago Symphony Orchestra/Levine. "A sound that dazzles and sings."—*Milwaukee Journal* RCA DIGITAL 153939

Teresa Stratas Sings Kurt Weill *Havana-Lied, Foolish Heart, Lonely House, Surebaya-Johnny, One Life To Live*, more. Nonesuch 124748

Rudolf Serkin: Mozart, Piano Concertos Nos. 12 & 20 "He makes every phrase glow with life."—*Stereo Review* DG DIGITAL 115062

Rossini, Overtures Orpheus Chamber Orchestra. *The Barber Of Seville, The Turk In Italy, Tancredi*, 5 others. DG DIGITAL 115527

Gregorian Chant Schola of the Hofburgkapelle, Vienna. 10 Propers from *Graduale Romanum*; more. Philips DIGITAL 115434

Alicia de Larrocha: Falla, Nights In The Gardens Of Spain Plus rhapsodies by Albéniz & Turina. London DIGITAL 115410

Tomita: The Mind Of The Universe (Live At Linz, 1984) *Ode To Joy*, Also *Sprach Zarathustra* (opening), more. RCA 173829

The International Preview Society

**3 COMPACT DISCS,
RECORDS OR
CASSETTES \$1.00**
for just

plus shipping
and handling with
Club membership

with No Obligation to Buy Anything...Ever!

Fiddler On The Roof Zero Mostel & original cast. *Matchmaker Matchmaker, Sunrise Sunset, If I Were A Rich Man*, more. RCA 100051

Mozart, Posthorn Serenade; 2 Marches Academy of St. Martin-in-the-Fields/Marriner. "Gracious, warm musicmaking."—*The New York Times* Phillips DIGITAL 115151

Pavarotti: Anniversary *Che gelida manina, E lucevan le stelle, Vesti la giubba, Cielo e mar, Addio alla madre*, 11 more. London 115344

Bach, Goldberg Variations Trevor Pinnock, harpsichord. "This is a definitive performance."—*Stereo Review* Archiv 105318

Kathleen Battle: Salzburg Recital With James Levine, piano. Purcell, Mozart, Strauss, Handel, Fauré, & more. DG DIGITAL 115292

Mendelssohn, A Midsummer Night's Dream Ambrosian Singers, Philharmonia Orchestra/Marriner. Phillips DIGITAL 115546

Artur Rubinstein: Chopin, 14 Waltzes "[His] playing is relaxed, assured, and wonderfully controlled."—*American Record Guide* RCA 101987

Kiri te Kanawa: Blue Skies With Nelson Riddle: Title song, *Speak Low, How High The Moon, So In Love*, 8 more. London DIGITAL 115035



Luciano Pavarotti

Strike Up The Band—The Canadian Brass Plays George Gershwin Title song, *The Man I Love, Porgy & Bess Suite, 3 Preludes*, more. RCA DIGITAL 160640

The King And I Yul Brynner, Constance Towers & revival cast. *Getting To Know You, Hello Young Lovers, Shall We Dance*, more. RCA 123742

Tchaikovsky, Symphony No. 4 Chicago Symphony Orchestra/Solti. "Eminently successful: powerful, fluent and virtuosic."—*Ovation* London DIGITAL 125038

Mozart, Symphonies Nos. 40 & 41 (Jupiter) James Levine conducts the Chicago Symphony Orchestra. RCA DIGITAL 104810

Beethoven, Symphony No. 3 in E-Flat (Eroica) Academy of Ancient Music/Hogwood. L'Oiseau-Lyre DIGITAL 115535

Rubinstein Plays Rachmaninoff Piano Concerto No. 2 & Rhapsody On A Theme Of Paganini. RCA 170232

Debussy, La Mer; Nocturnes Boston Symphony Orchestra/Davis. "The BSO is in tip-top form throughout."—*Ovation* Philips DIGITAL 115068

Bach, Organ Works Daniel Chorzempa plays the Toccata & Fugue in D Minor; the Prelude, Largo & Fugue in C; more. Philips DIGITAL 115193

Plácido Domingo Sings Tangos *Mi Buenos Aires Querido, Alma de Bohemio, Nostalgias, El Dia Que Me Quieras*, 6 more. DG 105302

Kiri te Kanawa: Ave Maria *Jesu, Joy Of Man's Desiring; Let The Bright Seraphim; O Divine Redeemer*, more. Philips DIGITAL 115213

Perlman: Mozart, Violin Concertos Nos. 3 & 5 Vienna Philharmonic/Levine. "Radiantly sumptuous."—*High Fidelity* DG DIGITAL 115146

Barry Douglas: Tchaikovsky, Piano Concerto No. 1 London Symphony Orchestra/Slatkin. *Ovation's* Debut Recording Artist Of The Year! RCA DIGITAL 164293

Values up to \$47.94

This remarkable \$1 offer is being made to introduce you to an outstanding classical music membership—with never any obligation to buy.

You'll find hundreds of outstanding albums in each issue of the Society's magazine, which will be sent to you every 4 weeks. You will also receive 6 special sale issues, giving you 19 opportunities a year to shop for fine music at home. But there is no obligation to accept any offering at any time.

You choose only the music you want!

If you'd like to accept the Main Selection, you need not do a thing. It will be sent automatically. If you'd prefer an alternate selection or none at all, just mail back the Notification Card by the specified date. You'll always have at least 10 days to decide.

Substantial savings with our half-price bonus plan.

For every regular purchase you do make, you may choose a bonus album for only half of the members' club price! A shipping/handling charge is added to each shipment.

3 Compact discs or records or cassettes for just \$1!

Begin your membership now by choosing any 3 albums shown here for just \$1 plus shipping and handling. Send no money now. We want you to judge for yourself before you decide to buy. If not delighted, return your 3 albums at the end of 10 days without obligation.

The International Preview Society

P.O. Box 91406 • Indianapolis, IN 46291

YES! Please accept my membership in The International Preview Society and send me, for 10 days' FREE examination, the 3 albums I have indicated below. I may return them after 10 days and owe nothing, or keep them and pay only \$1 plus shipping & handling.

Please send all selections on: Compact Disc Cassette Record

Write Selection Numbers Here:

--	--	--

Mr. Mrs. Miss First Name Initial Last Name (PLEASE PRINT)

Address _____ Apt. _____

City _____ State _____ Zip _____

Telephone (____ Area Code) _____

NOTE: Members who select compact discs will be serviced by the Compact Disc Club. Full membership details will follow with the same 10-day, no-obligation, no-minimum purchase privilege.

Limited to new members, continental USA only; one membership per family. We reserve the right to request additional information or reject any application. Local taxes, if any, will be added.

XAT86 (BF)

PXC (PJ)

Run PC Software on the PS/2

**CMS Transporter™
5¼" Floppy Disk
Subsystem**



**Call today for the name and number
of your nearest CMS dealer.**



CMS Enhancements, Inc.
1372 Valencia Avenue, Tustin, CA 92680 (714) 259-9555
Telex (023) 371-8711 FAX (714) 549-4004

®CMS is a registered trademark of CMS Enhancements, Inc.
IBM is a registered trademark of International Business Machine Corporation
Transporter is a trademark of CMS Enhancements, Inc.

Circle 47 on Reader Service Card (DEALERS: 48)

Fast Data Access

As personal computers accommodate larger and larger databases, we'll need new methods of "query optimization" to get at the data quickly

Jonathan Robie

THE HARDWARE FOR handling very large data sets on personal computers is here: 20-megabyte and 40-megabyte hard disk drives are commodity items. IBM has decided to port DB2, its mainframe relational DBMS, to the OS/2 operating system, and has announced that a 314-megabyte hard disk drive will be available for the PS/2 Model 80.

However, these large data sets require careful handling. Accessing the data in the wrong way can bog down the computer for hours or even days. You can't get quick responses if your query requires a 30-megabyte table to be sorted or if it compares every item in three 5-megabyte tables.

Mainframe and minicomputer users, who have dealt with large databases for years, have come up with two basic solutions. The first is to use hierarchical or network database managers that use pointers to set up paths for accessing data. These systems are called navigational databases because the user must "navigate" a series of pointers, telling the database manager precisely how to find the desired information. They are very efficient in the hands of an expert, but they are much harder to use than relational database managers.

The second solution is to use a query optimizer to find an efficient way of answering the user's question, making use of indexes, hashing, and other aspects of the database's organization. The user does not tell the database manager how to access the information and never sees the access plan that is used.

Query optimizers for relational data-

bases are the focus of this article. I will explain why they are necessary, cite general principles for query optimization, and show how a query optimizer generates an access plan for a simple query.

The Need for Query Optimization

Query optimizers are found on nonprocedural relational database managers (see the text box "Database Terminology" on page 244). The user's queries specify what information is wanted but not how the database manager should go about finding that information.

The query optimizer chooses an efficient access plan for the query using information about the structure of the database. If the optimizer makes the right choices, a relational database can be extremely efficient, but wrong choices can make it unbearably slow.

Almost all relational systems with query optimization use SQL (pronounced "sequel") or Quel as a query language. Of the two, SQL has wider support, and ANSI has adopted a SQL standard. Microcomputer programs that use SQL include PC Ingres, Sybase, Informix, Oracle, Emerald Bay, and SQLBase.

I would like to illustrate the nonprocedural nature of SQL with an example that will be used throughout this article. Figure 1 shows a simple database that might be used by a hardware store to manage its supply. Suppliers are each assigned a supplier ID (sid), and parts are assigned a parts ID (pid). The supply table tells how many parts are in stock for each supply ID and parts ID. Suppose the manager of the store wanted to know which

items in stock came from Wanda's Warehouse. He might use the following SQL statement:

```
select parts.pname, supply.quantity
from parts, supplier, supply
where supplier.sname
= "Wanda's Warehouse"
and supply.sid = supplier.sid
and supply.pid = parts.pid;
```

This query involves three tables and three conditions. Somehow we have to relate information across all three tables. The query does not specify how to do this.

The worst possible way to answer this query is also the most obvious—create a temporary table that has the information from all tables and pick out the rows that meet all the conditions. Suppose we have 650 parts that are commonly stocked, 500 items currently in stock, and 150 suppliers. Each row in the first table must be combined with each row in the second, and the result combined with each row of the third. Our temporary table would have $650 \times 500 \times 150$ rows.

But the where clause tells us that we don't need to use all these rows. We need only the rows from the supplier table in which supplier.sname = "Wanda's Warehouse". Once we know the supplier ID from this row, we need only the rows from the supply table that match it, and

continued

Jonathan Robie is a freelance systems consultant at Software by Design (P.O. Box 26121, Lansing, MI 48909). He can be reached on BIX as "jrobie."

we need only parts that are indicated by these rows. If only 15 items in stock are supplied by Wanda's Warehouse, we can find the answer using only 1 row in the supplier table, 15 in the supply table, and 15 in the parts table.

Some General Principles

Most relational databases create temporary tables to combine information from pairs of tables. The text box below explains how the join operation is used to do this. You will need to know about joins to

understand the rest of this article. SQL does not have an explicit join statement, but when several tables are referenced in a query, they must be joined to process the query.

There are two basic ways the database manager can join tables. The first is called a nested-loops join and involves comparing every row in one table to every row in the other and combining the qualifying rows.

The sort-merge join is generally much more efficient. The sort-merge algorithm

sorts each table on the columns that will be compared to join them. After this is done, each table can be scanned in order, and each row of each table will need to be examined only once. If one or both tables are in order, there is no need to sort before merging. Sometimes an index will let you retrieve data in the desired order; this can cut processing significantly.

The order in which tables are combined is extremely important. Temporary tables are merged with other tables, and

continued

Database Terminology

The terms *relational* and *nonprocedural* are often misused. Ted Codd, who invented the relational model, once griped that it is hard to find a vendor that does not claim its DBMS is relational. It is important to realize that most database managers claiming to be relational are not.

A relational database stores all information in tables and can manage data by direct manipulation of these tables without reference to other constructs. The basic relational operators—select, project, and join—each produce a new table by combining one or more tables. Any piece of information in a relational

database can be accessed directly by referring to the table name, key value, and column name. According to Codd, a database that meets these criteria can claim to be minimally relational. (To be fully relational requires much more, but exploring that is beyond the scope of this discussion.)

By these definitions, dBASE and R:base are not relational database managers. The dBASE program does not allow direct manipulation of tables but requires the use of work areas in order to relate tables. To gain acceptable performance, the user or programmer must explicitly reference the indexes on these

tables. R:base provides relational operators, but it does not allow the user or programmer to reclaim the space from a table without repacking the database. Since every relational operator creates a table, this makes it impractical to use R:base as a relational database manager. Most R:base programmers relate tables through the use of pointers, which is not necessary in a minimally relational database system.

Query optimizers are not used in products like dBASE or R:base. In dBASE, indexes must be explicitly used by the programmer. In R:base, indexes are used only for the last field mentioned in a query. In both languages, the programmer must know the structure of the tables in order to ensure efficient access.

One database manager, Condor 3, is relational but not nonprocedural. The user or programmer explicitly specifies the operators to be performed. Because of this, Condor III does not need a query optimizer but relies on the programmer to supply an efficient method of processing the query.

Joins are a way of combining two tables. The query shown in table A joins the supply and supplier tables from our sample database, combining each row from the first table with each row from the second. In the result set, the first three columns come from the supply table and the rest from the supplier table. This is sometimes called a Cartesian cross product. If there are n_1 rows in the first table and n_2 rows in the second, then the result set will have $n_1 \times n_2$ rows.

We usually want only a subset of the Cartesian cross product. For instance, we might be interested in only those cases in which `supply.sid` matches `supplier.sid`. This cuts down the number of rows considerably. Table B illustrates how this more restrictive join reduces the size of the result set.

Table A: Results of the join command `select * from supply, supplier`.

sid	pid	quantity	sid	sname	city
1	1	4	1	Big Bucks Supply	Lansing
1	2	12	1	Big Bucks Supply	Lansing
2	1	23	1	Big Bucks Supply	Lansing
2	2	5	1	Big Bucks Supply	Lansing
1	1	4	2	Wanda's Warehouse	Boston
1	2	12	2	Wanda's Warehouse	Boston
2	1	23	2	Wanda's Warehouse	Boston
2	2	5	2	Wanda's Warehouse	Boston
1	1	4	3	People's Stuff	Ann Arbor
1	2	12	3	People's Stuff	Ann Arbor
2	1	23	3	People's Stuff	Ann Arbor
2	2	5	3	People's Stuff	Ann Arbor

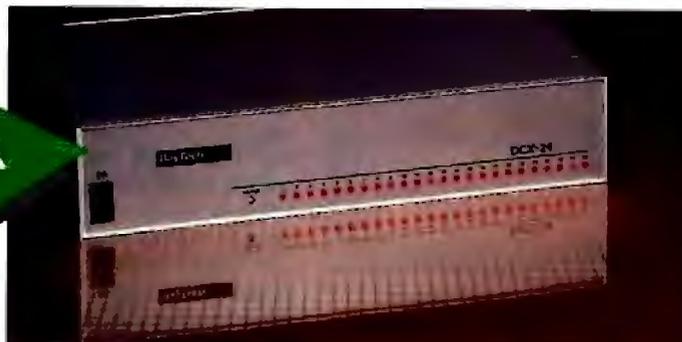
Table B: Result set after the command `select * from supply, supplier where supply.sid = supplier.sid`.

sid	pid	quantity	sid	sname	city
1	1	4	1	Big Bucks Supply	Lansing
1	2	12	1	Big Bucks Supply	Lansing
2	1	23	2	Wanda's Warehouse	Boston
2	2	5	2	Wanda's Warehouse	Boston

DCX-24

high performance
PERIPHERAL SHARING PLUS

UP
TO
4½MB
BUFFER



Engineered for speed, flexibility and expandability

BayTech

Bay Technical Associates, Inc., Data Communications Products Division
200 N. Second St., Bay Saint Louis, MS 39520 USA
Telex 910-333-1618 BAYTECH, Telephone 601-467-8231 or toll-free
800-523-2702

CHECK THE SPECS

- DCX (Data Communications Exchange) unit allows high speed exchange of data between computers, printers and other peripherals.
- Powerful 16-bit CPU plus multiple high performance I/O processors allow super high speed transfer of data demanded by new faster computers and software.
- Optimum flexibility: Select the right combination of serial and parallel ports, and set *any* of these ports as a peripheral port or as a computer port.
- Basic unit expandable to 24 ports by 4-port modules offered in serial/parallel combinations.
- Standard 512KB buffer expandable to 4½ megabytes, to handle big print/plot jobs and many small ones.
- Buffer memory dynamically allocated to maximize buffer utilization.
- Simultaneous data input and output on *all* ports, so no devices are kept waiting.
- Computer-to-computer communication concurrent with all other operations.
- Full duplex communication allows file transfer capability with many communications software packages.
- Compatible with virtually all computers, printers, plotters, modems and other peripherals.
- Pop-up RAM resident PC support software allows peripheral selection via hot key.
- Super fast throughput allows data to pass through with no apparent processing delays.
- Many user-definable parameters including separate baud rates, flow control and parity for each port.
- Internal serial-to-parallel and parallel-to-serial conversion.
- Cascading capability to increase available number of ports.
- Unlimited hotline tech support.
- Designed and manufactured in the U.S.A.

Circle 31 on Reader Service Card
(DEALERS: 32)

(a) Parts			(c) Supply		
pid	pname	size	sid	pid	quant
1	galvanized bolts	6	1	1	4
2	paintbrush	0	1	2	12
3	bucket	10	2	1	23
...	...	...	2	2	5
...

(b) Supplier			(d) Result Set	
sid	sname	city	pname	quant
1	Big Bucks Supply	Lansing	galvanized bolts	23
2	Wanda's Warehouse	Boston	paintbrush	5
3	People's Stuff	Ann Arbor	...	...
...

Figure 1: The supplier/parts database consists of three tables: (a) parts, (b) supplier, and (c) supply. Table (d) shows a result set after the following command: `select parts.pname, supply.quantity from parts, supplier, supply where supplier.sname = "Wanda's Warehouse" and supply.sid = supplier.sid and supply.pid = parts.pid;`

every row in a temporary table means extra processing later on. We want to keep them as small as possible. Whenever we merge two tables, we can use the where clause of the query to determine which rows are worth keeping.

Consider our sample query. If we start by combining the supply table with the parts table, the only restriction we can use is `parts.pid = supply.pid`. This means that our temporary table must include every combination in which the two columns match, so it will contain a row for each of the 500 items currently in supply.

If instead we start by combining the supplier table with the supply table, we can use the restrictions `supplier.name = "Wanda's Warehouse"` and `supply.sid = supplier.sid`, so our temporary table contains only the 15 items supplied by Wanda's Warehouse. In general, we'll use as many restrictions as possible whenever we merge tables, and we'll try to begin with the merges that produce the smallest tables.

But our query optimizer can't guess the size of the temporary tables without first guessing how many rows will satisfy a condition. If every supplier had the name "Wanda's Warehouse," starting with the supply table would not produce small temporary tables.

In ANSI standard SQL, you can specify that every value for an indexed field must be unique. This is often used on the key field for a table. If the table was created with this option, then we can guarantee that no more than one row can have a given value in the indexed field. If there is no unique index, then the database manager must either make guesses

based on the form of the query or keep distribution information on the data in tables.

Query optimizers that use only the form of the query make statistical assumptions about the distribution of information in the table. This method is not terribly precise, and optimizers that have access to the distribution of data tend to outperform optimizers that do not. One common way of doing this is to divide the table into ranges that each contain an equal number of values and to store the highest value in each range. This method is called distribution steps. According to Bob Epstein, principal architect of Sybase, 100 steps is good for general use, but in some systems the number of steps used will vary with the size and characteristics of the table. The Ingres database manager varies the number of items in each step depending on the distribution.

If the query optimizer needs to know the distribution of data, optimization must be performed when this information is available. If a query is embedded in an applications program, there are three times that a query might be optimized—at compile time, when the query is first executed, or every time that a query is executed.

If the query is optimized at compile time (as in IBM's DB2), distribution information is not available and cannot be used by the optimizer. If the query is optimized the first time it is executed, the initial distribution is known. In some applications, though, this distribution might change while the program is running. If the query is optimized every time a query is executed, distribution information is guaranteed to be current, but the

overhead of optimizing each time is considerable.

For most applications, it is sufficient to optimize the first time a query is executed, since the distribution of information in most databases is relatively stable. Since this is not adequate for all applications, it is helpful to provide a way of forcing the query to be optimized each time it is run (Ingres and Sybase do this).

A good query optimizer knows the quickest ways to get at information. It takes full advantage of indexes and hashing. If we want only rows that match a certain value, and the field that holds that value is indexed or hashed, there is no need to examine most rows in the table. The index can also be used to access data in a desirable order. Earlier I discussed the advantages of sorting tables before merging. If there is an index on the fields that will be the basis for the join, the index can be used to avoid a sort.

A query optimizer explores potential solutions, determines their cost, and stores the cheapest solution at each step. Whenever new possibilities are explored, they are compared to the cheapest solution. The cost of the solution includes both the CPU cost and the I/O cost. The relative weights of each will vary from one system to another. Since some queries tend to be CPU-bound and others tend to be I/O-bound, it is important to weigh these costs appropriately. Queries that involve a lot of data are usually I/O-bound, and those that involve little data are usually CPU-bound.

One additional cost to be considered is that of optimization itself. There is no point in spending a long time to optimize a query on a table with five rows. A good optimizer knows when to quit.

These are the basic principles behind query optimizers. Some ways of combining data are much more efficient than others. Factors that significantly affect the amount of processing include the order in which we retrieve data from a table, the order in which tables are merged, maintenance of statistical information on the contents of tables, and the use of indexes and hashing. A good optimizer must know the relative costs in its own environment, and it must also know when to quit.

A Programmer's View

To get a programmer's technical view of query optimizers, I asked Bob Epstein to give some specific examples of how query optimization is implemented in Sybase.

He explained that for each index, Sybase stores the distribution of the data. As an example, let's say you have stock

continued



Finally. A Portable Designed To Break The Mold, Instead Of Your Back.

Portable computers fit a predictable pattern. The more powerful they are, the less portable they are.

With one magnificently small exception. The T3100/20.

It's the best shape power has ever been in. A smaller, slimmer profile that's tailored to you, instead of the other way around.

Yet inside this sleek 15-pound package are 640KB of RAM and a built-in 20MB hard disk. All driven by an 80286 microprocessor, the same CPU that sparks the IBM® PC AT.*

Its gas plasma screen is so bright, it looks like a full-size CRT display. Which, by the way, you can easily plug into the T3100/20's standard RGB color port.

MS-DOS® 3.2 is standard. So are parallel, serial and 5¼" external drive ports. And a soft carrying case.

With every T3100/20, we'll include free copies of Lotus® Symphony®** and Lotus Metro®, two of the world's most popular programs, for the world's

most popular portable computer.

You can also add a 1200 bps Hayes® compatible modem, a five-slot IBM-compatible expansion chassis, 2 megabytes of extended memory, and a numeric keypad.

The T3100/20 is backed by Exceptional Care,** our promise that if we have to fix your computer, we'll fix you up with another one while you wait.

All of which leads one to a small dilemma. How to regard a machine that changes forever the way the world thinks about portable performance.

You could think of it as a desktop on a crash diet. Or the muscle of an AT without the bulk. Or simply as *PC World* put it: "A small miracle."

Call 1-800-457-7777 for the Toshiba computer and printer dealer nearest you. He can show you how to enjoy all the advantages of power.

With none of the burdens.

IBM & PC AT are registered trademarks of International Business Machines Corporation. MS-DOS is a registered trademark of Microsoft Corp. Lotus, Symphony and Metro are registered trademarks of Lotus Development Corp. Hayes is a registered trademark of Hayes Corp. *Limited time offer. **No-cost enrollment required. See your dealer for details.

In Touch with Tomorrow
TOSHIBA

Toshiba America, Inc., Information Systems Division

FAST DATA ACCESS

SUNDAY 10-5

PROMPT DELIVERY

APPLE Mac Plus w. Imagevr II After Insta. Rebr. Mac SE 2-800K F.D. w. 20 MB H.D. Macintosh II	1999.99 1989.99 2579.99 CALL	BROTHER HR15-XL HR-20 Dual HR-40 HR-60	249.99 CALL In Stock CALL	LAP TOP COMP. NEC Multi Speed NEC Multi Speed Et Sharp PC-4051 Toshiba T-1100 Toshiba T-1100 Plus Toshiba T-1200 Toshiba T-3100-20 Zenith Z-181-93 Zenith Z-183-92 Zenith Z-183-93	1449.99 829.99 CALL 779.99 2249.99 CALL 1449.99 2049.99 CALL
COMPAQ 386 1 MB-RAM 40 MB H.D. CALL	CALL	CITIZEN MSP-180 D MSP-10 MSP-15	CALL CALL CALL	LAP TOP PTR. Diconx 150-P	CALL CALL
COMPAQ PORT. Port III-20 mhz 1-1.2 MB F.D.	CALL	EPSON EK-800 EX-1000 FX-850 FX-2850	CALL CALL CALL CALL	LASER PTR. Brother Laser Canon Series II HP Laser Series II HP Laser Plus-500 HP Scanner Oudata Laser-6 Panasonic Laser	CALL CALL CALL CALL CALL CALL
Leading Edge Model D 512K RAM 2-360K F.D.	CALL	FUJITSU DX-2300 DX-2400 DL-3300 DL-3400	CALL CALL CALL CALL	MONITORS Mash. Diamond Scan NEC Multi-Sync II NEC Multi-Sync Plus POS MAX 12	1499.99 1639.99 CALL 1299.99 CALL
IBM AT-339 512K RAM 30 MB H.D. 1-1 MB RAM	1049.99 CALL CALL CALL CALL CALL	IBM Pro Printer II Pro Printer 24 Pro Printer 31-24 Quietwriter III P-2220 P-6	359.99 524.99 899.99 CALL 334.99 424.99		

HAPPY CHANUKA

GUARANTEED LOWEST PRICES

1-800-874-1235

TOLL FREE OUT OF N.Y. IN N.Y. CALL (212) 463-8330

S & W COMPUTERS & ELECTRONICS
31 West 21 Street, New York, N.Y. 10010

Hours: Mon-Thurs 9-6, Fri 9-2, Sun 10-5, Sat Closed

C.O.D. Accepted

Green Code Accounts charged on time
* Add shipping, handling
* Add charges for express orders
* Qty. limited - * Prices subject
to change without notice
* Not responsible for transportation
errors

prices and you have two similar queries: How many stocks are between \$1 and \$5, and how many are between \$100 and \$105? Sybex's internal statistics tell it that one query is likely to get you 20 percent of the stock market, the other less than 1 percent. Epstein notes that Sybex does the same thing for character fields as well as numbers, since nearly all keys are character-type. That gives you, with an arbitrary resolution that you can tune, the total breakdown of the distribution of the data.

Let's say we are dealing with 1 percent resolution: We know what value separates each 1 percent of data. If there are a million records, we store every 10,000th value. We can estimate the size of the result by noting how many intervals it spans. Contrast that to an optimizer that has no information about the information in a table. To this optimizer, the two stock market queries are equivalent. It can't tell if it has one record in a result set or a million.

A Simple Example

Now let's consider how an optimizer might handle our sample query. The actual heuristics will vary somewhat from one optimizer to another, but we'll use methods that are fairly typical. We'll make a fairly exhaustive list of the possibilities, examine the costs, and decide on an execution plan. Our plan will focus on the order in which the three tables will be combined and on the most efficient ways of combining them. Some optimizers combine the tables one step at a time and use information about the results to make more informed decisions in later processing. Others do all optimization before the query begins.

The information available to our optimizer is the structure of the query, the size of the tables, the available indexes, and the approximate distribution of data in indexed fields. We must choose a pair of tables to combine first. We want to avoid creating large tables in early processing, since this data will be involved in all later processing. If supplier.sname is uniquely indexed, we know that only one row will contain "Wanda's Warehouse." Therefore, merging supplier.sname with another table is likely to produce a small result. Our optimizer can guess that the supplier name should be one of the two tables in the first join.

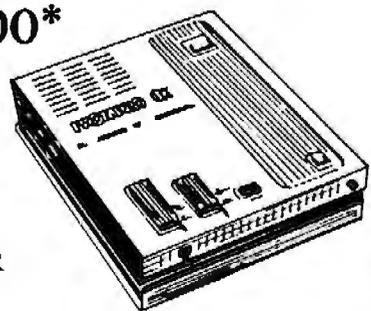
Now we need to choose the second table for the first join. In order to avoid unnecessarily large temporary tables, we need a table that has some direct relationship to the supplier table. The where clause in our query says that supplier.sid = supply.sid. Once we have sup-

continued

UNIVERSAL PROM/PAL*/MICRO PROGRAMMER

U.S. prices From **\$995.00***

- EPROMS TO 1 MEG
- EPROM SIMULATION
- SET PROGRAMS
- 20-24 PIN PLD/EPLD
- BIPOLAR PROMs
- SINGLE CHIP MICROS
- RS-232/PC DRIVEN OR STAND-ALONE



1-800-331-PROM
(305) 974-0967 Telex 383142 Fax (305) 974-8531
From a Name You Can Trust

LOGICAL DEVICES INC.
Represented In 18 Countries
1321 NW 65th Place, Ft. Lauderdale, FL 33309

*Some devices require optional Adaptors - PAL is a Trademark of Monolithic Memories Inc.

If you've ever had the plug pulled on your PC, just as you were about to finish a vital report, then you know the frustration of losing your data so close to completion. As the data disappeared from your PC's screen and memory, did it occur to you that the plug had also been pulled on your once promising career?

That's where Deja View™ flashback software comes in.

Deja View runs on your IBM PC, PS/2 or compatible, automatically protecting your work in progress from accidentally pulled plugs. Power failures and surges. Frozen keyboards. System crashes. Unintentional reboots. Inadvertently deleted information on your screen. And a thousand other potential disasters.

Even after your PC goes down, Deja View will flash you right back to where you were before the problem. And you can continue as if the mishap never occurred.

Deja View is a non-copy-protected, memory-resident utility that runs along with your application program. It automatically copies all of your PC's RAM and video memory onto your hard disk, saving your work in progress. You decide the frequency of the Auto-Save function, by number of keystrokes or specified time intervals. Or use the Save-Now key as needed.

Deja View also lets you flip back and forth between two different applications by depressing just three keys. You don't need to save work files, exit one application, and then load the new application and work files.

Now there's no need to buy an expensive battery back-up system. With

a price of only \$95, can you really afford to be without Deja View?

So call Meridian Technology today, or see your local dealer. We'll show you how Deja View not only saves your data, it can also save your neck, and your promising career.

Deja View and Use it or lose it are trademarks of Meridian Technology, Inc. Other products are trademarks of their manufacturers.

DEJAVIEW™
Use it or lose it.™

MERIDIAN TECHNOLOGY INC. ■■■■■

Corporate Park, Suite 100
Irvine, CA 92714. (714) 261-1189

You're about
to experience
Deja View.™



Circle 160 on Reader Service Card
(DEALERS: 161)

INFO 286[®]

TURBO SYSTEM

The fastest IBM™ AT™ Compatible

SUPERCHARGED SPEED

12MHz

286 CPU

10 MHz option available



Features:

- Intel 80286-10 microprocessor
- 6/12 MHz switchable clock speed
- Expandable to 1MB on board
- Chips & Technology VLSI chipset
- CMOS memory to maintain system configuration
- Legal BIOS
- Clock/calendar with battery backup
- 8 I/O slots - 6 w/62 & 36-pin card-edge connectors
- 2 w/only 62-pin card-edge connectors
- 200W power supply (220V-110V)
- XT size case w/keylock protection, reset switch, and LEDs for turbo, hard drive, and power on/off
- Enhanced keyboard w/separate cursor, keypad, and cross top function keys
- 20% smaller than IBM's AT™ system
- Operation manual
- Assembled and tested

FCC Class B Approved!

Dealers and distributors
welcomed

Immediate delivery available
Full one year warranty

Please call for more information on
FCC approved add-on cards and
AT™ compatible components!!

Increase your
profit margin!

Taiwan

Low Price!
High Quality!

Manufacture Direct

May Computers Corp.

(Manufacture Direct)

8210 Katella Ave., #D, Stanton, CA 90680

(714) 897-2037 (10 Lines)

Telex 3720112 MAY / FAX (714) 897 9173

FAST DATA ACCESS

plier.sid, we can narrow down the number of rows needed from the supply table. Nothing in the where clause relates the supply table directly to the parts table. If we joined the supply table and the parts table first, then the size of the temporary table would be the product of the sizes of the two tables, which is 150 × 600. If we join the supply and supplier tables, then our result would have no more than 500 rows, even if everything in stock came from Wanda's Warehouse, since only one row in the supply table is relevant.

If our optimizer uses intermediate results in setting up the plan, even more information is available. It can look up the supplier ID for Wanda's Warehouse and consult the distribution information in the supplier table, finding that there will be approximately 15 rows in the temporary table. Clearly, the first step is to join the supply and supplier tables. The most efficient way to do this is to use the index on supply.sid to find all matching rows. We need two columns in this intermediate table: supply.quant, to report the result, and supply.pid, to find the parts name from the parts table.

Now we can find our answer by joining our temporary table to the parts table and keeping only the columns asked for in the query. The cheapest way to access the parts table is through the index on the parts ID. Our temporary table is sorted by supplier.sid, so we'll sort it on pid before merging. This is cheap, since the temporary table has only 15 rows. The final result set includes parts.pname and supplier.quant from this join.

Let's examine the access plan generated by the query optimizer. I'll show the results for each step (only a few rows are given for each result). As I list the steps, I'll review the reasons these steps were selected.

1. Select the supplier named "Wanda's Warehouse." Since supplier.sname is uniquely indexed, we know there will be only one row:

sid
2

2. Use the index on supply.sid to select supply.quant and supply.pid for those rows matching the sid in our temporary table. This table is linked to our temporary table by the condition supply.sid = supplier.sid. No other table is linked to the temporary table by a condition, so if we chose another table we would not know which rows are needed and would have to include all rows.

Steps 1 and 2 would generally be done

as a single step, but are separated here for the sake of clarity.

quant	pid
5	2
23	1
...	...

3. Sort the temporary table on pid. In the next step, we'll be joining our temporary table to parts using the index on parts.pid, and this index provides rows in pid order. If our temporary table is sorted on pid, we can merge the two tables directly without making unnecessary comparisons.

quant	pid
23	1
5	2
...	...

4. Use the index on parts.pid to create the result set with supply.quant and parts.pname where parts.pid matches the pid in our temporary table.

pname	quant
galvanized bolts	23
paintbrush	5
...	...

This access plan is a set of specific procedures for finding the desired result. In a procedural database manager, the user would have to specify this access plan; our query optimizer has derived it for us.

No Room for Inefficiency

Large databases must be handled efficiently. Larger, more powerful microcomputers and the rush to SQL will result in many more large relational databases on microcomputers. Relational database managers depend on query optimizers to find efficient ways to access data. The best access plan is not always obvious from the structure of the query, and it actually depends on the distribution of data in the tables. Combining tables in the wrong way can be disastrous, but combining them properly is quite efficient. I have listed some of the general principles that are used by query optimizers and given an example of how a query optimizer generates an access plan.

For additional information on products and references, see the Managing Megabytes Resource Guide on page 265. ■

ACKNOWLEDGMENT

The author would like to thank Bob Epstein of Sybase and Bob Kooi of Relational Technologies for their time and help.

Ah, the big idea. Everyone has one. But not everyone can afford a plotter to plot one on. Which got us thinking. What if there was an HP quality plotter so reasonably priced you could afford to hook one up to every PC CAD workstation in the office?

Presenting the HP DraftPro Plotter. For only \$4900 any architect, engineer or designer can create perfect plots time after time.

Consider what the DraftPro can do:

It can draw straight lines, smooth arcs and perfectly-formed characters. All on C and D-size drafting film, paper or vellum, using eight different pen colors.

Furthermore, it works with

just about any PC, such as the HP Vectra PC and IBM PC's. As well as popular PC CAD programs like VersaCAD and AutoCAD.

If the idea of having HP reliability with a low price tag makes sense to you, call us now. For a brochure and sample plot, call 1 800 752-0900, Ext. 901A.

The HP DraftPro Plotter: high-quality drafting for only \$4900.*

The drawing shown below was produced on the HP DraftPro with VersaCAD software.



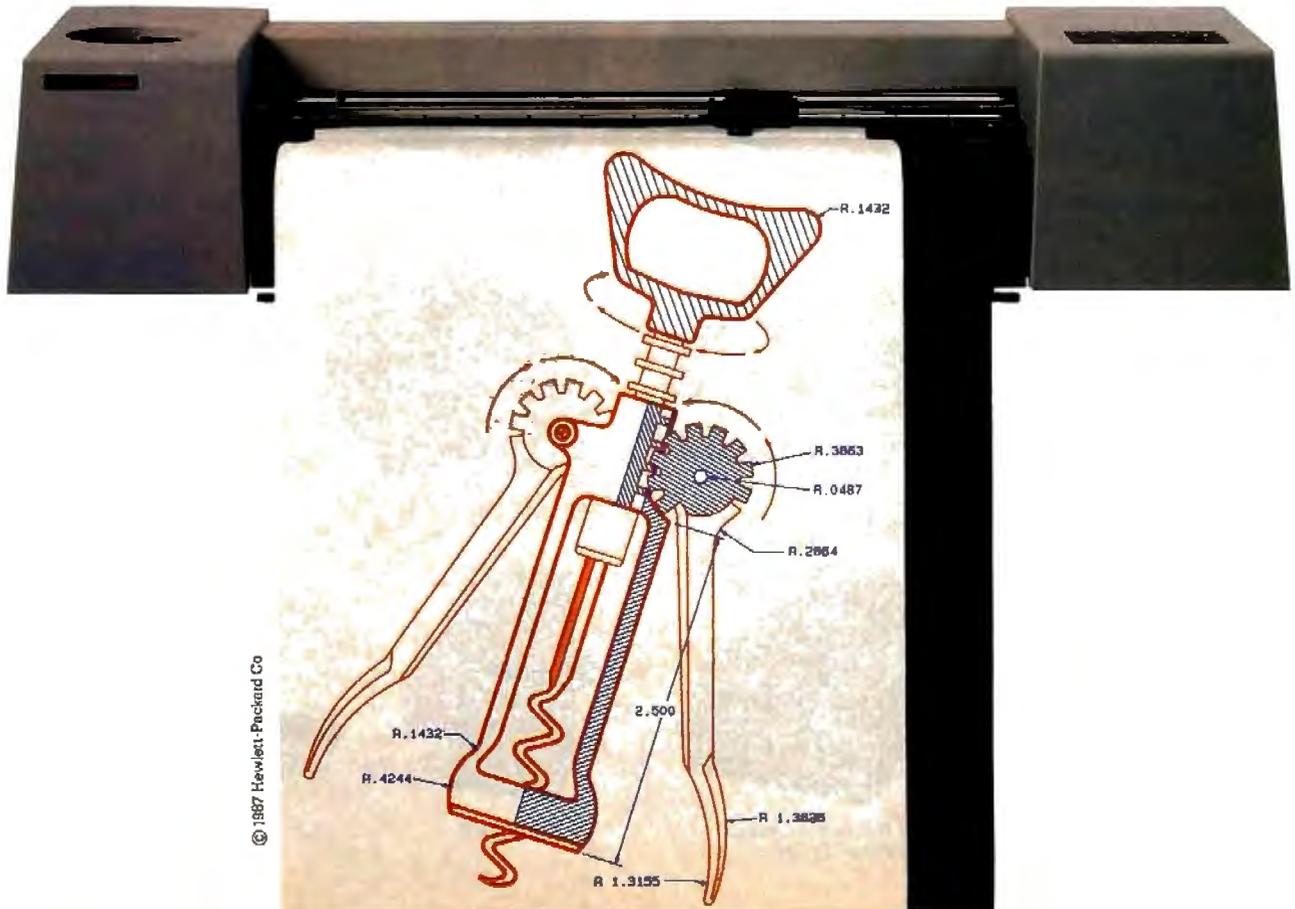
**HEWLETT
PACKARD**

VersaCAD is a registered trademark of T & W Systems. AutoCAD is a registered trademark of Autodesk, Inc. *Suggested U.S. list price

Circle 111 on Reader Service Card

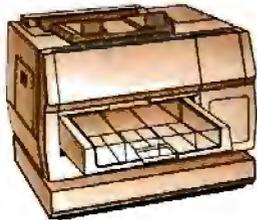
What if...

How to pull off a fantastic HP plot for only \$4900.



© 1987 Hewlett-Packard Co

Inside the revolution



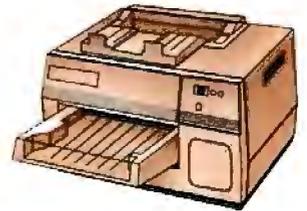
NBI, Inc. Model 908



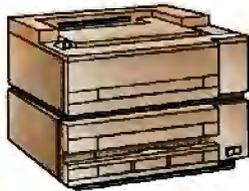
QMS-PS 800
QMS-PS* 800+
QMS-PS* 800 II*



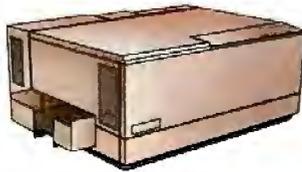
Linotype Company Linotronic 100
Linotype Company Linotronic* 300*



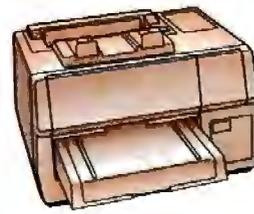
*Digital Equipment Corp.
ScriptPrinter**



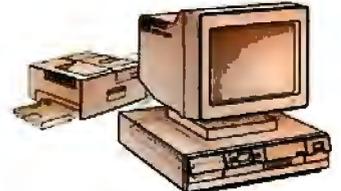
*Qume Corporation ScriptTEN***



Diconix Dijit 1/PS*



AST Turbo Laser/PS*



*IBM 4216-020 Personal Pageprinter***



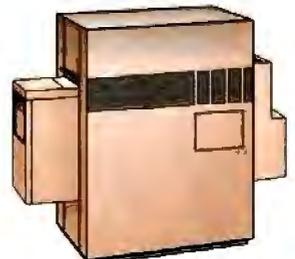
*Texas Instruments OmniLaser** 2108*



Vantyper VT-600



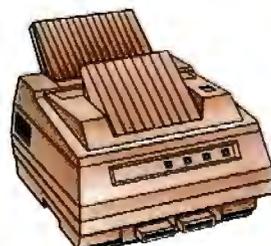
*Wang LCS15***



*Agfa-Gevaert P400PS***



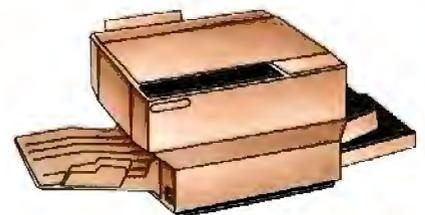
*The Laser Connection PS Jet/PS Jet+***



*NEC Information Systems
SilentWriter** LC-890*

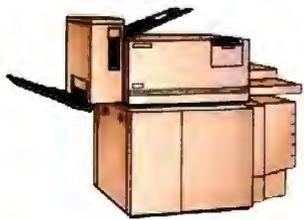


QMS-PS 2400*

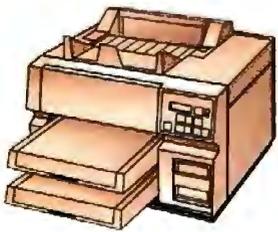


*Apollo Computer Inc.
Domain/Laser 26***

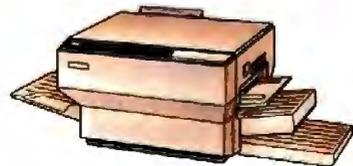
e printers a is going on.



Digital Equipment Corp. PrintServer 40™



Texas Instruments OmniLaser™ 2115



Dataproducts Corp. LZR™ 2665



Apple Computer Inc. LaserWriter®
Apple Computer Inc. LaserWriter® Plus

POSTSCRIPT® from Adobe Systems started a revolution in business communications. That's why you'll find POSTSCRIPT in virtually every popular laser printer sold today.

POSTSCRIPT, the page description language, is the unanimous choice for some very good reasons. POSTSCRIPT gives you the option of printing from an IBM® PC, Macintosh™, or mini/mainframe.

With so many printers to choose from, you won't be tied to a single vendor. And that gives you the flexibility to buy what's best for your



company's needs. Since POSTSCRIPT is device independent, you can design a document, then professionally print it later at a higher resolution.

You can also choose from hundreds of software programs supporting POSTSCRIPT. And POSTSCRIPT lets you combine text, line art, and even digitized photographs on the same page.

POSTSCRIPT from Adobe Systems. The only two names you need to know to join the communication revolution.

Ask for a demonstration on the POSTSCRIPT printer of your choice. With so many to choose from, the hardest decision you may face is which POSTSCRIPT printer to buy.



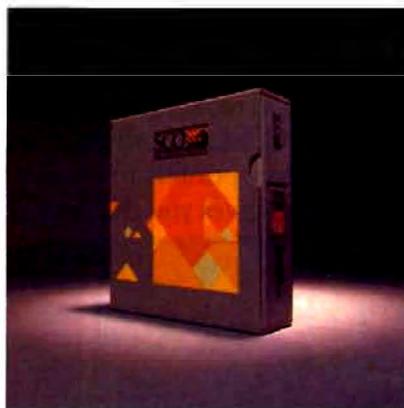
POSTSCRIPT from Adobe.
The Magic Behind Desktop Publishing.

Circle 5 on Reader Service Card

All products are registered trademarks and trademarks of their manufacturers.

Fast. Safe. Reliable. Economical. Easy to administer.

Finally, there is real multiuser relief
for your dBASE III PLUS® LAN headaches.



SCO FoxBASE+™

The dBASE III PLUS Workalike for XENIX® and Other UNIX® Systems

"SCO FoxBASE+ on SCO XENIX gives us the reliable, low-cost, multi-user environment we need and takes the integration headache away from the reseller."

Robert Davies, President, SBT Corporation

Join the thousands of dBASE III PLUS-compatible developers and VARs who are curing their LAN headaches with SCO FoxBASE+ and SCO XENIX.

If you have a large investment in dBASE III PLUS-compatible code, but want a lot more multiuser reliability, convenience and performance than you're getting from LANs — at a lot less cost per user — SCO FoxBASE+ and proven SCO XENIX are an unbeatable prescription.

SCO FoxBASE+ gives you the comfort of source-language and file compatibility, and the safety of identical record- and file-locking syntax, plus many significant enhancements over dBASE III PLUS.

Call SCO today and get fast relief from your LAN headaches — with the real multiuser dBASE III PLUS-compatible performance of SCO FoxBASE+ and SCO XENIX!



(800)626-UNIX (626-8649)
(408)425-7222
FAX: (408)458-4227
TWX: 910-598-4510 SCO SACZ
uucp: ...decvax!microsoft!scot!info

FoxBASE+ also available for enhanced dBASE III PLUS-compatible performance on DOS systems.

dBASE III PLUS is a registered trademark of Ashton-Tate. • FoxBASE+ is a trademark of Fox Software, Inc. • XENIX is a registered trademark of Microsoft Corporation. • UNIX is a registered trademark of AT&T
© 1987 The Santa Cruz Operation, Inc., 400 Encinal Street, P.O. Box 1900, Santa Cruz, CA 95061. The Santa Cruz Operation, Ltd., P.O. Box 47N, 18 Noel Street, London W1A 4YN United Kingdom. •44 1 439 2911. FAX: +44 1 637 9381, TELEX: 917572 sco.uss

Achieving Mainframe Performance

Having large amounts of on-line storage in a personal computer opens the door to techniques that speed performance significantly

Wink Saville

RAW PROCESSING POWER is often the primary consideration in evaluating the capabilities of personal computers. Unfortunately, this viewpoint rarely presents the complete picture. True, today's personal computers offer the same processing power found in mainframes 5 or 10 years ago, but it is the availability of large amounts of storage, both internal (RAM) and external (hard disk drives, CD ROM, and so forth), that has enabled personal computers to take a giant leap forward. Configured with this expanded memory, personal computers can execute applications that were once the domain of mainframes and minicomputers.

Early personal computers contained little more than 1000 bytes of memory. The Apple computers, with 64K bytes of memory and a quarter-megabyte of storage on a floppy disk, improved on this, and the IBM PC signaled a new era with 640K bytes of memory and a 10-megabyte hard disk drive. Now, a personal computer can be configured with more than 8 megabytes of RAM and 2 gigabytes of on-line storage in the form of hard disks. Storage of this magnitude in a personal computer can translate into mainframe-like performance.

This is not to say that personal computers can replace mainframes. Obviously, most large-scale applications call for the horsepower, sophisticated operating systems, and speed found in mainframe computers. My point is that, in certain applications, expanded memory in a personal computer can produce results in which the trade-off between performance and cost is nothing short of spectacular.

In other words, a personal computer might take 10 times longer than a larger machine to complete the task, but it will do the job at one-hundredth the cost.

The key for the programmer lies in knowing how to make the best use of expanded memory in personal computers. The three examples cited in this article—a graphics compression/display program, a mathematics routine, and a sort—serve to illustrate the kinds of tasks that can now be handled efficiently on personal computers.

Graphics: Zooming in

The expanded memory of microcomputers greatly enhances their ability to handle graphics. Expensive hardware is no longer required to produce striking bit-mapped images or to manipulate artwork in new and startling ways.

In this example, the task is to display bit-mapped images with different degrees of resolution. First, the image is scanned at 300 dots per inch (dpi). Each image consumes about 1.25 megabytes of space on the hard disk. To enlarge or crop the image, it is necessary for the microcomputer to provide the ability to zoom in and out on the image.

The image could be stored on a hard disk, but this would limit viewing to a small section at a time. Even rapid transfer rates would prove painfully slow in displaying several images in succession. This is unacceptable in a commercial setting.

The speed problem is solved when a personal computer has 4 megabytes of RAM—for instance, an IBM PC with

Lotus/Intel/Microsoft (LIM) extended memory. The initial data feed is a little slow, but once the information has been stored in RAM, you can pan the image or manipulate it quickly in any fashion.

Having the image in RAM gives you the ability to zoom in and out on the image rapidly, which is important in many graphic arts applications. You accomplish this effect by converting the original 300-dpi image to 150 dpi, 75 dpi, and 37.5 dpi and storing each version in RAM.

In the case of newsletter production, the lowest resolution provides a "Greeked" image of a page: You can determine the placement of headlines, columns of text, and photos, but none of the words can be read and none of the photos recognized. This level of detail would be useful in the early stages of page layout or as a final check of the end product before it is printed.

Since the image is stored in RAM at various resolution levels, you can move the cursor to any point in the display and immediately zoom to a higher level of resolution to review that portion of the page in greater detail. In desktop-publishing applications, for instance, you can zoom to a photo caption, headline, or subhead to check style or content. The method used to reduce the resolution by one half is to remove every other pixel in

continued

Wink Saville is vice president of software development at Meridian Data Inc. and author of several books on assembly language. He can be reached at 1239 Linda Vista Dr., San Marcos, CA 92069.

Listing 1: A C program to create lower-resolution versions of a bit-mapped image, for use in computers with LIM extended memory.

```

#define LINT_ARGS

#include <stdio.h>
#include <stdlib.h>
#include <types.h>
#include <io.h>
#include <fcntl.h>
#include <stat.h>

#define CREATE_RW ((int)(O_CREAT | O_RDWR | O_TRUNC |
                        O_BINARY))
#define OPEN_RW ((int)(O_RDWR | O_BINARY))
#define OPEN_RD ((int)(O_RDONLY | O_BINARY))
#define RW_PERMISSIONS ((int)(S_IREAD | S_IWRITE))
#define WORDS (640/16) /* 640 pixels horizontal */
#define LINES (480) /* 480 line vertical */

unsigned int srceArray[ LINES ] [ WORDS ];
unsigned char destArray [ LINES/2 ] [ WORDS ];

void abortCompress( msg )
char *msg;
/*****
purp: call perror with the message then exit
*****/
{
perror( msg );
exit( 1 );
}

unsigned char cvrt2Byte( w )
unsigned int w;
/*****
purp: convert the word to a byte
by removing every other bit
*****/
{
static unsigned char nibCompress[16] =
{
0x0, 0x1, 0x0, 0x1, 0x2, 0x3, 0x2, 0x3, 0x0, 0x1, 0x0, 0x1,
0x2, 0x3, 0x2, 0x3
};
unsigned char lowNib,highNib;

lowNib = nibCompress[ w & 0xf ] | (nibCompress[ w>>4 ] &
0xf ) <<2);
highNib = nibCompress[ (w>>8) & 0xf ] | (nibCompress[
(w>>12) & 0xf ]<<2)
return( lowNib | (highNib<<4));
}

void main(argc, argv)
int argc;
char *argv[];
/*****
purp: convert
*****/
{
int inHdl outHdl;
unsigned int numLines,numWords;
unsigned int curLine, curWord;
unsigned int *srce;
unsigned char *dest;
if( argc != 3 )
{
printf("Compress a 640 x 480 image to 320 x 240\n");
printf("\n");
printf("Usage: inputFile outputFile\n");
printf(" inputFile == The input file name\n");

```

continued

both dimensions. Repeating this process generates successively lower resolution images.

Listing 1 gives the method's implementation in C. The large amount of RAM in this application frees the programmer from worrying about memory constraints.

Sine

The next example uses a lookup table to implement the sine function. The program produces a significant performance increase over the use of other software or hardware implementations of the mathematical functions. Such an approach is practical only when plenty of memory is available.

Most programming languages provide a mathematical library for computing the sine (and other trigonometric functions) of an angle. Typically, the languages use a polynomial approximation to convert or to solve for the sine. This process may involve many different floating-point operations, requiring significant amounts of processing time.

The table-lookup approach gives vastly improved speeds. The degree of accuracy available depends on how much memory can be allocated to the table: Double precision will require twice as much storage as single precision, for instance, but access times will not be significantly affected by the degree of precision needed.

The basic algorithm is simple and requires just a few lines of code to express (see listing 2). The angle is passed to the subroutine, converted to an integer, and used as an index into the array of sine values to be returned. Prior to the subroutine's first use, an initialization program has computed the table of values. This table can be as accurate as you want to make it. For example, 360 data points will result in 1 degree of resolution on the sine. (If you allow for a few precalculations before using the lookup table, just 45 data points will give the same degree of resolution, since the trigonometric identities will map any angle into an equivalent angle on the interval [0,45].)

Using this approach, the result is accurate to within 1 degree and is typically expressed in two decimal places. There is no arbitrary limit to the refinement possible. Expanding the table's size to include fractional angles will produce greater accuracy—but will, of course, consume greater amounts of memory.

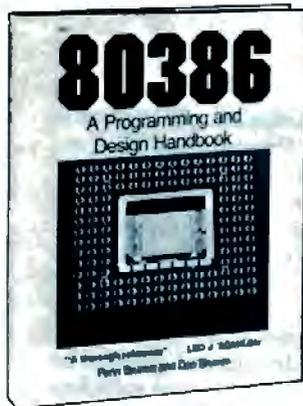
The algorithm runs 2 to 30 times faster than the standard sine algorithm used in the floating-point package of Microsoft C 4.0 (see table 1).

A number of existing applications use

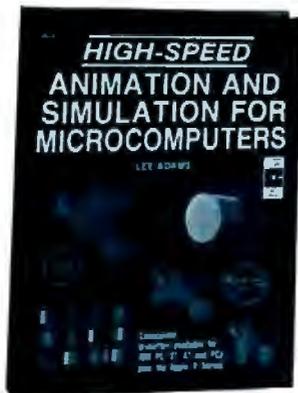
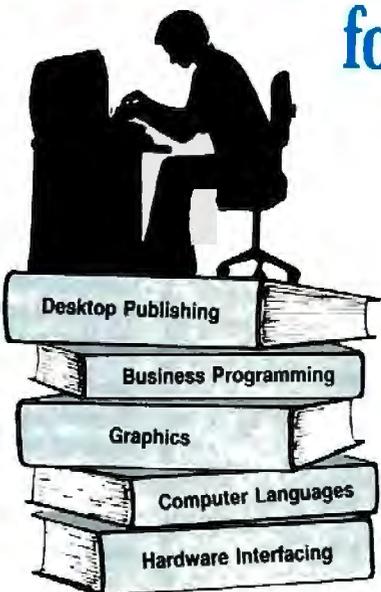
continued

SELECT 5 BOOKS for only \$3.95

(values to \$129.75)



2937 \$29.95
Counts as 2



2859 \$29.95
Counts as 2

When it's new and important in business or personal computing,
The Computer Book Club has the information you need . . .
at savings of up to 50% off publishers' prices!



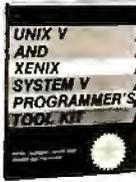
2771 \$25.95



2850P \$14.95



2691 \$23.95



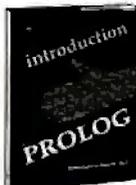
2751P \$19.95



2656 \$25.95



2730 \$27.95
Counts as 2



2682P \$16.95



2657 \$25.95



1807 \$17.95



2906P \$19.95



2838 \$19.95



2718 \$22.95



2833 \$21.95



2757P \$16.95



2917P \$16.95



2620 \$25.95



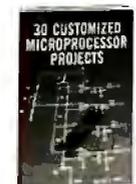
1848P \$15.95



2700 \$49.95
Counts as 3



2600 \$28.95
Counts as 2



2705 \$22.95



1990 \$24.95



1874 \$21.95



1862P \$12.95



2914P \$16.95



2808P \$19.95

All books are hardcover unless numbers are followed by a "P" for paperback. (Publishers' Prices Shown)



The Computer Book Club®

(Publishers' Prices Shown)



2696 \$21.95



2855 \$24.95



1988 \$23.95



2748 \$21.95

Membership Benefits • Big Savings. In addition to this introductory offer, you keep saving substantially with members' prices of up to 50% off the publishers' prices. • **Bonus Books.** Starting immediately, you will be eligible for our Bonus Book Plan, with savings of up to 80% off publishers' prices. • **Club News Bulletins.** 14 times per year you will receive the Book Club News, describing all the current selections—mains, alternates, extras—plus bonus offers and special sales, with hundreds of titles to choose from. • **Automatic Order.** If you want the Main Selection, do nothing and it will be sent to you automatically. If you prefer another selection, or no book at all, simply indicate your choice on the reply form provided. As a member, you agree to purchase at least 3 books within the next 12 months and may resign at any time thereafter. • **Ironclad No-Risk Guarantee.** If not satisfied with your books, return them within 10 days without obligation! • **Exceptional Quality.** All books are quality publishers' editions especially selected by our Editorial Board. BY-168



2654 \$18.95



1921P \$15.95



1873P \$17.95



1039 \$25.95



1866P \$12.95



2871P \$12.95

If card is missing, use this address to join: THE COMPUTER BOOK CLUB®, Blue Ridge Summit, PA 17294-0820

```

printf(" outputfile == The output file name\n")'
exit( 1 );
}

/* initialize */
sizeSrcArray = sizeof( srceArray );
sizeDestArray = size of ( destArray );
numLines = sizeof( srceArray ) / sizeof( srceArray[0] );
numWords = sizeof( srceArray[0] ) / 2;
/* read in the file */
if((inHdl = open( argv[1], OPEN_RD )) == -1)
    abortCompress("Unable to open inFile");
if(read( inHdl, (char *)srceArray, sizeSrcArray) !=
    sizeSrcArray)
    abortCompress("Unable to fill input buffer");
/* loop on every other line and remove every other pixel */
for( curLine = 0; curLine < numLines; curLine += 2 )
{
    dest = &destArray[ curLine / 2 ][0];
    srce = &srceArray[ curLine ][0];
    for( curWord = 0; curWord < numWords; curWord++ )
    {
        *dest++ = cvrt2Byte( *srce++ );
    }
}
/* write output file */
if((outHdl = open( argv[2], CREATE_RW, RW_PERMISSIONS )) ==
    -1)
    abortCompress("Unable to create the output file");
if(write( outHdl, (char *)destArray, sizeDestArray) !=
    sizeDestArray)
    abortCompress("Unable to write the output file"); }

```

Listing 2: A C program to implement a fast sine function using table lookups.

```

#define LINT_ARGS

#include <stdio.h>
#include <stdlib.h>
#include <math.h>
#include <types.h>
#include <time.h>

#define PI (3.14159265358979323846)
#define TWO_PI ( 2.0 * PI )
#define radians( x ) ( ( x * TWO_PI ) / 360.0 )
int fastMathInitialized = 0; /* not 0 if initialized */
double fastMathTableSize; /* size of the tables */
double fastMathTableSinInc;
float *fastMathSinTable; /* pointer to the sin table */
long curTime;

int fastMathInit (tableSize)
    unsigned int tableSize;
    /*****
    purp: initialize the fast math tables
    returns: 0 if no errors
    *****/
{
    unsigned int i;

    if( fastMathInitialized == 0 )
    {
        if((fastMathSinTable = (float *)calloc(tableSize,
            sizeof(float))) == NULL)
            return( 1 );
    }
}

```

continued

this approach in situations where speed is essential. Flight Simulator is a good example. The rotation of images on a personal computer screen at realistic speeds precludes the use of slower numeric approximation routines; lookup tables are used instead. The techniques used in Flight Simulator can be applied to a wider class of applications involving the manipulation of designs and graphics on a personal computer, assuming sufficient RAM is available.

Sorting Large Amounts of Data

To sort large amounts of data (i.e., hundreds of megabytes), you must obviously turn to mass storage devices to hold temporary files. However, the availability of extra RAM opens the door to techniques that will greatly improve sort times.

The sort algorithm I'm recommending takes the input file; sorts it into small sections; writes the small, newly sorted sections to an output file; and merges the small sections into a larger, sorted output file. The critical factor in this operation is the amount of memory available to the user. The more memory that is available, the larger the initial sort can be. This means that fewer merges are required to get the final sort. As a result, the final sort will be completed more quickly; the speed improvement is proportional to the amount of RAM available for the initial data sorting.

In a test run on a Compaq 386, a 150-megabyte file was sorted in 1.7 hours and merged in 3 hours, for a total completion time of 4.7 hours. The same file was sorted on a Burroughs 7900—a very large mainframe computer—in 30 minutes. The task took 8 times longer on the microcomputer, but it was completed at a fraction of the cost.

The algorithm used to sort large amounts of data on a personal computer is based on fixed-length fields. That is, data fields of a predetermined length are first sorted and then merged into the final output file. The program is not complex and could be generalized without degrading performance.

The sort/merge algorithm is straightforward. I'll illustrate the method using a stack of 30 cards numbered 1 through 30, in random order (see figure 1).

First, divide the 30 cards into three stacks of 10 and sort each of the three stacks. Each stack-sort operation corresponds to an in-memory sort.

Next, merge the three piles by taking the lowest-numbered card showing on top of the three stacks and saving it in an output stack.

Repeat the process until all three piles are empty, having been merged in order

continued



More than the sum of its parts.

Combine a PG 1600 display adaptor and our LM-301 monitor to create a display with incredible resolution and remarkable hardware and software compatibility. The PG 1600 was designed by Cornerstone Technology and is available exclusively from Princeton.

Now you can handle Windows, Gem, Ventura Publisher, AutoCad, and Publisher's Paintbrush, to name just a few. All with a razor-sharp resolution of 1600 x 1200 pixels for 150 dpi. And on-board CGA/MDA

hardware emulation insures complete PC application software support for Lotus, Microsoft Word, dBase III and many other popular packages. Get a consistently crisp image with no quivers, jitters, or flickers because of non-interlaced technology.

That's the image you've come to expect from Princeton Graphic Systems. The Visible Edge.

Compatible with IBM XT, AT, PS/2 Model 30, Compaq DESKPRO 386 and compatibles, including Intel 80386-based machines. PG 1600 is a registered trademark of Cornerstone Technology.



PRINCETON
GRAPHIC SYSTEMS
THE VISIBLE EDGE

BAR CODE

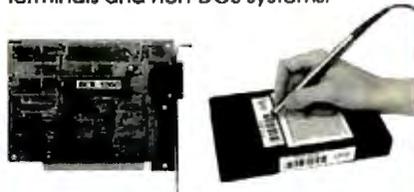


Faster, More Reliable Data Entry

Automating data input with bar codes slashes operating costs by increasing data entry speed and eliminating costly errors. Seagull Scientific Systems has designed innovative bar code reading and printing systems to save you time and money.

PC, XT, AT, PS/2 & RS-232

Our systems are compatible with all your existing DOS applications software because the data enters your computer as if it came from the keyboard. Internal and external bar code readers are available with stainless steel wands and laser interfaces. Our dual serial port (RS-232) model also supports data terminals and non-DOS systems.



BCR-1000 Bar Code Reader

This internal "half-size" card (for PC/XT/AT, PS/2 Model 30 and compatibles) combines a state-of-the-art decoding algorithm with the most advanced bar code support software available. User-definable attributes include selective auto-discrimination, 10 character pre/post-amble and much more. No DIP switches!



THE BAR TENDER® Label Printing Software

Prints high quality text and bar codes on dot matrix and laser printers. Easy-to-use menu driven operation includes Quick Print, automatic serialization and printing from a file. Format the labels any way you want, or use one of the pre-programmed formats: Rental Item, Identification Card, MIL-STD 1189A, AIAG VIN, HIBC and many others.

Call us, you won't believe how easy it is to bar code.

 **Seagull Scientific Systems**
601 University Avenue, Suite 150
Sacramento, CA 95825
(916) 386-1776

MAINFRAME PERFORMANCE

```

fastMathTableSize = (double)tableSize;
fastMathTableSinInc = ( TWO_PI ) / fastMathTableSize;
for(i = 0; i < tableSize; i++)
{
    fastMathSinTable[ i ] = (float)sin( (double)i *
                                        fastMathTableSinInc );
}
fastMathInitialized = 1;
}
return( 0 );
}
double angle 2 Idx (angle)
/*****
purp: convert the angle to an index
*****/
{
    unsigned int idx;

    if((angle < 0.0 ) || ( angle >= TWO_PI))
    {
        angle = angle - (unsigned int)(angle / TWO_PI) *
                    TWO_PI;
    }
    if( angle < 0.0 )
        angle += TWO_PI;
    }

    return((unsigned int)( angle / fastMathTableSinInc ) +
           0.5));
}
double fastSin( angle )
double angle;
/*****
purp: compute the sin of the angle in radians
*****/
{
    return((double)fastMathSinTable[ angle2Idx(angle) ] );
}
double fastestSin( angle )
unsigned int angle;
/*****
purp: compute the sin of the angle in radians,
      expressed as an integer, I.E. use angle2Idx
      to convert the angle to an index
*****/
{
    return((double)fastMathSinTable[ angle ] );
}

void startTiming()
/*****
purp: start the timer
*****/
{
    time(&curTime);
}

double endTimingSecs()
/*****
purp: return number of seconds since startTiming
*****/
{
    long endTime;

    time(&endTime);
    return((double)(endTime - curTime));
}

void main(argc,argv)
int argc;

```

continued

```

char *argv[];
/*****
test speed of sin
*****/
{
unsigned int tableSize,angleIndex;
unsigned long loops, i;
double value, endTime, result, fastSinfps;
double fastSinfps, sinfps, speedFactor;
if( argc < 3 )
{
printf("Usage: fastsin loops value {tableSize}\n");
printf(" loops == number of times the sin of value to
be taken\n");
printf(" value == value to take sin of\n");
printf(" tableSize == size of the look up table
(default=360)\n");
exit( 1 );
}
if( sscanf(argv[1],"%li",&loops) != 1 )
{
printf("Bad loops value\n");
exit( 1 );
}
if( sscanf(argv[2],"%lf",&value) != 1 )
{
printf("Bad loops value\n");
exit( 1 );
}
tableSize = 360;
if(argc == 4)
{
if( sscanf(argv[3],"%i",&tableSize) != 1 )
{
printf("Bad tableSize value\n");
exit( 1 );
}
}
if(fastMathInit( tableSize ) != 0)
{
printf("Error initializing fast math routine, NOT
enough memory\n");
exit( 1 );
}
/* convert from degrees to radians */
value = radians(value);

/* standard C library sin function */
startTiming();
for( i = loops; i != 0; i-- )
{
result = sin( value );
}
endTime = endTimingSecs();
if(endTime > 0.0)
sinfps = (double)loops / endTime;
else
sinfps = 0.0;
printf("time=%5.3lf, sin=%lf, functions per second =
%-0.3lf\n",endTime,
/* time fastSin */
startTiming();
for( i = loops; i != 0; i-- )
{
result = fastSin( value );
}
endTime = endTimingSecs();
if(endTime > 0.0)

```

continued

SAVE UP TO 70%
PRODUCTS NOT LISTED... CALL
Since 1984
CAD
SOFTWARE & PRINTERS

UPS ShipMate™ Manifest \$295
Since 1984

PRINTERS • LASERS • SCANNERS

AST TurboLaser/PS	Call	P-3	\$1819
Citizen 120-D	\$130	3510 3550	\$719
180-D	\$150	8010 8850	\$1809
MSP-10	\$249	Nashua NP-2405	\$799
MSP-15	\$319	NP-2410	\$1055
MSP-20	\$379	Panasonic 1000-M2	\$1182
MSP-25	\$375	1097-M2	\$1179
MSP-40	\$550	1050	\$239
MSP-45	\$386	1524	\$524
MSP-50	\$389	1582	\$389
MSP-55	\$439	1595	\$399
Premiere 25	\$429	2131	\$259
TruByte 224	\$579	3151	\$395
DocuCopy	Call	Scanner	\$919
Hermes 150	\$295	Tamaba 321 SL	\$499
4-P Laser Jet Series II	\$1250	341 SL	\$599
JPL	Call	351 II	\$999
REC P-6	\$425	351 C.2	\$1819
P-7	\$600		

CHIPS 64k 750k 8087 80287 80387 Call

MONITORS • TERMINALS • PANELS

Ambit 1280 w/ card	\$259	Toscan 123 G	\$85
Goldstar 111	\$79	124 A	\$85
RGB	\$198	635 Ultra HiRes RGB	\$378
RGB 31	\$286	650 Ultra HiRes RGB	\$408
Mitsubishi	Call	720 14" Multicolor	\$315
Mitsubishi	Call	770 14" Multicolor	\$359
Diamond Scan	\$450	Thompson Ultrascan	\$499
Others	Call	Viking 1 & 10	Call
REC Multisync	\$519	VNI	Call
Multisync Plus A 11	Call	Wye 30	\$292
Sony	Call	50	\$358
Sony Design LaserView	Call	75	\$590
Sony Multiscan	Call	700 & card	\$399

SOFTWARE

AutoCad	Call	NewsWise 1.1	\$439
AutoSketch	\$59	Paradox 2.0	\$395
BlockGraph 3D	\$199	Paradox 3.0	\$499
Carbon Copy Plus	\$181	ReachFirst Accounting P.	\$158
CPA- for Lotus 123	\$199	PFS First Choice	\$98
Copper	\$363	PFS First Publisher	\$44
Copy n PC	\$18	PFS Professional File	\$118
dBase III Plus	\$39	PFS Professional Plan	\$48
DeskView	\$89	PFS Professional Write	\$87
Draba 1 Plus	\$179	QSA	\$183
Dyn 2D Mouse & Joystick	Call	Paradymer	\$438
DS Backup Plus	\$32	R Data Sys	\$399
Enable 2.0	\$349	ShipMate™	
FastBack Backup	\$75	iUPS Manifest	\$295
FullBack Backup	\$48	Symphony	\$433
Generic Lead 3.0	\$55	TAS-Speaks Accounting	\$49
Generic & Dot Plot 3.0	\$71	Turbo Basic	\$52
Generic Options	Call	Turbo C	\$52
HAL for Lotus 123	\$182	Veritas Publishing 1.1	\$428
Harvard Graphics	\$175	Veritas Publishing 2.0	\$498
Harvard Top Proj Mgr	\$273	VP-Expert (All)	\$46
Lightning Speedup	\$54	VP-Grappa	\$46
Lotus 123 2.01	\$285	VP-Pragmex	\$46
MemCad	\$16	WordPerfect 4.2	\$186
MemoryMate	Call	WordPerfect & Library	\$239

DIGITIZERS & PLOTTERS

Calcomp Plotters	Call	Heath Type	\$399
Digitizers	Call	1111C Label	\$399
Enter Sweep 800	\$589	Others	Call
Others	Call	B-P Plotters	Call
Hausch Instruments	Call	Infim	Call
DMP 41/42	\$2259	IPS	Call
DMP 51/52	\$2259	Karna	Call
DMP 51/52MP	\$2959	Numatics	Call
DMP 56A	\$3089	SonyGraphics	Call
MP-Options	Call	12-12 Plus	\$348
		18-12 Professional	\$699

COMPUTERS

AST 286 Model 80	\$1339	Tamaba T1000	\$779
Model 140	\$2299	T1100	Call
Motor 160 w/ VGA & EGA	\$2499	T1100/13100	Call
Cardata	Call	Model M M	\$189
M/M	Call	T3100	\$2599
REC Multisync	\$1329	T3100/20	\$2985
Multisync EL	\$1599	Zenith 161 Laptop	\$1955
Summag 286 & 386	Call	163 Laptop	\$2159

BOARDS & NETWORKS

AST SixPak Plus 64k	\$125	Above Board PS AT 512k	\$335
StarLan Starter-2 set	\$449	NEC CG-3	\$299
Advanced NetWare/MS	Call	Netwin	Call
V2 Gs	\$499	Number 8	Call
Advanced NetWare/286	Call	Paradymer AutoSwitch	Call
ATI EGA Wonder	\$179	EGA 400	\$156
VPF Wonder	\$279	Signa Design VGA	\$299
Control Sys Artist	Call	Color 400	\$299
Karna SuperEGA	\$239	Vericom	Call
Harvard Graphics Plus	\$196	Vista 2 Vega	Call
Intel Others	Call	OnLine w/VGA	\$239
Above Board AT 512k	\$395	Vega VGA	\$279

DRIVES • MODEMS • FAX

Fujitsu 5.25	Call	Scapple S1225	Call
300k Drive	\$79	20" Loro	\$299
Maya	Call	512K 20" w/ Card	\$319
MicroLas	Call	SmartModem 1200 & SW	\$179
Mitsubishi 40mb 21ms	Call	2400B & SW	\$146
Drive	\$549	Tamaba 3.5" 331A1	\$115
Modem	Call	7200 Drive	Call
T1100-13100-2181	\$189	US Robotics	Call

MOUSE

IBM Mouse	\$49	Microsoft	Call
LapLink C7 Mouse	\$85	Mouse w/Paint	\$69
Logmouse Bus & Joypad	\$84	PC Mouse/Joystick	Call
Others (see Software section)	Call	Mouse II	\$97
		Summag Mouse Optical	\$99

HELPERS

Logical Connection 256k	\$299
312k	\$399

M.H.I. WAREHOUSE
5021 N 20th Street #10261 • Phoenix, Arizona 85064
TOLL FREE credit with order • 802-861-1800
Customer Service 802-997-8877
Customer Service Hours 9-3 M-F
Hours 8-5 MT M-F 9-2 SAT

© 1987 M.H.I. Warehouse and its products are registered trademarks of Computerware, Inc. All other trademarks are the property of their respective owners. Prices and P.O. box numbers are subject to change without notice. All prices are in U.S. dollars and include shipping and handling charges. All prices are subject to change without notice. All prices are in U.S. dollars and include shipping and handling charges. All prices are subject to change without notice.

```

fastSinfps = (double)loops / endTime;
else
/* time fastestSin */
angleIndex = angle2Idx( value );
startTiming();
for( i = loops; i != 0; i-- )
{
result = fastestSin( angleIndex );
}
endTime = endTimingSecs();
if( endTime > 0.0 )
fastestSinfps = (double)loops / endTime;
else
fastestSinfps = 0.0;
printf("time=%5.3lf, fastestSin=%lf, functions per second
      = %-0.3lf\n",endTime,

/* performance report */
if( sinfps > 0.0 )
speedFactor = fastSinfps / sinfps;
else
speedFactor = 0.0;
printf("fastSinfps / sinfps = %-0.3lf\n", speedFactor );

if( sinfps > 0.0 )
speedFactor = fastestSinfps / sinfps;
else
speedFactor = 0.0;
printf("fastestSinfps / sinfps = %-0.3lf\n", speedFactor
      );
}

```

into the output stack. The merge operation does not make use of large amounts of RAM.

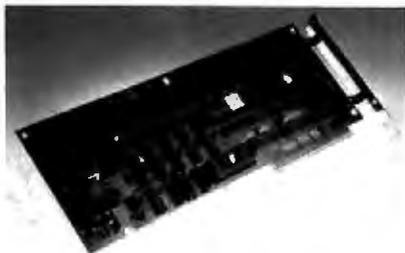
The cards represent fixed-length fields of data, and the numbers represent the data to be sorted. Variations on the process can be used to handle large and more complex sorts. The sort lends itself to large-RAM machines because you can choose the size of the initial stacks so as to take advantage of all available RAM.

A similar technique can be used to sort words rather than numbers. A user with a number of large documents to be stored on CD-ROM can, for example, sort the key words of the document. The final output, called an inverted index, will show where key words are used throughout the document.

A series of test runs on a Compaq 386 running at 16 MHz produced the results shown in table 2. The figures show the results of three different sorts of 20,000 records, 50 bytes each, with a 10-character field as the sort field. The first run sorted 10 records at a time into 2000 sorted sections. The second sorted 100 records into 200 sections, and the third sorted 1000 records into 20 sections. The sections were put into six output files and

continued

VERSATILITY AND TWICE THE CAPACITY



The PERSTOR 200 Series Advanced RLL Controllers double the storage capacity of your hard disk drive—almost any disk drive in almost any system—so you can extend the life of your drive. We give you what the other guys don't—more versatility and greater capacity.

Drives Supported

The PERSTOR 200 Series Controllers work with your CDC*, Maxtor*, Miniscribe*, Newbury Data*, Rodime*, Seagate*...probably the drive you currently have or the one you're planning to buy.

AT Compatibility

The same PERSTOR 200 Series Controller that runs in your PC or XT works in your AT, AT compatible, or 386 machine, and will effectively yield up to a two-fold increase in performance on your AT.

90% to 100% Increase in Storage

The Model PS180 Controller turns your 20mb drive into a 39mb drive, and the Model PS200 Controller turns your 20mb drive into a 43mb drive, instantly upon formatting.

PERSTOR

Sensible solutions for your hard disk problems

Perstor Systems, Inc. 7631 E. Greenway Rd., Scottsdale, AZ 85260 (602) 991-5451

*CDC is a trademark of Control Data Corporation
Maxtor is a trademark of Maxtor Corporation
Miniscribe is a trademark of Miniscribe Corporation
Newbury Data is a trademark of Newbury Data, Inc.
Rodime is a trademark of Rodime Incorporated
Seagate is a trademark of Seagate Technology

Case History #47582

"With over a million lines of source code, MortgageFlex is probably the largest application ever written for a LAN," says Lester Dominick, the developer of this monster program for mortgage banking back office management. "We probably encountered just about every programming challenge imaginable, but DataFlex's powerful 4th generation programming language proved more than a match for every situation."

A Straightforward English-like Syntax

"MortgageFlex is very easy to maintain and, because of DataFlex's English-like structure, new programmers with minimum training find it easy to figure out what programmers before them have done. DataFlex macro commands also take much of the burden off the programmers by

automatically taking care of the tedious chores of index manipulation, screen handling, cursor positioning and file management. We also like the way DataFlex uses indexes because it really lets the program take advantage of the capabilities of the system and run extremely fast."

Multi-user Capabilities for Today and Tomorrow

"We chose DataFlex 4½ years ago because of its outstanding multi-user capabilities and are very pleased with the way in which DataFlex has been continually adapted to new hardware and made even better as technology has improved. Not only do DataFlex programs run on more multi-user and LAN systems than any other DBMS product, but do so with absolutely no changes in the source code from system to system! I don't have to tell you what that means to

a developer with a million and a quarter lines of programming."

Take the first step to more efficient program development today. Return the coupon below for your free DataFlex Demonstration Diskettes.

Toll Free Sales Numbers
Nationwide 1-800-451-FLEX
In Florida 1-800-331-3960

"100 data files, 4,500 fields and 1.2 million lines of source code. Just try that with anything but DataFlex!"

*Lester Dominick
MortgageFlex Systems, Inc., Irvine, CA.*

Data Access Corporation
14000 S.W. 119 Avenue
Miami, Florida 33186
(305) 238-0012
TELEX: 469021 Data Access CI
FAX: (305) 238-0017

For more information call from your modem 1-800-444-8080 (300-1200 baud, 8 bit, no parity 1 stop bit) and enter the access code FLEX3 when prompted.

FREE SELF-RUNNING DATAFLEX DEMO (PC-DOS/MS-DOS ONLY)

Find out more about DataFlex's ease of use and programming power. Mail this coupon today for your free self-running demonstration diskettes.

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone () _____

How many computer systems are in use at your company? _____

Do you use a Local Area Network or Multi-User computer? _____

Will you be running the Demo off a hard disk? _____

Data Access Corporation, 14000 S.W. 119 Avenue, Miami, Florida 33186

Circle 75 on Reader Service Card

BYTE 1/1/88



Table 1: Performance of the table-lookup routine compared with standard sine functions in C, with and without a floating-point processor. Times are for 100,000 computations of the sine of 45 degrees.

Times for Compaq 286 Portable III with software FP			Times for 16-MHz Compaq 386 with an 80287		
	Computations per second	Speed-up factor		Computations per second	Speed-up factor
sin	215.6	1	sin	1411.2	1
fastSin	574.4	2.7	fastSin	2880.1	2.0
fastestSin	6839.9	31.7	fastestSin	21413.3	15.2

Table 2: Comparison of sort times on a 16-MHz Compaq 386 using various amounts of RAM to hold the active data.

Elements	Sections	Sort time	Merge passes	Merge time
10	2000	34.46	5	118.14
100	200	39.10	3	68.66
1000	20	35.14	2	41.36

were then merged.

The time to sort the files is about the same, regardless of the number of sections created. Each merge pass is about 22 seconds. It is clear, therefore, that the fewest number of merge passes will produce the shortest sort time.

You can decrease the merge time in two ways: Increase the size of the initial sort, or increase the number of files to merge. However, increasing the number of files does not pay off in the long run, due to the increased number of seeks required. Nevertheless, increasing the amount of memory will increase performance until the size of the file equals the size of the memory.

The Importance of RAM

Increased storage enables microcomputers to perform operations that were beyond their capabilities a few years ago. Larger RAM quickly translates into increased performance. Large, external storage capacity with relatively small RAM will get the job done, but at a painfully slow pace. To be effective, large external storage capacity must be coupled with ample RAM. The result is high performance on a small machine.

Note that some fancy footwork may be required because the IBM PC does not have a linear address space: The programmer cannot define a 1-megabyte array. With a large linear address space, as on the 68000-based and 80286/80386-based computers in protected mode, the task would be much simpler. Even with the complications of a nonlinear address space, the expanded memory, if used correctly, can give a microcomputer some mainframe-class performance ratings on given tasks.

As a programmer who used to work on a microcomputer that had 1024 bytes of RAM and a cassette recorder for external memory, I'm painfully aware of the numerous constraints that are synonymous with lack of memory. Fortunately, the RAM shortage problem is going away fast. The trick now is to find programming techniques that make optimal use of all that extra RAM. ■

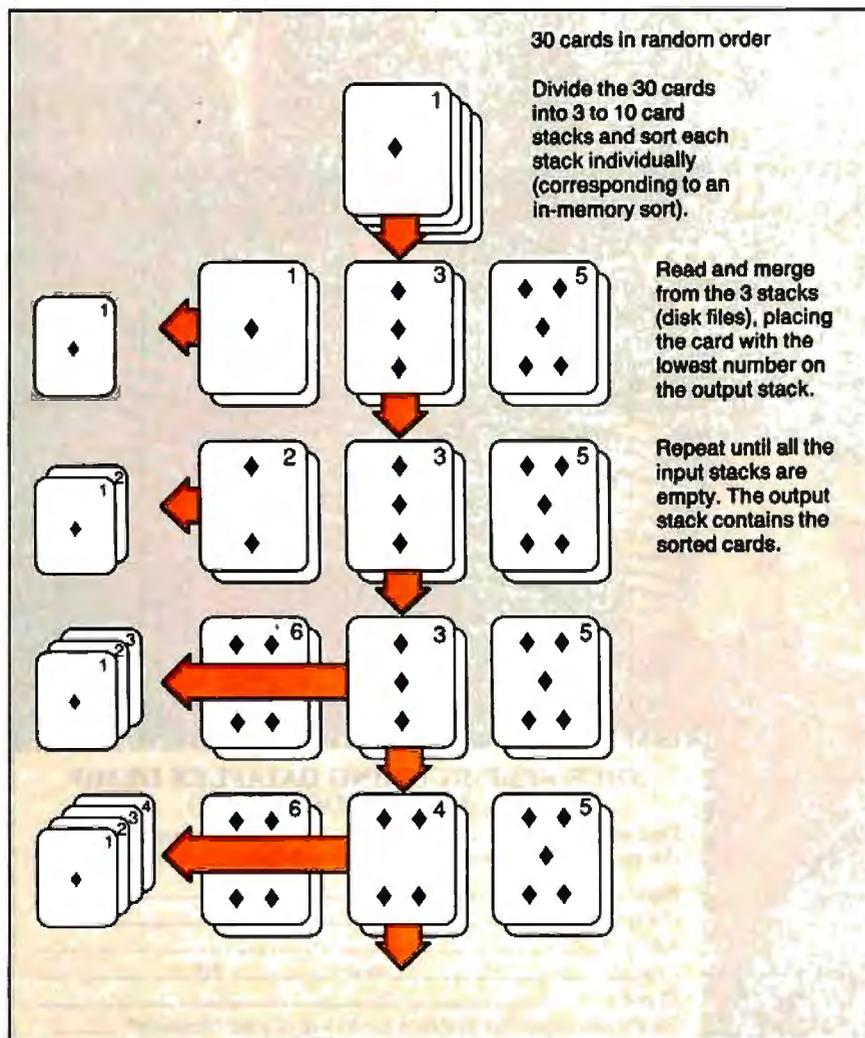


Figure 1: Illustration of the technique for in-memory sorts on very large data sets.

HYPertext

Guide
Macintosh, \$134.95
IBM PC, \$199.95
Owl International Inc.
14218 Northeast 21st St.
Bellevue, WA 98007
(206) 747-3203
Inquiry 955.

HyperCard, \$49
Apple Computer Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Inquiry 956.

KnowledgePro, \$495
Knowledge Garden Inc.
473A Malden Bridge Rd.
Nassau, NY 12123
(518) 766-3000
Inquiry 957.

MacSMARTS, \$149.95
Cognition Technology
55 Wheeler St.
Cambridge, MA 02138
(617) 492-0246
(800) 622-2829
Inquiry 958.

LARGE DATABASE MANAGEMENT SYSTEMS WITH QUERY OPTIMIZATION

Ingres
Relational Technology Inc.
1080 Marina Village
Parkway
Alameda, CA 94501
(415) 769-1400
Inquiry 959.

Sybase
Sybase Inc.
2910 7th St.
Berkeley, CA 94710
(415) 548-4500
Inquiry 960.

SQLBase
Gupta Technologies Inc.
1040 Marsh Rd., Suite 240
Menlo Park, CA 94025
(415) 321-9500
Inquiry 961.

Emerald Bay
(not yet released)
Ratliff Software Production
Inc.
2705 Ridgepine Dr.
La Crescenta, CA 91214
(818) 248-1092
Inquiry 962.

Informix-SQL
Informix Software Inc.
4100 Bohannon Dr.
Menlo Park, CA 94025
(415) 322-4100
Inquiry 963.

Oracle
Oracle Corp.
20 Davis Dr.
Belmont, CA 94002
(800) 345-3267
Inquiry 964.

OTHER DBMS PRODUCTS MENTIONED

Condor
Condor Computer Corp.
1490 Eisenhower Place
Ann Arbor, MI 48108
(313) 971-8880
Inquiry 965.

R:base
Microrim Inc.
3925 159th Ave., NE
Redmond, WA 98052
(206) 885-2000
Inquiry 966.

dBASE III
Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502-1319
(213) 329-8000
Inquiry 967.

SELECTED READING LIST, QUERY OPTIMIZERS

The following articles introduce the major techniques used in commercial query optimizers today. The database query-optimizer article combines approaches used by Selinger with distribution information proposed by Piatetsky-Shapiro and Connell. Youssefi and Wong use a different technique called decomposition.

Selinger, Pat, et al. "Access Path Selection in a Relational Database Management System." *Proceedings of the 1979 ACM-SIGMOD Conference on the Management of Data.*

Piatetsky-Shapiro, Gregory and Charles Connell. "Accurate Estimation of the Number of Tuples Satisfying a Condition." *Proceedings of the 1984 ACM-SIGMOD Conference on the Management of Data.*

Youssefi, Karel and Eugene Wong. "Query Processing in a Relational Database Management System."

Wong, Eugene and Karel Youssefi. "Decomposition—A Strategy for Query Processing." *ACM Transactions on Database Systems*, vol. 1, no. 1, September 1976, pp. 223-241.

For a general overview of query-optimization techniques, see:

Jarke, Matthias and Juergen Koch. "Query Optimization in Database Systems." *Computing Surveys*, vol. 16, no. 2, pp. 111-152.

This is my favorite general introduction to relational databases:

C. J. Date. *Relational Database—Selected Writings 1986.* Reading, MA: Addison-Wesley.

These two articles by Codd define the relational model in detail:

E. F. Codd. "Is Your DBMS Really Relational?" *Computerworld*, October 14, 1985, pp. ID/1-ID/9.

E. F. Codd. "Does Your DBMS Run by the Rules?" *Computerworld*, October 14, 1985, pp. 49-60.

—Jonathan Robie



“Unlimited”

un·lim'it·ed, a. [L. limitus]: *The ability to expand your personal computer's storage capacity beyond your wildest imagination. For less than \$350 per 40 MB.*

Up until now, the concept of unlimited PC storage capacity was about as practical as cramming all your office files into your briefcase. Storage capacity could only be stretched as far as the fixed capacity of your hard disk. Or to the limit of your patience for shuffling through stacks of floppies.

But imagine instead that you could insert and remove hard disks as easily as a VCR cassette—your PC's storage capacity would then be virtually limitless.

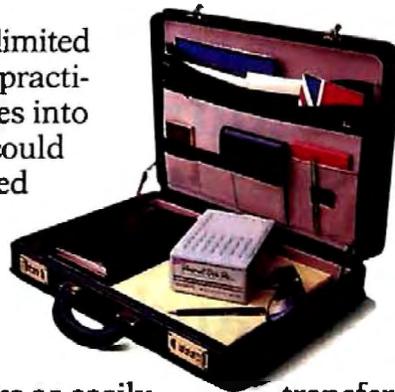
That's exactly the idea behind the Tandon Personal Data Pac, the world's first and only



portable, Winchester hard disk. Just attach a low-cost Ad-PAC drive receptacle to your PC, and its powers of memory are totally transformed. You can choose from a

number of self-contained, portable Personal Data Pacs that can be inserted and removed as easy as a floppy. Now a whole business worth of software and data can fit neatly into your briefcase. Ready to go anywhere your business will take you.

And when you are done for the



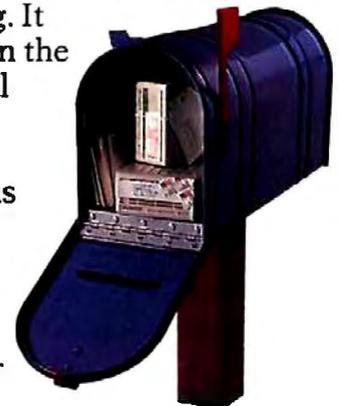
day, your entire information base can be simply locked away where only you can get at it.

If you want to share your software and data with others, the Tandon Personal Data Pac offers you the cheapest and most reliable “network” possible. Simply

transfer what you need from one Pac to another, and turn a shared PC into a dedicated workstation, just for you.

If your travels with the Data Pac take you on a bumpy road, don't worry. Your software and files will be safe and secure inside the Pac's rugged housing. It can even take a trip in the mail or an occasional fall off your desk.

See your Tandon Dealer today or call us at 1-800-556-1234, ext. 171 (in California 1-800-441-2345, ext. 171) and learn the new definition for personal computing.



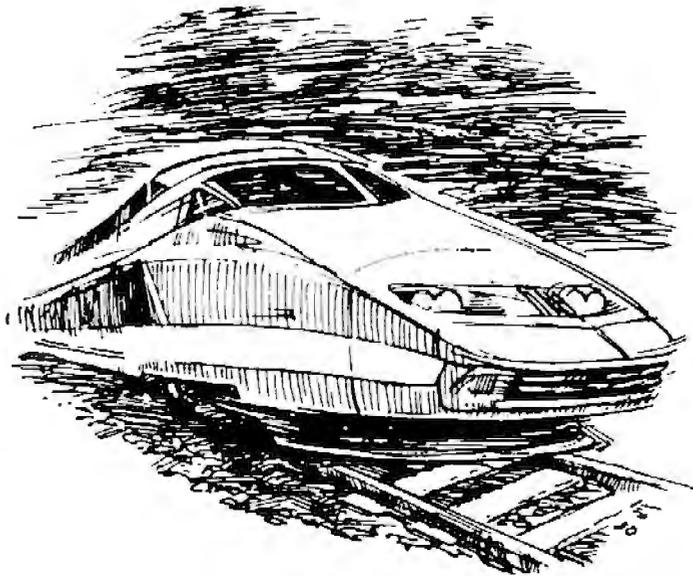
The possibilities are limitless.



Tandon

*We're redefining
personal computing.*

GV-286 "It coaxes extraordinary performance through the use of imaginative design and careful engineering." October 13, 1987



GV-386 "the performance is the best we have found to date." May 26, 1987

PC Designs announces two new high-performance systems, the GV-801 and GV-100, plus lower prices on the GV-286 and GV-386.

GV-286 Model 801

- 8 MHZ, 80286
- 1 MB / One Wait State DRAM
- 1.2 MB Toshiba Floppy
- One Parallel, 2 Serial Ports
- CMOS Clock Calendar & setup
- Maxi-Switch "AT" keyboard
- And much more
- Starting at \$1,200

GV-286 Model 100

- 10 MHZ, 80286
- 1 MB Zero Wait State DRAM
- 1.2 MB Toshiba Floppy
- One Parallel, 2 Serial Ports
- CMOS Clock Calendar and setup
- Maxi-Switch 101 keyboard
- And much more
- Starting at \$1,425

GV-286 Model 120

- 12 MHZ 80286
- 1 MB / Zero Wait State DRAM
- 1.2 MB Toshiba Floppy
- 2 Serial / 1 Parallel Ports
- CMOS Clock / Calendar
- Maxi-Switch 101 keyboard
- Desqview
- And much more
- Starting at \$1,950

GV-386

- 16 MHZ 80386
- 1 MB / Zero Wait State DRAM
- 1.2 MB Toshiba Floppy
- 2 Serial / 1 Parallel Ports
- CMOS Clock / Calendar
- Maxi-Switch 101 keyboard
- Desqview & QEMM
- And much more
- Starting at \$2,425

Toll-Free Technical Support Line

1-Year Warranty

30-Day Compatibility Guarantee

Call for competitive prices on popular options, including hard drives, EGA monitors, printers and other peripherals

2500 N. Hemlock Circle
Broken Arrow, OK 74012
800-32-BITPC
(918) 251-5550
FAX (918) 251-7057

PC Designs

19 Rector Street
New York, NY 10006
(212) 514-7280
FAX (212) 797-3973

XT and AT are registered trademarks of International Business Machines Corporations. Hercules is a registered trademark of Hercules Technologies. Max-12 is a registered trademark of Princeton Graphics Systems, Inc. Desqview and QEMM are registered trademarks of Quarterdeck, Inc.

Features

- 271 **Ciarcia's Circuit Cellar:
The BCC180 Multitasking
Controller**
Part 1: The Hardware
by Steve Ciarcia
- 285 **Focus on Algorithms:
Changing Reverse Polish to Infix**
by Dick Pountain
- 291 **Using Financial Tools for
Nonfinancial Simulations**
by James L. Conger



There's One More Computer Program You Need

the computer chronicles

THE COMPUTER CHRONICLES, THE ONLY NATIONAL TELEVISION SERIES AIMED AT COMPUTER USERS, OWNERS, EDUCATORS AND COMPUTER INDUSTRY PROFESSIONALS. NOW IN ITS FOURTH SEASON ON PUBLIC TELEVISION.

CO-HOSTED BY GARY KILDALL AND STEWART CHEIFET, WITH COMMENTATOR GEORGE MORROW, THE COMPUTER CHRONICLES KEEPS YOU UP-TO-DATE ON THE EVER CHANGING WORLD OF COMPUTING.

THE COMPUTER CHRONICLES, PROGRAMMED WEEKLY BY COMPUTER PROFESSIONALS FOR COMPUTER USERS.



The Computer Chronicles is funded by **Leading Edge** and McGraw-Hill's **BYTE** magazine.

LEADING EDGE™



Gary Kildall



Stewart Cheifet



George Morrow

TOPICS THIS SEASON INCLUDE:

EDUCATIONAL SOFTWARE • RISC • UTILITIES
DESKTOP PUBLISHING • GUIDE TO MACROS
RAM RESIDENT SOFTWARE • ON-LINE DATA BASES • MODEMS
PROJECT MANAGEMENT SOFTWARE • CD-ROMS
ARTIFICIAL INTELLIGENCE • PERSONAL CAD

PLUS...

RANDOM ACCESS

A WEEKLY NEWS SEGMENT DESIGNED TO KEEP YOU INFORMED ABOUT THE LATEST DEVELOPMENTS IN THE COMPUTER INDUSTRY.

The Computer Chronicles on PBS is a co-production of WITF/Harrisburg and KCSM/San Mateo.

The BCC180 Multitasking Controller

Using a Hitachi CPU, Steve comes up with this multitasking single-board computer



Necessity is indeed the mother of invention. I have been known to stretch that adage on occasion, but my track record is pretty consistent. Many people think that I study trends in computer technology, intensively investigate reader interest, and carefully formulate a writing strategy that results in the projects you see. While I do consider all those factors, the actual selection process is considerably less complex. If I need it, I build it.

Again, I am at the point where I need to configure a new piece of controller hardware or resort to less popular alternatives. I am presently installing and testing a video motion and tracking system that I may document as a future project. (McGraw-Hill's lawyers will probably hyperventilate when I start discussing the "laser targeting" section, but that's a story for another time.)

Using eight video cameras, the system senses motion and triggers specific control actions depending upon what it "sees." While real video recognition is still a bit in the future, coordinating all the control decisions presently generated—even from the uncompleted video unit and a multitude of hard-wired sensors—is becoming a monumental task.

Generally, I would code these kinds of control applications in interpreted BASIC on a board like my BCC52 (see the August 1985 Circuit Cellar). I could then use all its bus-compatible peripherals for the control and sensor I/O.

However, given the magnitude of the task, I thought a BASIC interpreter would be too slow unless it was liberally salted with assembly language calls. Either I had to write more assembly language code (I'm not enamored with programming as it is), dedicate a large computer to the task (an expensive alternative), or design a small controller that was both fast and powerful enough to accomplish the task (sure, why not).

The BCC180 Computer/Controller

This new controller is called the BCC180 (table 1 lists its specifications). Designed from the ground up for efficiency and performance, the BCC180 uses the same 64180

CMOS Z80 instruction-compatible processor as my SB180 and SB180FX computers (see the September 1985 Circuit Cellar). Configured primarily for process control, the BCC180 uses the same 44-pin I/O expansion bus as the BCC52. All the BCC bus peripherals that I've described over the years will work nicely.

The BCC180 also contains a substantial amount of on-board I/O. It has six parallel ports and three serial I/O ports, and it communicates command and control decisions serially via RS-232C, RS-422, or RS-485. It can accommodate up to 384K bytes of on-board memory, which can be pure application code, monitor and application code, or a resident high-level language and application code.

BASIC-180

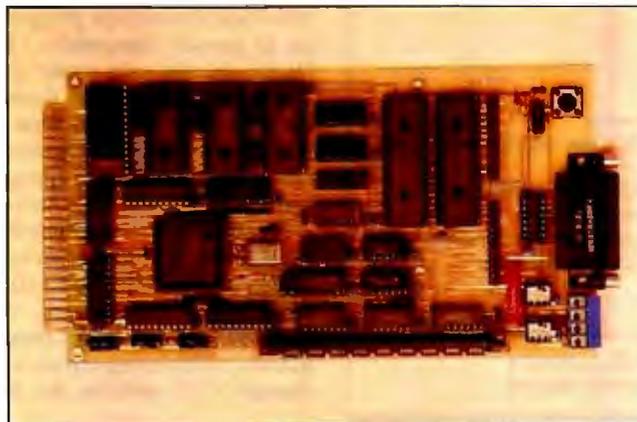
The most significant aspect of the BCC180 is its new approach to high-speed, high-level-language programming. Like the BCC52, I dictated that the BCC180 would have a ROM-resident BASIC. Unlike the BASIC-52 interpreter (albeit fast by most standards), the BCC180 has a *compiled multitasking BASIC*—BASIC-180—written by Softaid Inc. (8930 Route 108, Columbia, MO 21045). BASIC-180 was configured and adapted specifically for the 64180, and for the BCC180 in particular.

Unlike many generic BASICs that have 64K-byte ceilings, BASIC-180 uses the BCC180's hardware in the most efficient manner to optimize performance, and it can address and utilize a full megabyte of program space. (I've installed BASIC-180 as an EPROM rather than mask-programming it onto the processor. You can remove or switch the BASIC-180 EPROM at any time to allow the BCC180 to function completely in Z80 or 64180 assembly language code or another high-level language like C or Pascal.)

By using a multitasking BASIC compiler, I will have enough performance to continue my video-control project, plus the added benefit of a user-friendly software development environment. BASIC-180 can run up to 32 independent program tasks

of up to 32K bytes each *concurrently* and, while task complexity does affect execu-

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. The author of several books on electronics, he can be reached at P.O. Box 582, Glastonbury, CT 06033, or on BIX as "sciarcia."

tion speed, is a real screamer.

I'll go into benchmarks later, but if you are familiar with BASIC-52 and anxious for some comparisons, I'll give you a quick one: At 6.144 MHz, BASIC-180 executes an integer variable FOR...NEXT loop benchmark approximately 100 times faster than BASIC-52 does!

BASIC-180 comes in two flavors: disk-based, for development on an SB180/SB180FX, and ROM-based, for development on the BCC180 board. Using the disk-based version, you can create and—to a certain degree—test programs on the SB180/SB180FX. This lets you use a full-screen editor for writing source code and a disk drive for saving the code. You obviously can't test a program that requires any BCC180-specific I/O operations on the SB180, but you can test fundamental op-

erations without change.

Once you've written the code on the SB180 and you've verified that it's syntactically correct, you can compile it into one or more binary files and burn them into an EPROM (with the Circuit Cellar serial EPROM programmer, perhaps) or send the files directly to the BCC180 (with the monitor ROM installed) for testing in RAM or programming into an EPROM there.

If you don't have an SB180 for development or prefer to do all the development on the BCC180, you can use the ROM-based version of BASIC-180. It supports all the features of the disk-based version with a few modifications: Instead of saving program source code to disk, the ROM-based compiler saves it to EPROM. Only as much of the EPROM is programmed as is necessary to store the source code, so multiple programs (or versions of the same program) can be saved to the same EPROM. This is often referred to as write once, read many (WORM) storage. When you fill the EPROM up, you can simply erase it and use it again.

Additionally, the compiler can program the object code directly into an EPROM. You can then use this EPROM to replace the BASIC-180 ROM for auto-start applications. You might also want to compile the object code into RAM, where you can execute the program immediately.

The BCC180's Hardware

The BCC180 uses the same Hitachi HD64180 (or Zilog Z180) microprocessor used on my SB180 and SB180FX computers (see figure 1 for the BCC180's schematic). Briefly, this chip executes the complete Z80 instruction set, plus a few new instructions (including an 8-bit multiply).

The chip contains an on-board memory management unit (MMU), a built-in direct-memory-access (DMA) controller with two DMA channels, two asynchronous serial ports, one synchronous serial port, two 16-bit programmable reload timers, and eight internal and four external interrupt sources with a built-in interrupt controller.

The HD64180 can address up to 1 megabyte of memory and 64K I/O ports. Since the BCC bus has only 16 address bits, I decided that all memory would be resident on the main board and that all transactions the BCC180 carried out through the bus would be I/O-based. As a result, I tried to squeeze as much memory as possible onto the board.

The BCC180 contains four 28-pin sockets (IC10 through IC13) addressed in 32K-byte increments, starting at physical address 00000 and going through 1FFFF hexadecimal. Each socket will accommodate either a 27256 EPROM or a 62256 static RAM chip. This lets you burn the control program into one or more EPROMs and place it at low memory for execution upon reset.

You can use zero-power RAM (static RAM that contains its own battery) or SmartSockets (sockets that contain a battery) with static RAM chips plugged into them in the remaining sockets to provide inexpensive, nonvolatile storage. A 74LS138 (IC14) decodes each socket's address.

The four sockets just described allow up to 128K bytes of static RAM storage, but what about applications that need a lot of temporary storage? Dynamic RAM is ideally suited in cases where large amounts of storage are needed in a small area but that doesn't have to be battery-backed.

Dynamic memory arranged on a single in-line memory module (SIMM) is becoming more popular these days, so I added a SIMM socket to the BCC180, decoded to start at physical address 40000 hexadecimal. A 256K-byte SIMM brings the BCC180's total on-board system memory up to 384K bytes. An address multiplexing circuit made up of three 74LS158s (IC15 through IC17) switches the SIMM address lines between row

continued

Table 1: Specifications for the BCC180.

Processor

Hitachi HD64180, an 8-bit CPU in a 68-pin PLCC package
Superset of Z80 instruction set, including hardware multiply
Integrated memory-management unit
Dynamic RAM refresh
Wait-state generator
Clocked serial I/O port
Two-channel direct-memory-access controller
Two-channel asynchronous serial-communication interface
Two-channel 16-bit programmable reload timer
12 interrupts
6.144-MHz and 9.216-MHz system operation

Memory

Up to 384K bytes of total memory on-board
128K bytes of either static RAM (62256) or EPROM (27256)
Optional 256K-byte dynamic RAM SIMM
Full-function 8K-byte ROM monitor included

I/O

Console RS-232C serial port with automatic data transfer rate selectable to 38,400 bps
Peripheral serial port, 150 through 38,400 bps, selectable RS-232C, RS-422, or RS-485
48 bits of bidirectional parallel I/O
64K-byte I/O space available through the BCC bus edge connector

Power Supply Requirements

+5 V +/- 5 percent @ 700 mA (fully populated with LSTTL)
+12 V +/- 20 percent @ 30 mA
-12 V +/- 20 percent @ 30 mA
12-V supplies are required only for RS-232C operation

Dimensions and Connections

4.5- by 8.5-inch board
Dual 22-pin (0.156-inch) edge connector
Compatible with all Micromint BCC-series I/O expansion boards
25-pin DB-25S connector for RS-232C serial console I/O
20-pin header for RS-232C serial peripheral port
Four screw terminals for RS-422/RS-485 serial peripheral port
Two 26-pin headers for six bidirectional parallel ports

Operating Conditions

Temperature: 0-50 degrees C (32-122 degrees F)
Relative humidity: 10-90 percent, noncondensing

GET THE KNOW-HOW TO SERVICE EVERY COMPUTER ON THIS PAGE.

Learn the Basics the NRI Way—and Earn Good Money Troubleshooting Any Brand of Computer

The biggest growth in jobs between now and 1995, according to Department of Labor estimates, will occur in the computer service and repair business, where demand for trained technicians will actually double.

You can cash in on this opportunity—either as a full-time corporate technician or an independent service-person—once you've learned all the basics of computers the NRI way. NRI's practical combination of "reason-why" theory and "hands-on" building skills starts you with the fundamentals of electronics, then guides you through advanced electronic circuitry and on into computer electronics. You also learn to program in BASIC and machine language, the essential languages for troubleshooting and repair.

Total Computer Systems Training, Only From NRI

No computer stands alone... it's part of a total system. To really service computers, you have to understand computer systems. And only NRI includes a powerful computer system as part of your training, centered around the new fully IBM compatible Sanyo 880 Series computer.

You start with the step-by-step assembly of the new, highly rated fully IBM compatible Sanyo 880 Series computer. You install and troubleshoot the "intelligent" keyboard. Then you assemble the power supply, install the disk drive, and add extra memory to give you a powerful 256K RAM system. The new 880 computer has two operating speeds: standard IBM speed of 4.77 MHz and a remarkable turbo speed of 8 MHz, making it almost twice as fast as the IBM PC. Next, you'll interface the high-resolution monitor and begin to use the valuable software also included with your complete computer system.



IBM is a Registered Trademark of IBM Corporation.
Epson is a Registered Trademark of Epson America, Inc.
Apple and the Apple logo are Registered Trademarks of Apple Computer, Inc.
Compaq is a Registered Trademark of COMPAQ Computer Corporation.
© 1985 AT&T Technologies, Inc.

no need to quit your present job until you're ready to make your move. Your training is backed up by your personal NRI instructor and the NRI technical staff, ready to answer your questions and help you when you need it. You get it all with NRI at-home training.

100-Page Free Catalog Tells More

Send the postage-paid reply card today for NRI's big, 100-page, color catalog on NRI's electronics training, which gives you all the facts about NRI courses in Micro-computers, Robotics, Data Communications, TV/Audio/Video Servicing, and other growing high-tech career fields. If the reply card is missing, write to the address below.

AND MORE!

It all adds up to confidence-building, real-world experience that includes training in programming, circuit design, and peripheral maintenance. You'll be learning about, working with, servicing, and troubleshooting an entire computer system—monitor, keyboard, computer, disk drive, power supply—to ensure that you have all the essential skills you need to succeed as a professional computer service technician.

No Experience Needed, NRI Builds It In

This is the kind of practical, hands-on experience that makes you uniquely prepared, with the skills and confidence you need for success. You learn at your own convenience in your own home. No classroom pressures, no night school,



Your NRI total systems training includes:

- NRI Discovery Lab® to design and modify circuits
- Your four-function digital multimeter with walk-through instructions on audio tape
- Digital logic probe for visual examination of keyboard circuits
- The newest Sanyo 880 Series Computer with "intelligent" keyboard and 360K double-density, double-sided disk drive
- High resolution monochrome monitor
- 8K ROM, 256K RAM
- Bundled software including GW BASIC, MS-DOS, WordStar, CalcStar
- Reference manuals, schematics, and bite-sized lessons.

NRI SCHOOLS

McGraw-Hill Continuing Education Center
3939 Wisconsin Avenue, NW
Washington, DC 20016

We'll Give You Tomorrow.



addresses and column addresses. ME\ generates RAS\, and the flip-flop circuit made up of IC18 through IC20 generates CAS\.

Unfortunately, 384K bytes must be the upper limit for the time being. While the current HD64180s can address 1 megabyte of memory, they provide only 8-bit refresh (1 megabyte needs 9-bit refresh). Keeping possible future developments in mind, however, I've wired the SIMM socket to accommodate a

1-megabyte SIMM. If a new version of the HD64180 becomes available that provides 9-bit refresh, you'll be able to plug a 1-megabyte SIMM into the socket and bring the total system memory up to 896K bytes (since the SIMM's addressing starts at 40000 hexadecimal, we must throw away 256K bytes of the 1-megabyte SIMM).

Next, if a process-control computer is going to be useful, it must be able to deal with real-world inputs and outputs. For that

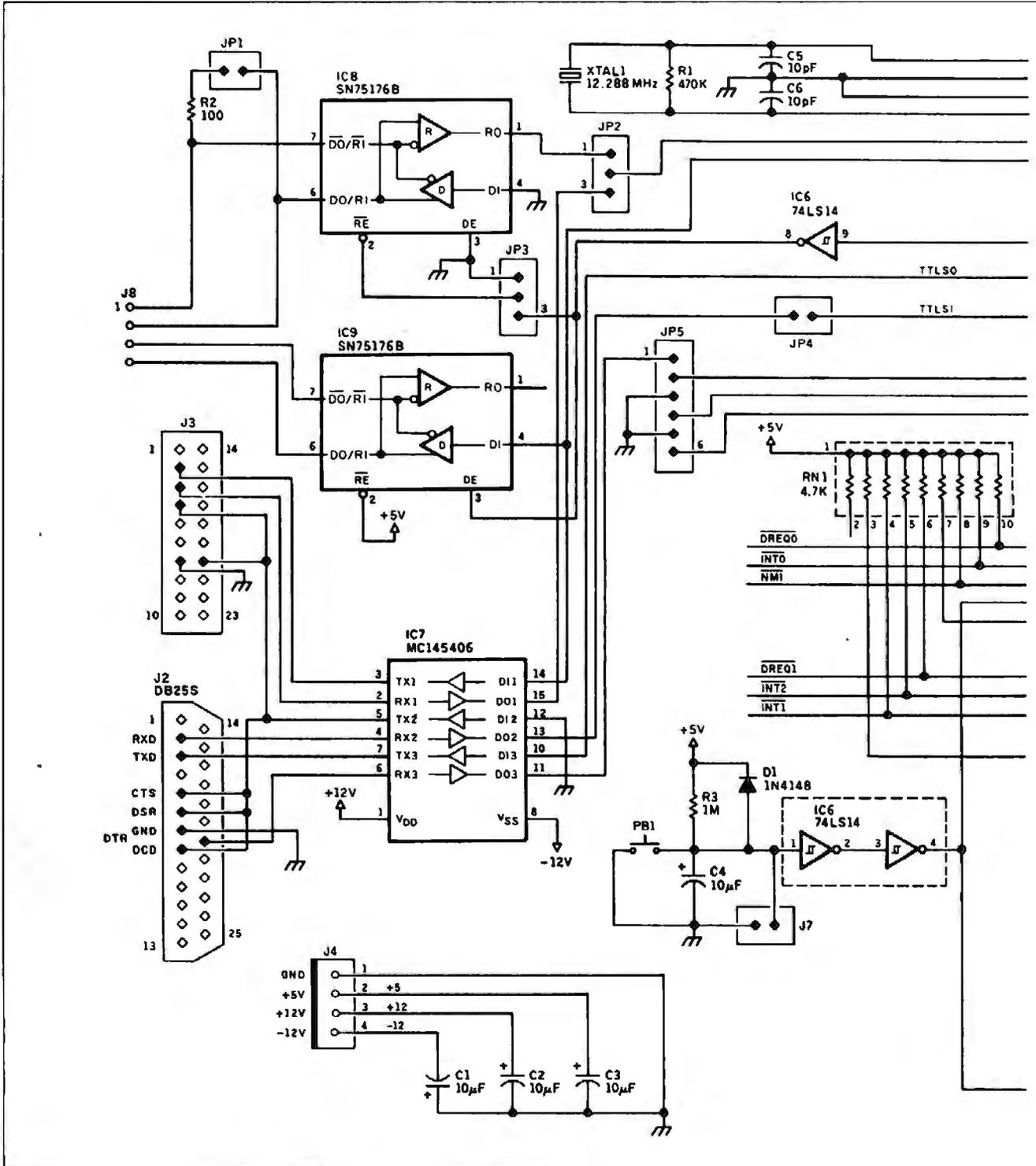


Figure 1: Schematic for the BCC180 computer/controller.

CIRCUIT CELLAR

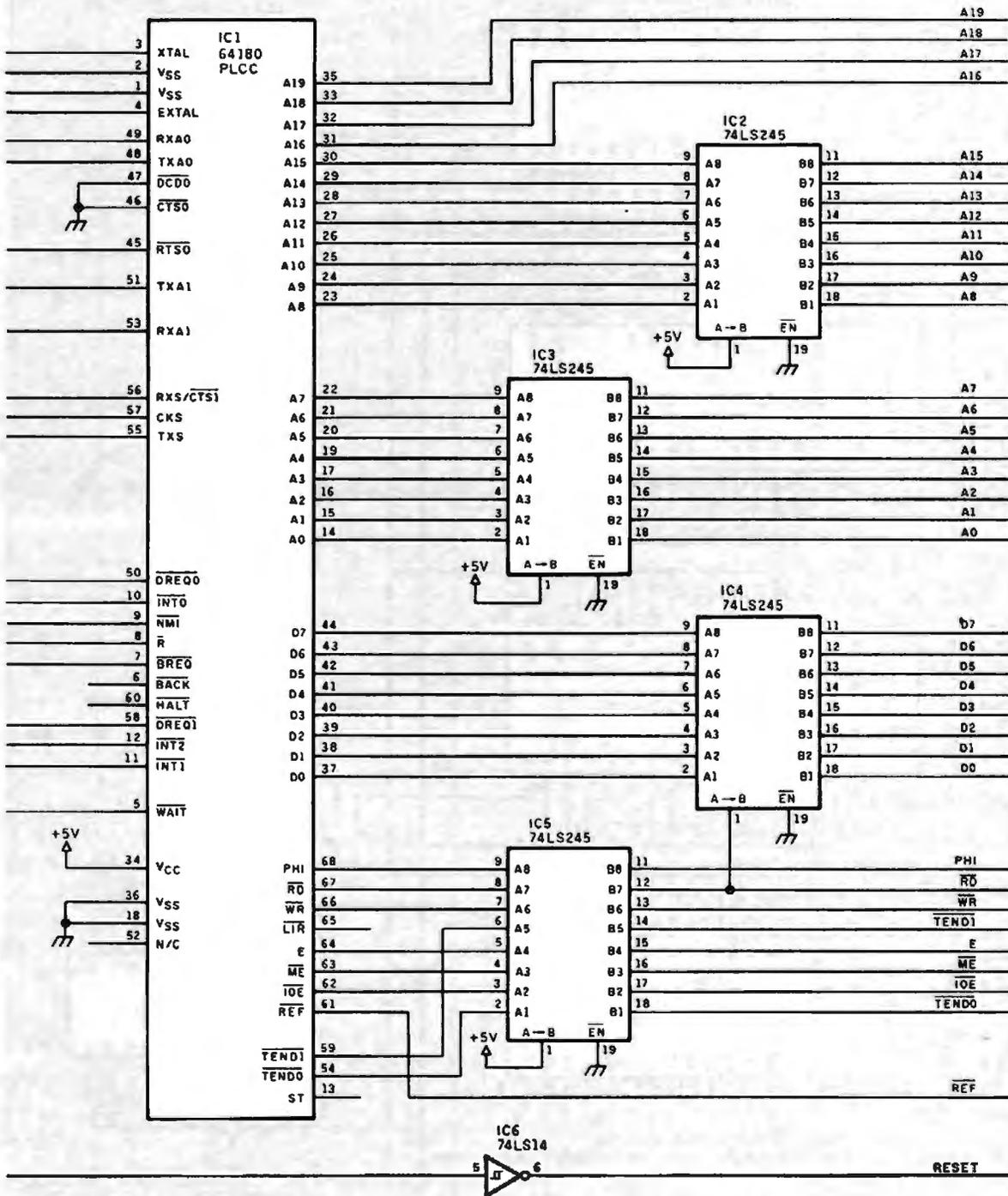
reason, two 8255 peripheral interface adapters (PIAs) are on the BCC180. Each 8255 has three 8-bit parallel I/O ports that can be individually configured for input or output, for a total of 48 bits of parallel I/O on the board (available on two 26-pin Berg-type connectors, J5 and J6).

In figure 1, IC23 and IC24 are the 8255s, and IC19, IC21, and IC22 decode an I/O address for each chip. You can select the addresses for the 8255s using jumpers JP10 and JP11.

Besides having parallel I/O, the BCC180 also has serial I/O. The serial ports let you communicate, via terminal, with the BCC180 and let it access external data-collection devices. Two asynchronous serial ports are built into the HD64180.

Serial port 1 uses an MC145406 (IC7) to convert TTL-level signals to RS-232C levels and is connected to a standard DB-25 connector (J2). Normally, you would connect an external termi-

continued



nal to J2. I've also connected serial port 1 to the BCC bus to allow TTL-level communication directly.

You can use the second asynchronous serial port (port 0) with one of three interfaces: RS-232C, RS-422, or RS-485. If you connect a jumper between pins 2 and 3 of JP2, port 0 passes

its signals through the MC145406 for use as an RS-232C port.

J3 connects port 0 to the outside world in this configuration. When JP2 has a jumper between pins 1 and 2, port 0 communicates through the two SN75176B chips (IC8 and IC9) for use in either an RS-422 or an RS-485 application.

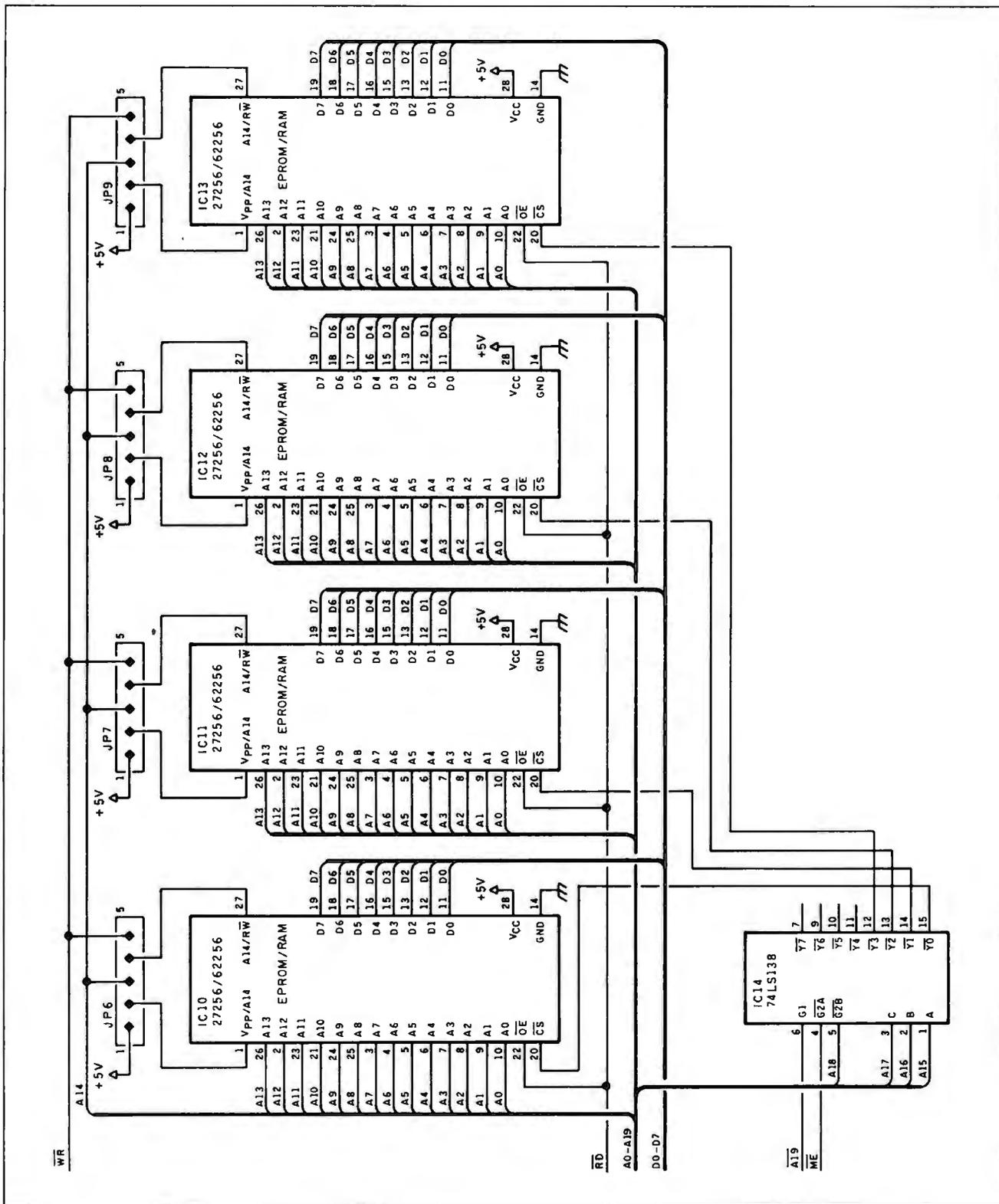


Figure 1: Continued.

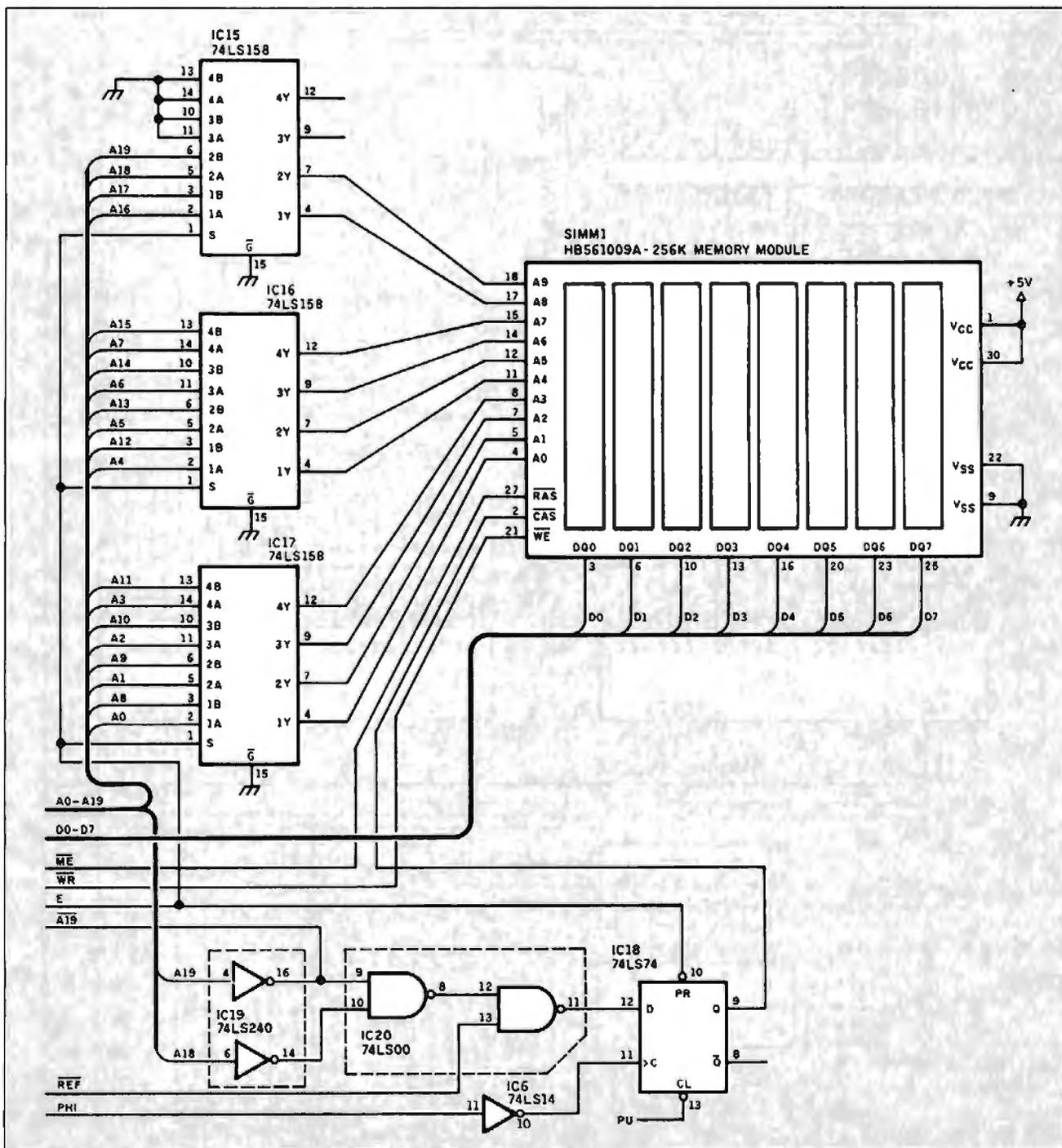
Due to their relatively high noise immunity over long distances, RS-422 and RS-485 are becoming popular for use in communicating between remote data-collection sites and a central controller. Unlike RS-232C, which is single-ended (one wire is tied to ground, and a voltage varies on the other), RS-422 and RS-485 use balanced lines for data transmission.

In a balanced line, the voltage differential between the two wires is what's important, rather than the absolute voltage referenced to ground. The absolute voltage of the pair of wires referenced to ground can be anywhere from -7 volts to +12 V, and it won't affect the operation of the connection. The twisted-pair

telephone line running into your home is an example of a balanced line. In RS-422 uses, separate transmit and receive pairs allow full-duplex operation, and each line has just one driver and one receiver. Its setup is similar to RS-232C, in that it's used mostly for point-to-point connections.

RS-485, on the other hand, is usually used in a party-line configuration. A single twisted pair connects numerous devices, and each device has a driver and a receiver connected to the same pair of wires. Only one driver can be active at a time, and all the receivers can be active at once. It's up to the software

continued



designer to implement a protocol. Although it can operate only in half-duplex, it is a simple and inexpensive way to implement a local-area network (LAN).

Although the BCC180's SN75176B is intended primarily for use in RS-485 applications, since RS-485 is really just a specialized use of RS-422, this driver IC will work well in most RS-422 applications. If you place a jumper between pins 1 and 2 on JP3, port 0 is set up for double-pair, full-duplex RS-422 operation.

Placing a jumper on JP3 between pins 2 and 3, and tying together pins 1 and 3 and pins 2 and 4 on J8, configures the board for single-pair, half-duplex RS-485 operation.

The BCC Bus

In the early days of microcomputers, Intel wanted to increase the capability of its microprocessors without increasing the number of pins needed on the chip. The company started using a method

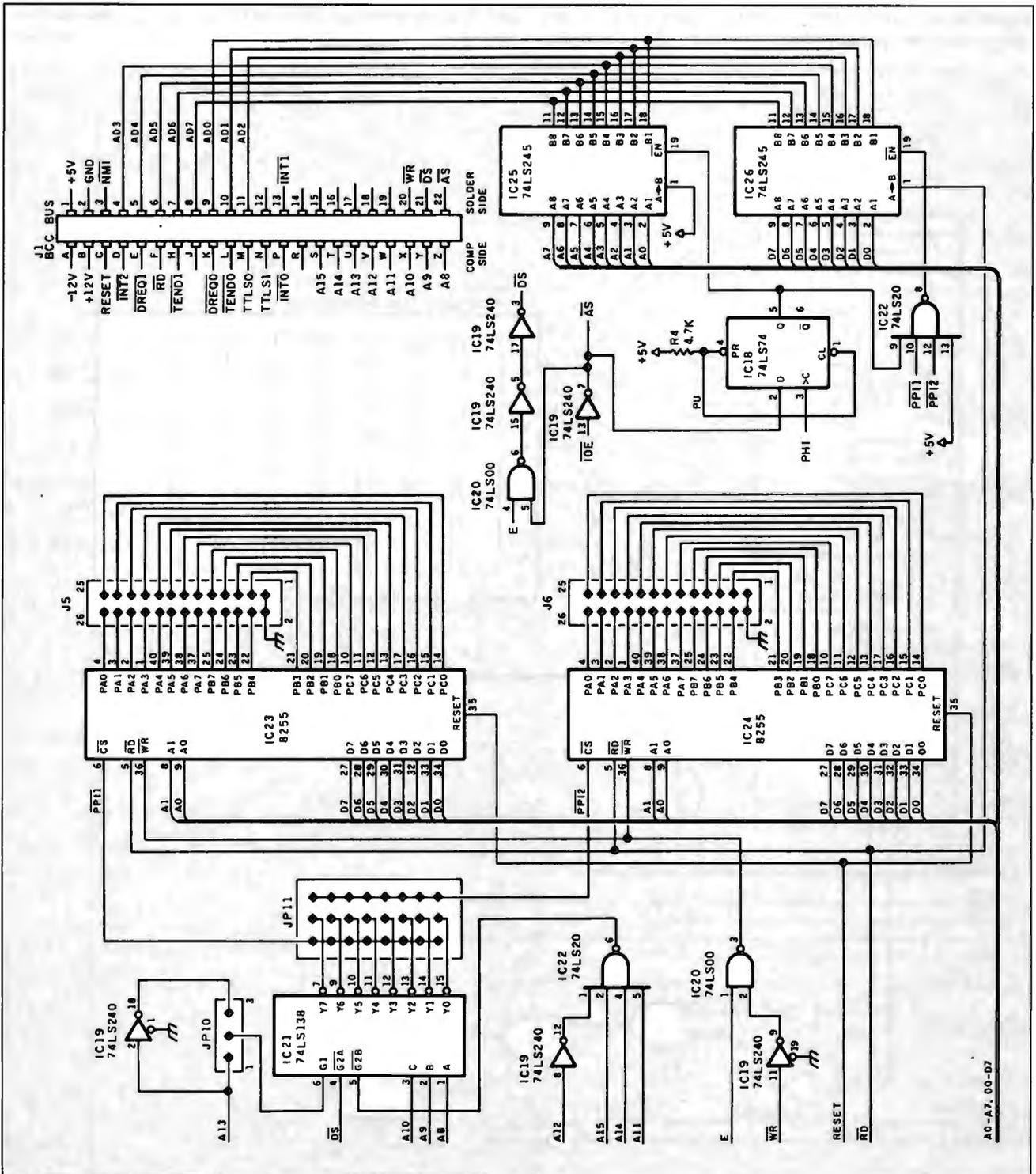


Figure 1: Continued.

known as multiplexing to place the eight low-order address lines on the same pins as the eight data lines. During the first clock cycle of a machine cycle, the high-order address is placed on the high-order address lines, and the low-order address is placed on the combined address/data lines.

When the address is stable, the microprocessor provides a strobe signal so that the low-order address bits can be latched into an external buffer. During the rest of the machine cycle, the system can use the same address/data lines for data since the low-order address bits have been latched.

When Zilog was started by several former Intel employees, some of Intel's design philosophies must have followed. While address/data multiplexing wasn't used on the Z80, it was used on the Z8. When I designed the BCC11 computer/controller (see the July 1981 Circuit Cellar) using the Z8 as the processor, I included the same multiplexed address/data lines in my definition of the BCC bus. Any peripheral card that you plug into the BCC bus must include the external latch mentioned above to latch the low-order address bits so the same lines can be used for data.

The BCC52 used the Intel 8052. Since the chip was from Intel, it had a multiplexed address/data bus like the Zilog Z8, and it was an easy task to attach it to the BCC bus. Consequently, all the peripheral boards that had been designed since the introduction of the BCC11 could function with the BCC52.

When I decided to make a BCC bus-compatible board using the 64180, it presented a bit of a problem. Since the HD64180 does not have a multiplexed address/data bus, I had to create a multiplexed bus interface.

The 8052 generates an address-strobe signal (AS\) and a data-strobe signal (DS\). When the address is stable and ready to be latched, the processor generates a low-to-high transition on AS\ . During a write cycle, when data is stable on the bus, the processor generates a low-to-high transition on DS\ to tell the peripheral that it can read the data.

Likewise, during a read cycle, when the processor reads the data bus, it generates a low-to-high transition on DS\ to indicate that it's done with the data being presented to it.

A look at the HD64180's timing diagrams shows that the I/O enable line (IOE\) goes from high to low at the end of T1 (the first clock cycle) to indicate the start of an I/O cycle. (Remember, we want all bus transactions to be I/O-based.) Since the address is stable at the beginning of T1, IOE\ was a perfect candidate for use in generating AS\ . Indeed, all it takes is an inverter to create the needed AS\ signal.

Generating DS\ is a little trickier, but not much. For that, I employed the ever-popular and ever-mystifying E signal. Most data sheets won't give you precise information on E's function. The HD64180 data book says nothing more than, "E is a synchronous clock for connection to HD63xx series and other 6800/6500 series compatible peripheral LSI."

Turning to the timing diagrams again, I discovered that, for an I/O read, E goes from high to low at the end of T3 (the last clock cycle) to signify that the processor has read the data bus. For an I/O write, E goes from high to low in the middle of T3 to signify that data is stable. It turns out that this is exactly what we need to generate DS\ . Combining E and IOE\ through an AND gate and inverting the result yields the desired active-low DS\ signal.

I used two 74LS245s (IC25 and IC26) with their "B" sides tied together to perform the multiplexing of the address and data lines. RD\ controls the direction line of the data buffer (IC26) so that it can operate bidirectionally, while the address buffer (IC25) is hard-wired for output-only operation.

To control the buffer-enable lines, we delay AS\ , using a 74LS74 flip-flop (IC18). When a machine cycle starts, AS\ is low and passes through the flip-flop, enabling the address

buffer and disabling the data buffer. After AS\ goes high, whatever other devices are on the BCC bus have latched the address bits, so the BCC180 disables the address buffer and enables the data buffer. To avoid race conditions and to allow for a small hold time, we don't disable the address buffer until the next rising edge of PHI after AS\ goes high.

This corresponds to the start of T2 (the second clock cycle) and provides plenty of time for the data to propagate through the data buffer before it is needed. At the completion of the machine cycle, when AS\ goes low again, the address buffer is reenabled by the rising edge of the first clock cycle of the next machine cycle. Since the address bus isn't stable until after the next machine cycle has started, we've preserved the address setup time.

The rest of the signals on the bus are straightforward. Most of them are connected to the HD64180, with the outputs going through buffers. Along with the two used for multiplexing the address and data bus (IC25 and IC26), a total of six 74LS245s are used. Needless to say, this is a well-buffered board. All the inputs are pulled high using 4.7-kilohm resistors.

The BCC180 Monitor ROM

Now that we have some hardware, we need something to make it go. I've already alluded to the special multitasking BCC180 BASIC that I'll begin describing next month, but the system needs something at a lower level so that we can exercise all parts of the machine without writing driver programs or purchasing the BASIC. For that purpose, part of the software for the BCC180 includes a monitor ROM.

The monitor provides functions that let you inspect memory, change memory, access I/O devices, and read and program EPROMs (see table 2). Veteran SB180 users will note the similarity between this monitor and the one on the SB180.

When you've installed the monitor ROM in the BCC180 and applied power to the controller, the system sends BCC180 to the terminal at 9600 bits per second. This message will display clearly on a terminal properly set for 9600 bps.

However, if you've set the terminal for some rate other than 9600 bps, pressing Return tells the BCC180 the terminal's actual data transfer rate. The system will then display an opening banner (at the proper data transfer rate) showing the amount of RAM and ROM in the system and give you a command prompt. Once in the monitor, you can obtain a full help screen by typing ?.

From the monitor, you can fill memory with a byte value, copy blocks of memory from one location to another and verify that the copy was performed properly, display sections of mem-

continued

Table 2: The ROM monitor provided with the BCC180 is a complete set of utilities and debugging aids. You invoke commands using a single character.

BCC180 ROM Monitor

A — ASCII table	N — New command
B — Bank select	O — Output port
C — Copy EPROM	P — Printer select
D — Download hexadecimal file	Q — Query memory
E — Emulate terminal	R — Read EPROM
F — Fill memory	S — Set memory
G — Goto program	T — Test system
H — Hexmath	U — Upload hexadecimal file
I — Input port	V — Verify memory
J — Jump to ROM language	W — Write EPROM
L — List memory	X — Examine CPU registers
M — Move memory	Y — Yank I/O registers

ory on the terminal, and modify individual memory locations. You can also search memory for a particular series of bytes.

The Bank command lets you set the 64K-byte bank of memory on which the above commands operate. (The system requires this command since the software is aware of only 64K bytes of memory, but the external address bus can access up to 1 megabyte of memory.)

The monitor lets you directly access I/O devices, both on the BCC180 board and on the BCC bus. Using a series of Input and Output commands, you can check a board that's just been plugged into the bus without having to write and debug a program.

Another useful function of the monitor is its EPROM programming support. You can transfer into memory the contents of an EPROM that has been plugged into the programming board, examine and possibly modify the contents, then program the block onto a blank EPROM. You can also send a file in Intel hexadecimal format to the BCC180 and have the computer program an EPROM.

This is the basis of the SB180-based development system I described earlier. On the SB180, you create a hexadecimal file containing the object code, then transfer that file to the BCC180 monitor. You use the monitor to program the final EPROM.

On the miscellaneous side, the monitor has commands that let you examine and modify the HD64180's general-purpose registers and display, with labels, the processor's 64 internal I/O registers. As a help to programmers, the A command displays an ASCII table, and H can perform simple hexadecimal mathematics.

Experimenters

While the BCC180 is available commercially, I encourage you to build your own. If you don't mind doing a little work, I will support your efforts as usual. A hexadecimal file of the executable code for the BCC180's ROM monitor is available for downloading from my bulletin board at (203) 871-1988. Alternatively, you can send me a preformatted IBM PC or SB180 disk with return postage, and I'll put the file on it for you. Add \$5 for a printed copy of the BCC180 manual.

I also have a number of copies of the BASIC-180 development software that, for the price of the manuals and distribution media, I will gladly give to experimenters who build the BCC180. Of course, this free software is limited to noncommercial personal use.

Next Month

I'll finish the hardware with a description of the BCC180's auxiliary EPROM programmer board and introduce BASIC-180. As I begin talking about BASIC-180, I'll include a tutorial on multitasking. ■

I'd like to acknowledge and personally thank Ken Davidson and Jack Ganssle for their efforts on the BCC180 project. Ken Davidson's extensive knowledge of the HD64180 helped us avoid the omnipresent hardware design pitfalls, and Jack Ganssle's superb software talents helped explain multitasking in a way that can really be understood.

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 Co., P.O. Box 400, Hightstown, NJ 08250.

It's virtually impossible to provide all the pertinent details of a project or cover all the designs I'd like to in the pages of BYTE. For that reason, I have started a 24-page bimonthly supplemental publication (with no advertising) called Circuit Cellar Ink, which presents additional information on projects published in BYTE, new projects, and supplemental

applications-oriented materials. For a one-year subscription, send \$14.95 to Circuit Cellar Ink, P.O. Box 3378, Wallingford, CT 06492, or call (203) 875-2199.

Ciarcia'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. *Volume V* covers July 1983 through December 1984. *Volume VI* covers January 1985 through June 1986.

The following items are available from

Micromint Inc.
4 Park St.
Vernon, CT 06066
For orders: (800) 635-3355
For information: (203) 871-6170
Telex: 643331
Inquiry 948.

1. A 9-MHz assembled and fully socketed BCC180 computer/controller board with 32K bytes of static RAM, ROM monitor, BASIC-180 development software (same as item 3), and user's manuals. BCC180-1-20\$395; for additional 256K DRAM, add \$100
2. BCC180 PAK evaluation system. Contains a 9-MHz BCC180 board with 32K-byte static RAM, ROM monitor, BASIC-180 development software, MB08 eight-slot backplane, CC01 10-inch card cage, UPS10 35-watt switching power supply, and user's manuals. BCC180-PAK\$595; for additional 256K DRAM, add \$100
3. BASIC-180 multitasking BASIC compiler for ROM- or disk-based development. Contains both BASIC-180 EPROM for direct use on BCC180 board and BASIC-180 disk for direct use or software development on SB180. Includes 100-page user's manual. Compiled code may be freely used without further license. BASIC-180 DEV \$250
4. An auxiliary 27256 EPROM programmer board for the BCC180. BCC180PROG5\$89

The following items are available from

CCI
P.O. Box 428
Tolland, CT 06084
(203) 875-2751
Inquiry 949.

1. A 9-MHz BCC180 computer/controller complete kit with 32K bytes of static RAM, ROM monitor, BASIC-180 development software, and user's manual. BCC180-KIT-20.....\$295
2. BCC180 auxiliary 27256 EPROM programmer board full kit. BCC180PROG5K.....\$74

For either source above, all payments should be made in U.S. dollars by check, money order, MasterCard, Visa, or American Express. Surface delivery (U.S. and Canada only): add \$5 for U.S., \$8 for Canada. For delivery to Europe via U.S. airmail, add \$14. Three-day air freight delivery: add \$10 for U.S. (UPS Blue), \$25 for Canada (Purolator overnight), \$45 for Europe (Federal Express), or \$60 for Asia and elsewhere in the world (Federal Express). Shipping costs are the same for one or two units.

There is an on-line Circuit Cellar bulletin board system that supports past and present projects. You are invited to call and exchange ideas and comments with other Circuit Cellar supporters. The 300/1200/2400-bps BBS is on-line 24 hours a day at (203) 871-1988.

To receive information about the Circuit Cellar Ink newsletter for hardware designers and developers, please circle 100 on the Reader Service inquiry card at the back of the magazine.

Programming Ease for Scientific & Engineering Applications

No matter what your level of programming expertise, if you write your own programs for engineering, science, or statistics applications, Wiley Professional Software's technical programming tools enable you to save programming time and development costs. These tools allow you to generate dependable, accurate and error-free code, quickly and easily.

NEW! Statistics Subroutine Libraries

STATLIB series, developed by PSI/Systems, is a one-stop source for Time Series and Graphics data analysis. These two new subroutine libraries are ready to address your statistics programming problems. STATLIB.TSF covers routines in forecasting and analysis of time-based data. Generalized linear regression models, ARIMA models, survival analysis, econometric forecasting, exponential forecasting, and spectral analysis are just a few of the routines which will prove invaluable to statisticians and to programmers, engineers, and scientists who use statistics.

STATLIB.GL is a statistical *graphics* library with subroutines for Box-Jenkins identification, scatter graphs, curve-fit graphs, contour maps, axonometric plots and much more, including a library of GKS device drivers.

Economists and marketing and financial forecasting professionals will find these routines invaluable in their day to day work. And they are a must for every scientist and engineer who programs in FORTRAN. These subroutine libraries give you all the benefits of a complete package and the added advantages of allowing you to quickly and easily customize *your* program for *your* needs. SOURCE CODE INCLUDED.

STATLIB.TSF: Time Series Analysis & Forecasting Subroutine Library\$295
STATLIB.GL: Statistical Graphics Subroutine Library\$295
 Microsoft and IBM Professional FORTRAN versions available.

The Classic Subroutine Library for BASIC, FORTRAN, and C Programmers

MICROSOFT FORTRAN Library\$175
C Language Library\$175
BASICA Library\$125
IBM Professional FORTRAN Library\$175

WordStar and WordStar 2000 are registered trademarks of MicroPro International Corporation. MultiMate is a registered trademark of MultiMate International, an Ashton-Tate company. WordPerfect is a trademark of Satellite Software International. DisplayWrite is a registered trademark of International Business Machines Corporation.

NEW! 50 More FORTRAN Library

The *50 MORE FORTRAN* Library, developed by Peerless Engineering Service, offers a collection of subroutines and utilities previously unavailable in our FORTRAN Library. Included are pretested and pre-compiled subroutines covering such areas as Matrices, Polynomials, Differential Equations, and Numerical Analysis (including FFTs), plus utilities for more effective screen handling. SOURCE CODE INCLUDED.

MICROSOFT FORTRAN or IBM Professional FORTRAN version\$125

NEW! SWAP Conversion Software

SWAP is a high-speed software program for the IBM-PC® that allows users to quickly and easily switch from one word processing file format to another. You don't need to own or operate the program you are converting from—just the program you are converting to.

Now you can SWAP documents to and from any of these popular word processing programs: WordStar®, WordStar 2000®, MultiMate®, WordPerfect™, DisplayWrite® 3 (DCA Revisable Format), and ASCIIonly \$79.95

SPECIAL FEATURES:

- *Batch processing* (allows you to convert more than one file at a time)
- *Lightning fast* (five times faster than competitive products)
- *Reliable* (guaranteed to convert all possible elements)
- *Easy to use* (does not require any previous computer knowledge)
- *More thorough and accurate* than conversions that are already built into popular word processing programs
- *A library approach* which allows easy and automatic access to the appropriate conversion
- *Updates* for new versions

To order any of Wiley's scientific and engineering programming tools with your VISA or MasterCard, call: **212-850-6788** or write:



Wiley Professional Software
 John Wiley & Sons, Inc.
 Attn: D. West
 605 Third Avenue,
 New York, NY 10158
Dealer inquiries invited

PICK BIX BRAINS

... With a 10 Day Trial Membership

If you've thought about joining **BIX** before but weren't sure it was what you needed, now is the time to try it. Because now for a limited time, we're inviting you to try **BIX** for 10 days. If at any time during this 10 day trial period you don't feel **BIX** has made you a more knowledgeable microcomputer user, we'll refund your entire registration fee. You pay only for time spent on the system.* (See log-on instructions for hourly rates).

Explore **BIX** in your home or office. Put its power to work for you and unleash your full microcomputer potential — programming, designing, specifying, researching — and more.

Try **BIX** for 10 full days and see what it can do for you. Explore more than 160 conferences. Access vendor support. Speak to expert consultants. Research new products and systems, and download public domain software.

Prepare yourself for success

It takes a sharp mind and hard work to stay ahead, and having the right tools helps.

Today, you can put one of the most powerful instruments for career advancement to work for you: **BIX**.

- Learn about new products before they hit the market.
- Get quality marketplace feedback on the products you're thinking of purchasing before you invest.
- Research problems and find the solutions that no one else has been able to render.
- Access some of the most advanced public domain software available in the industry.
- Increase your working knowledge of micros to make more confident purchasing decisions and recommendations.

Join **BIX** and arm yourself with the latest in microcomputer-related information

BIX's exclusive *Microbytes* newswire gives you complete, daily, up-to-date computer industry information. You'll gain insight from **BYTE** editors and writers who analyze new products and their potential impact, inform you of the latest mergers and acquisitions, and report late-breaking news from important seminars and conferences.

Talk to colleagues worldwide

You'll stay on top of your company's

business with **BIX's** electronic mail service.

"Talk" to your east coast, west coast — even European — contacts all in the same day.

Or, simply communicate with other **BIX** users worldwide. Share information and ideas privately, or in conference.

Choose any option for online access with a one time \$39 membership fee

- Corporate invoiced accounts with a minimum of five registered users. (A **BIX** first! Your company can pay for your usage.)
- Use American Express, Visa or MasterCard.
- Pre-purchase group accounts with fewer than five members.
- Individual Pre-purchase: draw against pre-paid time.

Use credit cards for immediate access or call the **BIX** Helpline for information on any other payment option at, 1-800-227-2983 (from U.S. and Canada) 603-924-7681 (in New Hampshire and elsewhere).

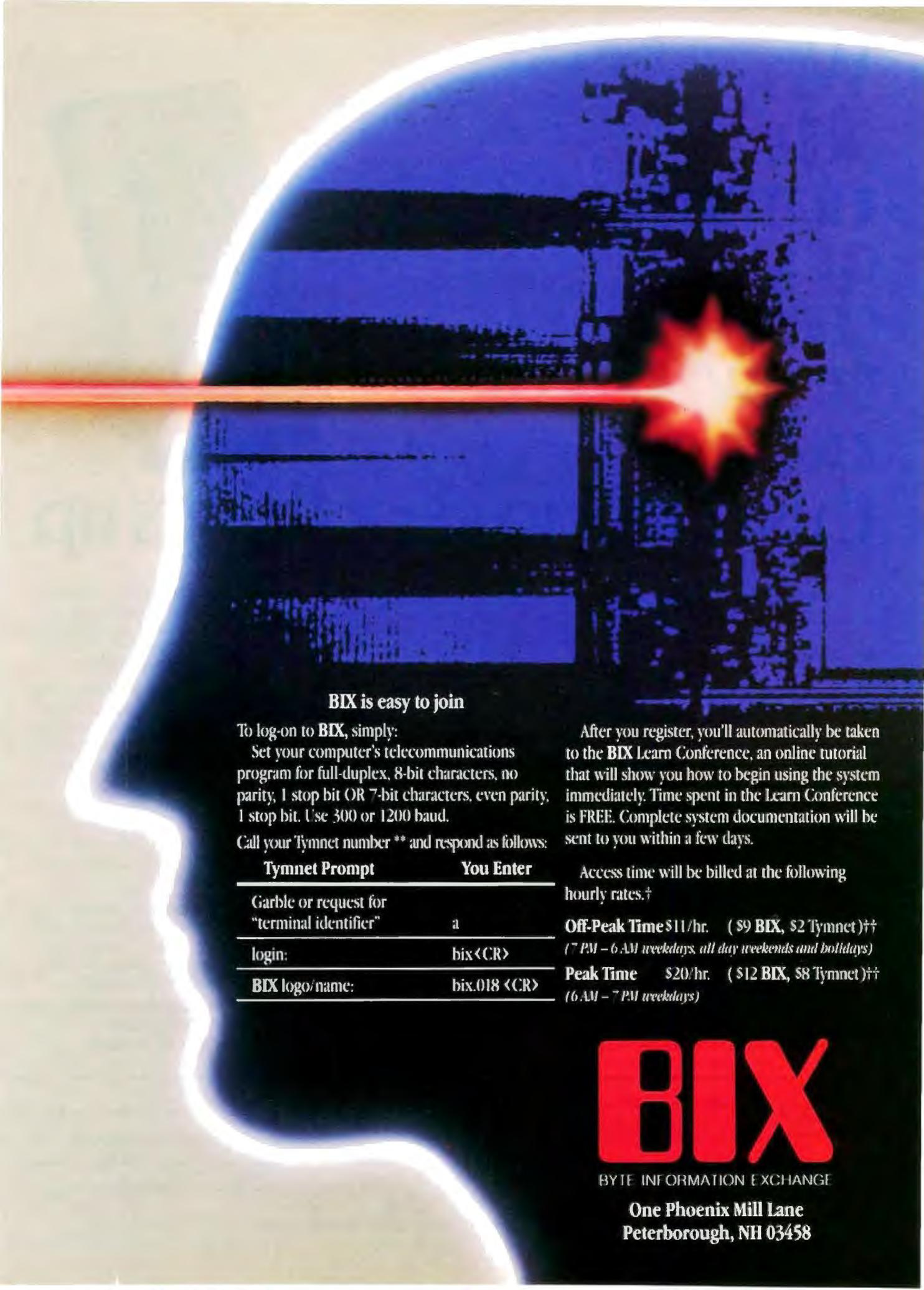
Act now! Our 10 day trial offer is subject to cancellation at any time.

*To notify **BIX** that you wish to discontinue service at any time during the trial period, call the **BIX** Helpline, and your entire membership fee will be refunded.

****BIX** can be accessed via Tymnet throughout the U.S. and Canada. For the Tymnet number nearest you, call the **BIX** Helpline or Tymnet at 1-800-336-0149.

†If your local Tymnet number is a toll call you will receive additional charges from your local phone company at their prevailing rate.

††Continental U.S. Tymnet rates. Rates from other areas are available from **BIX**.



BIX is easy to join

To log-on to **BIX**, simply:

Set your computer's telecommunications program for full-duplex, 8-bit characters, no parity, 1 stop bit OR 7-bit characters, even parity, 1 stop bit. Use 300 or 1200 baud.

Call your Tymnet number ** and respond as follows:

<u>Tymnet Prompt</u>	<u>You Enter</u>
Garble or request for "terminal identifier"	a
login:	bix<CR>
BIX logo/name:	bix.018 <CR>

After you register, you'll automatically be taken to the **BIX** Learn Conference, an online tutorial that will show you how to begin using the system immediately. Time spent in the Learn Conference is FREE. Complete system documentation will be sent to you within a few days.

Access time will be billed at the following hourly rates.†

Off-Peak Time \$11/hr. (\$9 **BIX**, \$2 Tymnet)††
(7 PM - 6 AM weekdays, all day weekends and holidays)

Peak Time \$20/hr. (\$12 **BIX**, \$8 Tymnet)††
(6 AM - 7 PM weekdays)

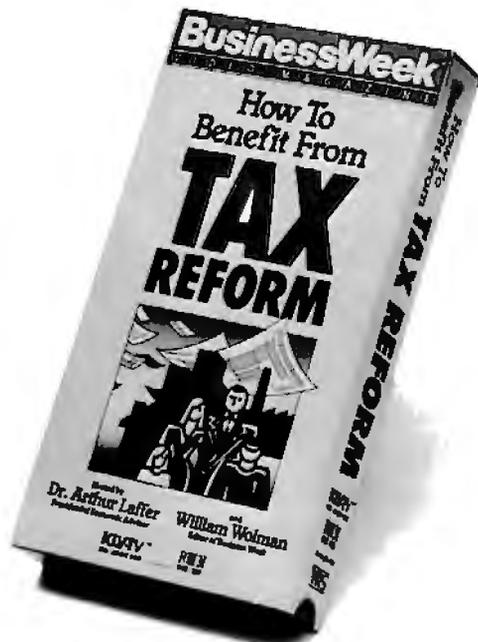
BIX

BYTE INFORMATION EXCHANGE

One Phoenix Mill Lane
Peterborough, NH 03458

With
all the
information
out to
clarify
the new
tax law,

this ought to clear things up.



Choose Business Week Video Magazine's "How to Benefit From Tax Reform". Why? That's simple. It's co-hosted by Dr. Arthur Laffer, one of the fathers of tax reform, and an economic advisor to the President. And Business Week Editor William Wolman.

So pull up your chair. And let a panel of America's top tax and investment experts tell you what they know. With candor. Commentaries. Interpretations. The hour will fly by. With clips from the past. Tips for the future. And most important, what you can do to start benefiting now!

Also included, get the "Business Week Personal Tax Planning Guide"—a comprehensive 48 page guide, prepared by Deloitte, Haskins & Sells—that complements the video. And helps you forecast your own 1987 and 1988 taxes.

Everything you need to know about tax reform. With that same insightful analysis that made Business Week the number one business magazine. The choice is clear. You can get your video somewhere else, but then it wouldn't be from Business Week.

To order now, just call toll-free: **1-800-523-5503** today. (In Illinois, call 1-312-250-9292.)

Or clip and mail in the coupon below.

DISTRIBUTED BY KARL-LORIMAR HOME VIDEO IN ASSOCIATION WITH FORUM ENTERTAINMENT

YES! Rush me *How to Benefit from Tax Reform* and my *Business Week Personal Tax Planning Guide* for only \$29.95 plus \$3.25 shipping & handling (Illinois residents add 7% sales tax).

Check one: Send VHS BETA
 My check (payable to Business Week Video) is enclosed.
 Charge my American Express Visa Mastercard

Acct. # _____

Exp. Date _____

Signature _____

Name (please print) _____

Address _____

City _____

State _____

Zip _____

Clip and Mail Today to: Business Week Video Magazine, PO Box 621, Elk Grove, IL 60009

Changing Reverse Polish to Infix

We can perform math in "infix" notation, but computers need to use reverse Polish notation

Parsing is one of those activities that really separates computers from humans. Parsing streams of symbols into meaningful messages seems to come easily to us humans. It's as if the template for a language parser is hard-wired into our brains, and that learning to speak is just filling out this template with the vocabulary of an actual human language.

The lessons in sentence parsing that many of us took in school just taught us to name the parts of speech; the parsing ability was already there subconsciously, or we couldn't have understood the lessons (or anything else for that matter).

Computers conspicuously lack this innate ability to parse. At the lowest level, a computer regards all input as a sequential stream of stuff (e.g., machine op codes) to be acted upon one at a time in strict sequence. If we want the computer to perceive a more complex structure in its input stream, we must program it to parse the stream according to the rules of some grammar or syntax.

The parsing of human (or natural) languages presents formidable difficulties to the parser writer because the syntax rules of our languages are complex, fluid, and inconsistent. The way a word is to be interpreted often depends upon the whole context in which it occurs, including not just the surrounding sentence, but maybe the whole utterance.

Our brains, which appear to be optimized for this sort of large-scale pattern matching, cope admirably, but computers find it hard going indeed. Natural-language parsers are included in some software packages, from adventure games to database managers, but their limited capabilities give some indication of the difficulty of the task.

Computer languages are deliberately designed with restricted grammars that a computer can parse more easily than, say, English. In particular, these grammars are usually of the kind called "context-free," which, crudely put, means that a symbol has the same meaning regardless of its surrounding symbols.

Most high-level computer languages are built around a parser or syntax analyzer, which processes the input source code, looking for well-formed constructs according to the syntax rules of the language. To see how such a parser is designed, see Jonathan Amsterdam's delightful series on building the SIMPL compiler (December 1985 through February 1986 BYTE).

Infix

The parsing of mathematical expressions is a special case (which is easier than parsing a whole programming language)

that can be applied separately, for example, in the construction of calculators.

Most popular programming languages (e.g., BASIC, Pascal, and C) include a mathematical-expression parser that accepts expressions written in the infix notation (also referred to as "algebraic notation" by calculator manufacturers) we learn at school. Infix means that a binary operator, say +, sits between its operands, as in 3 + 4.

The infix notation is so widely learned and so natural that someone raised on BASIC might wonder that an expression like

$$x = 34 + 57 / (120 * 3)$$

needs parsing at all. Unfortunately, the typical computer can't perform arithmetic in this order.

If we attempt to persuade a computer to execute the expression 3 + 4 in that sequence, we are saying: "Take 3, now add, now take 4." But the computer can't add until it has both values to be added, just as you can't make an omelet until you have broken the eggs. The point becomes clearer if we express the addition in a hypothetical assembly language:

```
mov regA,3
mov regB,4
add regA,regB
```

We need to move the two values into the registers before the addition can take place. Hence, infix notation is not at all natural for computers.

Instead, computers prefer a postfix ordering in which the operator always follows its operands. Reverse Polish notation (RPN) is a way of writing mathematical expressions in postfix form; 3 + 4 in RPN becomes 3 4 +. Its great attraction to a computer is that an RPN expression requires no brackets, so the computation can proceed in a strictly sequential manner. For example, the infix expression

$$5 * (7 + 9) / (5 + 6)$$

becomes

$$5 7 9 5 6 + / + *$$

in RPN. It's convenient to use a stack to hold the operands when evaluating RPN expressions. The operators are then applied successively to the top two stack items.

continued

Dick Pountain is a technical author and software consultant living in London, England. He can be contacted c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, or on BIX as "dickp."

Expression Parsing

An expression parser is a program that takes expressions in the infix form that humans prefer and reorders the operations into the postfix form that computers prefer. Given that BASIC, Pascal, and many other languages have an expression parser built in, why would anyone but a compiler writer want to write one?

Listing 1: Pseudocode for Forth's interpreter.

```

Program ForthInterpreter
  Get next word
  IF word is found in dictionary
  THEN execute it
  ELSE try to convert it to a number
    IF it's a valid number
    THEN push it onto stack
    ELSE ERROR
  ENDIF
ENDIF
    
```

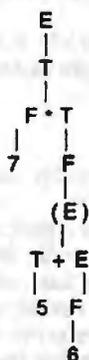


Figure 1: The parse tree for the expression 7 * (5 + 6). E, F, and T stand for expression, term, and factor.

Listing 2: Pseudocode of the algorithm for converting expressions from infix to reverse Polish notation.

```

Program Expression
  REPEAT Term UNTIL Finished

  Subprogram Term
    Read the next symbol -> NextSymbol
    IF NextSymbol IS
      ')' THEN Finished
      '(' THEN Expression
      '+' THEN Term
        Compile +
      '-' THEN Term
        Compile -
      '**' THEN Term
        Compile *
      '/' THEN Term
        Compile /
      identifier THEN Compile its
        execution address
      number THEN Compile as a literal
      ELSE
      ERROR "Illegal element
        in Expression"
    ENDIF
  
```

Well, for one thing, not all languages have such a parser. Some languages such as LISP and Prolog employ a prefix notation (i.e., operator before operands), since, in these languages, programs work via function applications.

(Some modern LISP dialects do in fact have an outer "shell" that parses infix expressions, as does Turbo Prolog.) Other languages such as Forth and PostScript already employ postfix notation.

Also, even in languages like BASIC and Pascal, the expression parser is normally available only to the language system itself, not to the user. If you write a program that takes mathematical expressions as strings input by the user at run time (e.g., a graphing program or an equation-solving program), you'll likely find that you have to parse these strings yourself, the hard way.

Acorn's BBC BASIC (and, I believe, the old Sinclair/Timex BASIC) has a function called EVAL("<string>") that takes a string and evaluates it as an infix expression, but this is not present in all BASICs.

The case of Forth is particularly interesting. The extremely small and simple Forth interpreter parses the input stream hardly at all, so math is naturally performed in strictly sequential (reverse Polish) order. Forth treats its input as a stream of words separated by spaces. The action of the interpreter is simple indeed (see listing 1). It would almost be true to say that Forth has no syntax at all, but the control structures do impose a few rules.

The RPN math doesn't phase seasoned Forth users who, like Hewlett-Packard calculator users, have become used to it. Some people even prefer it because the need for brackets is removed (see, for example, "Complex Math in Pascal" by David Gedeon in the July 1987 BYTE). There's no denying that it becomes a royal nuisance if large and complicated algebraic expressions have to be processed often, and that it is off-putting to casual users.

In a fairly large Forth program I wrote some time ago, I decided to incorporate a simple expression parser to permit the user to enter infix expressions instead of expressions in RPN. The Forth language supports recursion, and a recursive-descent algorithm seemed the most likely to produce a compact solution.

However, my parser needed to be very small indeed; much smaller, for example, than the typical Pascal implementation of a recursive-descent parser that can run to more than 200 lines of code (see Jonathan Amsterdam's August 1985 BYTE article, "Context-Free Parsing of Arithmetic Expressions," for a Modula-2 version).

Accordingly, I made several sacrifices to keep the size down. The first was to support the +, -, *, and / operations only for single (i.e., 16-bit) numbers. The second, and most hurtful, was to abandon operator priority, so that evaluation proceeds strictly from left to right unless parentheses are used. The third was that the parser works only in compiling mode. Thus, it cannot be used as a calculator to evaluate expressions interactively at the keyboard.

On the bright side, the parser costs absolutely nothing in run-time overhead, as it does all its work at compile time; the compiled code is *exactly* what Forth would have produced had you entered the expression in RPN.

I saved the most space of all by shortcutting the parse-tree generation stage of the recursive-descent algorithm. In many implementations of the recursive-descent method, the parser constructs a tree that depicts the expression viewed through the rules (or "productions") of the associated grammar. To illustrate, let's take this simple grammar for arithmetic, using +, -, *, and / as used in Jonathan Amsterdam's August 1985 article:

```
expression → term
            term + expression
            term - expression
```

```
term → factor
      factor * term
      factor / term
```

```
factor → number
        -factor
        (expression)
```

In this notation, loosely based on Backus-Naur form, the symbol \rightarrow means "may consist of," and a new line indicates alternatives (e.g., "term" or "term + expression") and so on. The rules say that an expression may be the sum or difference of terms, which are in turn the product or quotient of factors, and that a factor might be a number, a factor preceded by unary minus, or a whole expression surrounded by parentheses.

The rules are all recursive (i.e., the same name appears on right- and left-hand sides), and applying them successively leads you down through the levels, ending with a number (hence, the name recursive descent). The precedence of the operators is inverse to their order of appearance in the rules: + and - are lower than * and /, which are lower than unary minus and parentheses.

Applying these rules in succession to the expression $7 * (5 + 6)$ would yield the parse tree shown in figure 1. This tree might be physically represented as a linked list and then passed to another procedure for code generation (or, in the case of an interpreter, for direct evaluation).

Instead, I chose a scheme in which the "tree" is inherent in the course of the computation but is never explicitly created. My grammar is also more elementary, since with no operator precedence, terms and factors need not be distinguished:

```
expression → term
            term + expression
            term - expression
            term * expression
            term / expression
```

```
term → number
      identifier
      (expression)
```

I permit a term to be the identifier or name of any Forth word in the dictionary; constants and variables are the kinds of words most likely to be used here, but see below. The algorithm for compiling expressions is shown in pseudocode in listing 2, and it clearly illustrates how infix is turned to RPN by grabbing the next term *before* compiling the operator.

Notice also that term is both self-recursive and mutually recursive with expression. To turn this algorithm into Forth code requires little effort.

A problem that must be overcome is that the scoping rules of Forth, like those of Pascal, forbid forward references to words that are not yet defined. Such a forward reference is required to set up the mutual recursion of expression and term.

One solution is to create a variable called FORWARD, and then a dummy definition of the yet-to-be-defined word that just fetches the content of this variable and executes it. When the real definition of the word is completed, you take its execution address, store it into FORWARD, and voilà (see listing 3).

You use the parser like this:

```
: TEST INFIX( 7 * ( 3 + 4 ) ) ;
```

which compiles to exactly the same code as the RPN:

```
: TEST 7 3 4 + * ;
```

Expanding the Parser

Note that spaces are mandatory between all the symbols. Constants can be used in expressions, and so can variables, as long as they are followed by the @ operator to fetch their contents:

```
13 CONSTANT A VARIABLE B 12 B !
```

```
: TEST INFIX( A + 6 * ( B @ - 10 ) ) ;
```

If you find this @ offensive, you can modify the parser so that it automatically fetches the contents of a variable. However, to do this, you need to identify a variable just by looking at its code address (in the default section of the CASE in NEXT-TERM), and this involves a comparison with a system-dependent absolute address that you can determine only by inspecting your compiler.

In fact, this parser will accept and execute any defined Forth word inside an expression, but only those words that take nothing from the stack and return exactly one value will produce meaningful results.

An example of a word so usable could be RANDOM, which produces a random number. You could also include the Forth loop index words I and J in expressions contained in DO loops. It is easy to add extra binary operators to the CASE, and with rather more effort to accommodate double or floating-point numbers.

There is no explicit error checking in this code; the NUMBER

continued

MICROPOOLER

One Megabyte of
Intelligent Print
Buffering

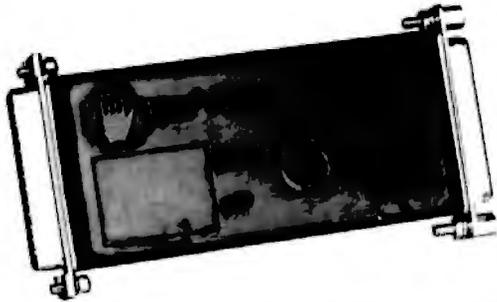


**THE
WAITING IS
OVER!**

CONSOLINK®

1275 South Sherman Drive
Longmont, Colorado 80501
(303) 651-2014 1-800-525-6705/TWIX 910-320-0786

Hard Locks for Soft Parts.



At Rainbow Technologies, we think protecting software developers' investments is very serious business. That's why we designed the first fully effective security solution for software running on PCs and other computers.

Our family of virtually impenetrable Software Sentinel hardware keys provides the highest level of software protection the developer can get. While remaining invisible to the end user.

Take a look.

Key Sentinel Family Features.

Prohibits unauthorized use of software □ No need for copy protection □ Unlimited backup copies □ Virtually unbreakable □ Pocketsize key □ Transparent operation □ Transportable

Software Sentinel.

- Runs under DOS and Xenix, on IBM PC/XT/AT and compatibles
- Algorithm technique (Never a fixed response)
- Serial or parallel port version
- Minimal implementation effort
- Higher level language interfaces included
- 100 times faster than fixed-response devices (1ms)

Software Sentinel-C.

- For developers who want to customize or protect multiple packages with one device
- 126 bytes of non-volatile memory that is programmed before shipment of software
- We supply a unique programming adapter for programming the unit

- Higher level language interfaces included
- Runs under DOS on PC/XT/AT and compatibles
- Parallel port version only

Software Sentinel-W.

- Designed for workstations, supermicros and minicomputers
- Serial port only (modem-type)
- Algorithm technique
- We provide detailed interface specifications: Developer creates a port driver
- Interface requirements: 25 pin DB25P or DB25S; RS232/RS422/RS423
- Only signals used: DTR & RTS from computer; signal ground; DSR or optional DCD from Software Sentinel-W or external device. TXD, RXD, CTS, RI passed through.

Call For Software Sentinel Evaluation Kit Pricing.

International Distributors Wanted

Listing 3: Forth code for implementing the algorithm given in listing 2. This code is standard Forth-83, with the addition of two almost universally adopted extensions: ASCII, which returns the code of a character, and the Eaker CASE construct. If you don't have ASCII, just use the actual code values for the "(" and ")" characters, namely, 40 and 41. A recursive call in Forth requires you to use either the word RECURSE or MYSELF rather than the name of the word itself. In the unlikely case your Forth system doesn't have either, you can define MYSELF as

```

: MYSELF CONTEXT @@ NAME>,; IMMEDIATE

( holds address for forward reference)
VARIABLE FORWARD
( dummy definition; merely executes the
  forward reference)
: INFIX( FORWARD @ EXECUTE ;
( get blank delimited word from the
  input stream and extract its first
  char)
: NEXT-SYMBOL BL WORD DUP 1+ C@ ;
( --- addr char )
: NEXT-TERM NEXT-SYMBOL DUP
( --- flag )
  ASCII ) = IF 2DROP
  0 EXIT ENDIF
  ASCII ( = IF DROP INFIX(
  1 EXIT ENDIF
  FIND
  ( is it in dictionary?)
  IF DUP CASE
    ['] + OF MYSELF
      DROP , ENDOF
    ['] - OF MYSELF
      DROP , ENDOF
    ['] / OF MYSELF
      DROP , ENDOF
    ['] * OF MYSELF
      DROP , ENDOF
    , ( default: just compile it)
  ENDCASE
  ELSE NUMBER DROP [COMPILE]
  LITERAL
  ENDIF 1 ;
: INFIX( BEGIN NEXT-TERM WHILE REPEAT ;
IMMEDIATE
( store address for the forward
  reference)
' INFIX( FORWARD !
  
```

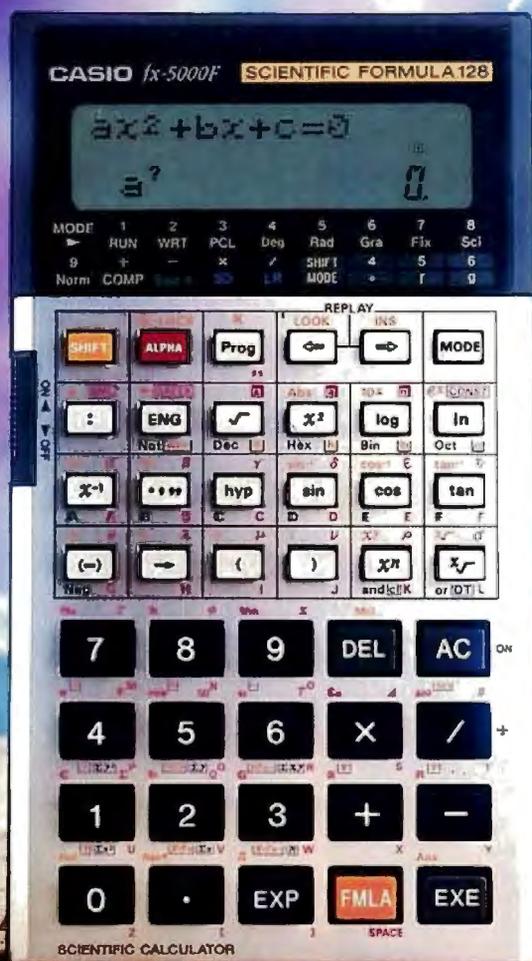
routine will return its own error message if an unidentified symbol is encountered. Similarly, Forth itself will report an unmatched right parenthesis. An unmatched left parenthesis, on the other hand, will put the compiler into an endless loop waiting for "(" , though the Break key will break out of this.

There is a neat way to trap this latter error, but one that will appall most computer scientists: Add an extra test to see if the next symbol is a ";" , which would mark the end of the enclosing colon definition and mean the parser has run away. Just insert the following as the second line of NEXT-TERM:

```

ASCII ; IF CR ." Unmatched left parenthesis!"
  ABORT ENDIF DUP
  
```

Next month, I'll present an algorithm for generating multi-column page text. ■



128 formulas at the speed of light.

The Casio FX-5000F Formula Calculator. To save you the time and trouble of looking up or memorizing many of the most important mathematical and scientific formulas, we put 128 of them in our FX-5000F Formula Calculator. And you can call them up in a flash.

The formulas are numbered and cover the fields of *math, statistics, physics, electronics* and *mechanics*. Plus you can input 12 of your own. Just key-in the appropriate number and the for-

mula you need appears instantly. The alpha numeric display with 10 digit mantissa plus 2 digit exponent is easy to read and scrolls to over 70 characters. Its two-line display shows both the formula and the answer simultaneously.

And it doesn't stop there. Once you've recalled the formula, the calculator prompts you to input the values of the variables and automatically calculates the result.

The FX-5000F's 675 steps of program memory allow you to create some pretty sizeable pro-

grams and store them until needed. While an instant replay feature lets you review and edit formulas at the touch of a button.

Adding to its usefulness are an additional 160 powerful functions, for a combined total of 288 functions and formulas.

To get the list of 128 formulas, as well as more information about how the Casio FX-5000F delivers them with the speed of light, call 1 800-626-2916 EXT. 85.

HOW GENERAL MOTORS IMPROVES ITS TOP END PERFORMANCE.



Elmer M. Estlin
Former President General Motors

Edward N. Cole
Former President General Motors

F. James McDonald
President General Motors

One of General Motors' most important suppliers doesn't make parts. It makes leaders.

Over the past 19 years all three General Motors Presidents have come from the ranks of a college program called Co-operative Education.

It's a nationwide program that allows students to alternate studies at the college of their choice with paid, practical work experience in the field of their choice.

For students, Co-op Education is a chance to pick up the most valuable kind of knowledge. For employers, it's a chance to pick up the most valuable kind of student. If you'd like some information on how your company can participate in Co-op Education, write to us at the address below. Who knows, you may end up hiring a future company president. It wouldn't be the first time.

Co-op Education

You earn a future when you earn a degree.



For a free booklet write: Co-op Education • P.O. Box 999 • Boston, MA 02115
A Public Service of This Publication © 1985 National Commission for Cooperative Education

Using Financial Tools for Nonfinancial Simulations

With Monte Carlo (random number) simulations, spreadsheets can model real-world events

Spreadsheets were originally designed for accounting problems such as balance sheets and forecasts. However, users have found that a spreadsheet is a versatile model for solving many numeric problems.

This article describes how you can use Lotus 1-2-3 to simulate inventory problems. Users of SuperCalc and VisiCalc will find the examples easy to follow, since the three programs use similar notations.

It is almost always cheaper and more efficient to try out a new idea through simulation before actually building the project. "Monte Carlo simulation" is an eye-catching name for using random numbers to simulate real-world events. This technique is now widely used in both industry and the military (see references 1 and 2).

The Problem: A Small Oil Terminal

An oil terminal receives its supply from a manufacturing plant and delivers it to customers. Production is steady at 2000 barrels

per day and can be stopped or started with 1 day's notice. The terminal has 5000 barrels of storage room in a tank. The terminal's many small customers have a combined average of 9 orders per day. Each order is for 200 barrels. How many times a month will the terminal be unable to satisfy all of its customer orders?

A little arithmetic shows that the average sales demand is only 1800 barrels a day. Since the production capacity is 2000 barrels per day, it might seem that the customers could always be satisfied. Unfortunately, things are not that simple.

The 9-orders-per-day average is made up of orders placed by many customers. Although the order rate may average 9 per day, on any given day you might get 10 orders, or 7, or 15. Clearly, if you get 15 orders several days in a row, the inventory tank will be depleted, causing missed sales. You need a way to simulate the incoming orders.

The Poisson Distribution

The Poisson distribution is an integral part of the simulation. In cases where many customers order independently, and where each customer has a low probability of placing an order on a

continued

James L. Conger is manager of business planning at the Oronite Additives Division of Chevron Chemical Co. (6001 Bollinger Canyon Rd., San Ramon, CA 94583).

	J	K	L	M	N
1	Lookup table for Poisson distribution				
2					
3	Average orders per day =		9	(From cell E4)	
4					Number of orders
5		Factorial	P(x)	Cumulative P(x)	
6					0
7	0	1	0.0001234	0.0001234	1
8	1	1	0.0011106	0.0012340	2
9	2	2	0.0049980	0.0062321	3
10	3	6	0.0149942	0.0212264	4
11	4	24	0.0337371	0.0549636	5
12	5	120	0.0607268	0.1156905	6
13	6	720	0.0910903	0.2067808	7
14	7	5040	0.1171161	0.3238969	8
15	8	40320	0.1317556	0.4556526	9
16	9	362880	0.1317556	0.5874082	10
17	10	3628800	0.1185800	0.7059883	11
26	19	1.22E+17	0.0013704	0.9989440	20
27	20	2.43E+18	0.0006167	0.9995607	21

Figure 1: The Poisson distribution lookup table. Figure 2 shows the formulas behind this portion of the spreadsheet.

USING FINANCIAL TOOLS

given day, the Poisson distribution will describe the probability of receiving a given number of orders on any one day (see reference 3).

The Poisson distribution has a convenient feature: You can calculate every value if you know the average. The formula is

$P(x) = A^x e^{-A} / x!$, where $P(x)$ represents the probability that you will receive x orders on a given day. A represents the average number of orders, and e is the base of the natural logarithms (approximately 2.7183).

continued

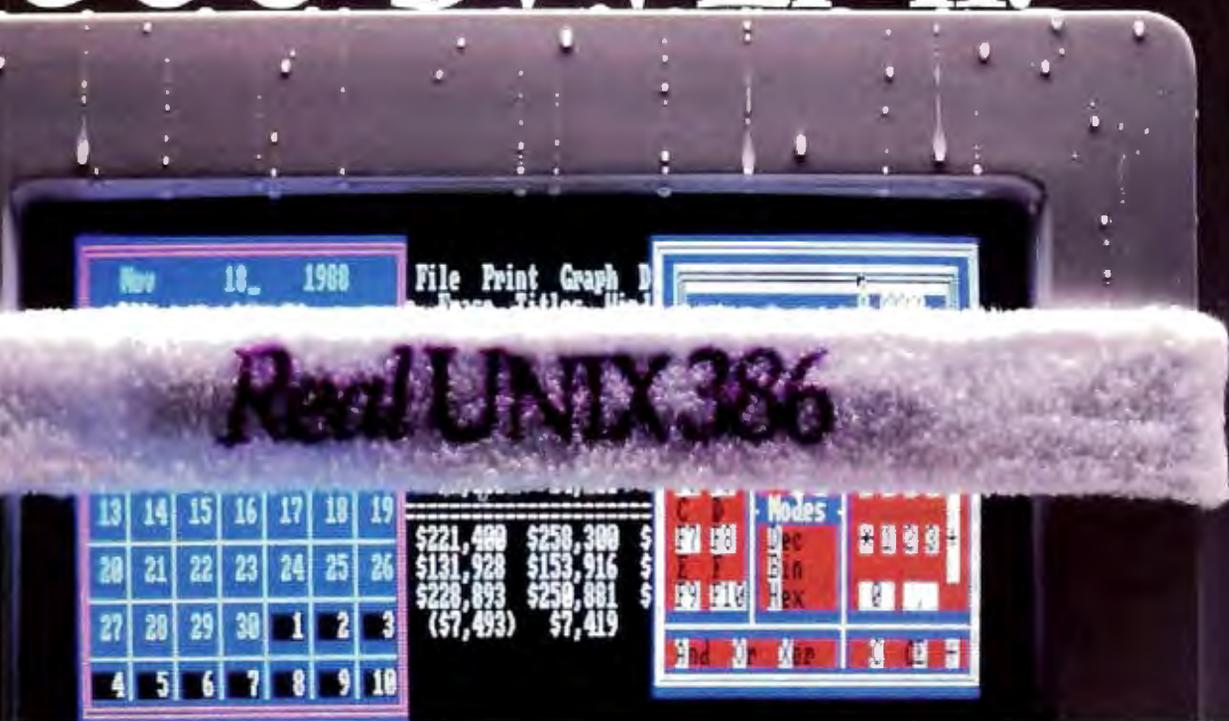
	J	K	L	M	N
1	Lookup table for Poisson distribution				
2					
3	Average orders per day =		+\$E\$4	(From cell E4)	
4					
5				Cumulative	Number of
6		Factorial	P(x)	P(x)	orders
7	0	1	(\$L\$3^J7)/(K7*(@EXP(\$L\$3)))	+L7+M6	+\$J7+1
8	+\$J7+1	(J8*K7)	(\$L\$3^J8)/(K8*(@EXP(\$L\$3)))	+L8+M7	+\$J8+1
9	+\$J8+1	(J9*K8)	(\$L\$3^J9)/(K9*(@EXP(\$L\$3)))	+L9+M8	+\$J9+1

Figure 2: Column J is a series of ascending integers starting with 0. Column K calculates the factorial of J. Column L uses the factorial to calculate the probability of a given number of orders, using the Poisson formula and the average number of orders (9 in this case). For example, the probability of getting exactly 7 orders on a given day is 11.7 percent (see figure 1, cell L14).

	A	B	C	D	E	F	G	H
1	Simulation of an inventory tank							
2								
3		Enter max	Enter rate		Avg. number	Enter avg.		
4		5000	2000		9	200		
5								
6	Day	Inventory	Production	Random no.	No. of orders	Gal. ordered	Gal. shipped	Gal. missed sales
7	<hr/>							
8	1	2500	2000	0.061857207	5	1000	1000	0
9	2	3500	0	0.162162030	6	1200	1200	0
10	3	2300	2000	0.430322811	8	1600	1600	0
11	4	2700	2000	0.031907307	4	800	800	0
12	5	3900	0	0.766562630	11	2200	2200	0
13	6	1700	2000	0.162895409	6	1200	1200	0
14	7	2500	2000	0.392827360	8	1600	1600	0
15	8	2900	2000	0.451411125	8	1600	1600	0
16	9	3300	0	0.369841825	8	1600	1600	0
17	10	1700	2000	0.443499729	8	1600	1600	0
18	11	2100	2000	0.589248446	10	2000	2000	0
19	12	2100	2000	0.968387924	15	3000	2100	900
20	13	2000	2000	0.552589404	9	1800	1800	0
21	14	2200	2000	0.184578735	6	1200	1200	0
22	15	3000	2000	0.379185897	8	1600	1600	0
23	16	3400	0	0.426193598	8	1600	1600	0
24	17	1800	2000	0.734686950	11	2200	1800	400
25	18	2000	2000	0.952955192	14	2800	2000	800
26	19	2000	2000	0.794911813	11	2200	2000	200
27	20	2000	2000	0.040212391	4	800	800	0
28	21	3200	0	0.118399010	6	1200	1200	0
29	22	2000	2000	0.108103999	5	1000	1000	0
30	23	3000	2000	0.958301718	14	2800	2800	0
31	24	2200	2000	0.593840786	10	2000	2000	0
32	25	2200	2000	0.162433155	6	1200	1200	0
33	26	3000	2000	0.330655601	8	1600	1600	0
34	27	3400	0	0.951867276	14	2800	2800	0
35	28	600	2000	0.123729203	6	1200	600	600
36	29	2000	2000	0.596039101	10	2000	2000	0
37	30	2000	2000	0.319844722	7	1400	1400	0
38	31	2600	2000	0.878265568	13	2600	2600	0
39	<hr/>							
40	Average	2445	1612	0.452829610	8	1722	1629	93

Figure 3: The main portion of the spreadsheet, minus the Poisson lookup table. The formulas behind the left side of the spreadsheet (columns A through C) are shown in figure 4. The formulas behind the right side of the spreadsheet (columns D through H) are shown in figure 5.

HOW TO MAKE YOUR 386 SWEAT.



Now you can take advantage of every last bit in your DeskPro 386. All 32 of them. With Microport's System V/386.[™] Developed specifically for the 386 by AT&T, Intel and Microport, System V/386 is a real UNIX[®] System V Release 3. It's the only industry standard, multi-user multi-tasking way to push a DeskPro 386 to its absolute limits. And deliver almost unlimited speed and power to your desktop in the process.

You get 80386 protected mode, 80286 protected mode, and fully compatible 8086 emulation. There's direct access to 4 gigabytes of RAM with demand paged virtual memory and more.

All of which prepares your Compaq for some of the most powerful software tools ever to run on a micro. Like 32-bit Microport/Green Hills C, Fortran, or Pascal compilers that help you develop 386-optimized software of your own. And DOS Merge, Microport's multi-user, multi-tasking environment that runs MS/DOS, and MS/DOS applications (like 1-2-3, Sidekick, and dBASE) transparently under UNIX. On both 286 and 386 Compaq's. Run UNIX on one machine (so you can keep all that power for yourself) with one or two users, or connect 10, 20, 30 or more on a single DeskPro 386 in

what may be the world's most cost-effective multi-user MS/DOS environment. You get advantages that OS/2 can only promise. Today. When you need it most.

Better UNIX. Best Price.

That's the kind of thinking you've come to expect from Microport. Real honest to goodness AT&T UNIX systems. Only \$199 for the DeskPro 286 or 386. DOS Merge starting at only \$149. All warranted and with technical support. Plus, a full line of off-the-shelf UNIX applications. Call today for free info and a real UNIX discount coupon. Microport. We'll make your Compaq Deskpro 386 sweat. So you don't have to.

(800) 722-UNIX/(800) 822-UNIX in CA

Real UNIX,* \$199.



Microport Systems, Inc.
10 Victor Square • Scotts Valley, CA 95066
(408) 438-8649 • Telex: 249554 MICR UR • FAX: (408) 438-2511

*A real UNIX system, System V/386 \$199 (2 user); Software Development System \$499; Text Preparation System \$199; Complete System \$799; UNIX is a registered trademark of AT&T. Merge is a trademark of Locus Computer Corp. System V/386, and DOS Merge are trademarks of Microport Systems, Inc. Other brands and products are trademarks of their respective holders.

	A	B	C
1	Simulation of an inventory tank		
2			
3		Enter max	Enter rate
4		5000	2000
5			
6	Day	Inventory	Production
7			
8	1	+B4/2	@IF(\$B8+\$C\$4 > \$B\$4,0,\$C\$4)
9	+A8+1	+\$B8+\$C8-\$G8	@IF(\$B9+\$C\$4 > \$B\$4,0,\$C\$4)
10	+A9+1	+\$B9+\$C9-\$G9	@IF(\$B10+\$C\$4 > \$B\$4,0,\$C\$4)

Figure 4: We start inventory at half full to get the model going. Each successive day's tank inventory is the inventory from the previous day plus production and minus sales for the day. We conservatively assume that the day's sales occur before the production arrives. Thus, sales are missed if the tank does not have sufficient barrels at the start of the day, regardless of possible filling of the tank later in the day.

	D	E	F	G	H
1					
2					
3		Avg. number	Enter avg.		
4		9	200		
5				Gal.	Gal.
6	Random no.	No. of orders	Gal. ordered	shipped	missed sales
7					
8	@RAND	@VLOOKUP(\$D8,\$M\$7:\$N\$27,1)	+\$E8*\$F\$4	@IF(\$B8-\$F8 > 0,\$F8,\$B8)	+\$F8-\$G8
9	@RAND	@VLOOKUP(\$D9,\$M\$7:\$N\$27,1)	+\$E9*\$F\$4	@IF(\$B9-\$F9 > 0,\$F9,\$B9)	+\$F9-\$G9
10	@RAND	@VLOOKUP(\$D10,\$M\$7:\$N\$27,1)	+\$E10*\$F\$4	@IF(\$B10-\$F10 > 0,\$F10,\$B10)	+\$F10-\$G10

Figure 5: Column E employs the @VLOOKUP command to scan the Poisson table (figure 1). The random number in column D here is compared with the contents of column M in figure 1. The largest value in M not exceeding the random number is the match. Column N provides the corresponding number of orders. The volume ordered is the number of orders times the barrels per order (column F here). The amount shipped cannot be greater than the amount in the tank. The difference between the amount ordered and the amount shipped shows up as lost sales in column H.

Note that the Poisson distribution gives P(x) only for whole-number values of x. It does not define the probability of receiving 3 1/2 orders or -2 orders.

Using this formula, you can calculate how often, on the average, you will receive a given number of orders. For example, using the problem's average of 9 orders per day, the probability of getting only 2 orders is

$$P(x) = 9^2 e^{-9} / 2! = .004998 = 0.50\%$$

In order to make use of the Poisson distribution, use a random-

number generator and the lookup-table function in the spreadsheet.

Putting the Poisson Distribution in a Spreadsheet

A random number between 0 and 1 will determine the number of orders for a given day. For our problem, the average number of orders is 9.

Once you have calculated the probabilities, use a lookup table of the Poisson distribution as shown in figure 1.

To use the probabilities calculated in figure 2 in a lookup

continued

C_talk™ OBJECT-ORIENTED PROGRAMMING IN C

What is C_talk™

C_talk™ is an object-oriented development environment in C with Smalltalk-like messaging formats. It lets the software developer use the C_talk™ Browser to develop an object-oriented program, then use the C_talk™ Compiler to convert this program into C code compatible with most popular C compilers.

System Requirements

C_talk™ (version 1.0) is designed to run on the IBM® PC (or compatibles) with graphics (CGA, EGA, VGA) and with one of the following C languages: Microsoft® C, Lattice C, Turbo C, or C86. A system configured with a hard drive and mouse is highly recommended.

The Power of .OOO's

C_talk™ is designed to let you take full advantage of object-oriented languages (.OOO's). In fact, the makers of C_talk™ have designed it so that both the object-oriented guru and the "non-objecting" neophyte can use C_talk™ to explore and export the exciting world of .OOO's. C_talk™ contains:

- Encapsulation ("objects")
- Messaging
- Inheritance

Efficiency

C_talk™ does just what its name suggests - lets you talk in C, and thereby gives you all the efficiency and advantages of C.

- Speed, Size, Flexibility
- Ease of Application Delivery
- Access to C Libraries and C tool sets

The user of standard C will find programming in C_talk™ is basically programming in C, but with a powerful difference. C_talk™ is an object-oriented environment. C_talk™ introduces to C a new data type - the object, and a new operation - the message.

TO ORDER:

CMS, Inc.
 Software Products Dept.
 7090 Shady Oak Road
 Eden Prairie, MN 55344
 (612) 944-0170

PRICE: \$149.95
Credit Cards: Master Card, Visa

CMS is a registered trademark of CMS, Inc.
 MICROSOFT is a registered trademark of MICROSOFT CORP.
 IBM is a trademark of IBM Corp.

The Productivity of C_talk™

C_talk™ is a synergy of C and Smalltalk-like features - combining talents which yield much greater productivity to the software builder.

- Define software components in object-oriented terms.
- Extend software components with full class inheritance.
- Automatically convert work into C code.
- Reuse software components to obtain results in less time.
- Learn quickly using standard C in C_talk™

Our Commitment

The makers of C_talk™ are committed to serving the software development community. Our goal is to help the software developer produce better software at lower cost. We strive to provide easy-to-use development and learning tools which help reduce both software development costs and maintenance costs.

MICROMINT'S Gold Standard in Single Board Computers & Controllers

Announcing ImageWise™ Serial Digital Imaging System



MICROMINT INTRODUCES A STAND-ALONE SERIAL DIGITAL IMAGING SYSTEM. The MICROMINT ImageWise™ Serial Digital Imaging System is the most cost effective and versatile high performance graphic video digitizing system on the market today. The ImageWise system has been designed to function as a standalone digitizer or as an integral component of a complete tele-imaging system. ImageWise™ is serially bit mapped digitized pictures give it almost universal compatibility with any computer capable of attaching to a modem or terminal. It is ideally suited for CAD/CAM Desktop Publishing, automatic inspection and security applications. Critical-system functions such as image resolution and picture update can be controlled and commanded remotely. Images are transmitted and received serially either compressed or uncompressed and can be displayed, transmitted, stored, edited, or processed for use in a variety of industry standard application software.

IMAGEWISE SYSTEM SPECIFICATIONS

- I/O bus dependent - can function standalone
- True frame grabber - uses a high speed Bus A/D converter and RAM bytes of static RAM to capture an image in 1/60th second
- Accepts any 1/2" or color NTSC video signal
- Stores pictures in 16K bytes of 256 levels, 64 levels, grayscale
- Resolution of transferred image is software selectable (all images are represented at 64 levels of gray scale)
- Selectable Resolutions:
 - High resolution 440 x 350 pixels
 - Mid resolution 320 x 256 pixels
 - Low resolution 256 x 192 pixels
- Video Input: 1 volt peak-to-peak, B/W or color 0.75 ohm termination
- Video Output: 75 Ohm 1.7 volt peak-to-peak NTSC composite video
- Serial Input/Output: RS-232-C bus, one stop bit, no parity 300 bps - 31.25 Kbps selectable data rate - Xon/Xoff Handshaking Switch selectable data compression control
- Modern composite. Query functions as a video telephone to send video images anywhere
- Video processing: data upload/download, and display utilities provided for PC DOS and MS-DOS machines

Optional PC Utilities Disk converts ImageWise™ files for use with popular Desktop and Base Programs.

DT01	ImageWise Digitizer / Transmitter	\$349.00
DB01	ImageWise Receiver / Display	\$349.00



Announcing OEM-286 — \$775.00 complete PC/AT-CPU



Low Power! **Expansion Card Form Factor!** **100% AT Compatible!**

MICROMINT'S OEM-286 is a complete PC/AT-CPU and more. The OEM-286 is the best low power, 100% AT compatible which has been specifically designed for OEM use within the industrial and business sectors. The OEM-286 features the Zentax CMOS PDMACH set and 100% compatible Award BIOS. The development of the PDMACH chip set has allowed the 109 IC's on a standard AT to be reduced to 93 IC's and two SIMMs. What this means for you:

- 1) The overall size of a standard AT/PCU has been condensed into the expansion card form factor (11 1/2" x 4 1/2")
- 2) Power requirements are less than 1 A @ 2 volts
- 3) OEM-286 plugs into a passive backplane for easy connection to other expansion peripherals

The OEM-286 is available in both a 10 and 10 MHz versions and comes with the Award BIOS

OEM-286 FEATURES

- 100% AT compatible
- 80386 microprocessor @ 10 or 10 MHz
- 100K Co-Processor optional
- 64 Kbytes of DRAM can accommodate 128 Kbytes
- 512 Kbytes of RAM
- Keyboard Controller
- Expansion card size factor
- Standard interface to the System Expansion Bus
- Battery backed real time clock
- Award BIOS included

OEM-286/6	6 MHz AT/PCU	\$775.00
OEM-286/10	10 MHz AT/PCU	\$829.00
OEM-286/10	6 SLICE PASSIVE BACKPLANE	\$115.00

SB180FX — \$409.00 Single Board Computer



- ### SB180FX TECHNICAL SPECIFICATIONS
- PROCESSOR**
- Hitachi HD64160 - an 8-bit CPU in a 64 pin PLCC package
 - Support of Low microcost vcc including hardware multiply
 - Integrated Memory Management
 - Use with 256 Kbytes address space
 - Dynamic RAM refresh
 - Wait state generation
 - Chained serial I/O port
 - 6 channel DRAM Memory Access Controller
 - 4 channel Asynchronous Serial Communication Interface
 - 4 channel 16-bit Programmable Delay Timer
 - 8 timers
 - Dual bus interface to data and address support chips
 - 6 14889E, 6 81288E, and 12 size 80C05 system operation
 - 512K bytes dynamic RAM on board
 - Memory externally expandable to 4 Mbytes RAM
 - Z8000 on DR 8704, 8814 or 8815 with 80C05/06 available
 - Full function 8K ROM monitor
- CONTROL**
- Custom 80-842 serial port with auto baud rate select to 38.4K baud
 - Enhanced 8255 serial port: full handshaking 192.5K baud
 - Late parallel I/O port
 - 16 bit bidirectional parallel I/O
 - 16 bit address decoding, I/O port direct mode, and dual bus interface through one to expansion bus connector
 - Can be directly attached to CF 140 640 x 640 color graphics adapter
 - Fully implemented SCSI hard disk and communications bus interface
- FLATPANEL/OEM INTERFACE**
- 4 pin Standard Microplane video disk connector
 - Compatible with NEC NS4 controller
 - On chip digital data separator
 - Can connect 1/2" 1/4" and 8" floppy disk drives - up to a 4 way configuration
 - Handles both 16 bit encoded single density and 16M encoded double density data
 - NEC 23240 SCSI bus controller for hard disk or network communication
- SOFTWARE COMPATIBILITY**
- IBM DOS/PC DOS Compatible

SB180FX-1	SB180FX 8 166 MHz computer board populated with 256K bytes RAM, 4K byte ROM monitor, without SCSI chip	\$409.00
SB180FX-1-30	SB180FX computer board as ordered above with 256K bytes RAM, including 256K, 200K, 128K and 64K ROM monitors, and 4K byte SCSI hard disk populated with 1.44 or 5.25 inch floppy disk	\$499.00

SB180 — \$299.00 Single Board Computer

SB180-1	SB180 8 166 MHz single board computer w/256K bytes RAM and ROM monitor. Add \$30.00 for 6 MHz	\$299.00
SB180-1-80	Same as above w/SCSI, 256K, 64K and ROM sources	\$399.00
COMM180-4	SCSI Hard Disk Interface	\$180.00
SB180-1	OEM 100 QUANTITY PRICE	\$195.00

GT180 — \$395.00 Graphics Display System



The GT180 offers these features:

- Advanced graphics controller provides intelligent link between computer and user
- Only 5 1/2" x 8" - plugs-backs on either an SB180 or SB180FX computer
- High resolution at low cost: 640 x 480 with 256 color palette
- Hardware drawing Commands: LINE, RECTANGLE, POLYLINE, POLYGON, CIRCLE, ELLIPSE, ARC, FILLED RECTANGLE, DASH, PATTERN, WINDOW, and COPY to name but a few
- Automatic translation of logical X-Y coordinates to physical frame buffer addresses
- Fast drawing speed of 8 million pixels per second
- Provides fully programmable horizontal split screens and window screen
- Fully supported by GT180-Graphic Toolbox written in Modula-2

GT180-1	Graphic Display Expansion Board (TTL 80C180)	\$395.00
GT180-8	Graphic Display Expansion Board (TTL 80C180 and Analog 80C180)	\$499.00

SB180 Software and Accessories

SB180-U	Uniform Data Format Conversion Software	\$ 89.95
SB180-ZMSO/TKBBS	256K Bufferboard Board Software	\$109.00
SB180-MOD01	Turbo Modula 2	\$ 89.00
SB180-MOD02	Turbo Modula 2 with graphics Toolbox	\$ 89.00
SB180-CASE	Three half height 5 1/2" drive enclosure w/ziper-wire supply mounting brackets and hardware for the SB180 or SB180FX	\$187.00
SB180-CABLE	Set of 4 cables including power, term, disk and print	\$ 79.00

BCC22 — \$249.00 Term-Mite Smart Terminal

Why pay \$300 or more for a smart terminal? The TERM-MITE ST offers you all of the following on a single board for less than 1/2 the price:

- Dimensions 4" x 6 1/2"
- 128 displayable characters
- 24 lines x 80 characters
- Separate transmit & receive handshaking (110 (0-2000bps))
- CRT refresh at 60 Hz
- Supports scanned and encoded keyboards
- 11 Graphic characters
- 25th line reverse video status display
- 91 escape functions
- 14 control functions
- Binary/dims composite video or separated w/ monitor
- All functions are firmware controlled. Source code available

EDITING FEATURES: typeover, clear to screen to space or null, erase to end of page, erase to end of line, absolute cursor addressing.

VIDEO ATTRIBUTES: reverse video, half intensity, double height, double width, underlined, blinking, and blank characters.

BUS CONFIGURATION: MICROMINT BCC compatible or no bus connection necessary for stand-alone operation with parallel keyboard.

BCC22	TERM-MITE Smart Terminal Board	\$249.00
BCC22K	PARALLEL Encoded ASCII KEYBOARD plugs directly into TERM-MITE	\$ 79.00

BCC52 — \$199.00 BASIC 52 Computer/Controller



The MICROMINT BCC52 Computer/Controller is a stand-alone single board microcomputer which needs only a power supply and terminal to become a complete system programmable in BASIC or machine language. The BCC52 uses the Intel 80288 BASIC microprocessor which optimizes a ROM resident 8K byte floating point BASIC interpreter. It contains buffers for up to 48K bytes of RAM, EPROM, an intelligent 256K/128K EPROM programmer, 2 parallel ports, a serial terminal port with auto baud rate selection, a serial printer port.

BCC52*	BASIC 52 Computer/Controller	\$199.00
OEM 100 QUANTITY PRICE		\$149.00

*NOW AVAILABLE IN INDUSTRIAL TEMPERATURE RANGE - CALL FOR INFORMATION

BCC11 — \$139.00 Basic Controller



Features:

- Uses 26 single chip microcomputer
- On board 8K byte basic interpreter
- 6 on board parallel ports & serial port
- 4 interrupts (4 external)
- Just connect a CRT and write control programs in basic
- 6K bytes of RAM or EPROM memory on board
- 64K bytes 110-9600 bps
- Data and address bus available for 50K memory and I/O expansion. Comes with only 1 1/2 watts @ 5, 10 & 15V

BCC11*	BASIC System Controller	\$139.00
--------	-------------------------	----------

*NOW AVAILABLE IN INDUSTRIAL TEMPERATURE RANGE - CALL FOR INFORMATION

BCC40 — \$159.00 Power I/O Expansion Board

The MICROMINT BCC40 POWER I/O Expansion Board provides robust control and monitoring of up to 10 250 WAC or 5-HPDC devices. Up to 10 POWER I/O boards may be used as a power bus for a total of 10 inputs and 10 outputs.

BCC40	POWER I/O Expansion Board with no power modules	\$159.00
	with 4 Output Modules	\$209.00
	with 8 Input Modules	\$299.00



BCC52 & BCC11 Software and Accessories

BCC52-ROM A	ROM A Utilities-BASIC extensions	\$ 29.95
BCC52-ROM A/B	ROM A and B Utilities	\$109.00
BCC52/74	BASIC extensions and Assembler ROM C Utilities-Real Time Clock and Power I/O firmware	\$ 54.00
BCC52-OK-CLK	SMARTIME BCC52 Clock and ROM C	\$ 89.00
BCC52-8K-CLK	SMARTIME BCC52 Clock with ROM C	\$ 79.00
BCC53	Multi-Function Exp. Board w/8K - adds 8 ports and 69K byte Serial I/O Expansion Board	\$169.00
BCC08	75-250 to 50ma Converter	\$ 34.00
BCC15	1 bit, 8 channel A/D Board	\$189.00
BCC30	12 bit, 16 channel A/D Board	\$197.00
BCC25-4	4x10 LCD Display	\$129.00
BCC25-6	6x10 LCD Display	\$229.00
BCC25R	6x10 Encoded ASCII keyboard	\$ 79.00

MOTHER BOARDS - CARD GAGES - POWER SUPPLIES

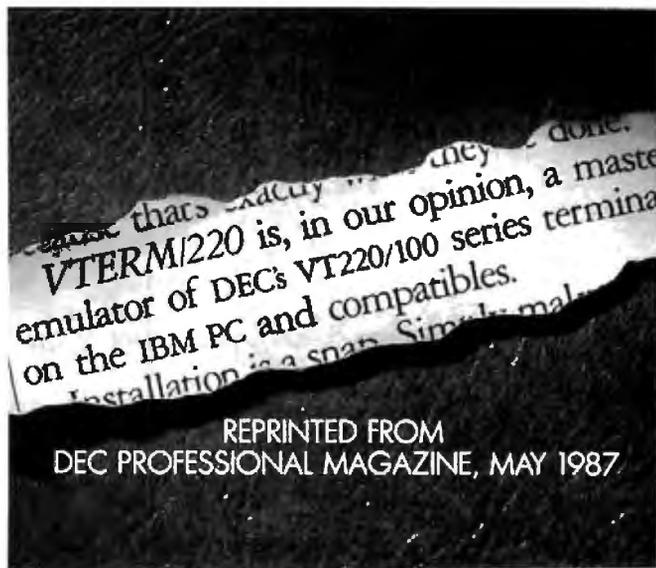
MB02	1 Slot mini-mother board (not compatible with CC01, CC02)	\$ 89.00
MB06	6 Slot half mother board	\$ 65.00
MB44	44 pin gold card edge connector	\$ 6.00
CC01	10 inch Card Gage for one MB06	\$ 79.00
CC02	10 inch Card Gage for 16 MB06s	\$ 139.00
UPS11	Universal Power Supply - used for single board applications	\$ 19.00
UPS05	0A @ 5V 3A @ 5V and 1A @ 15V Card Gage Power Supply - designed for 4 or 3 board system	\$ 39.00
UPS10	1A @ 5V 3A @ 12V 1A @ 15V Heavy Duty Switching Power Supply - used for entire BCC system	\$ 69.00
UPS21	5.5A @ 5V 7A @ 12V 3A @ 15V 6V 10W Programmable Power Supply - used for EPROM programming on the BCC52	\$ 49.00

To order call
1-800-635-3355

for technical information 1-(203)-871-6170

TELEX: 643331





(WITH REVIEWS LIKE THESE, WHO NEEDS CLEVER HEADLINES?)

Find out why magazines like DEC Professional and PC Week and over 60,000 PC users appreciate the convenient yet powerful features of VTERM/220, VTERM III and VTERM/4010.

Send in this coupon to see for yourself the most functionally complete emulation of DEC VT220, VT100, VT52 or Tektronix 4010 terminals. **VTERM***

I would like to find out why magazines like DEC Professional, PC Week and others rate VTERM/220 so highly.

Please send me the DEC Professional and PC Week reviews.

Please send me information on your free 30-day evaluation of VTERM/220, VTERM III and VTERM/4010.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE NUMBER _____

Write: Coefficient Systems Corporation
611 Broadway, New York, N.Y. 10012

or call (212) 777-6707 ext 413

FAX: (212) 228-3137 TELEX: 6503156498

*VTERM refers to VTERM/220, VTERM III and VTERM/4010 from Coefficient Systems Corporation

table, add them in ascending order to provide the cumulative probability (column M). Compare the random number with column M's values to find the largest value in column M not exceeding the random number.

To get the number of orders, go across to column N. A random number of 0.29 would correspond to 7 orders, while 0.59 would yield 10 orders.

Note that column N is offset by one position from the starting values in column J. This compensates for the way the lookup function "backs up" to the previous row when a match is found. For example, any random number below .0001234 would yield a result of 0 orders on that day (cell N6 is the output).

The combination of random numbers between 0 and 1 and the Poisson lookup table allows you to produce a series of orders with the right average and with the right variability.

Figure 3 shows the simulated first month of the terminal's operation. The Poisson lookup table (columns J to N) is located to the right of the main simulation section and is not repeated in figure 3. Figures 4 and 5 show the formulas behind the numbers in figure 3.

You can enter the input values for the production, maximum inventory, average number of orders, and the size of the orders under the appropriate heading in row 4. After that, you can hit the Calc key and watch the simulated month take place.

Interpreting the Results

At the bottom of figure 3 are the averages of the column values. Note that although the input average number of orders per day was 9, the actual average was 8.

Figure 3 therefore represents a slightly worse than average month as far as sales go. If you simulate the next month (regenerate the random numbers used in column D, and set the inventory at the last day's level) you will get a different average. This new average will of course result in a different number of orders and missed sales.

You need to repeat the simulation perhaps 20 times to get a representative feel for the number of missed sales. You can answer "what if" questions by changing the input conditions. You might try a larger tank or higher production levels on the production side, or a greater average number of sales or higher number of barrels per sale on the sales side.

Final Comments

You can extend this general approach to any arbitrary level of complexity. For example, you might use a second set of random numbers to simulate unplanned failures in the production unit, or mechanical breakdowns of the tank's pump.

Keep in mind, though, that when adding new random variables, you need to use an independent source of random numbers. Your simulation would lose a degree of realism if it always showed high sales demands coinciding with broken pumps, for instance. For large simulations, a full-scale simulation language (see references 1 and 2) is more efficient than using a spreadsheet. However, for small problems where you need a fast answer, the spreadsheet approach works extremely well. ■

REFERENCES

1. Russel, Edward C. *Building Simulation Models With Simscript II.5*. Los Angeles, CA: CACI.4 (Consolidated Analysis Centers Inc.), 1985.
2. Schriber, Thomas J. *Simulation Using GPSS*. New York: John Wiley & Sons, 1974.
3. Kaufman, A. *Introduction to Operations Research*. Troy, MI: Academic Press, 1968.
4. Knuth, Donald E. *The Art Of Computer Programming: Semi-Numerical Algorithms*, vol. 2. Reading, MA: Addison-Wesley, 1981.



American Semiconductor

the fastest growing supplier of quality computer parts now gives you complete systems for less than

ANYBODY! And we can FINANCE YOU!

NOT A LEASE ★ YOU OWN IT!

\$35.mo. 

TURBO XT MODEL #5301
 • Selectable 4.77 & 8 MHz Processing Speed • 640K RAM Memory • Bios • Line 360K Floppy Drive • Floppy Controller w/ Cable • Eight Expansion Slots • PC XT Compatible Keyboard
RETAIL VALUE 1099.
OUR PRICE 567.

\$40.mo. 

TURBO XT MODEL #5302
 • Selectable 4.77 & 8 MHz Processing Speed • 640K RAM Memory on Main Board • Bios • 16 Bit 8088-2 CPU • One 360K Floppy Drive • Multi I/O w/ Floppy Controller • Clock Calendar Parallel • Serial & Game Port • Eight Expansion Slots • PC XT Compatible Keyboard
RETAIL VALUE 1599.
OUR PRICE 711.

\$45.mo. 

TURBO XT MODEL #5303
 • Selectable 4.77 & 8 MHz Processing Speed • 640K RAM Memory on Main Board • Bios • 8088-2 CPU • One 360K Floppy Drive • Multi I/O w/ Floppy Controller • Clock Calendar Parallel • Serial & Game Port • Eight Expansion Slots • One 10MB Hard Drive w/ Controller • PC XT Compatible Keyboard
RETAIL VALUE 1999.
OUR PRICE 979.

\$45.mo. 

TURBO XT MODEL #5304
 • 8 MHz Processing Speed • 640K RAM Memory on Main Board • Bios • 16 Bit 8088-2 CPU • Two 360K Half Height Floppy Drives • Multi I/O w/ Floppy Controller • Clock Calendar Parallel • Serial & Game Port • One 20MB Hard Drive w/ Controller • TURBO Normal Mode Either Software or Hardware Selectable • Eight Expansion Slots • PC AT Compatible Keyboard
RETAIL VALUE 2499.
OUR PRICE 1151.

\$45.mo. 

TURBO XT MODEL #5305
 • 8 MHz Clock Speed • 640K RAM Memory on Main Board • Bios • 16 Bit 8088-2 CPU • Two 360K Half Height Floppy Drives • Multi I/O w/ Floppy Controller • Clock Calendar Parallel • Serial & Game Port • 20MB Hard Drive w/ Controller • TURBO Normal Mode Either Software or Hardware Selectable • Eight Expansion Slots • PC AT Compatible Keyboard
RETAIL VALUE 2999.
OUR PRICE 1348.

\$65.mo. 

TURBO XT MODEL #5306
 • 8 MHz Processing Speed • 640K RAM Memory on Main Board • Bios • 16 Bit 8088-2 CPU • Two 360K Half Height Floppy Drives • Multi I/O w/ Floppy Controller • Clock Calendar Parallel • Serial & Game Port • 20MB Hard Drive w/ Controller • TURBO Normal Mode Either Software or Hardware Selectable • Eight Expansion Slots • PC XT Compatible Keyboard • IBM Compatible Enhanced Graphics Adapter (EGA) • High Resolution EGA Monitor
RETAIL VALUE 3999.
OUR PRICE 1926.

\$55.mo. 

TURBO XT MODEL #5307
 • 6-8-10 MHz Processing Speed • 6 MHz • 640K (Expandable to 1MB on Main Board) • Bios • 80286 Based CPU • 360K Half Height Floppy Drive • Hard Drive w/ Controller • Multi I/O w/ Floppy Controller • Clock Calendar Parallel • Serial & Game Port • 20 MB Hard Drive w/ Controller • AT Style Keyboard
RETAIL VALUE 3999.
OUR PRICE 1599.

\$60.mo. 

TURBO AT MODEL #5501
 • 512K RAM Memory (Expandable to 1MB on Main Board) • 80286 Based CPU • Bios • 1.2MB Half Height Floppy Drive • 20MB Hard Drive w/ Controller • Eight Expansion Slots • Parallel Port • AT Style Keyboard • Performance 16, 12, 10, 8, 6 MHz Available
RETAIL VALUE 3999.
OUR PRICE 1768.

\$75.mo. 

TURBO AT MODEL #5502
 • 8 MHz Clock Speed • 512K RAM Memory (1MB Option Available) • Bios • Intel 80286 Microprocessor • 1.2MB Half Height Floppy Drive • 20MB Hard Drive w/ Controller • Eight Expansion Slots • Serial Parallel Adaptor • AT Compatible Keyboard • Performance 16, 12, 10, 8, 6 MHz Available
RETAIL VALUE 4499.
OUR PRICE 2132.

\$75.mo. 

TURBO AT MODEL #5503
 • 8 MHz Clock Speed • 512K RAM Memory (1MB Option Available) • Bios • Intel 80286 Microprocessor • 1.2MB Half Height Floppy Drive • 40MB Hard Drive w/ Controller • Eight Expansion Slots • Serial Parallel Adaptor • AT Compatible Keyboard • Performance 16, 12, 10, 8, 6 MHz Available
RETAIL VALUE 5999.
OUR PRICE 2132.

CHEAPER PRICES? AMERICAN SEMICONDUCTOR had to make a choice between building our products as cheaply as possible and selling it as a get-by product or building quality into our products for service, durability and your long lasting enjoyment. We know you would prefer to deal with a company that puts everything possible into its product. To make it the best! The best things are never the cheapest! and cheap things are seldom the NO OTHER COMPANY CAN OFFER YOU A YEAR WARRANTY ON ITS XT & XT TURBO MOTHER BOARDS AND INSTANT CREDIT BESIDES! *Our direct control from R&D component selection to final assembly enables us to maintain quality throughout the complete manufacturing process. THAT'S WHY WE SELL SO MANY

★ ★ ★ ★ ★ ★ ★ ★ ★ ★
INSTANT CREDIT NOW!
 ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

President, American Semiconductor, Inc. *Anthony L. O'Neill*

1-800-825-SAVE

OPEN MON-FRI 8 AM-7 PM.
 OPEN SATURDAY 9 AM-5 PM (EST)

CORPORATE HEADQUARTERS: 15240 RACE TRACK RD, TAMPA, FL 33626, (813) 886-8631

PRICES SUBJECT TO CHANGE DUE TO AVAILABILITY AND MARKET FLUCTUATIONS. VOID WHERE PROHIBITED. \$25.00 CREDIT APPLICATION FEE.

THE BUYER'S MART

A Directory of Products and Services

THE BUYER'S MART is a 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—\$475 3x—\$450 6x—\$425 12x—\$375
Prepayment must accompany each insertion. VISA/MC Accepted.

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 approximately 2 months prior to issue date. For example: March issue closes on January 7. Send your copy and payment to THE BUYER'S MART, BYTE magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call Mark Stone at BYTE 603-924-3754.

ACCESSORIES

FREE CATALOG

Thousands of parts and new surplus electronic parts at super low prices. **FAST ORDER PROCESSING AND SHIPPING** (95% of all orders shipped within 48 hours).

CALL OR WRITE FOR A FREE CATALOG.

ALL ELECTRONICS CORPORATION

P.O. Box 567, Van Nuys, CA 91408-0567

1-800-826-5432

Inquiry 551.

ACCESSORIES

FREE CATALOG

Diskettes & Acc • Dust Covers • Furniture • Data Cartridges • Plotter Pens • Clean'g Supl • Tapes & Acc • Ribbons • Printers • Computer Paper • Copier Supplies • Surge Prot • Cables & Acc • Print Wheels • MUCH MORE!

Call, write or circle inquiry card for a FREE Catalog

GAAN COMPUTER SUPPLIES

188 B East Sunnyside, Campbell, CA 95008

(800) 523-1238, In Calif. (408) 370-6747

Inquiry 556.

BAR CODE

BAR CODE READERS

For PC/XT/AT, and ALL PS/2 models—attaches as 2nd keyboard, reads as keyed data. External mounting via velcro to side of monitor. OR can be short slot mounted in PCs. PC—\$385. PS/2—\$399. Cable for PC to PS/2 upgrade—\$30. RS-232 Model—\$399. Reads UPC, EAN, 2 of 5, Code 39. 30 day \$ back

Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060

(800) 345-4220 In CA: (408) 458-9938

See our ad on page 42

SOFTWARE PACKAGING, DISKS

Cloth binders & slips like IBMs. 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 552.

IBM PC ACCESSORIES!

Our FREE Catalog includes hundreds of Switches/Cables, Buffers/Converters, Print Spoolers, PC Stands, Furniture, Surge Protectors & More for your IBM PC. **LOW Direct Prices, SAME DAY Shipping & Satisfaction GUARANTEED!** Write or Call for a FREE CATALOG Today!

Tipz Computer Accessories

P.O. Box 690, San Francisco, CA 94101-0690

800-367-8479 or 415-628-2344

Inquiry 557.

PRINT BAR CODES/BIG TEXT FROM YOUR PROGRAM

Add bar codes and big graphics text to your program. Print from inside of dBASE, BASIC, C, etc. Bar codes UPC, EAN, 2 of 5, Code 39. Epson/Okuli/IBM dot matrix text up to 1/2". LaserJet fonts up to 2" (144 pts). tall. \$159-\$239. 30 day \$\$ back guarantee

Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060

(800) 345-4220 In CA: (408) 458-9938

See our ad on page 42

JOB PROTECTION

If your job depends on your computer, you should have our FREE catalog. Call (800) 356-5794 Ext. 8984 for a FREE catalog from the world's largest manufacturer of single phase uninterruptible power supplies. Call or write today!

BEST POWER TECHNOLOGY, INC.

P.O. Box 280, Necedah, WI 54646

In Wis. (608) 565-7200 Ext. 8984

(800) 356-5794 EXT. 8984

Inquiry 553.

ARTIFICIAL INTELLIGENCE

FamilyCare™ Software

This comprehensive medical diagnostic expert system spares expensive, unnecessary trips to a physician by guiding you quickly through possible symptoms and giving you specific directions for medical care, home treatment, and medications. Includes hundreds of symptoms, injuries, and diseases of newborns through teenagers.

FamilyCare™ Software

Lundin Laboratories, Inc.

2945 Greenfield Rd., Suite #218, Southfield, MI 48076

800/426-8426 or 313/659-4561

Inquiry 558.

BARCODE BARGAINS

Buy direct and save. We'll beat any written quotes for competing equivalent bar code readers or bar code label generation software. Call or write for brochures. Quantity discounts, warranty, same day shipping. Bar codes are all we do at ITS.

International Technologies & Systems Corp.

1950 White Star Dr., Diamond Bar, CA 91765

(714) 861-7977 Telex 265718 ITSCOO

Inquiry 560.

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) 884-8044

Inquiry 554.

muLISP™-87 for MS-DOS

Fast, compact, efficient LISP programming environment. muLISP programs run 2 to 3 times faster & take 1/2 the space of other LISP's. 450 Common LISP functions, multi-window editing & debugging, flavors, graphics primitives, lessons & help, demo programs, comprehensive manual.

Soft Warehouse, Inc.

3615 Harding Ave., Suite 505, Honolulu, HI 96816

(808) 734-5801

Inquiry 559.

BAR CODE MADE EASY

PERCON® E-Z-READER™ keyboard interfaces and multuser RS-232 models make it easy to add bar code to virtually any computer/terminal WITHOUT SOFTWARE MODIFICATION. Immediate shipping. Two year warranty. Bar code pricing software available. Call for details on fast, accurate, easy data entry. Substantial reseller discounts.

PERCON®

2190 W 11th St., Eugene, OR 97402

(503) 344-1189

Inquiry 561.

BAR CODE

PRINT BAR CODES AND BIG TEXT

On your EPSON/IBM/OKI/LaserJet printers. 1" tall text readable at 50 ft. Code 39, 2 of 5, UPC/EAN, MIL-STD, AIAG. Menu-Driven. Any format/size. File input. Design label on 1 screen \$2/9. Other simple programs for bar codes from \$49. 30 day \$ back guarantee.

Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060

(800) 345-4220 In CA: (408) 458-9938

See our ad on Page 42

Inquiry 555.

READ & PRINT BAR CODES

Fast, reliable data entry into your programs as if from your keyboard. Internal unit for PC, XT, AT PS/2-M30. RS-232 unit for DOS & Non-DOS systems (incl. all PS/2). Stainless steel wand and LASER interfaces. Powerful Bar Code and Text printing software.

Seagull Scientific Systems

601 University Ave., Suite 150, Sacramento, CA 95825

(916) 386-1776

Inquiry 562.

THE BUYER'S MART

BAR CODE

BAR CODE READERS

Among the industries best and most widely used barcode reader, reads all major barcode formats (code 39, 2 of 5, UPC/EAN, codabar), connects between keyboard & system, advanced CMOS uses keyboard power supply, connects to all IBM compatibles and DIN terminals, completely OS independent, software independent. Same day ship, 1 year warranty, 30 day satisfaction guarantee. CALL for prices too low to advertise.

Solutions Engineering Sales
8653 Georgia Ave., Silver Spring, MD 20910
800-635-6533

Inquiry 563.

dBARCODE™

Print Code 3 of 9, 2 of 5, UPC-A using dBASE III Plus and dot matrix or HP Laserjet printer. Vary bar code width, height, spacing, print multiple columns, etc. dBASE program (source code included) prints bar codes from your databases, or call binary format module from your own programs. \$99 + \$/M.

TimeKeeping Systems, Inc.
Dept. B, 12434 Cedar Rd., Cleveland, OH 44106
(216) 229-2579

Inquiry 564.

DATA INPUT DEVICES

Bar Code & Magnetic Stripe Readers for microcomputers & terminals, including IBM PS/2 & others, DEC, AT&T, CT, Wyse, Wang. All readers connect on the keyboard cable & are transparent to all software. Low cost bar code print programs & magnetic encoders are also available. GSA approved.

TPS Electronics
4047 Transport, Palo Alto, CA 94303
415-856-6833 Telex 371-9097 TPS PLA

CAD/CAM

LOGIC SIMULATION

Now you can have state of the art logic simulation for only \$98. Logic, timing, verification and fault simulation. Automatic test pattern generation, timing traces, & tabular output. Optional part library & model generation. (MADS) IBM XT/AT MC/VISA

MICRO-ANALYTIC
2860 Hudson Ave., Corona, CA 91719
In CA: (714) 371-5703 (800) 527-3780

Inquiry 565.

COMMUNICATIONS

MULTI-USER BBS (FOR IBM PC AT)

TEAMate — a mainframe quality BBS. A mini CompuServe. Full screen cursor-controlled interface, topic outline structure, public and private topics, audit trails, xmodem, integrated mail, content retrieval and more. MS-DOS, XENIX and UNIX versions.

MMB Development Corporation
1821 No. Sepulveda Blvd., Suite K, Manhattan Beach, CA 90266
(213) 545-1455

Inquiry 566.

COMPUTER BOOKS

Software for Operating Systems

MINIX For the IBM® PC, XT, and AT
Created by Andrew Tanenbaum, this new operating system is similar to UNIX, but with all the SOURCE CODE, and at a much lower price!

640K IBM® PC AND XT version \$110
512K IBM® PC/AT version \$110
Manual Only \$32

Contact: Prentice Hall Publishers
College Marketing Dept., Englewood Cliffs, NJ 07632
Attn: R. Colt (201) 767-8837

Inquiry 567.

COMPUTER INSURANCE

Data Security Insurance

The "all risk" Personal Computer Policy from DSI includes essential coverage not available with other policies: protection against loss of data (even from accidental erasure), loss of custom programs, & fraud. As low as \$35 a year. Coverage can be bound by telephone, 9 to 4 Mountain Time.

Data Security Insurance
4800 Riverbend Rd., P.O. Box 9003, Boulder, CO 80301
303/442-0900 800/822-0901

Inquiry 568.

COMPUTERS + INSURANCE = SAFEWARE

Call toll free for information

- HOME COMPUTERS • BUSINESS COMPUTERS
- OVERSEAS COMPUTERS • LEASED COMPUTERS
- COMPUTERS LEASED TO OTHERS
- COMPUTERS TAKEN TO SHOWS
- COMPUTERS HELD FOR SALE
- OTHERS' COMPUTERS IN YOUR CARE

SAFEWARE,
The Insurance Agency Inc.
CALL TOLL FREE 1-800-848-3469

Inquiry 569.

COMPUTER MAINTENANCE

FREE TOOL CATALOG

Jensen's new catalog features hard-to-find tools, test equipment, computer and workstation accessories, tool kits, hundreds of items used for computer service, maintenance, and repair.

For your free catalog, call or write:
JENSEN TOOLS INC
7815 S. 46th St., Phoenix, AZ 85044
(602) 968-6231

Inquiry 570.

CROSS ASSEMBLERS

CROSS ASSEMBLERS for VAX VMS and PC/MS DOS

Faster Version 2.1 Now Available
Relocatable Macro Cross Assemblers,
Linkers, Librarians
Targeted to almost all Microprocessors

ENERTEC, INC.
BOX 1312, Lansdale, PA 19446
215-362-0966 MC/VISA

Inquiry 571.

CROSS ASSEMBLERS

Macros, PC Compatible, Relocatable, Conditionals, Fast, Reliable from \$160
also: Cross Debug/Simulators
EPROM Programmer Tool

MICROCOMPUTER TOOLS CO.
Phone (800) 443-0779
In CA (415) 825-4200
912 Hastings Dr., Concord, CA 94518

Inquiry 572.

680X0 Cross Assemblers

Now, inexpensive quality 680X0 Cross Assemblers that use your IBM PC or compatible. All versions include extensive listing facilities, up to 32 character labels, sorted symbol tables, INCLUDE files, PATH names, ORG, DC, DS, EQU, many other directives (except MACROS), printed manuals. Basic versions create S-records. Linking versions create either S-records or relocatable modules, and include a linker which creates S-records or binary output files. Not copy protected. Minimum requirements are 320K, DOS 2.0X, & 1-1/4" 5.25".
Basic: 680X0/68010—\$48.95 Linking: 680X0/68010—\$89.95
Basic: 68020/68080—\$149.95

Checks, VISA, MC accepted. MN residents + 6% sales tax. No PC's or CD's, please.
RAVEN Computer Systems
Box 12116, St. Paul, MN 55112 (612) 636-0365

Inquiry 573.

CROSS ASSEMBLERS

ASSEMBLERS & TRANSLATORS

Over 20 high quality, full function, fast relocatable and absolute macro assemblers are available immediately. Source language translators help you change microcomputers. Call for info about MSDOS, CPM80, ISIS versions.

RELMS™
P.O. Box 8719
San Jose, California 95150
(408) 265-5411
TWX 910-379-0014

Inquiry 574.

Disassemble MPU OBJECT CODE on your PC

Relocatable, symbolic disassemblers are now available for the Motorola, Intel, RCA, TI, Rockwell, & Zilog micro! Automatic label generation, assembly capability and much more. Call and ask for what you need.

RELMS™
P.O. Box 8719
San Jose, California 95150
(408) 358-1210
TWX 910-379-0014 (800) 448-4880

Inquiry 575.

DATA CONVERSION

MEDIA CONVERSION/DATA TRANSLATION

More than just a straight dump or ASCII transfer!
Word Processing, DBMS, and Spreadsheet data on Disk or Tape transferred directly into applications running on Mainframes, Minis, Micros, Dedicated Word Processors, Typesetters, and Electronic Publishing systems.
IBM PS/2 & Macintosh supported!
#1 in the translation industry!

CompuData Translators, Inc.
3325 Wishire Blvd., Suite 1202, Los Angeles, CA 90010
(213) 462-6222

Inquiry 576.

DATA TRANSLATION

Tape/Disk • Disk/Disk • OCR
Transfer data to and from hundreds of formats, data types, and word processors. Quick turnaround! Call today for a quotation to fit your special need.

- Reformat databases to your specifications
- Translate and print mailing lists
- Quality word processor to word processor conversions
- Authorized KEYWORD Service Bureau

DataCopy Service of Texas
3306 W. Walnut, Suite 400, Garland, TX 75042 (214) 272-7781

Inquiry 577.

DATA/DISK CONVERSION

Disk/Disk • Tape/Disk • OCR

Over 1,000 formats! 3 1/2, 5 1/4, or 8 inch disks; 9 track mag tape; 10 MB Bernoulli cartridge. Data base and word processor translation. Specialists in Government Sensitive Data. Call for free consultation.

Computer Conversions, Inc.
We take the hassle out of data conversion . . .
9580 Black Mt'n Rd., Ste J, San Diego, CA 92126
(619) 693-1697

Inquiry 578.

DISK CONVERSIONS

Media transfer to or from: IBM, Xerox, DEC, Wang, Lanier, CPT, Microm, NBI, CT, also WP, WS, MSWORD, DW3, MM, Samna, DEC DX, MAS 11, Xerox-Writer, ASCII.

FREE TEST CONVERSION
CONVERSION SPECIALISTS
531 Main St., Ste. 835, El Segundo, CA 90245
(213) 545-6551 (213) 322-8319

Inquiry 579.

THE BUYER'S MART

DATA/DISK CONVERSION

DISK & TAPE CONVERSIONS AUTOMATICALLY SAVE TIME AND MONEY

Over 1000 formats from Mini, Micro Mainframe, Word Processors, & Typesetters.

Tape Conversions as low as \$23.00 MB

DISK Conversions as low as \$25.00 per Disk
Call or write TODAY for a cost saving quotation.

CREATIVE DATA SERVICES

1210 W. Latimer Ave., Campbell, CA 95008
(408) 866-6080

Inquiry 580.

DISK AND TAPE CONVERSIONS

High quality conversion services, disk duplication & OCR scanning for Dedicated Word Processors, Mini and Micro computers. Over 1000 3 1/2", 5 1/4", and 8" formats, 800-1600BPI tape. Conversion between Wang, NBI, CPT, DEC, Vydec, Lanier, OS/8, Xerox, Linolex, Lextron, MemoryWriter, EditWriter, CompEdit, Exxon 500, Exxon Qyx, IBM Sys34/36/38/5520, MAC, Victor, TRS, Apple II & III, NSTAR, IBM PC/AT/3 1/2", HP, and most other Micros. Conversion directly into word processing software such as DW3, WP, MSWORD, VSA, Samna, MM, PFS, & many others.

DATA FORMATS, INC. (408) 829-1088

Inquiry 581.

Call Toll Free 1-800-431-2577 CONVERSIONS

Tape-to-Disk/Disk-to-Tape/Optical Scanning
Most popular 5 1/4" and 8" floppy disk formats. 9 track tape, and 1/4" tape. Palantir Compound Document Processor.

DCC DATA SERVICE

1200 18th St N.W. Ste. 704, Washington, DC 20036
1-800-431-2577

D.C. (202) 482-1410

CT (203) 748-8594

Inquiry 582.

IBM PC ↔ HP FILE COPY

IBM PC to HP File Copy allows IBM PCs, PS/2, compatibles to read, write files written by Hewlett Packard Series 70, 80, 200, 300, 1000, 9000's. We offer custom word using our file copy utilities and program translators. Call for estimate, catalog, data sheet.

Oswego Software 312/554-3567
507 North Adams St. Fax 312/554-3573
Oswego, Illinois 60543 Telex 858-757

Inquiry 583.

CONVERSION SERVICES

Convert any 9 track magnetic tape to or from over 1000 formats including 3 1/2", 5 1/4", 8" disk formats & word processors. Disk to disk conversions also available. Call for more info. Introducing OCR Scanning Services.

Pivar Computing Services, Inc.

165 Arlington Hgts. Rd., Dept. #B
Buffalo Grove, IL 60089 (312) 459-8010

Inquiry 584.

DATABASE MGMT. SYSTEMS

ID_ENTITY RELATIONAL DBMS

Full relational power without programming. Retrieve data in multiple tables easily. Modify table structures to speed queries. Import & Export data fast. Report writer. ID_ENTITY makes relational tasks other DBMS's avoid EASY. \$295 Reg. For limited time \$99 plus UPS.

Horizons Unlimited & Assocs.

1786 Michael Lane, Pacific Palisades, CA 90272
(213) 454-4178

Inquiry 585.

dBASE III COMPILERS

FREE dBASE III + COMPILER DEMO DISK

Don't buy Clipper™ until you see our FREE dBASE Compiler Evaluation Kit. Includes DEMO DISK with 8 PPG's and results of compiling with Clipper, Quicksilver & FoxBASE +. Also 15 benchmark tests, complete magazine reviews, and detailed brochures about all 3 compilers. FREE. No obligation. Call 24 hours, 7 days.

dataBASE Specialties (415) 652-2790

P.O. Box 2975, Oakland, CA 94618

DEMOS/TUTORIALS

INSTANT REPLAY III

Build Demos, Tutorials, Prototypes, Presentations, Music, Timed Keyboard Macros, and Menu Systems. Includes Screen Maker, Keystroke/Time Editor, Program Memorizer, and Animator. Rec'd Great Review! Simply the BEST. Not copy protected. No royalties. 60 day satisfaction money back guar. IBM and Compatib \$149.95 USChk/Cr. Crd. Demo Diskette \$5.00

NOSTRADAMUS, INC.

3191 South Valley Street (ste 252)
Salt Lake City, Utah 84109 (801) 487-9662

Inquiry 586.

DESKTOP PUBLISHING

Professional Type Composition

MP-XL—Hard-core typography and Typesets for the HP LaserJet II, Okidata LaserLine 6, or Ricoh PC 6000 Laser Printers. H&J, Indents, Tabs, Graphics, 1/4 pt. leading, random mix of size & face, 6-72 pt. fonts. MP-XL complete with 22 fonts, Pl + Bkrm 6-24 pt. \$195. MAC VISA
Many additional type faces available 6-30 pt.

Micro Print-X, Inc.

P.O. Box 581, Ballingoc, TX 76821
(815) 368-2343

Inquiry 587.

DISK DRIVES

PS/2 DRIVES FOR PC's AT's

CompatKit/PC \$329
CompatKit/AT \$309

Built-in floppy controllers—no problem.
Supports multiple drives and formats. Lets your computer use IBM PS/2 1.44M diskettes plus more!
Call for further information or to place an order.
VISA/MC/COD/CHECK

Micro Solutions Computer Products

132 W Lincoln Hwy, DeKalb, IL 60115 815/756-3411

Inquiry 588.

DISKETTES

DISKETTES ALL BRANDS

Xidex DS/DD Bulk 5 1/4"	.39
3M DS/DD/RH Boxed 5 1/4"	.75
CompuDisk DS/DD Boxed 5 1/4"	.40
Ashon Tape Degaused 5 1/4"	.25
Fuji DS/DD Bulk 3 1/2"	1.00
Xidex HD Boxed 5 1/4"	1.00

1-800-544-0141

Computech Products Inc.

10085-B Sandmeyer La., Philadelphia, PA 19116

Inquiry 589.

5 1/4" DISKS 23.9¢

Lowest Advertised Price in the Solar System!
3 1/2" DISKS \$80 per 100
MINIMUM QUANTITY 1000 Pcs.

5 1/4" DS/DD premium quality diskettes. These are un-sold, previously programmed, factory erased diskettes. Guaranteed replacement. SLEEVES AND LABELS INCLUDED.
Doubters: Call for FREE Sample. \$239.00 per 1,000
Large Qty. Prices Available. Sold in 1,000 increments.
Customer pays all shipping charges. Send check or money order to:

ELECTRONIC LIQUIDATORS

P.O. Box 1352, Melrose, MA 02178 (617) 682-8363

Inquiry 590.

DUPLICATION SERVICES

SOFTWARE DUPLICATION

- One Stop Shopping
- Custom Packaging
- Copy Protection
- Technical Support
- Drop Shipping
- Fast Turnaround
- Competitive Pricing

SATISFACTION GUARANTEED
800-222-0490 NJ 201-462-7628

MEGAsoft

P.O. Box 710, Freehold, NJ 07728 See our ad on page 316.

Inquiry 591.

BLANKET SERVICES

Diskette duplication • Packaging • Stocking/Drop shipping • 48 hour delivery • EVERLOCK copy protection • No master-ing fee • No charge for standard labels •

Star-Byte, Inc.

713 W. Main St., Lansdale, PA 19446
215-368-1200 800-243-1515

Inquiry 592.

ENGINEERING TOOLS

IBM PC ENGINEERING TOOLS

Sponky Bus Card \$89.00
UV Erasers \$39.95
PAL/EPROM Gang Programmers \$345.00
PAL Assembler \$89.00
Cross Assembler \$150.00
30 Day money back guarantee

CASPIAN TECHNOLOGY

P.O. BOX 7120 POMPANO BEACH, FL 33069
(305) 974-0978

Inquiry 593.

ENTERTAINMENT

"DRACO" MASTER CHESS

"DRACO's" powerful features include: 2/3D col- or graphics • monochrome • Easy to use on- screen menu structure • User may select open- ing from large library • Play through master games or set up end games • Time clocks; tourney mode; view captures & more. For IBM/comp. (128K) \$29.95 Visa/MC.

Arrowhead Software

P.O. Box 591, Chanhassen, MN 55317
612/559-6109

Inquiry 594.

FLOWCHARTS

FLOW CHARTING II+ HELPS YOU!

Precise flowcharting is fast and simple with Flow Charting II+. Draw, edit and print perfect charts: bold and normal fonts, 24 shapes — 95 sizes; fast entry of arrows, bypasses & connectors; Fast Insert Line, shrink screen displays 200-column chart; 40 column edit screen for detail work, much more!

PATTON & PATTON

81 Great Oaks Blvd. San Jose, CA 95119
1-800/672-3470, ext. 897 (CA residents)
1-800/538-6157, ext. 897 (Outside CA)
408/629-5044 (Outside the U.S.A.)

Inquiry 595.

FOREIGN LANGUAGES

ON THE IBM PC & PS/2

Use Arabic, Cyrillic, Farsi, French, German, Greek, Hebrew, Italian, Spanish, Turkish, Vietnamese, Scientific Notations, etc. . . in popular software: Wordperfect, Wordstar, Volkswriter, PC-Write, Dbase, Spreadsheet, Basic, Protog, Desktop Publishing, Dot matrix and laser printers option. EGA \$75, VGA \$85 CGA, MDA \$95 one language.

VN Labs

4320 Campus Dr., Suite 114, Newport Beach, CA 92660
(714) 474-6968

Inquiry 596.

THE BUYER'S MART

HARDWARE

DISCOUNT CLONES

- XT Turbo — \$460.
- AT 870 MHz — \$1290.
- Seagate ST225 20MB hard drive with controller — \$300.
- Seagate ST251 40MB 3ems — \$425.
- Hayes compatible 1200 baud modem — \$95.
- Genius Mouse software — \$60.
- HP Laser Jet Series II — \$1700.

Automated Business Solutions
516-379-3995

* 30 day money back guarantee • 1 yr parts & labor warranty
 Dealer Inquiries Invited. Please call for complete price list

Inquiry 597.

CHIP CHECKER

- 74/54 TTL + CMOS
- 144000 CMOS
- 14-24 Pin Chips
- 8000 Nat. + Signetics
- 9000 TTL
- .3" + .5" IC widths

Tests/Identifies over 650 digital chips with ANY type of output in seconds. Also tests popular RAM chips. IBM compatible version \$259. C128 + C64 version \$159.

DUNE SYSTEMS

2603 Wills Dr., St. Joseph, MI 49085

(616) 983-2352

Inquiry 598.

HIGH PERFORMANCE LOW COST

SINGLE BOARD COMPUTER has optimum features for Monitor + Control Applications. 16 Chan A/D with Sample + Hold + 2 RS232C/422 Ports + Buffered Digital I/O + Timer + 5.25 x 80 OPTIONS Resident **FORTH 79 OS** with Target Compiler, Editor, Assembler, RamDisk + Auto Load/Start; 5 MHz 8085 + 10 bit A/D + Bat. Backed Clock/RAM + Networking Expansion Boards + IBM/CPM Support.

The NEW E-PAC 1000 + \$249.00

EMAC INC.

PO BOX 2042 CARBONDALE IL. 62902 618-529-4525

Inquiry 599.

Save on brownout protection!

Line Conditioner keeps power constant whenever AC input power varies up or down! Prevents damage and downtime! Maintains constant output of 120V. This is a stepped transformer system that has higher efficiency than CVT's and gives lower waveform distortion. Built-in spike protection!

INDUS-TOOL

730 W Lake St., Chicago, IL 60606

Phone 312-648-2191

Inquiry 600.

87C51 PROG. \$125.00

The UPA 87C51 Programming Adapter lets you use your general purpose programmer to program the 87C51, 8751H, AMD8753H, 87C252, and 8752BH. Also lets you program the 87C51/8751H security bits and the 87C51 encryption array. It's very simple and VERY cost effective.

LOGICAL SYSTEMS CORPORATION

6184 Teall Station, Syracuse NY 13217

(315) 478-0722

Telex 6715617 LOGS

Inquiry 601.

68000 COMPUTER \$249.95

The MS68K SBC includes an 8 MHz 68000, 256K bytes of RAM (expandable to 512K bytes), up to 128K bytes of EPROM, two serial ports, a parallel port, a floppy disk controller, socket for a SCSI controller and a complete expansion bus. A complete ROM monitor is provided. +5 volt power. 5 1/4" x 8"

MARION SYSTEMS CORPORATION

1317 Fifth Street, Suite 301, Santa Monica, CA 90401

(213) 451-8910

Inquiry 602.

HARDWARE

ADDCARD PUTS 8 SLOTS IN THE 5 SLOT IBM-PC FOR ONLY \$79.00.

Fits inside system • 100% IBM Compatible • Uses existing motherboard • Accepts many boards including Turbo, RAM, tape backup, modem, floppy or hard disk controllers & others.

• Visa/MC/ODD • Call or write for orders or brochure:

1-800-231-4310 Ext. 768 / 313-562-9768

Merak Inc. • 8704 Edna • Warren MI 48093

Inquiry 603.

NEW/USED APPLES & STUFF MACINTOSH — Call Apple Parts — Call

Mac accessories—hard drives Call We buy, sell & horse-trade — Apple, IBM.

SHREVE SYSTEMS

845 Lark Ave., Shreveport, LA 71105

318-865-6743 4-9 p.m. • 1-800-227-3971

C.S.T.—VISA/MC

Inquiry 604.

USA WHOLESALE

EVEREX MODEM	1200/2400	\$79/\$188
EVEREX CARDS	EMS/EGA	\$99/\$109
LOGITECH MOUSE	SERIAL/BUS	\$69/\$79
HARD DRIVE KIT	20MB/30MB	\$239/\$269
SYSTEM DRIVE	XT/AT	\$179/\$229
8087	5/8/10	\$99/\$135/\$190
80287	8/9/10	\$156/\$235/\$289

800-666-SAVE ★ 214-385-1138

P.O. Box 819058-590, Dallas, Texas 75381

Inquiry 605.

LIQUIDATION SALE

Brand new Laser Siegler (formerly Envision) Color Graphics Terminals at close-out prices. Includes 30-day warranty

- * 16 colors from 4096 palette
- * 640 x 480 resolution
- * DEC VT100/ANSI X3.64 compatible
- * Tektronix 4010/4014/Plot 10 compatible

\$595 (Model 7105) and \$695 (Model 7107)

Call 714-974-4113 or write: Wells Data Systems, 2461 E. Orangethorpe Ave., Fullerton, CA 92631. In Canada, call 1-800-387-9537.

Inquiry 606.

HARDWARE/ADD-ONS

Motherboard Clock \$59

SideClock does not waste an expansion slot! The Inventions' Clock/Calendar, installs in seconds! Just open the computer cover and snap it into place. Never enter the time and date again. SideClock does it for you. Software and user replaceable battery included. 30 day \$\$ back gtd. 2 year limited warranty. \$59 + \$3 s/h. Site discounts. Dealers welcome.

Aristo

18911 El Camino, #213-D, Houston, TX 77058

713/460-6266, 800/SARISTO.

Inquiry 608.

Z80 / HD64180/CP/M CO-PROCESSORS

Plug-in co-processors for PC, PC/AT.

Blue Thunder Z80 co-processors

6 MHz \$249.95 10 MHz \$399.95

12.5 MHz \$599.95

HD64180 co-processors \$295 and up

All co-processors with CP/M emulator. Software only emulator Z8IM only \$99.95.

Z-WORLD 916-753-3722

1772A Picasso Ave., Davis, CA 95616

See our ad on page 320.

Inquiry 608.

HARDWARE/COPROCESSOR

PC MINI-SUPERCOMPUTER

Up to 40 MIPS in Your PC!

Fill your PC/XT/AT with 1 to 6 PC4000 boards for a high speed PC-RISC system. The PC4000 uses the NC4016 RISC Engine which executes high level Forth in silicon. Each PC4000 is a general purpose parallel coprocessor that delivers speeds in the 5 to 7 MIPS range... over a 100 times faster than a PC. K & R standard C and Forth available. From \$1295

SILICON COMPOSERS (415) 322-8763
 210 California Ave., Suite 1, Palo Alto, CA 94306

Inquiry 609.

LAPTOP COMPUTERS

LAPTOPS SPECIALS

Zenith 181 & 183 • Toshiba • NEC Multispeed EL • Datavue Sharp • AFFORDABLE 5 1/4" or 3 1/2" DRIVE UNITS FOR LAPTOPS & DESKTOPS • DICONIX PRINTERS • 1200 & 2400 BAUD MODEMS (for LAPTOPS) • Fast delivery & reliable friendly service
 Call for low pricing...

COMPUTER OPTIONS UNLIMITED

201-469-7678 (7 Days, 9AM-8PM Eastern time)

Inquiry 610.

LAP-LINK

The ultimate solution for linking laptop computer with any IBM compatible desktop PC. 115, 200 baud transfer rate—faster than any other product available. No installation necessary. easy to use split screen design. Includes incredible "universal cable" that connects any two computers. Transfer entire disks faster than a DOS copy command! Only \$129.95 including universal cable and both 3 1/4" and 5 1/4" disks. "Bridge" owners can trade in for only \$89.95 w/o cable.

Travelling Software, Inc.

19310 North Creek Parkway, Bothell WA 98011

1-800-343-8080 (206) 483-8088

Inquiry 611.

LEGAL

DESIGNED FOR LEGAL WORK

The SoftWars™ Substantive System. "This could save a law office 30% — 45% of the time to process pleadings." Brief, 9/87. Version 3.3 \$159. Free brochure.

TSC

The Software Company

P.O. Box 872687, Washila, AK 99887

(907) 745-6267

Inquiry 612.

MAILING LIST PROGRAMS

COMPUTERIZED ZIP DIRECTORY

ZIPLIST Data file of USPS zipcodes includes City, State, and County information. Two Sizes: 41,000 records—\$198.00 97,000 records—\$246.00. Verify accuracy • Speed data entry • Compatible with most database software • On disk or tape • CLEAN-A-LIST Software that identifies and corrects errors in City, State Zip — \$200.00

ASSIGN-A-ZIP 5-digit Zip assignment by street address. Zipcode latitude/longitude data files Population data files.

DCC DATA SERVICE

Call Toll Free 1-800-431-2577

1200 18th St. N.W., Ste. 704 D.C.: 1-202-452-1419

Washington, DC 20036 CT: 1-203-746-6584

Inquiry 613.

MEMORY CHIPS

MEMORY CHIPS

41256-15-12-10	Call	51000 (1 Meg.)	Call
4164-15	Call	51256 for Compaq 386	6,43
4184-12	Call	8087-92	98/143
41128 Piggy Back for AT.	2.63	80287-8-8-10	155/233/293
41484-12 (84Kx4)	3.27	80387	Call
414256 (256Kx4)	Call	NEC-V-20-4	Call
2784.27128.27256.27512	Call		

Prices subject to change

ESSKAY

1-800-327-3237

718-353-3353

Inquiry 614.

THE BUYER'S MART

MUSIC

Electronic Musician

The leading magazine on using computers for music. EM features articles on MIDI, music software, electronic instruments and home recording.

"The BYTE of the electronic music world"
—Jerry Pomele, BYTE, 12/88

Special offer: only \$11 US (\$21 US foreign) brings you a full year (12 issues)

800-334-8152; 619-745-0687 in CA

Electronic Musician

Dept. B, 2606 Ninth St., Berkeley, CA 94710

Inquiry 615.

NEURAL NETWORKS

Neural Net + Compiler

NetworkX demos neural net finding nearest match of input word to list of words. PL/D compiles NetworkX and itself for retarget to new CPUs. Three manuals total 150 pages. All source. Need PC/XT/AT w/ 256KB. October 1987 issue of BYTE, page 46, has more info.

NetworkX: 79.95 PL/D: 124.95 Both: \$154.95

DAIR Computer Systems

3440 Kenneth Dr., Palo Alto, CA 94303

(415) 494-7081

Inquiry 616.

"AWARENESS"

- 4 programs to demonstrate 4 neural network algorithms
- Runs on IBM PC's and compatibles. 256K RAM, MS-DOS or PC DOS 2.0 or higher with a graphics card

- See Oct. 87 issue of BYTE "NEURAL-NETWORK NEURISTICS" by G. JOSEPH for intro to AWARENESS plug
- NEURAL SYSTEMS is sponsored in part by the CALIFORNIA'S INSTITUTE OF TECHNOLOGY/JET PROPULSION LAB.
- \$250 until 12/31/87 plus S&H. To order, call or write:

NEURAL SYSTEMS INC.

2827 West 43rd Ave. Vancouver, B.C. V6N 3H9

(604) 263-3667

Inquiry 617.

PROGRAMMER'S TOOLS

FINITE STATE PROGRAM COMPILERS

Software designed as Finite State Programs develop quicker, run faster and use less memory than sequentially coded programs. Our Editor forms state tables, the Compilers state programs in: ADA, BASIC, C, FORTRAN & PASCAL

\$100 Editor (With primer) \$75 per Compiler
IBM PC 128K RAM Dos 2.0 +

AYECO 5025 Nassau Circle, Orlando
INCORPORATED FL 32908 (305) 295-0930

Inquiry 618.

TLIB™ 4.0 Version Control

The best gets better! They loved TLIB 3.0: "packed with features... [does deltas] amazingly fast... excellent!"—PC Tech Journal Sept 87. "has my highest recommendation!"—R. Richardson, Computer Shopper Aug 87. Now TLIB 4.0 has: branching, more keywords, wildcards & file lists, revision merge, LAN and WORM drive support, more. MS/PC-DOS 2.x & 3.x \$99.95 + \$3 s&h. Visa/MC.

BURTON SYSTEMS SOFTWARE

P.O. Box 4156, Cary, NC 27519 (919) 489-3088

Inquiry 619.

Modula-2

Repertoire, now at rel 1.5, is the largest and most widely used M2 library in the world. Includes extensive low-level, user interface, and ultra-sophisticated database tools suitable for use with bitmaps, text, lists, structured records, etc. Only \$89. From the creators of ModBase, EmsStorage, and Graphix. Complete manuals for all products available on free demo disks. MC/VISA/AMEX/PO/CCO.

PMI 4536 SE 50th, Portland, OR 97206
(503) 777-8844; BIX: pmi

Inquiry 620.

PROGRAMMER'S TOOLS

FREE BUYER'S GUIDE

Call or write for our FREE comprehensive buyer's guide containing hundreds of languages, utilities and books specifically for IBM personal computers and compatibles. We're the world's leading independent dealer of programmer's development tools because we provide sound advice, low discount prices, fast delivery. FREE U.S.A. shipping and no hidden charges.

Programmer's Connection 216-484-3751 OH & AK (Collect)
7249 Whipple Ave. NW 216-484-3761 (International)
North Canton, OH 44720 800-225-1166 Canada
800-336-1166 USA 9102406879 Telex

Inquiry 621.

NETWORK CONTROL LIBRARIES

NETWORK INTERFACE allows file sharing and redirection through DOS functions. \$99.

NETBIOS ROUTINES allows access to low-level network functions. Name, session & datagram routines. Wait and no-wait options. \$199.

NETWORK MASTER provides access to Netware internal functions. Complete control of your network from our compiled programs. \$299.

Starlight Software

2661 Central Street, Evanston, IL 60201

(312) 864-6370

Inquiry 622.

PUBLIC DOMAIN

\$3 SOFTWARE FOR IBM PC

Public Domain & User Supported Software. Hundreds to choose from, wordprocessors, data bases, spreadsheets, assorted games for all ages, communications, business, music, art, programming language and useful utilities for making your computer easier to learn. Most programs have documentation on the disk. Write for your FREE catalog today!

BEST BITS & BYTES

P.O. Box 5332, Dept-8, North Hollywood, CA 91616

(818) 863-6304

Inquiry 623.

QUALITY I.B.M. SHAREWARE

\$3.95/Disk — 10 for \$30.00

P.C Write 2.7, DOS utilities, commercial unlock, 8088 assembler DOS tutor, BASIC tutor, print utilities, games (7 disks), many more. Free list! MC/Visa.

C. D. I.

1-800-537-8000 ext. 25

9152 State Rd., #64, Ste. 140, Davis, CA 95618

365-473-9117

Inquiry 624.

FREE CATALOGUE

PUBLIC DOMAIN/SHAREWARE

• 400 IBM PC & compatibles disks •

• 200 Amiga disks • 125 Atari ST disks

PC disks as low as \$1.25 each. Amiga & ST as low as \$1.60 each! Rent or buy. Free shipping! Call toll free, write or circle reader service for FREE BIG CATALOGUE with full descriptions. Please specify computer—48 hr. turnaround!

Computer Solutions

P.O. Box 354—Dept. B, Mason, Michigan 48854

1-800-874-8378 (M-F 10-6 EST) 1-517-628-2843

Inquiry 625.

RENT SOFTWARE \$1/DISK

Rent Public Domain and User Supported Software for \$1 per diskfull or we'll copy. IBM (3 1/2" also), Apple, C-64, Sanyo 550 and Mac. Sampler \$3. VISA/MC. 24 hr. info/order line. (619) 941-3244 or send #10 SASE (specify computer) Money Back Guarantee!

FutureSystems

Box 3040 (T), Vista, CA 92083

office: 10-6 PST Mon.-Sat. (619) 941-9761

Inquiry 626.

SALES/MARKETING TOOLS

SALES MAGIC

Software solutions for better selling from

MARKET POWER INC.

computer innovations

We are proud to have helped these companies: Navistar, Westinghouse, Kodak, Chemical Bank, Chrysler, Canadian National Hotels, and more...

Whether you are a company or an individual, we can help you

Call or write **(916) 432-1200**

101 Providence Mine Rd., Suite 108 A FREE
Nevada City • California 95959 DEMO DISK

Inquiry 627.

SOFTWARE/ACCOUNTING

ACCOUNTING SOFTWARE

Applications for Microsoft® Works. Prints checks, invoices, statements, and purchase orders on pre-printed forms. 15 reports give you totals to post to your general ledger. A/R, A/P, Payroll, and Purchasing at \$49.95 each. All four at \$169.00

BAKERForms®

P.O. Box G-826/Dept. F, New Bedford, MA 02742

(800) 338-1753

(617) 896-6732 in MA

Inquiry 628.

dBASE BUSINESS TOOLS

- General Ledger
- Accounts Recvbl.
- Order Entry
- Sales Analysis
- Purch Ord/Inventory
- Accounts Payable
- Job Costing
- Job Estimating

\$99 EA. + s&h w/BASE 2, 3 or 3 + SOURCE CODE

dATAMAR SYSTEMS™ Cr. Crd/Chk/COD

4876-B Santa Monica Ave.

San Diego, CA 92107

(619) 223-3344

Inquiry 629.

ACCOUNTING KIT \$79.95

Peanut & Cavier is a kit designed to introduce the principles of accounting and bookkeeping to non-accountants. It includes a reusable general ledger software package free. The kit consists of a 200 page book, worksheets, homework, homework analysis and GL software. The software generates detailed reports, trial balance, income statement and balance sheet. IBM or compatible. Used in curricula by Platt College, Denver Public Schools, etc. \$79.95

Learn-Ed Software

10700 E. Dartmouth St., Ste. K202, Denver, CO 80014

1-800-621-8385 ext. 736

Inquiry 630.

SOFTWARE/A.I.

Neural Net Model

SIMNET a/w shows how a neural net model may be instructed to learn specific binary pattern associations. Once you have been taught the user may test its capability for generating proper output patterns in response to random input sequences. Also allows adjustments of learning rate. \$59.95 U.S. money order, cash or certified check. Needs IBM PC 256K, one floppy.

Blair House Innovations

P.O. Box 7, Belcarra Park, Port Moody, BC V3H3E1 Canada

604-939-5998

Inquiry 631.

SOFTWARE/ARCHITECTURE

NATURAL 3-D NAVIGATION

- 3 Vanishing Point Navigator: Great help for artists & architects. Navigator provides rapid moving natural views and the capability for unusual slanted rotation. The perspective can also be suppressed or enhanced. \$449.95 + \$4.00 S&H (may change without notice.)
- Require IBM PC or compatible (256K up).

Demo-disk \$7.00 + \$1.00 S&H (Version 2.0)

bp-Coding Systems, Inc.

2445 University Heights Ave., Boulder, CO 80302

telephone (303) 449-3640 • facsimile (303) 442-1967

Inquiry 632.

THE BUYER'S MART

SOFTWARE/BASIC

XGRAF DRAWS IN BASIC!

FINALLY! XGRAF replaces QuickBASIC's poor drawing commands with assembly language calls that work on Hercules, EGA, VGA, CGA and EEGA screens. Only \$99.00 + \$4.00 S&H. Call us at 1-800-423-3400 (9:00 AM to 8:00 PM EST)

KOMPUTERWERK, INC.

851 Parkview Blvd., Pittsburgh, PA 15215
For info., call (412) 782-0384

Inquiry 633

SOFTWARE/BUSINESS

DATA ENTRY SYSTEM

Heads-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

21929 Makah Rd., Woodway, WA 98020
(206) 776-6443

Inquiry 634.

LP88 — SPREADSHEET LP

Our best-selling menu-driven linear programming system now solves problems with 1000 constraints and 5000 variables up to 30 times faster! New version reads/writes Lotus worksheets! Use 1-2-3/Symphony as a matrix generator or post processor. Many other features including interactive and batch operation, spreadsheet-style display, equation processor, problem/basis storage, file I/O, Simplex restart, report generator, sensitivity analysis. IENews says "The flexibility and features of this program are a bargain at its low price \$149 with 8087 support and 100-page manual \$29 for working demo and manual."

EASTERN SOFTWARE PRODUCTS, INC.
P.O. Box 15328, Alexandria, VA 22309 (703) 360-7000

Inquiry 635.

dFELLER Inventory

Business inventory programs written in modifiable dBASE source code.

dFELLER Inventory \$150.00

Requires dBASE II or III, PC-DOS/CPM

dFELLER Plus \$200.00

with History and Purchase Orders

Requires dBASE III or dBASE III Plus (For Stockrooms)

Feller Associates

550 CR PPA, Route 3, Ishpeming, MI 49849

(906) 486-6024

Inquiry 636.

SOFTWARE/CHURCH

PowerChurch Plus®

Fast, friendly, reliable church administration system. Full fund accounting, mailing lists, membership, contributions, attendance, word processing, accts. payable, payroll, multi-user support, and much more - all for \$695 complete. FREE demo version.

F1 SOFTWARE

P.O. Box 3096, Beverly Hills, CA 90212

(213) 854-0865

Inquiry 637.

ROMAR CHURCH SYSTEMS™

Membership-61 fields plus alternate addresses, labels, letters, reports any field(s) Offering-256 funds, optional pledge, statements; post to 255x/yr. Finance-gen. ledger w/budget up to 500 subtotals & 99 depts., month & YTD reports anytime for any month Attendance-8 service times, 250 events per service, 60 consecutive weeks. Available for floppy, 3 1/2" & hard disk. Ad too short! Write for free 48-page guide

Romar Church Systems, Attn: BJB

P.O. Box 4211, Elkhart, IN 46514

(219) 262-2188

Inquiry 638.

SOFTWARE/ENGINEERING

PC TECHNICAL GRAPHICS

TEKMAR is a graphics library for the EGA or Tecmar Graphics Master. Similar to PLOT-10, includes WINDOW, VIEWPORT, AXIS. Support for HP, Hi plotters Curve fitting, complete plotting program. Log, semi-log, multi-axis, 3-D, contours. Jerry Pournelle (Aug 86 Byte): "As good as any I have ever seen..." Demo disks, literature available.

Advanced Systems Consultants
21115 Devonshire St. #323, Chatsworth, CA 91311
(818) 407-1059

Inquiry 639.

Affordable Engineering Software FREE APPLICATION GUIDE & CATALOG

Circuit Analysis • Root Locus • Thermal Analysis • Plotter Drivers • Engineering Graphics • Signal Processing • Active/Passive Filter Design • Transfer Function/FFT Analysis • Logic Simulation • Micro-strip Design • PC/MSDOS • Macintosh • VISA/MC Accepted

BV Engineering • (714) 781-0252
2200 Business Way Suite 207, Riverside, CA 92501

Inquiry 640.

OPTIMIZATION WITH MICRO-DOT

Micro-Dot is an efficient, nonlinear, constrained optimizer for engineering design. Written in FORTRAN, Micro-Dot is a general purpose program that can be used interactively or linked with user supplied programs to solve a wide range of design, analysis and management problems. Demonstration Diskette \$15, applicable towards purchase. VISA/MC/Check

Engineering Design Optimization, Inc.
1275 Camino Rio Verde, Santa Barbara, CA 93111
(805) 967-0058

Inquiry 641.

Engineer's Aide

Join the Desktop Engineering Revolution!

• Pipeline/Ductwork Sizing • Office/Control Valve Sizing
• Pump/Fan/Compr. Sizing • Project Financial Analysis
• Heat Exchanger Sizing • Conversion Calculator
• Fluid Properties Library • Specification Writer

Above programs in one stand alone integrated package for \$695. For IBM PC & Macintosh.

Engineering Programming Concepts

1-800-367-3585 (24 hr) 1-805-484-5381 (Ca)

Inquiry 642.

FINITE ELEMENT ANALYSIS

MSC, the leader in FEA technology, markets a full line of FEA tools for personal computers. Starting at \$45 for MSC/pal INTRO on either the IBM PC or the Apple Macintosh, our products are designed to be complete and easy to use. Interfaces for most CAD systems available.

The MacNeal-Schwendler Corporation

815 Colorado Blvd. Los Angeles, California 90041

(213) 259-3888

Inquiry 643.

SIMULATION WITH GPSS/PC™

GPSS/PC™ is an IBM personal computer implementation of the popular mainframe simulation language GPSS. Graphics, animation and an extremely interactive environment allow a totally new view of your simulations. Simulate complex real-world systems with the most interactive and visual yet economical simulation software.

MINUTEMAN Software

P.O. Box 17171, Stow, Massachusetts U.S.A.

(617) 897-5662 ext. 540 (800) 223-1430 ext. 540

Inquiry 644.

SOFTWARE/ENGINEERING

Circuit Analysis — SPICE

Non-linear DC & Transient; Linear AC. * Version 3B1 with BSIM, GaAs, JFET, MOSFET, BJT, diode, etc. models, screen graphics, improved speed and convergence. * PC Version 2G6 available at \$95. Call, write, or check inquiry # for more info.

Northern Valley Software
26327 Rothrock Dr., Rancho Palos Verdes, CA 90274
(213) 541-3877

Inquiry 645.

mTAB™/SAP86™

Finite Element Analysis on IBM-PC Compatible Computers
Bridging the gap between mainframe & PC finite element analysis
• Statics and Dynamics
• Large Element Library
• 3D Model Generation
• Coax Stress Contours
• AutoCAD/CAEKEYVERSACAD
• NASTRAN/ANSYS/STARDYNE
& Others

Price: Educational (900 dot) \$99
Utility (2400 dot) \$95 Professional (12000 dot) \$395

STRUCTURAL ANALYSIS, INC.
1701 Directors Blvd., Suite 380, Austin, TX 78744
(512) 444-0655

Inquiry 646.

CIRCUIT ANALYSIS FOR WORKSTATIONS

ECA-2, an advanced analog circuit simulator, now available for Apollo workstations, includes:

- AC, DC, Transient, Fourier analysis.
- Worst Case, Monte-Carlo, nonlinear simulation.
- Larger circuits, faster simulations than SPICE.

ECA-2 Apollo \$3,000. Apollo Eval Kit \$380.

ECA-2 IBM PC/XT/AT \$675. PC Eval Kit \$95.

Call 313-863-8810 for DEMO.
Tatum Labs, Inc.
1478 Mark Twain Ct., Ann Arbor, MI 48103

Inquiry 647.

SOFTWARE/FORTRAN

FORTRAN 77 Extension

EXTEND subroutines for MS, RM, IBM Pro compilers to control keyboard, monitor, file & graphics, DOS file & directory operations, parallel & serial I/O. Plus user graphics for CGA, EGA, VGA, HP7475A, TEK 4010, AutoCAD DXF & db save files. Both 8087 & non 8087 libraries pkgd for \$149. Royalty free. VISA/MC/PO/CHK.

Design Decisions, Inc.

P.O. Box 12884, Pittsburgh, PA 15241

(412) 941-4525

Inquiry 648.

SOFTWARE/GAMBLING

BE A LOTTO MILLIONAIRE!

NEW! Lotto PickerPlus v2.0 stores winning Lotto 6/7, Keno, & Pick 3/4 numbers & uses multiple statistical methods in order to wheel what might be your million dollar ticket! All U.S. & Can. games are included. Programmable, full-featured, and not copy protected. For IBM, Apple II & C64/128 \$34.95 (+ 4.55 sh).

GE RIDGE 170 B'dway, #201B, NY, NY 10038

Orders 1-800-634-5463 ext. 293

Info 718-317-1961

Inquiry 649.

SOFTWARE/GENERAL

WOULD YOU LIKE TO KNOW?

Your I.Q.? Memory Level? Response Time? Coordination? Visual Perception?

Expand your mind with MENTOR™—software that lets you explore your hidden talents. 58 psychometric exercises, incl. 25 I.Q. tests.

IBM PC/Compatibles • 256K • \$49.95 • VISA/MC

Heuristic Research, Inc.

3112-A West Cuthbert Ave., Midland, TX 79701

800-443-7380 (In TX, collect 915-694-8636)

Inquiry 650.

THE BUYER'S MART

SOFTWARE/GENERAL

SAVE 90% ON SOFTWARE!

Shareware programs compare favorably to commercial programs costing \$200 and up! EZ Forms, PC Key Draw, PC Outline, PC Accounting, over 170 others to choose from all for \$6.95 or less per disk! Money-back guarantee. IBM PC, Jr, or compatibles. Send today for FREE catalog.

SHAREWARE EXPRESS

32302 Camino Capistrano, Suite 204M, P.O. Box 219
San Juan Capistrano, CA 92693-0219

Inquiry 651.

SOFTWARE/GRAPHICS

F PLOT PEN PLOTTER EMULATOR

Use your dot matrix or laser printer as an HP pen plotter. Hi-res output. Vary line thickness. Includes V PLOT virtual plotter utility to capture plotting commands. Supports NEC P5/P6/P7, IBM Proprietary, Epson LQ/MX/FX/RX, HP Laserjet. Uses Hercules, CGA, or EGA for screen preview. \$60 + \$4 s&h.

HORIZON SOFTWARE

Suite 605, 24-16 Steinway St., Astoria, NY 11103

Inquiry 652.

GRAPHICS PRINTER SUPPORT

AT LAST! Use the PrtSc key to make quality scaled B&W or color reproductions of your display on any dot matrix, inkjet, or laser printer. GRAFPLUS supports all versions of PC or MS-DOS with IBM (incl. EGA, VGA), Techar, and Hercules graphics boards \$49.95.

Jewell Technologies, Inc.

4740 44th Ave. SW, Seattle, WA 98116

800-628-2828 x 527(206) 937-1081

Inquiry 653.

FORTRAN PROGRAMMER?

Now you can call 2-D and 3-D graphics routines within your FORTRAN program.

GRAF-MATIC: 75 callable routines for screen output. \$135.

PLOT-MATIC: Pen plotter driver \$135. For the IBM PC, XT, AT and compatibles. We support a variety of compilers, graphics boards and plotters.

MICROCOMPATIBLES

301 Prelude Drive, Dept. B
Silver Spring, MD 20901

(301) 593-0883

Inquiry 654.

CGA → Hercules™ Graphics

Mode-MGA™ allows you to use business graphics, games, BASICA graphics and other CGA specific software with your Hercules™ Monochrome Graphics adaptor and monochrome monitor. Works with all CGA programs. \$79.95 (+ \$5 s&h) for the 3k-TSR version. 30-day money back guarantee. Call or write:

T.B.S.P. Inc.

2285 Westwood Blvd., Suite 793, Los Angeles, CA 90064

(213) 312-0154

Inquiry 655.

SOFTWARE/INVESTMENT

MUTUAL FUND INVESTORS

The new Business Week Mutual Fund Scoreboard Diskettes use the enormous power of your IBM or compatible PC to select rate and compare virtually every equity and fixed income mutual fund on the market (\$49.95 each or \$239.90 for subscriptions to both).

Order now or receive more information by calling 1-800-533-3875 (in Illinois, call 1-312-250-9292).

Business Week Mutual Fund
Scoreboard Diskettes

P.O. Box 621, Elk Grove, IL 60009

Inquiry 656.

SOFTWARE/LANGUAGES

Ada Language Training and Programming

AdaLAB Systems permit Ada training and programming for from 1 to 500 simultaneous users! Existing PC/AT's and compatibles can be incorporated into multiuser systems. All systems permit continued use of present PC-type applications software. Turn your word processors and spreadsheet machines into a powerful Ada System!

For FREE Specifications Overview book

WRITE: AdaVISION, Inc., Suite 342, 18530 Mack Avenue
Grosse Pointe Farms, MI 48236 Phone: (313) 561-0064

Inquiry 657.

SERIES 32000 MODULA-2 COMPILER

National Semiconductor's 32000 family of microprocessors and Modula-2 have common characteristics that make them the ideal combination for virtually any embedded microprocessor system. Both are well designed and easy to use. The Modula-2 compiler helps you develop and maintain your software in a fraction of the time spent writing programs in Assembler, C, or ADA. Includes EDITOR, COMPILER, LINKER, DECODER and MAKE UTILITY. Any individual application can consist of up to 400 modules written entirely in Modula-2.

Low-cost compiler board for IBM PC/XT/AT bus \$750
High performance compiler board for IBM PC/XT/AT bus \$1995
High performance compiler board for Micro Channel bus \$1995

ALOIS SCHÖNBACHLER

Frieschützgasse 14, CH-8004 Zürich, Switzerland
41-1-241-0514

Inquiry 658.

VIDEO TAPES

UNDERSTANDING C . . . \$39.95

8086 ASSEMBLER \$29.95 68000 ASSEMBLER \$29.95

Loaded with examples! Each tape leaves no stone unturned! Takes you from novice to expert in 4-6 hours. A pleasant learning experience and handy reference. Book accompanies VHS/Beta. In TX, add tax. \$5.00 S&H.

APPLIED LOGIC

2309 Royce Dr. Arlington, TX 76016

(800) 752-7001 ext. 918

Inquiry 659.

THE PL/M CONNECTION

• Your link to the IBM PC from PL/M 66
Write programs—Create utilities
Build application systems

• Complete system interface libraries
• Dos 1, Dos 2, Dos 3, Bios, Graphics
• Large and compact memory modules
• 200 page Technical Reference Manual
• Complete source in PL/M 66 and Assembler
• Demonstration utilities with source

CompuFirm Corporation

7841 Balboa Ave., Ste 210, San Diego, CA
(619) 571-0228

Inquiry 660.

DRUMA FORTH-83

Strict '83 STANDARD. Developed for in house use. No 64K limitation. 64K speed & compactness to 320K.

• IBM PC/XT/AT & compatibles, DOS 2.0 +
• ROM: Headerless code, separated variables
• Editor, assembler, file & DOS interfaces
• Many powerful and innovative features
• Full Pkg. \$79. Demo \$10. S&H \$2. VISA/MC

DRUMA FORTH-83, DRUMA INC.

P.O. Box 610097, Austin, TX 78761

Orders: 512-323-0403 BBoard: 512-323-2402

Inquiry 661.

MACINTOSH DEVELOPERS

Speed up application development and PC to MAC porting with compiled libraries. • PROGRAMMER'S EXTENDER VOL. 1 — menus, windows, dialogs, text edit — VOL. 2 — Printing, graphics, lists.

• Extender GrafPak-line, bar, log, graphs; multiple curves; customizable.

Invention Software Corp.

P.O. Box 3168, Ann Arbor, MI 48106

(313) 998-8108

Inquiry 662.

SOFTWARE/LANGUAGES

SCRUTINY

• An advanced symbolic debugger for all MS-DOS computers
• Compatible with Turbo Pascal, Microsoft Assembler, others
• Packed with features, including support for graphics and 80386 debug registers

M STREET SOFTWARE

5400 E. Mockingbird Lane, Suite 114, Dallas, TX 75206

214-827-4908

Information also available via our 24 hr 300/1200
modem 214-669-1882

Inquiry 663.

SOFTWARE/LASER FONTS

LaserJet Soft BIGfonts

PC-DOS/MS-DOS Program prints 76 pt and 153 pt (2") big characters. Also includes 1", 2", 3", & 5" fonts. Co-exists with any soft fonts. Print from Wordstar, Lotus, ANY program. \$159 includes 20K LaserJet Printer Management and Print program. Fast Batch Font Download. 30 Day \$\$ Back.

Worthington Data Solutions

417-A Ingalls St. Santa Cruz, CA 95060

(800) 345-4220 In CA: (408) 458-9938

See our ad on Page 42

SOFTWARE/LOANS

Execamort™ Amortizer +

Loan Amortization reports—simple or complex, extra payments, points/fees, APR's (per Regulation Z), balloons, solve for unknowns, yield/IRR, PV, FV, store/retrieve, PMT/escrow charges, more IBM-PC/XT/AT/PS2 compatible. Simple yet complete—great for client services. Claimed nationwide by Bank/CPA/CU/Finance/Legal/RE/S&Ls. \$129.95 + \$4.00 ship. Visa/MC/AmEx. 30 day MBG.

Electronics

36360 Garfield #1, Fraser, MI 48026

800/858-8448, 313/791-0770.

Inquiry 664.

SOFTWARE/MEDICAL

MEDICAL OFFICE MANAGER

• Patient Accounting • Mail List
• Claims Preparation • Diagnostic Coding
• Schedules Appointments • Tracks Physician Referrals
• PC/XT/AT/Comp • Hard disk required
• Automatically bills patients and insurance companies
• Statistical analysis for practice

\$239

GB Consulting (301) 498-2769

1000 Century Plaza Suite 214, Columbia, MD 21044

Inquiry 665.

SOFTWARE/PRINTER

PRINTER GENIUS

Powerful memory resident printer control, from pop-up menus or within documents • Print spool to disk • Background print • Directory search & file browse • Edit & print small text • Redirect output to any media or printer • Superb documentation • Preset for all dot matrix and laser printers • Completely flexible • PC MS-DOS • \$69 + \$4 S/H —VISA/MC/COD

Nor Software Inc.

527 3rd Ave., Suite 150, New York, NY 10016

(212) 213-9116

Inquiry 666.

SOFTWARE/SCIENTIFIC

Data Acquisition & Analysis on PC's

• FOURIER PERSPECTIVE II Advanced Digital Signal Analysis.
• PRIME FACTOR FFT suboptimal library. Call from Turbo Pascal C. Former, Basic. Up to 65,520 data points. 2D interface available. Rectangular FFT's now possible in a multitude of dimensions.

• 2 & 3D Scientific Graphic packages with plotter support from Golden Software.

• Data Acquisition & Control Boards from Metrabyte, Analog Devices, Burn-Brown, Strawberry Tree, National Instruments, Coniac, & Techar.

• Data Acquisition & Analysis Software—Labtech Notebook, Anyt, UniScope, Lotus Measure with 1-3-3'symphony, & Curve-Curve.

Call for FREE Application Assistance & Technical Literature

LOW PRICES—Satisfaction GUARANTEED

Alligator Technologies — (714) 722-1842

P.O. Box 11386 Costa Mesa, CA 92627

Inquiry 667.

THE BUYER'S MART

SOFTWARE/SCIENTIFIC

NONLINEAR DYNAMICS

Tools for Studying Mathematical and Experimental Systems

- Ordinary and Delay Differential Equation Solvers • Bifurcation Diagrams • 2- and 3-D Plotting, Sequential Magnification, Poincaré Sections • Next Maximum, 1-D & Circle Maps
- Phase Portraits with Multiple Initial Conditions • Spectral Analysis, Fractal Dimensions, Lyapunov Exponents

DS:I \$250.00 DS:II \$350.00

DYNAMICAL SYSTEMS, INC.

P.O. Box 35241, Tucson, AZ 85740, 602-791-7898

Inquiry 668.

SCI-GRAF and SCI-DATA

SCI-GRAF produces huge hi-res graphs thru easy menus or linkable C libraries. Supports log scales, error bars, screen and printer output.

SCI-DATA performs least squares and normal curve fits, scaling and polar coordinate transformations.

Prices start at \$59.95.

Microcomputer Systems Consultants

Box 747, Santa Barbara, CA 93102

(805) 963-3412

Inquiry 669.

ORDINARY/PARTIAL DIFFERENTIAL EQN SOLVER

FOR THE IBM PC & COMPATIBLES

MICROCOMPATIBLES INC.

301 Prelude Dr., Silver Spring, MD 20901

(301) 593-0683

Inquiry 670.

Scientific/Engineering/Graphics Libraries

Turbo & Lightspeed Pascal, Modula-2, C
Send for FREE catalogue of software tools for Scientists and Engineers. Includes: Scientific subroutine libraries, device independent graphics libraries (including EGA, HP plotter and Laserjet support), scientific charting libraries, 3-D plotting library, data acquisition libraries, menu-driven process control software. Versions available for a variety of popular languages.

Guinn-Curtis

49 Highland Ave., Needham, MA 02184

Inquiry 671.

forMath® text-formatter

- Equations, matrices, ratios, integrals, diagrams
- Macros, fonts, Greek/math symbols
- Hyphenation, secn/eqn/ref numbering
- Indexes, table of contents, footnotes
- Dot-matrix, daisy-wheel, laser printers, all monitors

\$400, \$50 for demo

SHANTHA SOFTWARE INC.

50 West 97th St. Room 11N, New York City 10025

(212) 222-SNIP

Inquiry 672.

SOFTWARE/SORT

OPT-TECH SORT/MERGE

Extremely fast Sort/Merge/Select utility. Run as an MS-DOS command or CALL as a subroutine. Supports most languages and filetypes including Btrieve and dBASE. Unlimited file sizes, multiple keys and much more! MS-DOS \$149, XENIX \$249.

(702) 588-3737

Opt-Tech Data Processing

P.O. Box 678 - Zephyr Cove, NV 89448

Inquiry 673.

SOFTWARE/STOCKMARKET

STOCK TREND PREDICTOR!

New from MONEYLAB, Inc., the most powerful single Market analysis software tool ever offered! A PC or compatible is only requirement. Works equally well with Stocks, OTCs, commodities, P/E ratios, etc. GRAPHS of past, present and future trends generated automatically. Floppy + Manual.

Only \$69.95! (Add \$3.50 for shipping & handling.)
(Michigan residents add 6% Sales Tax.)

ORDER NOW! Send Check or M.O. to

MONEYLAB, Inc., 380 Nell Rd., Grosse Pointe, MI 48230
or CALL (313) 884-8427 VISA or MASTERCARD ACCEPTED

Inquiry 674.

SOFTWARE/TAX PREP.

TaxEase™ System

Federal & State returns on single disk—only \$69.95. Easy to use. Calculates automatically, performs complex "What If" options, prints IRS-approved forms. AZ, CA, CO, DC, GA, IL, IN, MA, MD, MI, MN, MO, NC, NJ, NY, OH, OK, PA, VA, WI. Requires Lotus 1-2-3 or comp. spreadsheet. VISA/MC. \$3 s/h chg. Money back guarantee. Professional package available—\$99.

Park Technologies, Inc.

P.O. Box 1317, Clinton Park, NY 12085

518/877-5881 or 800/423-3189 outside NY

Inquiry 675.

SOFTWARE/TOOLS

Turbo Pascal 4.0 Software

Spec your customer this AM, show a demo this PM. Save 80% of programming time in Turbo Pascal 4.0. Create a complete database in 6 seconds. B-Tree file manager included! \$99 Turbo GhostWriter starter pkg. or \$289 for everything.

800/227-7681. MC-Visa-Choice-COD.

ASCII 3239 Mill Run, Raleigh, NC 27612

Inquiry 676.

SCREEN MANAGER

MENU, WINDOW, and DATA ENTRY Support for the Professional Programmer! Interfaces to most languages. BASIC, C, FORTRAN, COBOL, PASCAL, ASSEMBLER. 100 Page Manual. Thirty day money back guarantee. No Royalties.

from \$79. Visa/MC

The West Chester Group

P.O. Box 1304, West Chester, PA 19380

(215) 844-4206

CALL FOR FREE DEMO

Inquiry 677.

STATISTICS

STATA

Statistics and graphics join to make STATA the most powerful package for the PC. No comparable program is as fast, friendly, and accurate. \$20 Demo. Quantity discount available. Call toll-free for more information. AX/VISA/MC.

1-800-STATAPC

Computing Resource Center

10801 National Boulevard, Los Angeles, CA 90064

(213) 470-4241

Inquiry 678.

THE SURVEY SYSTEM

An easy-to-use package designed specifically for questionnaire data. Produces banner format, cross tabs & related tables, statistics (incl. regression) & bar charts. Codes and reports answers to open-ended questions. All reports are camera-ready for professional presentations. CRT interviewing option.

CREATIVE RESEARCH SYSTEMS

15 Lone Oak Cir., Dept. B, Potomac, CA 94952

707-765-1001

Inquiry 679.

STATISTICS

NUMBER CRUNCHER STAT SYS

Menu-driven. Multiple & stepwise regression, ANOVA, time series, discriminant cluster and factor analysis, principal components, scatter plots, histograms, t-tests, contingency tables, non-parametrics. Import export data. Spreadsheet, sort, join, merge. \$99. MS-DOS. Quantity discount.

NCSS-B

865 East 400 North, Kaysville, UT 84037

801-546-0445

Inquiry 680.

STATISTIX™ II

Comprehensive, powerful and incredibly easy-to-use. Full screen editor, transformations, linear models (ANOVA, regression, logit, PCA, etc), ARIMA, most standard stat procedures. Clear, well organized documentation. Satisfaction guaranteed. \$169 PC DOS, \$99 Apple II.

NH ANALYTICAL SOFTWARE

P.O. Box 13204, Roseville, MN 55113

(612) 831-2852

Inquiry 681.

RATS! Version 2.1

Best selling econometrics program. Over 4000 copies sold. OLS, 2SLS, logit, probit and much more! Forecasting with ARIMA, VAR. Exponential smoothing. Model simulations. Support for daily/weekly data. High-quality graphics to screen, plotter, printer. \$200-\$300. VISA/MC. Demo available.

VAR Econometrics, Inc.

P.O. Box 1818, Evanston, IL 60204-1818

(312) 864-8772; (800) 822-8038

Inquiry 682.

StatPac Gold™

Voted World's Best Statistical & Forecasting Package in 1987 by PC World Magazine readers. Six times more votes than the next closest competitor. More comprehensive & easier to use than all others. Get the facts. Call now for your FREE brochure.

1-800-328-4907

Walonick Associates, Inc.

6500 Nicollet Ave. S., Minneapolis., MN 55423

(612) 866-9022

Inquiry 683.

TAXES

TAX PAK

Sch A B C D E F R S Fms 1040, 1040A, 2106, 2119, 2441, 3488, 3800, 3903, 4562, 4684, 4797, 4972, 6251, 6252, 8582, 8598, 8606, 8615, IRS approved print for IBM PC CPM (Z80) CPM86 Kaypro 4 Morrow M3 Professional Incids Batch Processing & Tax Organizer \$185 (sep \$25) Personal has abrvd list of forms & features \$37; Updt \$125 & \$27; GA CA NY \$75.

Candelaria Works

3955 Club Dr., Atlanta, GA 30319

(404) 266-2420

Inquiry 684.

1099's-ON-DISK

Meet new IRS regs to file 1099's on magnetic media. Use your IBM-compatible PC's to prepare 5 1/4" diskette, print information returns and reports. Fast, easy to learn and use. For all 1099's. 1098, 5498, W-2G. Not copy protected. Only \$49. MC/VISA accepted.

CUSTOM CRAFT SOFTWARE, INC.

5790 R St., Lincoln, NE 68505

(402) 464-3184

Inquiry 685.

THE BUYER'S MART

TESTING/DOCUMENTATION

TESTING/DOCUMENTATION

Quality presentation is a key factor in successfully marketing your products. Our professional services include:

- Test & evaluation
- Camera-ready copy
- Technical writing
- Finished manuals

Special services/fees for Shareware developers. For FREE quotes or further information, contact:

DOCUGRAPHICS

P.O. Box 6066—Suite L108, Santa Maria, CA 93458

Inquiry 686.

UTILITIES

FILE TRANSFER BY CABLE

Laptop and PS/2 owners—transfer files between any PC, XT, AT, PS/2 or compatibles over a serial cable. Groups of files transferred quickly with only a few keystrokes. \$50 for program on 2 disks (5 1/4" and 3 1/2") and a cable. Money back guarantee.

Clarity Computer Consultants

1831—13th St. Moine, IL 61265 309-797-0908

Inquiry 687.

MATCH PRINTERS TO PC

Match A Printer adapts most printers to PC/PS2 and compatibles. With this resident driver get the full extended IBM ASCII character set on most printers. French, Spanish, German, Italian, Swedish, Greek, etc. and logic symbols. Works great with Apple Imagerwriter and D.M.P. Epson and most daisy wheel printers. Solve character compatibility now, great for academic and engineering application. Introductory Price \$59.95 & \$2.55/H. California residents add 6 1/2% sales tax. VISA/MC/Discover.

MATCH SOFTWARE

8428 Coldwater Canyon, North Hollywood, CA 91606-1113
Toll free # 1 (800) FLOPPYO

Inquiry 688.

COPY AT TO PC

The 1.2MB drive has long been known to READ but NOT reliably WRITE on 360KB floppies. With "CPYAT2PC"™ 1.2MB drives CAN reliably WRITE 360KB floppies saving a slot for a second hard disk or backup tape. "CPYAT2PC"™ (Not Copy Protected) offers the preferable SOFTWARE SOLUTION. ONLY \$79.95 + \$4 S/H VISA/MC/CD UPS B/R

MICROBRIDGE COMPUTERS

855 Skyway, San Carlos, CA 94070
Order toll free 1-800-523-8777
415-593-8777 (CA) 212-334-1858 (NY)
TELEX EZLNK 62873089 Dealer inquiries invited

Inquiry 689.

UTILITIES

Recover deleted files fast!

Disk Explorer now includes automatic file recovery. You type in the deleted file's name. Disk Explorer finds and restores it. Disk Explorer also shows what's really on disk; view, change or create formats, change a file's status, change data in any sector. MS-DOS \$75 U.S. Check/Credit card welcome.

QUAD SOFTWARE LIMITED

45 Charles St. E. 3rd Fl.
Toronto, Ontario, Canada M4Y 1S2
(416) 961-8243

Inquiry 690.

UNEQUALED POWER!

That's what you have with the PMK Utilities. **Delete files, change file attributes, edit any disk or file sector, search for text/data anywhere, and much more.** With so much power and incredible ease of use, it makes the others look bad. **Only \$25 (\$2 s/h).** IBM PC & compatibles.

RPQ Software Farm

Box 9221, Columbus, MS 39705

Inquiry 691.

EXTENDED BATCH LANGUAGE (EBL)

INTEGRATE and customize your programs with EBL. Write powerful utilities, insulate your programs from novices, build custom menus automatically. Many power user features: floating point arithmetic, simulate keystrokes, if-then-else, and more. Money back guarantee. Call or write for information. \$49 + \$3 s/h.

Seaware Corp.

P.O. Box 1856-B, Dairay Beach, FL 33444
800/834-8188 305/382-2046

Inquiry 692.

HANDS OFF™ PC SECURITY

- Locks Hard Disk. - Restricts Floppy Use.
- Protects Subdirectories
- Normal Use of DOS Commands and Application Software
- IBM PC, XT, AT and True Compatibles
- DOS V2.0 and Higher. Hard Disk System
- Keep Other People's HANDS OFF Your System
- \$89.95 VISA/MC

SYSTEM CONSULTING, INC.

314 Canterbury Dr., Pittsburgh, PA 15238
(412) 963-1624

Inquiry 693.

UTILITIES

\$59.95!!

Buy the RED Utilities now! Programs include: Disk cache to speed hard disk. Printer spooler. Batch file compiler. Path command for data files. Wild card exceptions. Protect hard disk from accidental formatting. Sort directories. Over 10 more programs. IBM PC. Visa/MC. **The Wenham Software Company**
5 Burley St., Wenham, MA 01984 (617) 774-7036

Inquiry 694.

WORD PROCESSING

HEBREW / GREEK / ARABIC

Russian and European Languages. Full featured, multi-language word processor supports on-screen foreign characters with no hardware modifications. \$350 (dot matrix) or \$500 (laser) + \$5 s/h. Or send \$15 + \$4 s/h for demo. Req. 512K/graphics

Gamma Productions, Inc.

710 Wilshire Blvd., Suite 609, Santa Monica CA 90401
(213) 394-6622

Inquiry 695.

DuangJan 1.3

Bilingual word processor for English and one of these: Armenian, Bengali, Euro/Latin, Greek, Hindi, Khmer, Lao, Russian, Tamil, Telugu, Thai, Viet, ... or create your own language with font editor. \$69 + \$4 s/h (+ \$10 for LaserJet) + \$49 Demo \$5 IBM compatibles.

MegaChomp Company

3524 Cottman Avenue, Philadelphia, PA 19149 1606
(215) 331-2748/8138

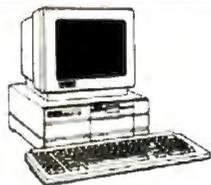
Inquiry 696.

PC-Write™ Shareware Ver. 2.71

Fast, full featured word processor/text editor for IBM PC. With spell check, screen clip, mailmerge, split screen, ASCII files, macros. Easy to use. Supports 400 printers - LaserJet+ and PostScript. Software, User Guide, and Tutorial on 2 disks for \$16. Try it, then register with us for only \$89 and get User Manual, 1 year tele-support, newsletter and 2 upgrades. 90-day guarantee. VISA/MC.

Quicksoft 1-800-888-8088 CALL TODAY!
219 First N., #224-BYTC, Seattle, WA 98109

Inquiry 697.



TRI STATE COMPUTER

160 BROADWAY, NEW YORK, NY 10038

(Bet. Maiden Lane and Liberty St.)

(212) 349-3134 • Open weekdays 9-6, Sunday 10-4

CALL TOLL FREE ORDERS ONLY 1-800-221-1926

Leading Edge Model D

- 512K Dual Floppy
- Keyboard
- Monitor \$899**
- w/20 MB \$1149**

NEC Power Mate I 20 MB

- AT Compatible
- 640K 80286 8 MHz
- 1.2 FD, DOS
- HD controller card \$1399**

SUPER SPECIALS

- Seagate ST 225 w/cont. 264.95
- Plus 20 MB 509.95
- Plus 40 MB 799.95

MODEMS

- INTERNAL 1200B 79.95
- INTERNAL 2400B 179.95
- EXTERNAL 1200 99.95
- EXTERNAL 2400 179.95

LASER PRINTERS

- HP Laser Jet II 1599.95
- OKI Laser 1249.95
- Epson CO 3500 1299.95

PRINTERS

- Brother HR 20 324.95
- Brother M 1509 349.95
- Brother HR 40 529.95
- IBM Pro Printer XL 509.95
- IBM Pro Printer II 349.95
- IBM Pro Printer 24 XL 649.95
- IBM Pro Printer 4 499.95
- Epson LX 800 179.95
- Epson FX 895 289.95
- Epson FX 286E 439.95
- Epson LQ 800 389.95
- Epson LQ 1000 489.95
- Epson EX 800 389.95
- Epson EX 1000 429.95
- Epson LQ 850 499.95
- Epson LQ 1050 679.95
- Epson LQ 2500 859.95
- Panasonic KXP 1080 144.95
- Panasonic KXP 1091 164.95
- Panasonic KXP 1524 489.95
- Panasonic KXP 1092 274.95
- Panasonic KXP 1592 369.95
- Panasonic KXP 1595 409.95
- Panasonic KXP 3131 249.95
- Panasonic KXP 3151 389.95
- OKI ML 2936 418.95
- OKI ML 2926 299.95
- OKI ML 192 259.95
- OKI ML 192 Plus 259.95
- OKI ML 193 Plus 379.95

- OKI ML 294 679.95
- NEC P6 399.95
- NEC P7 559.95
- NEC P9 949.95
- NEC P 2200 324.95
- Star NX 10 149.95
- Toshiba 341-SL 599.95
- Toshiba 351-2 789.95
- Toshiba 321 SL 449.95
- Toshiba 341 399.95

AT&T 6300

- 6300 1 - 380K FD
- 640K RAM, • Graphics Card
- Clock/Calendar
- Keyboard \$849**
- w/20 MB HD \$1149**

Epson Equity I Plus

- 840K Dual Floppy
- Parallel Serial Ports
- DOS & Basic
- Keyboard, • Video Board
- Mono Monitor \$949**
- w/20 MB \$1199**

Epson Equity II IN STOCK

MC & VISA ACCEPTED
NO ADDITIONAL CHARGE

Laptop Computers

- Toshiba 1200 2299.95
- Toshiba T3100/20 3099.95
- Toshiba T1000 779.95
- Toshiba T1100 1549.95
- Sharp PC 7100 1729.95
- Zenith Z-181 1499.95
- Zenith Z-183 2049.95
- NEC Laptop 1169.95
- New NEC Laptop EI 1479.95

Apple Computers

- Apple II GS 689.95
- Apple RGB Monitor 379.95
- Macintosh Plus 1499.95
- Mac SE Dual Floppy 1999.95
- Mac SE Hard Drive 2495.95
- SE Keyboard 109.95
- Imagewriter II 429.95

SOFTWARE FOR IBM

- Base III Plus 369.95
- Word Perfect 42 199.95
- Lotus 123 289.95
- Framework II 339.95
- Laser Fonts 146.95
- Jack II 39.95
- Doc Easy Accounting 2.0 47.95
- Managing Your Money 105.95
- Turbo C Computer 59.95
- Fox Base Plus 209.95
- Microsoft Windows 59.95
- Typing Tutor IV 34.95
- Inset 2 59.95
- Software Carousel 34.95
- Prolog 67.95

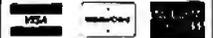
All items subject to availability and price changes. Mail and phone orders C.O.D. MC and VISA, S&H extra. Not responsible for typographical errors. All systems fully tested and installed by Tri State Computer. Printer price w/purchase of cable only. Special to BYTE readers — Full Size Printer Stand \$12.95

**PURCHASE ORDERS
& BID REQUESTS
WELCOME**

Compu\$ave

Call Toll Free: 1-800-624-8949

**WE ACCEPT MAJOR
CHARGE CARDS**



PRINTERS

CIE Thnprinter	1395	Alps 224	465
CIE 800 Line	SAVE	Alps 324	675
Citizen 1290	142	Alps P2100	1085
Citizen 180	158	Alps 2424C	935
Citizen MSP15E	309	Alps P2000	672
Citizen MSP40	275	Diconia D300	SAVE
Citizen MSP45	399	Diconia D150	295
Citizen MSP50	375	NEC PSXL	629
Citizen MSP55	465	NEC P660	422
Citizen Premier 35	438	NEC P760	592
Citizen Tribute 124	539	NEC P9XL	1010
Citizen Tribute 224	595	NEC P2300	342
C. Itoh C715	899	NEC CP660	519
C. Itoh C815	1365	NEC CP760	682
C. Itoh C310XP	485	OTC 850XL	1665
C. Itoh C310CKP	535	Okidata 182+	222
C. Itoh C315XP	585	Okidata 192+	299
C. Itoh C315CKP	659	Okidata 193+	435
Fujitsu DX2300	392	Okidata 292E	436
Fujitsu DX2400	495	Okidata 293E	575
Fujitsu DL3300	535	Okidata 294	619
Fujitsu DL3400	626	Okidata 2910	1739
Panasonic 18601/82	157	Star NB2410	435
Panasonic 18911/82	175	Star NB2415	589
Panasonic 10321	232	Star ND10	269
Panasonic 1524	535	Star ND15	412
Panasonic 1592	379	Star NP10	138
Panasonic 1595	412	Star NR15	458
Panasonic 3131	249	Star NX10	155
Panasonic 3151	389	Star NX15	299
Data South	SAVE	TI 810	1125
Data Products	SAVE	TI 850XL	435
Seitoshia SP180	SAVE	TI 855	539
Toshiba P321SL	495	TI 855	1549
Toshiba P341SL	649	TI 880 AT	1549
Toshiba P351 I	869	TI 880 DP	1479
Toshiba P351C II	999	TI 865	669
Canon Diablo/Epson/Gencom/Dume	CALL		
Quadram Microfazer: 64K/Parallel			139
Quadram Microfazer II: 512K/Par & Serial			309
Quadram Microfazer IV: 256K/6 Serial Ports			495
Cables: Ribbons/Sheet Feeders			LOW PRICES
Stands/Switch Boxes/Tractors			LOW PRICES

LOW PRICES FOR LASER PRINTERS

CIE LIPS 10+	2345	Acer LD-75	1745
Citizen Overline	1399	AST Turbo P/S	3095
Data Products 1230	2545	Canon B-II	1645
Data Products 2665	13500	Gencom PP8	1765
Diablo 4045CP	4195	HP LaserJet II	1729
Okidata Laserline 6	1365	NEC 850	1545
Panasonic 4450	1679	NEC 860+	1999
Printnrix L1012	2295	NEC 890	3199
Quadlaser 1	2425	Dume L10	2195
Dume Script 10	3795	Dume L10+	2695
Taxan Crystal Jet	2445	TI 2108	4195
Toshiba Page 12	2575	TI 2115	5595
Contada And Other Makes And Models			CALL

IMAGE SCANNERS

AST Turbo Scan Mac + & Mac 512	1295
AST Turbo Scan PC/XT/AT	1329
Datacopy 730	1195
Datacopy Jetreader	945
Hewlett-Packard Scanjet	SAVE
Panasonic FX-RS505	989
PGS LS300: With Adapter & PC Paintbrush	719
PGS LS300: With Adapter & OCR Software	979
Taxan Crystal Scan: Apple	1075
Taxan Crystal Scan: IBM	1175

COMPUTERS

AT&T 6386 All	SAVE	AST Model 80	1338
AT&T 6312 12 MHz	1945	AST Model 85	1595
Compaq All	SAVE	AST Model 90	1699
IBM PS-2 All	SAVE	AST Model 120	1999
NEC Multispeed HD: 2445		AST Model 140	2345
NEC Multispeed	1359	AST Model 170	2725
NEC Multispeed EL	1595	AST 386 20MHz	SAVE
Toshiba T100	789	Sharp 4501	939
Toshiba T1100	1449	Sharp 4502	1229
Toshiba T1200	2395	Sharp 7000A	1295
Toshiba T3100/20	3029	Sharp 7100	1969
Zenith Z-181	1579	Zenith Z-183	2299
Acer 710-D: 8088, 10 MHz; 768K; 2 Drives			829
Acer 710-S: 8088, 10 MHz; 768K; 1 Drive			739
Acer 900-B1: 80286, 10 MHz			1399
Acer 910-B1: 80286, 10 MHz; 512K			1315
Acer 1100-B4: 80386, 0 Wait; 40M Drive			3065
Acer 1100-B8: 80386, 0 Wait; 80M Drive			3795
Acer 1100-B13: 80386, 0 Wait; 130M Drive			5195
ITT Xtra 301: 10 MHz; 3.5" Drive			809
ITT Xtra 400 EGA: 80286, 10 MHz			1749
ITT Xtra 400: 80286, 10 MHz			1649
Mitsubishi MP-286: All Models			SAVE
Packard Bell VT286: 15 MHz; 640K; EGA			1995
Samsung S-300: 512K; 1 Drive; Keyboard			699
Samsung S-500: 80286; 18 MHz; 1.2M Drive			1195
Spery IT: 1M / 44M Drive / Keyboard			2785
Tandon PAC 286: 30M Drive			1745
Tandon PAC 70: 8 MHz / 70M Drive			2095
Televideo 286: 512K/20M Drive; Monitor			1749
Televideo 386: 2M; 0 Wait; 1.2M Drive			2495
Televideo 386: 2M; 0 Wait; 40M Drive			3445
Wyse 286: 10 MHz; 640K; 1.2M Drive			1339
Wyse 2188: 8 MHz; 512K; 1.2M Drive			1145
Wyse 2112: 12.5 MHz; 1M; 1.2M Drive			1565
Wyse 2214: 12.5 MHz; 2M; 1.2M Drive			1695
Wyse 3216: 80386, 0 Wait; 1M; 1 Drive			2595
Altos Apple; Cordata; Samsung; Mitsubishi			CALL

TERMINALS

Ampex 220	399	Adds 1010	299
Ampex 230+	395	Adds 2020	415
IBM 3151	395	Adds 3220	479
Kumtron K770-PC	359	Altos III	482
Liberty 1+	392	Altos V	472
Liberty 1: Turbo	429	Link MC3	425
Dume 101G	325	Link MC10	SAVE
Dume 101G+	359	Wyse 30	282
Televideo 905	285	Wyse 50	355
Televideo 955	369	Wyse 60	395
Televideo 965	419	Wyse 85	419
Televideo 9220	452	Wyse 99GT	475
Televideo 9550	349	Wyse 350	725

MODEMS

Anchor 1200 Int	79	AST 9600	795
Anchor 2400 Int	125	AST 2400-B	299
Multitech 224EC	329	Avalex 1200 HC	109
Practical 1200 Int	85	Hayes 1200	279
Practical 1200 Ex	109	Hayes 1200-B	265
Practical 2400 Int	149	Hayes 2400	425
Practical 2400 Ex	175	Hayes 2400-B	385
Prometheus 2400-G	219	Aligent Pocket	155
Prometheus 2400-B: 2	125	Multitech 224E	388
Rascal-Vadic 2400VP	398	Novation Parrot	89
USR Courier 2400	322	USR HST 9600	682
USR Courier 2400E	379	Ver-Tel 2400+	368
Ver-Tel 2400 MNP	462	Ver-Tel 2400+	292
Ver-Tel 18000 Bps	949	Zoom 2400-PC	155
UDS & Many Other Models			CALL

BOARDS

Arnstocad Kicker	159	Artist 1	875
AST Rampage: AT	299	Artist 1+	1425
AST Rampage: XT	199	Artist 10	2095
Genoa Super EGA	189	AST Advantage	235
Genoa EGA Hi-Res	225	AST Six Pak	115
Hercules InColor	279	AST 5251-11	549
Intel Inboard 386	1329	ATI EGA Wonder	182
NEC GB-1 Graphics	255	ATI V1 P	279
Orange ProGrappler	75	Boca EGA	132
Orchid Tiny Turbo	275	Boca RAM: AT	145
Drehid Turbo PGA	1095	DCA Irma	SAVE
Paradise Auto 480	149	Intel PS 286	359
Paradise Basic EGA	115	Intel PS: 256K	319
Quadram Ultra VGA	362	Orchid Jet 386	689
Sigma Designs 400	275	Panasonic FAX	649
Sigma Designs VGA	289	Paradise Auto	139
STB Chautleaur HT	145	Quadram HPG	675
Talltree J-RAM: AT	169	STB Multires 2	229
Talltree J-RAM 2	125	STB VGA	299
Talltree J-RAM 3	169	Vega VGA	299
Talltree J-RAM-AT3	219	Tseng EVA 480	249
Taxxon Gold Card	169	Tseng Ultrapak	125
Tecmar EGA Master	259	Vermont IIA640	1099
Vermont IM1024	2395	Verticom M16E	995
Verticom CA 480	445	Verticom H16	2099
Verticom M256E	1199	Verticom H256	2399
AST Advantage Premium			289
ATI Graphics Solution			135
Hercules Graphics			169
Intel Above Board 286			319
Number 9 Pepper Sgt.			1169
Quadram Prosymch With Mouse			2199
Talltree J-Laser + AT			429
Talltree J-Laser + PC			369
Paradise VGA Plus			249
Video 7 Vega Deluxe			208
Advanced Digital Alloy Others			CALL

MONITORS

Amdek 1280 V Card	672	Amdek 732	432
AST Turbo Vision	1429	Amdek 410	142
Verticom 2 Page	1795	Amdek 432	169
Hatami CM1588A	1699	Amdek 730V	369
Hatami CM2073	2595	Conrac 7351	2695
Intecolor 19" EGA	1495	Conrac 7250	2199
Magnavox Composite	89	Genus 402	1295
Mikrovitek Autosync	1695	PGS LMK300	485
Mitsubishi Diamond	475	PGS PSM-03	165
Mitsubishi 6922	2095	PGS MAX 15	179
Mitsubishi 9979BK	2495	PGS Ultrascan	499
Veracom 2 Page	1795	Roland MB142	149
NEC Multisync II	535	Samsung TTL	85
NEC Multisync +	895	Samsung RGB	259
NEC Multisync XL	2065	Samsung EGA	369
Sigma Laser 15	1369	Tatung	SAVE
Sigma Laser 19	1729	Taxan 770+	528
Wyse 700 With Card	685	Thomson 437A	549
Zenith 1470	195	Thomson 450A	152
			635

DISK DRIVES

Miniscribe 40M	349	Plus 20M Card	535
Miniscribe 20M Card	385	Plus 40M Card	819
Miniscribe 30M Card	415	Pran ID45H	639
Miniscribe 3053	SAVE	Pran ID100RC	1099
Miniscribe 6053	599	Pran ID230RC	2325
Miniscribe 6085	829	Seagate 20M Kt	285
Seagate 40M Drive	415	Seagate 30M Kt	298
Seagate 80M Drive	679	Toshiba 3.5" Kt	109
Alloy/AST Mountain/Teac/Tallygrass/Maynard			CALL

PLOTTERS

Calcomp 1041GTO	4495	Enter SP600	675
Calcomp 1042GT	7695	Enter SP1000	SAVE
Calcomp 1043GT	6495	Enter SP1200	3395
Calcomp 1044GT	10795	Houston PC595	499
Cal. Plotmaster	3799	Houston PC685	586
Cal. Colormaster	3499	Houston DMP29	1625
H-Packard 7475A	1429	Houston DMP40	869
Houston DMP61	3395	Houston DMP62	4696
Houston DMP41.42	2195	Joine 3700	3099
Houston DMP51.52	3195	Joine 4000	4095
Houston DMP51.52MPC	3495	Numerics 3460	2095
Houston DMP56A	3695	Numerics 5660	3349
Joine 3700 Multi	3495	Plotland DXY890	139
Joine 4000 Multi	4495	Plotland DXY885	939
Plotland DXY980	6595	Plotland DXY980	1195
Plotland DXY2000	4095	Taxan 710S	769
Plotland DXY3000	5395	Veratec	CALL

DIGITIZERS

Houston: All Models	CALL	Calcomp 12 x 12	349
Kurta IS: 8.5 x 11	295	Calcomp 12 x 18	799
Kurta IS: 12 x 12	469	Calcomp 18 x 24	1795
Kurta IS: 12 x 17	619	Calcomp 24 x 36	3995
Kurta IS: Pen	95	Calcomp 36 x 48	4195
Kurta Series 3	CALL	Calcomp 44 x 60	4795
Numerics 12 x 12	379	GTCD 12 x 12	399
Numerics 12 x 17	729	GTCD 20 x 20	2345
Numerics 20 x 20	1245	GTCD 24 x 36	2495
Numerics 20 x 24	1399	GTCD 36 x 48	2899
Numerics 24 x 36	2399	Hitachi 11 x 11	459
Numerics 36 x 48	3149	Hitachi 12 x 17	995
Numerics 44 x 60	3595	Hitachi 15 x 15	1145
Scriptel 12 x 12	599	Summa - 12 x 12	369
Scriptel 12 x 18	899	Summa 12 x 18	639
Scriptel 18 x 24	1795	Summa 17 x 24	2395
Scriptel 20 x 20	2095	Summa 24 x 36	3299
Other Models	CALL	Summa 36 x 48	3995

MICE

Mouse Systems Serial	99	Summa Mouse	79
Mouse Systems BUS	109	Mouse Systems A+	75
Microsoft BUS: With Windows 2.0 Software			122

SOFTWARE

Brooklyn Bridge	75	Carbon Copy +	109
Crocket Graph	115	Charmaster	222
Crossstalk XVI	98	Crocket Draw	162
DAC Easy Accounting	45	dbase III +	419
First Choice	85	Desqview	75
Harvard Graphics	219	Fastback	89
Mace Utilities	62	Filemaker	145
Microsoft Excel PC	309	GEM Draw +	162
Microsoft Windows 2.0	62	Laplink	75
Microsoft Word	255	The Library	59
Microsoft PC Works	115	MacDraft	158
Multimate Advnty II	255	MORE	145
Norton Utilities	55	Multimate	255
Norton Utilities Adv.	77	Newmaster	54
PFS 1st Choice	85	Paradox 2.0	399
PFS 1st Publisher	59	Q&A	205
PFS Professional File	139	Q&A Write	115
PFS Professional Write	112	Reflex	85
Picture Perfect 4.0	189	Sidellack	52
Quick Basic Compiler	62	Smartem 240	189
R-Base System V	429	Supersant	59
Super Project +	285	Timeline 2.0	77
Ventura Publisher	469	Turbo C	279
WordPerfect Executive	109	WriteNow	99
Wordstar 2000 -	212	WordPerfect	212
Wordstar Professional	242	XTREE	

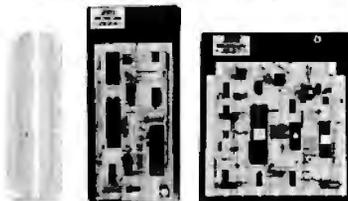
Worldwide • Since 1974

• QUALITY COMPONENTS • COMPETITIVE PRICING
• PROMPT DELIVERY

Mail Order Electronics • Worldwide
Jameco
ELECTRONICS

PROTOTYPING PRODUCTS

Jameco Solderless Breadboard Sockets



Part No.	Dim. L x W	Contact Points	Binding Posts	Price
JE23	6 1/2 x 3 1/4	200	0	\$ 2.29
JE21	3 1/4 x 2 1/4	400	0	\$ 4.49
JE22	6 1/2 x 1 1/2	630	0	\$ 5.95
JE23	6 1/2 x 2 1/4	830	0	\$ 7.49
JE24	6 1/2 x 3 1/4	1,360	2	\$14.95
JE25	6 1/2 x 4 1/4	1,660	3	\$22.95
JE26	8 1/2 x 5 1/4	2,390	4	\$27.95
JE27	7 1/4 x 7 1/2	3,220	4	\$37.95

Jameco General Purpose Prototype PC Boards



- Wire Wrap
- Component Testing
- Point-to-Point Wiring
- 31/62 Connection

JE415 (6 1/2" No Pads, PC/XT)	\$14.95
JE417 (6 1/2" Plated w/Pads, PC/XT)	\$19.95
Extender Board	
JE421 (4" Extender, 31/62 Connector)	\$19.95

DATA BOOKS

30003 National Linear Data Book (82)	\$19.95
30005 Logic Data Book - Vol II (84)	\$19.95
30009 Intel Data Book (87)	\$14.95
21398 CMOS Cookbook (88)	\$14.95
210830 Intel Memory Handbook (87)	\$17.95
230843 Intel Microsystem Handbk. Set (87)	\$24.95

MUFFIN/SPRITE-STYLE FANS



TA450S	\$11.95
Torin Industries (4 5/8" sq., 50 cfm)	
SU2A1	\$11.95
EG&G Rotron (3 1/2" square, 34 cfm)	



NEW! Switching Power Supply

+5V @ 5A, +12V @ 1A x 2

Regulated 110VAC/220VAC
Switchable • 40 watt • Size 8 1/2" L x 3" W x 2 1/4" H • Weight 1 1/2 lbs • Data included

PSC07	\$14.95
-----------------	---------

Jameco Computer Power Protection



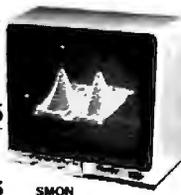
JE1190 Power Base	\$29.95
JE1191 6-Outlet Power Strip	\$11.95
JE1192 300 Watt Back-Up	\$299.95
JE1193 500 Watt Back-Up	\$399.95

IBM AND APPLE COMPATIBLE DISPLAY MONITORS

Franklin 12" Green Monochrome

- Apple II, II+, IIe, IIc Compatible
- Composite video output • 18MHz
- Resolution: 800 lines at center

SMON \$59.95



12" Amber Monochrome —

TTL Input, High Resolution (PC/XT/AT)

AMBER \$109.95

14" RGB Color — CGA Compatible Amber/Green/Color Switchable.

640 x 200 Resolution (PC/XT/AT)

TTX1410 \$279.95

14" EGA Color — EGA/CGA Compat. 720 x 350 (max) resolution (PC/XT/AT)

TE5154 \$399.95

14" Ultrascan Color — CGA/EGA/PGC/VGA Compatible. 800 x 560 (max) Resolution (PC/XT/AT)

4375M \$579.95

IBM PC/XT/AT Compatible Cards

JE1050 Mono Graphics Card	\$ 59.95
JE1052 Color Graphics Card	\$ 49.95
JE1055 EGA Card	\$149.95

JAMECO COMPUTER KITS

FREE! PC Write Word Processing Software Included!

Jameco's IBM™ AT Compatible Mini-286 6/8/10/12 MHz Kit!

Part No.	Description	Price
JE1043	1.2M/360K Floppy Control	\$ 49.95
JE1015	XT/AT Style Keyboard	\$ 59.95
41256-120	512K RAM (18 Chips)	\$ 71.10
JE1012	Baby AT Flip-Top Case	\$ 69.95
JE1032	200W Power Supply	\$ 89.95
JE1022	5 1/4" High Density Disk Drive	\$109.95
JE1003	Baby AT Motherboard (Zero-K RAM incl. Award BIOS ROM)	\$399.95
EGA Monitor	TE5154 \$399.95	Reg. List \$850.80
EGA Card	JE1055 \$149.95	SAVE \$50.85!
(not included)		

JE1008 IBM™ AT Compatible Kit \$799.95

Jameco's 4.77/8MHz Turbo IBM PC/XT Compatible Kit

4164-150	128K RAM (18 Chips)	\$ 22.50
41256-150	512K RAM (18 Chips)	\$ 58.50
JE1010	Flip-Top Case	\$ 34.95
JE1015	XT/AT Style Keyboard	\$ 59.95
JE1032	150 Watt Power Supply	\$ 69.95
JE1020	5 1/4" HDD Disk Drive	\$ 89.95
AMBER	12" Amber Monitor	\$109.95
JE1001	4.77/8MHz Turbo Motherboard (Zero-K RAM — Includes Award BIOS ROM)	\$104.95
JE1071	Multi I/O with Controller and Graphics	\$119.95

Regular List \$670.65
SAVE \$70.70!

JE1005 (IBM™ PC/XT Turbo Compatible Kit) . . \$599.95

Jameco's IBM PC/XT/AT Compatible Motherboards

• Award BIOS ROM included

JE1000	4.77MHz (PC/XT)	\$ 89.95
JE1001	4.77/8MHz (PC/XT)	\$104.95
JE1003	6/8/10/12MHz (AT)	\$399.95

Additional Add-Ons Available!

COMPUTER PERIPHERALS



Seagate 20, 30 & 40MB Half Height Hard Disk Drives

ST225	20MB Drive only (PC/XT/AT)	\$269.95
ST225K	20MB w/Controller (PC/XT)	\$319.95
ST238	30MB Drive only (PC/XT/AT)	\$299.95
ST238K	30MB w/Cont. (PC/XT/AT)	\$339.95
ST251	40MB Drive only (PC/XT/AT)	\$459.95
ST251XT	40MB w/Cont. Card (PC/XT)	\$549.95
ST251AT	40MB w/Cont. Card (AT)	\$589.95



Jameco PC/XT & AT Compatible Disk Drives

JE1022 (Pictured)

JE1020	360K Black Bdr. (PC/XT/AT)	\$ 89.95
JE1021	360K Beige Bdr. (PC/XT/AT)	\$ 89.95
JE1022	1.2MB Beige Bdr. (AT)	\$109.95

DATATRONICS

2400/1200/300 Modems



- Hayes command compatible • Bell 103/212A compatible • Auto-dial, auto-answer • FCC approved • 1-year warranty • The 1200H & 2400S include MaxiMate Communication Software • The 1200C & 2400E do not include software

1200H	1200/300 Baud Internal Modem	\$ 79.95
2400S	2400/1200/300 Internal Modem	\$174.95
1200C	1200/300 Baud External Modem	\$119.95
2400E	2400/1200/300 External Modem	\$219.95

Jameco Extended 80-Column Card for Apple IIe



- 80 Col/64K RAM • Doubles amount of data your Apple IIe can display as well as its memory capacity • Ideal for word processing • Complete with instructions

JE864 \$49.95

ADD12 (Disk Drive II, II+, IIe) \$99.95

Additional Apple Compatible Products Available

ZUCKERBOARD



TANDY 1000 Expansion Memory Half Card

Expand the memory of your Tandy 1000 (128K Version) to as much as 640K. Also includes DMA controller chip

TE512	Includes 512K RAM	\$119.95
TANC	Plug-in Clock option chip (only)	\$39.95

20Meg Hard Disk for Tandy 1000/SX

T20MB	20MB Hard Disk Drive Board for Tandy 1000	\$494.95
SX20MB	20MB Hard Disk Drive Board for Tandy 1000SX	\$499.95

Accessories for Commodore VIC-20, C-64 & C-128



JE232CM	(RS232C Inter. VIC-20, C-64 and C-128 in 64 mode)	\$39.95
CPS10	(C-64 Power Supply)	\$39.95
CPS128	(C-128 Power Supply)	\$59.95

U.S. Funds Only
Shipping: Add 5% plus \$1.50 Insurance
(May vary according to weight)

California Residents:
Add 6%, 6 1/2% or 7%
Sales Tax
FAX 415-592-2503
1/88



\$20 Minimum Order
IBM is a registered trademark of International Business Machines

Mail Order Electronics • Worldwide
Jameco
ELECTRONICS



Data Sheets — 50¢ each
Prices Subject to Change

Send \$1.00 Postage for a
FREE 1988 CATALOG

Telex: 176043

©1988 Jameco Electronics

1355 SHOREWAY RD., BELMONT, CA 94002 • FOR ORDERS ONLY 415-592-8097 • ALL OTHER INQUIRIES 415-592-8121

ZSTEM **VT240 Smart Terminal Emulator and Communications Program**
for the IBM XT, AT, PS/2 and compatibles

- Emulate a VT240/241 at 2-4 times the speed.
- Complete VT240 ANSI emulation including true double-high/double-wide characters, true smooth scrolling, national/multinational support, and downloadable fonts.
- At least 128 columns displayable in 132-column mode on the CGA, EGA, VGA, and Hercules adapters
- Full Tektronix 4010/4014 and REGIS graphics support with dynamically maintained full image display in the correct aspect ratio.
- XERMIT and XMODEM transfers

VT240 \$295
plus your PC or compatible

Also available VT220, VT100, 4014 emulators and the *PowerStation™* VT200 style keyboard.

KEA SYSTEMS LTD.
Suite 412 2150 West Broadway Vancouver, B.C. Canada V6K 4L9
Telephone (604) 732-7411 Telex 04-352848 VCR Fax. (604) 732-0715
Order desk: 800-663-8702 Toll Free 30 day money back guarantee **AMEX/MC/VISA**

Circle 136 on Reader Service Card

PDK51



The \$595 Solution to 8051 Product Development

The PDK51 is a powerful and economical choice for the development of 8051-based systems. The PDK51 is used with an IBM-PC or equivalent and includes:

- SIBEC-II 8052 Basic Microcontroller
- SXA51 Cross Assembler
- ROM-Based Monitor/Debugger
- PROM Programmer
- Power Supplies
- Documentation, Tutorial and More

Call Now! (603) 469-3232

Binary Technology, Inc.
Main St., P.O. Box 67, Menden NH 03770

MADE IN U.S.A.
5 1/4" DISKETTES

DSDD 33¢ each
DSHD 89¢ each

• Sturdy Blank PVC Jacket
• With ID Label
• With Write Protect Tabs
• With Envelopes
• In Factory Sealed Poly Packs

SOLD IN LOTS OF 100

3 1/2" DISKETTES (UNBRANDED)

SALE 99¢ each **SOLD IN LOTS OF 50**

S & H \$4.00. FIRST 100 OR FEWER DISKS. \$3.00 EACH SUCCEEDING 100 OR FEWER DISKETTES

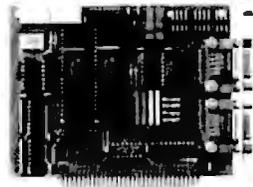
MINIMUM ORDER \$25.00 S&H Continental USA Foreign Orders APO/FPO please call MI residents add 4% tax C.O.D. add \$4.00 Payment with cash certified check or money order Prices subject to change Hours: 8:30 AM - 7:00 PM ET

Call for FREE CATALOG FOREIGN INQUIRIES INVITED

Precision Data Products™
P.O. Box 6367 Grand Rapids, MI 49516
1-616-452-3457 • FAX 1-616-452-4914 COD
Michigan 1-800-632-2488
Ouis de Michigan 1-800-258-0028

Circle 208 on Reader Service Card

RS-422
Communications Board



- For IBM PC/XT/AT/PS/2
- Dual channel RS-422/RS-485
- Selectable/shareable interrupts
- Differential drivers to 4000 ft.
- Immediate delivery

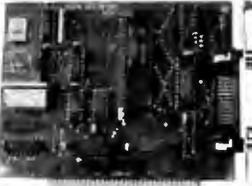
1-800-553-1170

QUA TECH INCORPORATED

Leaders in Communication Technology
478 E. Exchange St., Akron, OH 44304
(216) 434-3154 TLX: 5101012728

Circle 221 on Reader Service Card

IEEE-488



MXI-100

- GPIB controller board for IBM PC/XT/AT
- Control up to 14 Devices
- User friendly Software Commands
- DMA Transfer to 200k byte/sec.

\$345.00 including software

QUA TECH INCORPORATED

478 E. Exchange St., Akron, OH 44304
(216) 434-3154 TLX: 5101012728
1-800-553-1170

Circle 222 on Reader Service Card

MODULAR DATA ACQUISITION



- FOR IBM & Compatibles
- Flexible and Inexpensive
- Money Back Guarantee
- Free Technical Support

Fast Delivery
1-800-553-1170

QUA TECH INCORPORATED

Leaders in Communication Technology
478 E. Exchange St., Akron, OH 44304
(216) 434-3154 TLX: 5101012728

Circle 223 on Reader Service Card

MULTILINE



'99 PER LINE

BULLETIN BOARD INFORMATION HOST SYSTEM

A Revolutionary E-Mail/BBS Information Host System now makes the setup of a turnkey On-Line Information & Conferencing Utility incredibly easy.

This amazing system can be operated unattended, 24 hours a day, and can simultaneously support up to 16 modems on 16 dial-up telephone lines under nothing more than MS or PC DOS.

ION STORE **PHONE (805) 656-3741**

Circle 193 on Reader Service Card

ICs PROMPT DELIVERY!!!
SAME DAY SHIPPING (USUALLY!)
QUANTITIES ONE PRICES SHOWN FOR NOV 22, 1987

OUTSIDE OKLAHOMA NO SALES TAX

	DYNAMIC RAM	EPROM	STATIC RAM
1Mbit	1048Kx1 100 ns \$29.50	27C1000 128Kx8 150 ns \$37.95	432556L-12 32Kx8 120 ns \$11.50
1Mbit	256Kx4 120 ns 34.00	27C512 54Kx8 200 ns 15.50	5565PL-15 8Kx8 150 ns 3.30
51258	* 256Kx1 100 ns 6.95	27256 32Kx8 250 ns 5.95	
4464	84Kx4 150 ns 3.60	27128 16Kx8 250 ns 5.75	
41256	256Kx1 80 ns 5.75		
41256	256Kx1 100 ns 5.15		
41256	256Kx1 120 ns 3.95		
41256	256Kx1 150 ns 3.55		
41264	+ 64Kx4 120 ns 5.25		

640K MOTHERBOARD UPGRADE Zenith 150, IBM PC XT, Compat, Portable & Plus, hp Vectra

80287-2 \$160.00
80287-4 \$235.00
80287-6 \$310.00

OPEN 6 1/2 DAYS, 7 to 10 PM SHIP VIA FED-EX ON SAT.
SUNDAYS & HOLIDAYS SHIPMENT OR DELIVERY VIA U.S. EXPRESS MAIL.

S&H DELIVERY INCLUDED ON FED-EX ORDERS RECEIVED BY:
FR. 20 08 34 11 B
FR. 21 5138 2 15

MASTERCARD/VISA / UPS CASH CO.
Factory New, Prime Parts
MICROPROCESSORS UNLIMITED INC
24 000 S. Peoria Ave.
BEGGS OK 74421
(918) 267-4961

No minimum order. Please allow for price and quantity changes. All items are factory material. Orders received by 4 PM CST can usually be delivered the next morning via Federal Express Standard Air or \$4.00, or guaranteed next day Priority One at \$10.00!

Circle 167 on Reader Service Card

Set up a complete graphics workstation on your PC for under \$100!

PC-PLOT-III graphics terminal emulator software package enables IBM PC's and compatibles to appear to a mainframe as DEC VT-100/200, VT-52, Retrographics VT-640 or Tektronix 4010 4014 and 4027 terminals. The program also provides valuable communication commands and more.

An enhanced version, PC-PLOT-IV, further allows complete Tektronix 4105 terminal emulation.

For more information call **614/882-4786**

MicroPlot

659-H Park Meadow Rd. Westerville, OH 43081

Circle 166 on Reader Service Card

GENERAL DISCOUNT
FREE WHEN YOU PAY
GROUND RATES!

NO SURCHARGE!

S-100™

"THE PC PEOPLE"

SINCE 1977

Circle 262 on Reader Service Card
(DEALERS: 263)

PC COMPATIBLE SYSTEMS

AST Premium 286™ \$55./mo.*

Model 140 with 44Mb Dr, 1Mb RAM, S&P Ports, Ck/Cal, RT-Style Keyboard, 3-G Plus Card with EGA, CGA, HGC, MS-DOS 3.2, GW-Basic
This ad produced on an AST Premium Publisher.

* 1 to 5 year leases available to qualified businesses.

FORTRON

80386-16 MHz Server w/2 Mb-16 Mb RAM, @ 0 wait, 1 para, 2 ser. ports on Mb, 8 AT & 4 XT slots, 230W, maxswitch enhanced keyboard, up to 6HH dr, 80287 socket, WD-WA2 ctrl, 1.2Mb floppy drive. **\$2,578**

INDTECH

5191 Basic System - 12 Slots, 80286-10 ("0" wait), 512K-1Mb, 238W P/S, WD-WA2 Ctrl, 1.2Mb Flyp Dr, Keyboard, MS-DOS 3.3 & GW-Basic, Manual & Set-Up. Will Run Novell Non-Ded 286!!... **\$1,275**

OTATUNG*

TCS-7000B /10MHz "AT", 640K, S&P, 1.2Mb flyp, K.B., 210W, DOS 3.2 & GW-Basic..... **\$1,285**

MONITORS & TERMINALS

NEC Pro.Graphics Pkg multisync, PGA Card **\$988**



SAMSUNG

Samsung EGA Tilt 'n' Swivel, 14" Monitor..... **\$359**
Samsung 14" Tilt 'n' Swivel Color Hi-Res **\$249**
Samsung 12" TTL Tilt 'n' Swivel Amber **\$ 79**

OTATUNG*

CM-1365 RGB 13" 5-Color Text Switch..... **\$319**
CM-1495 OmniScan 14" tilt 'n' swivel for PGA, EGA, HGC, CGA, etc..... **\$649**
MM-1422 Dual Freq, T 'n' S 14" Grn/Ambr..... **\$119**



IBM 3151 ASCHII terminal.... **\$429**
3 year on-site warranty!



WYSE 50..... **\$379**
WYSE 60..... **\$419**
WYSE WY700 1280 x 800..... **\$759**

COMPUTER ACCESSORIES

P-15 Monitor Base **\$ 75**
Data Display for overhead projectors..... **\$875**
FREE Carrying Case! - While Inventory Lasts
Power Savers 400-1000W Models...FROM... **\$495**

CONNECTIVITY

4-User Network Special NOVELL

Server/Work Station:

INDTECH 8/8 MHz AT-Fileserver - 12 slots, 238W Power Supply, Serial & Parallel Ports, Monitor, 1.2 Mb Floppy, 1 Mb RAM, 72 Mb Hard Drive, 60Mb Tape.

CACO U400 U.P.S.

NOVELL ELS NetWare 286 Level I (4-users)

Network set-up is Menu Driven!

4 ArcNet Cards, Cables & 1 Passive Hub

3 FastData SUPERturbo XT's - Ea. Incl: 640K, 4.77/10MHz, 8088-1 CPU, AT-Style Key-board, & Amber Tilt 'n' Swivel Monitor. FCC Approved.

** A COMPLETE NETWORK **

RETAIL..... **\$9,258** NOW ONLY **\$5,995**



The ALL "NEW"
FastData™ Mini-AT

Mini-AT - 80286-10 runs 11.5 Norton SI, 512K-1Mb RAM, Award Bios, only 16" wide, 8 slots, room for 3 half-ht drives. Speed, drive, power LED's, key, reset & turbo switch on front panel. AT-Style Keyboard, 200W 110/220V P/S, FCC app., 1 year warranty.... **\$795.00**

SUPERturbo XT - AT-Style Case & Keyboard, 10 MHz 8088-1, 120nSEC RAM 640K, 150W P/S, 360K Floppy. FCC approved, 1 year parts & labor warranty..... **\$495.00**

MGP - Mono, Graphics, Printer Bd... **\$48.00**

CGP - Color, Graphics, Printer Bd... **\$59.00**

EGA - w/CGA, MDA, HGC Board... **\$135.00**

Monitors..... See Samsung

WD-WA2 - H. D./Floppy controller... **\$149.00**

Fujitsu 360K Grey Floppy **\$79.00**

Fujitsu 1.2 Mb Grey Floppy **\$119.00**

20 Mb Seagate and Controller **\$288.00**

IOC - Floppy, S, P, Game, Ck Ctrl... **\$75.00**

MUL - 0-384K, S, P, Game, Clock... **\$79.00**

MUL-AT - 0-3Mb, S, P..... **\$125.00**

MaxiSwitch Enhanced Keyboard... **\$79.00**

Call for FREE brochure on FastData™

PC COMPATIBLE SOFTWARE*

Data Base Management

Ashton-Tate dBase II **\$288**
Ashton-Tate dBase III Plus **\$378**
KnowledgeMan 2.01 **\$285**
PFS: Professional File **\$111**
R:Base 5000 System V..... **\$415**
Communications
Carbon Copy Plus (Meridian)..... **\$118**
Crosstalk XVI (Microstuf)..... **\$ 88**
Microsoft Access **\$137**

Word Processors

NewWord (Wordstar 4.0 clone)..... **\$178**
WordStar 4.0..... **\$334**
MultiMate Advantage II..... **\$248**
PFS: Professional Write..... **\$ 88**
Word Perfect Executive..... **\$102**

Integrated / Spreadsheets

Enable 2.0 (software group)..... **\$375**
Framework II (Ashton-Tate)..... **\$375**
Lotus 1-2-3..... **\$298**
Multiplan 1.11..... **\$138**
PFS: First Choice..... **\$ 78**
Symphony (Lotus)..... **\$438**

Desktop Publishing

PFS: First Publisher..... **\$ 54**
Xerox Ventura 1.1..... **\$485**

Graphics & Mice

Harvard Graphics **\$188**
IMSI OptiMouse Serial **\$ 88**
IMSI Genius Mouse Serial **\$ 59**
Microsoft Buss Mouse..... **\$ 98**
Microsoft Serial Mouse..... **\$ 99**
SummaMouse-Optical..... **\$ 78**

Project Management

Harvard Total Project Manager..... **\$284**

* Compatibility with PC/XT/AT Clones not guaranteed

LASER PRINTERS

H.P. LaserJet Series II
8 Pgs/min, 6 internal fonts,
512K RAM HP, LaserJet Plus
compatible..... **\$1,799!**



Brother HL-8 1 Mb, 20 fonts..... CALL
NEC Model 890 PS..... CALL
QUME Script 10 - PostScript..... **\$4,395**
XEROX 4045 Model 50 - 512K-1.5Mb, S&P I/F, 10 Pgs/Min., and 90 days on-site service..... **\$3,495**
AST TurboLaser/EL 512K-3Mb, Ricoh Engine, Upgradeable to PostScript..... **\$1,678**
AST TurboLaser/PS ricoh, postscript, AppleMac/PC I/F, 2Mb, 35 fonts, 300dpi, Fast Graphics! **\$2,895**

PRINTERS & PLOTTERS

brother HR-20 - **\$415**



M-1709..... **\$429** / M-1509..... **\$339**
HR-40..... **\$569** / HR-60..... **\$699**

houstons instrument CALL

Panasonic

1080 Model 2..... **\$179** 1091 Model 2.. **\$199**
1092 I **\$329** 1592 **\$449**
1595 **\$499** 3131 **\$299**
3151 **\$469**

DRIVES

PRIAM

ID 130 133Mb, 20mSEC w/ Installation Hardware/
Software (Maxtor XT-1140 Compatible)..... **\$2,189**
ID75 74Mb, 20mSEC **\$995**
ID100 103Mb 20mSEC w/AT RLL Ctrl..... **\$1,179**
ID230 233Mb 20mSEC w/software, RLL Ctrl **\$2,549**
V160 43Mb 30mSEC..... **\$899**
Everex 60I 60 Mb Internal Tape..... **\$799**

MICROPOLIS

Micropolis 85Mb 28mSEC **\$ 888**
Mitsubishi MF501 **\$ 95** / MF504 1.2Mb **\$125**
Mitsubishi 3.5" 1.4 Mb Floppy **\$139**
Mitsubishi 3.5" 720K..... **\$115**
Seagate 20 Mb PC Subsystem **\$ 288**
Seagate 30 Mb PC Subsystem, ST-238&Ctrl... **\$388**
Teac FD-55-BV 48tpi .. **\$ 95** / FD55GV 1.2 .. **\$125**
Fujitsu 360K flyp dr **\$ 79** / 1.2 Mb **\$125**

MODEMS & BOARDS

ANCHOR

1200 External..... **\$119** / 1200 Internal. **\$ 79**
2400 External..... **\$149** / 2400 Internal. **\$129**
CTS 2424 ADH ASYNCH/SYNCH (Hayes)..... **\$229**
CTS 2424 AMH Class 4 MNP Error Correct... **\$289**
MultiTech..... CALL
Prometheus ProModems..... CALL
U.S. Robotics Personal Modems..... CALL

6-PAK Plus..... **\$119**
RAMPAGE-286-512K..... **\$400**
RAMPAGE XT-256K..... **\$256**
Hot Shot 286-10XT Accel. Bd. **\$369**
ADVANTAGE-AT-512K..... **\$275**

Intel Above Board/286-512K 4020..... **\$339**
Microsoft Mach 10 / Window / Mouse..... **\$324**

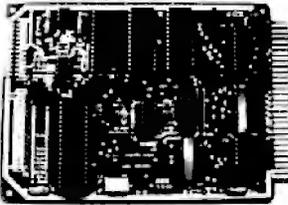
800-528-3138 Orders Only 602-991-7870 Customer Service

S-100 Div./696 Corp. • 14151 N. 76th St. • Scottsdale, AZ 85260 • TELEX 9103806778 SNSCORP FAX 602-483-0920

Advertised prices are cash, prepaid, VISA or M/C Only! Customers qualifying for terms calculate addl charges in the following way: P.O.'s & AMEX + 5%; C.O.D.'s + 99; Shipping first 6 lbs. min. \$8.00
*Free FedX only applies to orders from 1-9 lbs & over \$50. Sales tax AZ res. only. All returns subject to a restocking fee or full credit towards a future purchase. All prices subject to change without notice.

ForthCard

ON THE STD-BUS



as
Low
as
\$179

The ForthCard provides the ability to develop Forth code using a single normal including on-card EEPROM programming. Operating as a stand alone computer or as an STD bus CPU this card is perfect for projects that require a simple dedicated SBC with a floating file memory, and I/O expansion. Forth programs can be entered directly to RAM or downloaded from your PC's serial port. Upload into RAM or download from your PC's serial port. Upload into RAM or download from your PC's serial port. Upload into RAM or download from your PC's serial port.

CALL TODAY FOR COMPLETE INFORMATION
619-566-1892

Circle 114 on Reader Service Card

CLIP \$44.00* THE BACKUP PROGRAM

The PROBLEM

Your free backup utility is slow, difficult to use, and can only restore files to ready-made directories

It does not record its progress—so you backup everything to be safe

Or nothing because it's such a bore.

The SOLUTION

CLIP keeps a log of its backups, so you can afford to be selective. It maintains a menu of your customized commands, so you do not have to stop and think. It is fast, and it compresses data.

Result—fewer disks, less time, less effort, no worry, greater security

* Unique high-speed data compression • Several ways to select backup files • Saves to any media or to a network • Menu or command-line driven • Instant menu editing • help • PS/2, PC, XT, AT or Compatibles •

Keele Codes have five years specialist experience in backup. Purchasers of 1000+ CLIP units include major international Philips and British Telecom.

CLIP avoids the dangers and lies of direct hardware addressing. It saves you time in ways which do not risk your data. Safety first.

* Registered airmail c/w/o Mastercard
U.K. L30 inc vat, 1st class mail.
Distributor/Trade enquiries invited



KEELE CODES LTD

University of Keele, Newcastle, Staffordshire ST5 5BG, U.K.
Tel: 011-44782-62921 (FAX: 613847) Telex: 36113 UNKLIB G

Circle 137 on Reader Service Card

EPROM PROGRAMMER \$349



THE EP-1'S A GREAT VALUE & HERE'S WHY:
• READS, PROGRAMS, COPIES OVER 300 EPROMS AND EEPROMS FROM 29 MANUFACTURERS INCLUDING 2716, 2713, 2804, 28256, 27011
• READS & WRITES INTEL, MOTOROLA, STRAIGHT HEX AND BINARY
• OPTIONAL HEADS PROGRAM RITE! EPY, EPY1, EPY51, EPY52, EPY55
• MENU DRIVEN CHIP SELECTION BY MFG & PIN NO. MODULES
• FAST, SLOW, QUICK PULSE PROGRAMMING ALGORITHMS
• SPLITS FILES BY BASE ADDRESS AND ODD/EVEN (16 & 32 BIT)
• ALL INTELLIGENCE IN UNIT 280 MICROPROCESSOR BASED
• 5, 12.5, 21, 25 VOLT PROGRAMMING FOR CMOS AND -A SUFFIX PARTS
• FREE PC DOS SOFTWARE • RS232 TO ANY COMPUTER
• GOLD TEXTBOOK ZIP SOCKET • 8 BAUD RATES TO 38400
• SAME DAY SHIPMENT • GENERATES CHECKS CHECKSUMS
• ONE YEAR WARRANTY • TWO FREE FIRMWARE UPDATES
• MONEYBACK GUARANTEE • UV ERASE PRG FROM \$34.95

CALL TODAY FOR MORE INFORMATION

BP MICROSYSTEMS

800-225-2102 713/461-9430 TELEX 1584177
10681 HADDINGTON #190 HOUSTON, TX 77043

Circle 40 on Reader Service Card

Why waste your time formatting disks?

Preformatted disks
save you time and money!

Memorex • Nashua • 3M

5 1/4" (from 48c) • 5 1/4" HD • 3 1/2" • 3 1/2" HC

Call toll-free TODAY!

1-800-321-4668

In Colorado (303) 234-0871.
Open 8:00 to 5:30 Mountain Time,
Monday—Friday.

ALF

ALF Products, 1315F Nelson St,
Denver, CO 80215

Circle 9 on Reader Service Card

DYNAMIC RAMS

1MBIT	100ns	\$ 29.00
51258	100ns	\$ 5.95
41464	150ns	\$ 3.75
41256	100ns	\$ 4.60
41256	120ns	\$ 3.60
• 41256	150ns	\$ 3.35
41264	150ns	\$ 5.25
• 4164	150ns	\$ 1.60

PROCESSORS		E PROMS	
80387-18	16MHz \$475.00	27C101	250ns \$ 32.00
80287-10	10MHz \$295.00	27C517	200ns \$ 18.00
80287-8	8MHz \$245.00	27C517	250ns \$ 10.00
80287-6	6MHz \$165.00	27C256	250ns \$ 5.50
8087-1	10MHz \$195.00	27256	250ns \$ 4.75
8087-2	8MHz \$147.00	27138	250ns \$ 4.75
8087	8MHz \$104.00	27054	200ns \$ 4.00
V-30	8MHz \$ 12.75	2784	250ns \$ 4.25
V-20	10MHz \$ 21.00	43256	120ns \$ 12.95
V-20	8MHz \$ 12.75	4364	150ns \$ 3.25

I.C. EXPRESS

15358 Valley Blvd. City of Industry, CA 91746 Tel 818-369-2688
ORDER TOLL FREE (Mon-Fri 8-5 PST)
(800) 892-8889 • (800) 882-8181

Circle 115 on Reader Service Card

Brand Name DISKETTES

29¢ 49¢ 79¢

5 1/4" DSDD Min. 100 Cdr 5 1/4" DSDD Min. 50 5 1/4" BMAAT HD Min. 50
Min. 50

2 for 1 Replacement Guarantee! 1 found faulty, shipping with 30 months
Warranty. 2nd disc. For TMED discs, add 2¢

99¢ \$1.09 \$4.29

3 1/2" DSDD Min. 25 3 1/2" DSDD Min. 25 Box of 10 5 1/4" DSDD Min. 10 boxes

\$5.99 \$19.20

Box of 10 Cdr 5 1/4" DSDD Min. 5 boxes Free Plastic Case

\$15.90

Min. 5 600" 120 MB Data Cartridge
Min. 5 205" 40 MB Min Cartridge 3M/DEI Compatible

Immediate shipping - Guaranteed satisfaction 100% Lifetime Warranty
Call for greater discounts on larger orders. MC/VISA accepted
Shipping \$3.50 per min. order \$1.50 each add'l

1-800-537-1600 OPERATOR NO. 227
MICRO ELECTRONIC PRODUCTS

Circle 163 on Reader Service Card

A MUST for Computers

VIZIFLEX SEELS

The Ideal Keyboard Cover!

Protect your computer and eliminate downtime caused by liquid spills, contaminants, environmental hazards, etc. with VIZIFLEX SEELS - the only keyboard cover that:

- Remains securely in-place during the operation of the keyboard and will not interfere with computer performance in any way.
- Is designed to "form-fit" to the exact contours of the keyboard to provide superior tactile sensitivity & feel for individual keys.
- Consists of Ultraflex™ material, a transparent, flexible "film" which allows all "markings" to be clearly visible.

VIZIFLEX SEELS are the only keyboard covers for your computer!

VIZIFLEX SEELS INC

15 E. Lafayette St. Hackensack, NJ 07601 (201) 687-8000

Circle 286 on Reader Service Card

Share Your Printers!

This Buffered Automatic Print-Controller has 4 Parallel Inputs, and 2 Parallel Outputs! PC and Laser Compatible! Simultaneous Data Path, Multiple Copies and Numeric Display! 64K Buffer is Expandable to 256K! Automatic or Manual Operation! The Best 4 to 2 Printer-Sharing Choice!!!

64K Model Only \$279!

MaxTech Computer Products

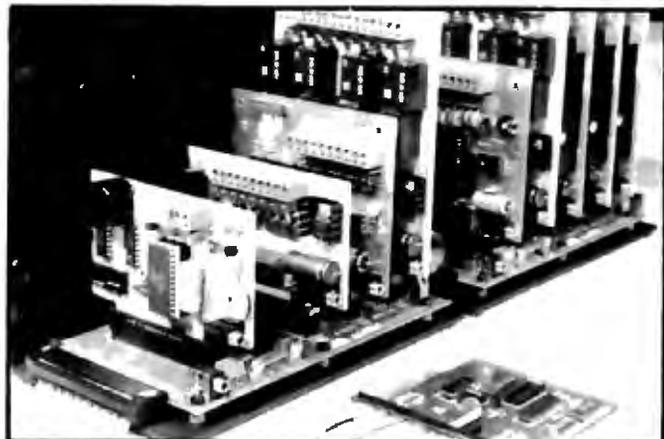
Call (918) 437-2600

Call for Best Price Cables • Switches!
No Minimum. GDS and NAPS accepted.
Shipping • Handling added. 3% surcharge on MC/Visa. POB 690958 Tulsa, OK 74169

Circle 155 on Reader Service Card

The Amazing A-BUS

NEW



An A-BUS system with two Motherboards
A-BUS adapter (IBM) in foreground

Plug into the future

With the A-BUS you can plug your PC (IBM, Apple, TRS-80) into a future of exciting new applications in the fields of control, monitoring, automation, sensing, robotics, etc.

Alpha's modular A-BUS offers a proven method to build your "custom" system today. Tomorrow, when you are ready to take another step, you will be able to add more functions. This is ideal for first time experimenting and teaching.

A-BUS control can be entirely done in simple BASIC or Pascal, and no knowledge of electronics is required!

An A-BUS system consists of the A-BUS adapter plugged into your computer and a cable to connect the Adapter to 1 or 2 A-BUS cards. The same cable will also fit an A-BUS Motherboard for expansion up to 25 cards in any combination.

The A-BUS is backed by Alpha's continuing support (our 11th year, 50000 customers in over 60 countries).

The complete set of A-BUS User's Manuals is available for \$10.

About the A-BUS:

- All the A-BUS cards are very easy to use with any language that can read or write to a Port or Memory. In BASIC, use INP and OUT (or PEEK and POKE with Apples and Tandy Color Computers)
- They are all compatible with each other. You can mix and match up to 25 cards to fit your application. Card addresses are easily set with jumpers
- A-BUS cards are shipped with power supplies (except PD-123) and detailed manuals (including schematics and programming examples)

Relay Card

RE-140: \$129

Includes eight industrial relays. (3 amp contacts. SPST) individually controlled and latched. 8 LED's show status. Easy to use (OUT or POKE in BASIC). Card address is jumper selectable

Reed Relay Card

RE-156: \$99

Same features as above, but uses 8 Reed Relays to switch low level signals (20mA max). Use as a channel selector, solid state relay driver, etc.

Analog Input Card

AD-142: \$129

Eight analog inputs. 0 to +5V range can be expanded to 100V by adding a resistor. 8 bit resolution (20mV). Conversion time 120us. Perfect to measure voltage, temperature, light levels, pressure, etc. Very easy to use

12 Bit A/D Converter

AN-146: \$139

This analog to digital converter is accurate to .025%. Input range is -4V to +4V. Resolution: 1 millivolt. The on board amplifier boosts signals up to 50 times to read microvolts. Conversion time is 130ms. Ideal for the thermocouple, strain gauge, etc. 1 channel. (Expand to 8 channels using the RE-156 card)

Digital Input Card

IN-141: \$59

The eight inputs are optically isolated, so it's safe and easy to connect any "on/off" devices, such as switches, thermostats, alarm loops, etc. to your computer. To read the eight inputs, simply use BASIC INP (or PEEK).

24 Line TTL I/O

DG-148: \$65

Connect 24 input or output signals (switches or any TTL device) to your computer. The card can be set for: input, latched output, strobed output, strobed input, and/or bidirectional strobed I/O. Uses the 8255A chip

Clock with Alarm

CL-144: \$89

Powerful clock/calendar with: battery backup for Time, Date and Alarm setting (time and date); built in alarm relay, led and buzzer; timing to 1/100 second. Easy to use decimal format. Lithium battery included.

Touch Tone® Decoder

PH-145: \$79

Each tone is converted into a number which is stored on the board. Simply read the number with INP or POKE. Use for remote control projects, etc.

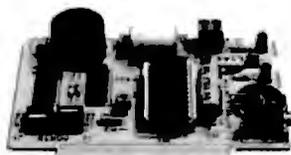
A-BUS Prototyping Card

PR-152: \$15

3½ by 4½ in. with power and ground bus. Fits up to 10 I.C.s



ST-143



CL-144



RE-140



IN-141



AD-142

Smart Stepper Controller SC-149: \$299

World's finest stepper controller. On board microprocessor controls 4 motors simultaneously. Incredibly, it accepts plain English commands like "Move arm 10 2 inches left". Many complex sequences can be defined as "macros" and stored in the on board memory. For each axis, you can control coordinate (relative or absolute), ramping, speed, step type (half, full, wave), scale factor, units, holding power, etc. Many inputs: 8 limit & "wait until" switches, panic button, etc. On the fly reporting of position, speed, etc. On board drivers (350mA) for small steppers (MO-103). Send for SC-149 flyer

Remote Control Keypad Option RC-121: \$49

To control the 4 motors directly, and "teach" sequences of motions

Power Driver Board Option PD-123: \$89

Boost controller drive to 5 amps per phase. For two motors (eight drivers).

Breakout Board Option BB-122: \$19

For easy connection of 2 motors 3 ft. cable ends with screw terminal board.

Stepper Motor Driver ST-143: \$79

Stepper motors are the ultimate in motion control. The special package (below) includes everything you need to get familiar with them. Each card drives two stepper motors (12V, bidirectional, 4 phase, 350mA per phase). Special Package: 2 motors (MO-103) + ST-143 PA-181: \$99

Stepper Motors MO-103: \$15 or 4 for \$39

Pancake type. 2¼" dia. ¼" shaft. 7.5°/step. 4 phase bidirectional. 300 step/sec. 12V, 36 ohm, bipolar. 5 oz-in torque, same as Airpak K82701-P2.

Current Developments

Intelligent Voice Synthesizer, 14 Bit Analog to Digital converter, 4 Channel Digital to Analog converter, Counter Timer, Voice Recognition.

A-BUS Adapters for:

IBM PC, XT, AT and compatibles. Uses one short slot	AR-133: \$69
Tandy 1000, 1000 EX & SX, 1200, 3000. Uses one short slot	AR-133: \$69
Apple II, II+, IIe. Uses any slot	AR-134: \$49
TRS-80 Model 102, 200. Plugs into 40 pin "system bus"	AR-136: \$69
Model 100. Uses 40 pin socket (Socket is duplicated on adapter)	AR-135: \$69
TRS-80 Mod 3, 4, 4 D. Fits 50 pin bus. (With hard disk use Y-cable)	AR-132: \$49
TRS-80 Model 4P. Includes extra cable. (50 pin bus is recessed)	AR-137: \$62
TRS-80 Model I. Plugs into 40 pin I/O bus on KB or E/I	AR-131: \$39
Color Computers (Tandy). Fits ROM slot. Multipak or Y-cable	AR-138: \$49

A-BUS Cable (3 ft, 50 cond.) CA-163: \$24

Connects the A-BUS adapter to one A-BUS card or to first Motherboard

Special cable for two A-BUS cards: CA-162: \$34

A-BUS Motherboard MB-120: \$99

Each Motherboard holds five A-BUS cards. A sixth connector allows a second Motherboard to be added to the first (with connecting cable CA-181: \$12). Up to five Motherboards can be joined this way to a single A-BUS adapter. Sturdy aluminum frame and card guides included

Add \$3.00 per order for shipping.
Visa, MC, checks, M.O. welcome.
CT & NY residents add sales tax.
C.O.D. add \$3.00 extra.
Canada: shipping is \$5
Overseas add 10%



ALPHA Products

242-B West Avenue, Darien, CT 06820

Technical info: (203) 658-1806
Orders only: 800 221-0916
Except in CT
Connecticut orders: (203) 348-9436
All lines open weekdays 9 to 5 Eastern time

SPECIAL EPROM PROGRAMMER



APROTEK 1000
ONLY
\$225.00

COMPLETE WITH
PERSONALITY
MODULE

117 AC POWER-RS-232 CONNECT
- 8 BAUD RATES - HANDSHAKE TO HOST
ALLOWS READ, WRITE, VERIFY & COPY

Comes complete with IBM-PC, Apple IIe, or GPM
(Specify Computer) Driver Program on Disc.

Programs the following 5 Volt 24 or 28 pin
devices: 2716 series through 27512, 25xx series,
68784 plus others. Please Specify Personality
Module desired with order. Additional Personality
Module only \$15.00 ea. Full 1 year warranty.

TO ORDER CALL 1 800 962 5800 OR WRITE
APROTEK

1071 A AVENIDA ACASO Addl
CAMARILLO, CA 93010 54 00 Shipping USA
Info (805) 987 2454 VISA or MC Aml 3 %
We Accept Govt. School & Large Corp P O s

Circle 16 on Reader Service Card

SAVE ON 9 TRACK TAPE SYSTEM



- Mainframe to PC Data Transfer
- High Speed Backup
- All Software, Complete System
- Service and Support, easy
Installation

call (818) 343-6505 or write to
Contech Computer Corp.
P.O. Box 153 Tarzana Calif. 91356

CONTECH

Circle 69 on Reader Service Card

MAXELL 100% CERTIFIED BULK DISKS

5 1/4" DS/DD **59¢**
3 1/2" DS/DD **1.19**
5 1/4" DS/HD **1.59**

Price based on quantity of 300
includes sleeves, labels and tabs.

800-222-0490
In NJ 201-462-7628

• 24 Hour Shipment •

MEGAsoft

P.O. Box 710, Freehold, NJ 07728
Full service duplication facility

Circle 159 on Reader Service Card

Dealers!

Network-OS LAN Systems - Includes Boards,
Cabling, Terminators and Software. Two-user
hardware and software for under \$1,000 list!

Close-Up Remote Communications - Support
your customer without leaving your office.
Authored by Cogitate for Norton-Lambert!

Context Sensitive Help for DataFlex, RM/
COBOL, Clipper and dBase III - Puts your
application's documentation "on line."

DataFlex Database Management - True Multi-
User database for MS/PC-DOS, Unix and Xenix.
Site licensing available.

Dump/Restore-XT - Seven utilities for the MS/
PC-DOS user.

Call or write today for our catalog and pricing!

COGITATE, INCORPORATED

"A Higher Form of Software"
24000 Telegraph Road
Southfield, MI 48034
(313) 352-2345/Telex: 386581
Visa/MasterCard Accepted

Circle 53 on Reader Service Card

Get the whole story on graphics terminal emulation.

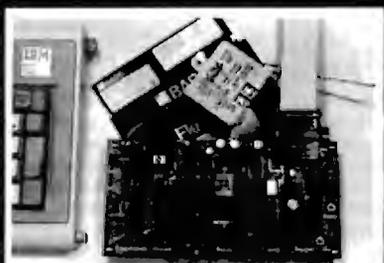


To find out more about software
that lets your PC emulate
TEKTRONIX™ 4105/6/7/9 and
DEC VT100™ terminals,
call or write:

GRAFPOINT

4340 Stevens Creek Blvd., Suite 280,
San Jose, CA 95129 (408) 249-7951

Circle 105 on Reader Service Card



6805/6305 SINGLE CHIP MICROCOMPUTER DEVELOPMENT SYSTEMS

Two systems allow the IBM PC/XT/AT to be used as
a complete development system for the MOTOROLA
6805 series single chip microcomputers. Model
MCPM-1 supports the MC68705P3, P5, U3, U5, R3,
& R5 chips. Model MCPM-2 supports the
MC1468705F2 & G2 CMOS versions. Both systems are
priced at \$495 and include a cross assembler pro-
gram, a Simulator/Debugger program and a program-
ming circuit board with driver software. A system is
also avail. for the HITACHI 63705 ZTAT micro.

THE ENGINEERS COLLABORATIVE

P.O. Box 53, West Glover, VT 05875
(802) 525-3458

Circle 90 on Reader Service Card

ROMDISK®

EPROM & SRAM
Disk and Drive
Emulators for
IBM PC, XT, AT
and Compatibles



FEATURES

- Disk and drive emulators up to 12 MB - standard and
cassette version
- Cassette versions available using SRAM or EPROM
technology to 786KB
- Devision programs on a diskette and simply copy
directly to ROMDISK
- Programming utilities provided for ROMDISK
- Auto-booting and file modes - operate up to four units
per computer
- Fast EPROM programming - approximately 180KB/min

APPLICATIONS

- Industrial control, instrumentation and manufacturing
test systems in environments hostile to disks
- Unattended remote site installations
- Diskless PC systems and workstations requiring
autoboot capability, reliability and high performance
- Military equipment requiring ruggedization and
operational reliability

List prices from \$495 (PC-1800) to \$1295 (PC-12MB)

CURTIS, INC. • 612/484-5064

10 Anemone Circle
St. Paul, MN 55127

*IBM is a registered trademark of IBM Corporation

Circle 73 on Reader Service Card



Presto!
A Link to
Mainframe
Graphics

Find out how our whole family of
EMU-TEK graphics terminal emulation
software makes good sense for the work you do.
Call today for more information.

**FTG DATA
SYSTEMS**

(714) 995-3900
(800) 962-3900 (800) 972-3900 (Calif.)
10801 Dale St., Suite M-2
Stanton, CA 90680

Circle 97 on Reader Service Card

BAR CODES MADE EASY

PC E-Z-READER

PERCON® E-Z-READER™

FAST • ACCURATE • RUGGED
NO SOFTWARE CHANGES with PC XT AT and
PS/2 AT&T 6300/7300 TeleVideo 905/955/
PL51 Wyse 30160/85/PE (A), Kimeron KI 71PC
Link PC Term MC 11 MC 1 & DEC V.1220 keyboards
multiuser RS 232C interfaces • Immediate ship-
ment • Free phone support • 2 year warranty •
Bar code printing software available

Details on Questions Call
(503) 344-1189

A LEADER IN BAR CODE READER ENGINEERING

PERCON®

Circle 102 on Reader Service Card



FCC APPROVED!

**Sub-Mini AT!
The Space Saver
3-DR. Capability
8-Expansion Slots!**

Comes with:

- 6-10-12 MHz Speed, 1 wait state
- 8 Expansion Slots
- Award Software BIOS
- 1 ea. 1.2MB high density floppy drive
- Floppy & HD controller
- 512K RAM (Expandable to 1M)
- 200-watt power supply
- AT Style keyboard
- Assembled & Tested
- Expansion options available

Order # MAT-1 **\$965.00**

XT Turbo Basic System

- 4.77/BMHz keyboard selectable
- 8 expansion slots
- Award Software BIOS
- XT Style slide case
- 256K RAM Expandable to 640K
- XT Style keyboard
- Assembled & Tested
- Expansion options available

Order # XT-TURBO-1
\$290.00

AT Turbo Basic System

- 6/10MHz, 0/1 wait state (6/12MHz option)
- 8 expansion slots
- Award Software BIOS
- 512K RAM (Expandable to 1M)
- 1.2MB high density floppy drive
- Floppy & HD controller
- 200-W power supply
- AT Style keyboard
- Assembled & Tested
- Expansion options available

Order # ATTURBO-1
\$945.00

PERIPHERALS

- | | |
|-------------------------------------|----------|
| 1. Floppy Disk Controller - 2Dr. | \$29.00 |
| 2. Floppy Disk Controller - 4Dr | \$34.00 |
| 3. WDC H.D. Controller | \$75.00 |
| 4. WDC H.D. Controller - RLL | \$105.00 |
| 5. Floppy & HD Controller - XT/AT | \$155.00 |
| 6. WDC Floppy & HD Controller | \$155.00 |
| 7. 0-384K Multifunction Card | \$79.00 |
| 8. Multi I/O (Ser/Par/Game/Clk) | \$54.00 |
| 9. Multi I/O With Controller | \$75.00 |
| 10. Multi I/O For AT (Ser/Par/Game) | \$52.00 |
| 11. 0-640K RAM Card | \$40.00 |
| 12. 0-2M EMS RAM Card For XT | \$99.00 |
| 13. 0-2M EMS RAM Card For AT | \$119.00 |
| 14. Color Graphics Card | \$45.00 |
| 15. Color Graphics Card W/Printer | \$55.00 |
| 16. EGA Card (Made in USA) | \$139.00 |
| 17. Mono Gr. Card W/Printer | \$50.00 |
| 18. XT Turbo Motherboard W/BIOS | \$95.00 |
| 19. 6/10 MHz AT Motherboard | \$370.00 |
| 20. 8/12 MHz AT Motherboard | \$410.00 |
| 21. 6/12 Mini AT Motherboard | \$410.00 |
| 22. XT Style Keyboard | \$47.00 |
| 23. AT Style Keyboard (AT/XT) | \$54.00 |
| 24. Enhanced Keyboard (AT/XT) | \$67.00 |
| 25. 150-watt Power Supply | \$49.00 |
| 26. 150-watt Power Supply-UL | \$60.00 |
| 27. 200-watt Power Supply-UL | \$95.00 |
| 28. XT Flip Top Case | \$32.00 |
| 29. XT Slide Case | \$34.00 |
| 30. XT Slide Case (AT Style) | \$47.00 |
| 31. AT Slide Case | \$63.00 |
| 32. Mini AT Slide Case | \$54.00 |

ORDER HOT LINE 1-800-543-5107
Technical Information (714) 990-2097

Hours: Mon. - Fri. 9:00 am - 6:00 pm PST

JAWIN COMPUTER PRODUCTS

565 W. Lambert Rd., #C
Brea, CA 92621

Terms: Please add 5% (or \$2.00, whichever is higher) plus 25¢ for each \$100.00 CA residents please add 6% sales tax. We accept VISA/MC/Cash. Personal checks please allow 2 weeks to clear. All merchandise is warranted for 1 year unless otherwise stated.

HARD DISK CONTROLLERS

ADAPTEC	
PC XT Controller ST506/412	\$59
3530 SCSI to Tape QIC 36	\$99
4000 SCSI to ST506/415	\$109
4070 SCSI to ST506/412 RLL	\$129
4520 SCSI to ESDI	\$139
5500 SCSI to ST506/412	\$255
5580 SCSI to SMD	\$450

XEBEC	
S1410 SASI Controller	\$109
S1420 SASI to 5 1/4" Floppy & Hard Disk Controller	\$99
Apple II, II+, IIE Host Adapter	\$29
Toshiba PC to SASI/SCSI Host Adapter	\$29
9205 Multibus Hard Disk Controller	\$199
9305D IEEE 488 (HPIB) to ST506/412 Controller	\$89
1490 SASI to SMD Controller	\$149

OTHERS	
OMTI 20C, L SASI Controller	\$99
DTC 510A SASI Controller	\$99
Shugart 1610-1.3 or 4 SASI/SCSI Controller	\$79
WD 1002 SHD Xebec Compatible SASI Controller	\$109



• Call for cable prices
• Controller manuals \$8 each

Computer Surplus Store "WE BUY AND SELL"
Phone 408-434-1060
FAX 408-434-0931
Telex 1561447
MC/VISA/Discover/COD's

Circle 65 on Reader Service Card

IBM PC/VT220

- EM220** • VT220, VT102 emulation
\$169
- File Transfer
 - 132 Column modes
 - Color Support
 - Hot Key

TEK 4010/4014

- EM4010** • Tektronix 4010 emulation
\$249
- VT220, VT102 emulation
 - Picture files
 - High resolution hardcopy
 - Supports IBM, IBM Enhanced, Hercules, Tecmar and AT&T.

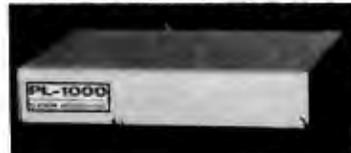


DCS
3775 Iris Ave., Suite 1B
Boulder, CO 80301
(303) 447-9251

Trademarks: VT220 - Digital Equipment; IBM PC, XT - IBM Corp.

Circle 82 on Reader Service Card

**DATA ACQUISITION TO GO
INTERFACE FOR ANY COMPUTER
FREE IBM SOFTWARE**



Connects via RS-232. Fully IBM compatible. 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.

(201) 299-1615

PO. Box 246, Morris Plains, NJ 07950

ELEXOR

Circle 88 on Reader Service Card

**DON'T
BUY A
BBS!**

Until You've Found
Out About DLX

Inner Loop Software
5456 McConnell Avenue
Los Angeles, CA 90066
(213) 822-2800 (Voice)

Circle 118 on Reader Service Card

**HIGH SPEED DATA
ACQUISITION AND ARBITRARY
WAVEFORM
GENERATION**



Add Waveform Acquisition and Arbitrary Generation (WAAG) capabilities to your IBM personal computer **\$895.00**

Your PC becomes a dual-channel scope and a waveform generator when you plug in this single-slot board. All the software you need is supplied to allow you to:

- Display and measure captured waveforms on one or two channels
- May also be operated in X-Y mode
- Create new waveform displays in the Generator Mode
- Save acquired or generated waveforms on disk
- Plot waveforms with Freeze or other graphics utility

MARKENRICH CORPORATION

1812 Flower Ave. • Duarte, CA 91010
810-359-9790 • TELEX: 298727 MARK UR • FAX: 810-359-5223

Circle 153 on Reader Service Card

**CAPITAL
AVAILABLE**

**\$1,000,000
Min.**

Will assist with financial plan,
for information call
Mr. ADAMS at WESTEX
714/964-2386

Circle 289 on Reader Service Card

MONTGOMERY GRANT

115 Nassau St. NY, NY 10038 Bet. Beekman & Ann Sts. (212) 732-4500
 Sun 9:30 - 5:30 / Closed Sat
 Mon - Fri, 8:30 - 6:30

Penn. Station, Amtrack Level
 Beneath Madison Sq. Garden, NY, NY. (212) 594-7140
 Open Mon - Wed, 8:30 - 8 / Thurs & Fri, 8:30 - 9 / Sat & Sun, 10 - 7

FOR ORDER & INFORMATION
 CALL TOLL FREE
 OPEN 7 DAYS A WEEK

1 (800) 345-7059

IN N.Y.S. CALL
 (212) 594-7140

FOR CUSTOMER SERVICE
 CALL (718) 965-8686

MON-FRI 9AM-6PM

FAX NO. 212-564-1497 TELEX 422-132

EPSON EQUITY II



IBM PC/XT COMPATIBLE PACKAGE

- Equity II Computer • 640K RAM
- Power • 360K Disk Drive • 10 MHz
- Serial/Parallel Ports • 12" High Resolution Monitor • Keyboard

\$899
 Same Package with 20MB Hard Drive **\$1169**

IBM XT



HARD DRIVE PACKAGE

- IBM XT Computer • IBM Keyboard
- 256K RAM Expandable to 640K • 360K Disk Drive • 20MB Hard Drive • Package of 10 Diskettes • (Monitor Optional)

\$1499
 IBM XT Package with 2 360K Floppy Drives **\$1199**

IBM PERSONAL SYSTEM 2



MODEL 25 PACKAGE

- 8088 Processor • 8 MHz • 512K RAM
- 1 720K Disk Drive • Keyboard • Serial & Parallel Ports • Monochrome Monitor

\$999
 Color System - Add \$200
 Personal System 2/Model 50...\$2549

IBM PERSONAL SYSTEM 2



MODEL 30 PACKAGE

- IBM Computer • Two 720K Drive
- 640K RAM • Built-in Graphics
- Serial/Parallel Ports • Optional 12" Monitor

\$1199
 PS/2 Model 30 w/720 Floppy Drive & 20MB IBM Hard Drive **\$1599**

NEC POWERMATE I PACKAGE



- 800288 8 MHz Processor • 640K RAM • 1.2 MB Floppy • 12" Monitor

\$1349
 w/20MB Hard Drive...\$1579
POWERMATE II with monitor \$1879

HARD DRIVES - CARDS - MODEMS

HARD DRIVES & CARDS

SEAGATE 20MB 1/2 Ht. w/Controller.....	\$279
30MB 1/2 Ht. w/Controller.....	\$319
40 MB 1/2 Ht. w/Controller.....	\$449
EVEREX EGA CARD.....	\$139.95
MINISCRIBE 40MB 1/2 Ht. w/Controller.....	\$389
CMS 20MB Card.....	\$339
CMS 30MB Card.....	\$379
TOSHIBA 360K 1/2 Ht. w/Floppy Drive.....	\$99

MODEMS & CARDS

EVEREX 1200 INT.....	\$85
EVEREX 1200 EXT.....	\$99
EVEREX 2400.....	\$179
M-2 Mouse.....	\$79

PRINTERS

EPSON		STAR	
FX-88E.....	\$318.95	NX-10.....	\$149.95
FX-288E.....	\$469.95	NX-10C.....	\$159.95
FX-800.....	\$429.95	NX-15.....	\$289.95
LO-800.....	\$389.95	NB-2410.....	\$399.95
LO-850.....	\$499.95	NB-2415.....	\$559.95
LO-1000.....	\$539.95		
LO-1050.....	\$679.95		
EX-800.....	\$419.95		
EX-1000.....	\$569.95		

PANASONIC

1080-I.....	\$159.95
1092.....	\$279.95
1091-II.....	\$179.95

TOSHIBA

321-SL.....	\$479.95
341.....	\$849.95
351-II.....	\$799.95

Laserjet Series II \$1649

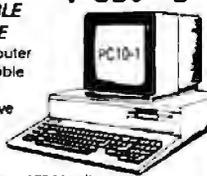
LEADING EDGE MODEL D PACKAGE



- 512K RAM Computer • Keyboard • 360K Floppy Drive • 4.7-7.16 MHz • 12" Monitor • 8088-2 Processor

\$799
 Same Package with 20MB Hard Drive **\$1049**

Commodore PC10-1



- PC10-1 Computer
- 512K Expandable to 640K
- 360K Disk Drive
- Enhanced Keyboard
- Serial & Parallel Ports • 12" Monitor
- All Hook-up Cables & Adapters
- Package of 10 Diskettes

\$529
 Same Package with 20MB Hard Drive **\$789**
PC10-2 IBM PC/XT COMPATIBLE PACKAGE \$649

SANYO



MBC-875 IBM PC/XT COMPATIBLE PRINTER PACKAGE

- 640K RAM • Two 360K Drives • High Resolution Monitor • 80 Column Printer • Parallel & Serial Ports
- Package of 10 Diskettes • Keyboard

\$669
 W/ONE 360 K DRIVE **\$869**
 20 M B HARD DRIVE
 INCLUDES FREE SOFTWARE

IBM PC/XT COMPATIBLE PACKAGE

- Keyboard • 640K RAM Power TurboSpeed • 4.778 MHz • Two 360K Floppy Drives • MS DOS
- Mon • Graphics Card • High Resolution Mono Monitor • FREE Word Processing software

\$679

COMPAQ



DESKPRO MODEL 2.....\$1150

DESKPRO 286

MODEL 1.....\$2190

DESKPRO 286

MODEL 20.....\$2899

Apple PACKAGES



- Apple IIC or IIE Keyboard 5.25" Disk Drive 12" Monitor All Hook-up Cables and Adaptors Package of 10 Diskettes

APPLE IIC APPLE IIE \$579 \$799

Apple IIGS Computer 3.5" Drive Apple RGB Color Monitor Package of 10 Diskettes All Cables & Adapters Apple Software **\$1379**

MAC PLUS Computer Package.....\$1579
 IMAGEWRITER Printer.....\$449
 MAC SE Computer w/Dual Drive.....\$1949
 MAC SE Computer w/20MB APPLE Hard Drive.....\$2499
 APPLEWORKS Software.....\$89

LAPTOPS MONITORS



TOSHIBA 1000

720K Floppy Drive 512K RAM 4.77 MHz Super Twist LCD Screen

NEC MULTISPEED EL.....	\$1549
NEC MULTISPEED.....	\$1249
TOSHIBA 3100/20.....	\$3295
ZENITH 181.....	\$1599
ZENITH 183.....	\$2299
SPARK by DATAVUE 640K w/two 720I Drives.....	\$1099

COMMODORE 1902 RGB Color Monitor.....	\$214
COMMODORE 2002 New RGB Color Monitor.....	\$229
THOMPSON 14" CGA Monitor.....	\$289
GOLD STAR EGA Monitor.....	\$369
w/1in EGA Card.....	\$489

Get Commodore **AMIGA 500** NEW AMIGA 500 COMPUTER 68000 Processor • 512K RAM Power Expandable to 9MB • Graphics Capability

WE WILL BEAT ANY PRICE

AMIGA 1010 DISK DRIVE
 AMIGA 1020 DISK DRIVE
 AMIGA 501 - 512K EXPANSION
 2002 RGB COLOR MONITOR
 THESE & ALL OTHER PERIPHERALS IN STOCK!

Commodore 128 PACKAGE

Commodore 128 Computer Commodore 1571 Disk Drive Commodore 1902 Color Monitor Commodore 1515 80 Column Printer **\$729**

Commodore 64/c PACKAGE

Commodore 64/C Computer Commodore 1541 Disk Drive Computer Printer 12" Computer Monitor **\$399**

AMIGA 500 w/2002	AMIGA 500 w/2002 /1010
\$769	\$979

AMIGA 2000-WILL BEAT ANY PRICE



Certified checks, bank checks, MasterCard, Visa, AMEX, Diner's Club, Carte Blanche, Discover Card and C.O.D.s accepted. No additional charge for credit card orders. Non-certified checks must wait 1-2 weeks clearance. Money orders are not refundable. Please add 5% for shipping and handling. Minimum shipping charge is \$10. APO/FPO and PO Box addresses: please call for shipping charges. N.Y. residents add applicable sales tax. Prices and availability subject to change without notice. Not responsible for typographical errors. Returns of defective merchandise must have prior return authorization number. Not responsible for IBM PC/XT are registered trademarks of International Business Machines Corp. All orders can be shipped Air Express - call for details. For your protection, we check for credit card theft.

NO ADDITIONAL SURCHARGE FOR CREDIT CARD ORDERS

Circle 186 on Reader Service Card

DISK-KING®

WORLDWIDE SALE!!

WHY RISK THE UNKNOWN...when you can get premium quality disks from the Leader and Inventor of magnetic media...for less!!

- 100% tested & certified at 60% or higher clippage level
- Sturdy thicker PVC jacket
- Made in the USA
- LIFETIME WARRANTY

5.25" DS-DD Diskettes: **Bulk** **Boxed**

DISK-KING	35	38
DISK-KING Color	48	55
3M No Logo	52	62
DISK-KING DSHD-AT	95	1.05
DISK-KING Color-DSHD	1.05	1.15

3.5" DS-DD Diskettes:

DISK-KING	1.09	1.19
DISK-KING Color	1.19	1.29

All 5.25 diskettes are supplied with Tyvek sleeves, color coded, 0.001" w/1.00" tabs. **COLOR DISKS IN RAINBOW ASSORTMENT**

DISKCOtechnicolor®

- Warranted Forever
- 100% tested & certified
- Clipping level-75%
- Exceeds ANSI Specs
- 14 color options
- Tyvek® & labels

DS-DD-48 TPI	5.25"	DS-HD-96 TPI
.59	COLOR BULK	1.19
.79	Plastic Library Box	1.29
3.50" DS/135 TPI	Color	1.49
Plastic Library Box		

3M MARK Q

performance through quality

DS-DD	Quantity Discounts Available	DS-HD
.79	5.25"	1.59
1.59	3.50"	4.75
1.53	8.00"	2.05

3M Headin Kit for 5.25" ... 6.99 for 3.5" ... 10.99
 3M Mag. Tape 2400' w/seal ... 10.99
 3M Mag. Tape 1200' w/seal ... 7.99
 DC-1000 ... 12.75 DC-300XL/P ... 19.45
 DC-2000 ... 17.25 DC-600A ... 21.65

3M's Highland Diskettes

DS-DD	DS-HD
.50	1.25

10/Box with sleeves, labels, tabs

BASF

★ FREE Color-Coded Modular Flexy Files a \$19.95 value!

5.25" DS-DD in *Minidex/60	.83
3 50" DS DD in *Microdex/25	1.49
5 25 DS-HD in Soft Box	1.29
3 50" DS-DD in Softbox	1.42
5 25" DS DD in Plastic Library Case	.79

Nashua

BRAND DISKETTES pre-formatted also available!!!

5 25" MD2D(DS/DD) Boxed	.53
5.25" MD2HD (DS-HD) Boxed	1.29
5 25" MD 2F (DS-DD 96TPI) Boxed	1.19
3 50" MF-2 (DS-DD) Boxed	1.39

RIBBONS STORAGE

IBM 8" x 11" 80/100	2.89	3M Desktop 50	7.95
MX/RX/FX 100-185	3.75	3M D/Defender 070 w/key	14.95
IBM L01000	3.99	3M Data Defender 050	14.99
IBM L01500	3.99	SRW Maudex/60	9.95
IBM L01500	1.19	SRW Microdex/25	9.50
Okidata 182/192/193	3.45	IBM Proprinter	3.99
Apple Imagewriter	2.75	Panasonic KXP	4.99

TERMS: No surcharge on VISA MasterCard or AMEX. CDD add \$3.00. Prepaid deduct 2% cash discount. PPA accepted from recognized institutions and corporations on Net 30. Shipping \$4.00 or fewer disks. Foreign orders: APD/PPD please call. Reduced shipping on larger quantities.

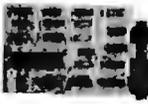
1-800-523-9681 **1-801-572-3589**

TLX-9102404712 FAX-801-572-3327

DISKCOtech

DISKCO TECHNOLOGIES, INC.
 P.O. Box 1339 Sandy, Utah 84092

8080 Z80 HD64180 CP/M-80



D64180

Develop code for embedded microprocessors on your IBM-PC using our software tools and coprocessor cards. Test your software on our Z80 and HD64180 coprocessor cards. Execute your CP/M-80 development tools at clock speeds up to 12.5 MHZ! Use our remote debugger to debug in your target system. Complete development systems for less than \$1000.

Z-World
 1772A Picasso Ave
 Davis, CA 95616
 (916) 753-3722



In Germany: iSystem Tel: 08131/1687

Circle 302 on Reader Service Card

C See how well you can program for Z80 or HD64180

This professional, IBM-PC based, compiler is a complete implementation of the "C" language for the Z80 or HD64180 microprocessor. Includes features such as: function prototyping, 31-character names, single precision floating point, full library source, M80-L80 and SLR Systems compatibility, etc. Hi-Tech™ "C" has been established for years in Australia. Pricing from \$195.00. We also have Z80/HD64180 coprocessor cards for IBM-PC and PC/AT. Call for a full catalog of Microprocessor development tools.

Z-World
 1772A Picasso Ave.
 Davis, CA 95616
 (916) 753-3722



"Z80 Specialists"
 In Germany: iSystem Tel: 08131/1687

Circle 303 on Reader Service Card

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
 Wintek Corp.
 1801 South Street
 Lafayette, IN 47904
 317-742-8428

Circle 295 on Reader Service Card

BIGMOUTH™

REAL VOICE Digital Recording for your PC, XT, AT or Compatible

- VOICE MAIL SYSTEM Full Featured Unlimited Boxes
- TELEMARKETING Intelligent Inbound and Outbound Capabilities, User-Definable Structure
- ADVANCED ANSWER CAPABILITIES Toll-saver Message Forward Timed Calls, Touch-Tone Remote
- AUTODIALER—DATABASE Auto Search and Sort Auto Redial
- VOICEPAD™ Voice AND Sound Effects for your Programs Demos, and Tutorials

Complete with Hardware, card, software, phone cable, and external speaker

\$239.00 - 5.49
(415) 339-TALK
 Talking Technology, Inc.
 6558 Lucas State 301 Oakland, CA 94611

Circle 264 on Reader Service Card

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 12 - \$58 14 - \$ 89 22 - \$109 24 - \$169
 Parallel 12 - \$78 14 - \$139 22 - \$119 24 - \$199
 LED and spike protection on serial models add \$20

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 - \$485 4 B \$795 selector - \$39

Give a Rose to your computer

ROSE ELECTRONICS (713) 933-7673
 P.O. BOX 742571
 HOUSTON, TX 77274
 MC & VISA Accepted
 Dealer Inquiries Invited
 CALL US FOR ALL YOUR INTERFACE NEEDS

Circle 236 on Reader Service Card

Beat the limits! vfeature™ DELUXE

Software for hard disks

- DOS partitions to 1 GIGABYTE
- Spans two drives in one bootable partition
- Supports big drives on AT and XT
- Secures data

GOLDEN BOW SYSTEMS

\$120
 \$3 shipping/handling California orders add 6%



2870 Fifth Avenue Suite 201 San Diego, CA 92103
619/298-9349

Circle 104 on Reader Service Card

WE CUSTOM CONFIGURE ALL SYSTEMS • CALL 800-654-7762 For YOUR Configuration

 **CAT 8MHZ**
BASE SYSTEM

- 256K (Optional 640K)
- 150 Watt Power Supply
- AT Style Keyboard
- 4.77 or 8 MHZ Keyboard Selectable
- FDC Controls 4 Disk Drives
 - 8087 Socket
 - 360K Floppy Drive



\$36900

 **CAT 286-10**
BASE SYSTEM

- 512K (120 NS)
- 200 Watt Power Supply
- AT Style Keyboard
- Western Digital Controller
- Teac 1.2 Meg Floppy
- Legal Bios w/manuals
- Systems Documentation
 - 1 Year Warranty
 - Clock Calendar
- 10 MHZ - 0 Wait State



\$89800

HARD DRIVES



COMPLETE KITS

- ST225** 20Meg w/cont. & Cables **279⁰⁰**
 - ST238** 30Meg w/cont. & Cables **299⁰⁰**
 - ST251** 40Meg 1/2 HT 40 Mil w/software **429⁰⁰**
 - ST4051** 40Meg Full HT w/software **459⁰⁰**
- ST225 & ST238 come with Western Digital Controllers

1 Yr. Warranty
Bitcom Software

MODEMS



- EV-920** EverCom 12 300/1200bps. **84⁰⁰**
- EV-940** Internal 300/1200/2400 **179⁰⁰**
- EV-945** External 300/1200/2400 **239⁰⁰**

Complus

- 1200 Baud w/Bitcom **69⁰⁰**

POWER SUPPLIES

- 150 Watt
 - UL Approved
 - Direct PC Replacement
- 59⁰⁰**

3 1/2 DISK DRIVES
by TOSHIBA

- 720k w/mounting Brackets
- 109⁰⁰**

TAPE BACKUPS



- 40Meg Internal XT or AT **349⁰⁰**
by TEAC
 - 60Meg Internal w/Qic-02 **595⁰⁰**
 - 60Meg External w/Qic-02 **868⁰⁰**
- This Month's SPECIALS at our COST**
- H Placer Set II** **1695⁰⁰**
 - Boldstar Ega Monitor 650x350** **335⁰⁰**
- (Expires 1-31-88)

COPROCESSORS

- Intel 8087 5Mhz **102⁰⁰**
 - Intel 8087 8Mhz **149⁰⁰**
 - Intel 80287 6Mhz **179⁰⁰**
 - Intel 80287 8Mhz **249⁰⁰**
 - Intel 80287 10Mhz **289⁰⁰**
 - Intel 80387 16Mhz **479⁰⁰**
 - Intel 80387 20Mhz **747⁰⁰**
 - Intel Above Board **CALL**
- MEMORY UPGRADES**
- 256k 100NS **5⁰⁰ ea**
 - 256k 120NS **4⁰⁰ ea**
 - 256k 150NS **3⁰⁰ ea**

HARD CARDS

- by OSICOM Technologies
- 32.7 MB FORMATTED
 - USES ONLY 1 1/2 SLOTS
 - INSTALLS IN SECONDS
 - 65 MSEC ACCESS
 - AUTO HEAD PARKING
 - SHOCK MOUNTED
 - 1 YEAR WARRANTY
- 30Meg **379⁰⁰**
 - 20Meg **309⁰⁰**

LIQUIDATION SALE — ALL ITEMS LISTED BELOW

50% — 80% OFF LIST PRICE

MEAD Computer has just purchased these items from an OEM at a liquidation price
We are passing these savings and warranties on to you!

- Mac II Monitor
- Major Mfg.
- 640x480 VGA
- 14" w/cable
- List 895⁰⁰ Mead's 495⁰⁰

- 1.2 Meg Floppy Drive
- 5 1/4 - 1/2 HT
- 6 Month Warranty
- Major Mfg.
- List 189⁰⁰ Mead's 79⁰⁰

PC Security Lock

Security lock guards the on/off power switch on your PC. Simply turn off the power and lock up the switch. The lock is constructed of heavy-gauge metal. It's easy to install and won't void your computer's warranty.

List 79⁰⁰ Mead's **19⁰⁰**

10MEG HARD DRIVE

- 1/2 Height/Factory Fresh
- 80 Mil. Sec.
- 3 Month Warranty

List 299⁰⁰ Mead's **129⁰⁰**

3M Equivalent Data Cartridges

- DC 300 XLP
- 45 Meg (450 ft)
- Individually Wrapped
- 5 Year Warranty

List 39⁰⁰ Mead's **14⁰⁰ ea**

4128-128k Upgrades

225 ea
NEC V-20 80 Mhz
900

Intel Above Board

- 2010 - 128K Exp. to 2Meg
- PC AT Compatibles
- Provides Conventional-Expanded & Extended

List 545⁰⁰ Mead's **199⁰⁰**

TANDON TM100-2A

- This was the original drive used by IBM
- Full Height
- 360k

List 249⁰⁰ Mead's **89⁰⁰**

EPSON LQ 1500 Tractors

- This tractor has been discounted by EPSON
- Mead has purchased remaining stock at a liquidating sale

List 99⁰⁰ Mead's **39⁰⁰**

MIGENT DATABASE

- Software
- Ability 1.0A
 - Database Manager
 - Spreadsheet • Word processor
 - Communications & More

List 199⁰⁰ Mead's **29⁰⁰**

ALL TRADEMARKS ARE REGISTERED with their respective companies

800-654-7762

SALES
7AM—6PM PST

702-294-0204

Customer Service • Order Status
9AM—4PM PST

FAX

702-294-1168



1000 Nevada Highway • Unit 101
Boulder City, Nevada 89005

NO SURCHARGE FOR MC/VISA

TERMS:

- MC • VISA • COD • CASH
- Purchase Orders from Qualified Firms
- Personal Checks • AE add 4%



SHIPPING: (Minimum 6⁰⁰)
UPS • Federal Express

DiskMASTER[®]
The Ultimate Diskette Value ...



Discover the Difference ...
2 FOR 1 LIFETIME WARRANTY

- ✓ Pkg'd in 6 different colors, bulk or boxed
- ✓ Backed by 2 for 1 Lifetime Warranty
- ✓ 100% tested and certified
- ✓ Made to exceed A.N.S.I. specs by 62.5% with a guaranteed clipping level of 65% or above
- ✓ Includes tyvek envelopes (not paper), write protect tabs and user labels
- ✓ Brand-name quality at affordable prices

5-1/4" - 48 TPI DS-DD	DS-HD 96 TPI IBM-AT Compatible
.49	1.09
BULK COLOR OR GRAY	
.59	1.19
BOXED COLOR	

Simply top Brand-Name Quality, made in the U.S.A. by a leading manufacturer. Factory polybagged in lots of 20 (min order 40)

AMERICA'S
WCENTECH[®] Premium Quality Color Diskettes

- ✓ TIMELESS WARRANTY
- ✓ Performance exceeds A.N.S.I. spec. by 88%
- ✓ Each disk 100% tested and certified
- ✓ 14 COLORS for data organization
- ✓ Pkgs. of 10 tyvek sleeves, w/p tabs, & ID labels

5-1/4" - 48 TPI DS-DD	DS-HD 96 TPI IBM-AT Compatible
.89	1.55
PLASTIC STORAGE BOX COLOR	
.69	1.25
BULK COLOR	
3-1/2" - 135 TPI DS-DD COLOR	3-1/2" - 135 TPI BLACK DS-HD
1.75	4.90
PLASTIC STORAGE BOX	

3M America's No. 1 Name-Brand Diskettes

5-1/4" - 48 TPI DS-DD	DS-HD 96 TPI IBM-AT Compatible
.79	1.60

With FREE Platen Cleaner

Nashua

5-1/4" - 48 TPI DS-DD	DS-HD 96 TPI IBM-AT Compatible
.54	1.45
BOXED	

BULK

32¢ 5-1/4" DS/DD 48 TPI
 Exceeds ANSI specifications + 6¢ FOR TYVEK

ORDERING INFORMATION

TERMS: P.O. orders accepted, government and schools on net 30. SHIPPING: U.S. orders add \$3.00 per 100 diskettes or fraction thereof, add \$3.00 for COD orders
 PRICE PROMISE: We will better: any lower delivered price on the same products and quantities advertised nationally

MasterCard   

Toll Free Order Line: **1-800-233-2477** Information Line: **1-801-561-0092**

Computer Affairs, Inc. 199 COTTAGE AVE.
 SANDY, UTAH 84070
 HRS: 8 AM TO 5 PM (MTN. TIME)

9-TRACK MAG. TAPE SUBSYSTEM[®]
FOR THE IBM PC/XT/AT AND...



For information interchange, backup and archival storage AK Systems offers a 9-track, IBM format-compatible 1/2" magnetic tape subsystem for the IBM PC, featuring:

- IBM format 1600 3200 and 800 cpi.
- Software for PC-DOS, MS-DOS, XEMIX
- Also for AT&T, DEC, VAX, VME, S-100, RS-232, IEEE 488.

AKSystems
 20741 Marina St
 Chatsworth, CA 91311
 (818) 708-4100
 Telex: 910-860-2671

Circle 7 on Reader Service Card

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
 SAFWARE, The Insurance Agency, Inc.

Circle 237 on Reader Service Card

16-BIT RESOLUTION ANALOG-TO-DIGITAL CONVERTER
12,000 SAMPLES/SEC
for IBM PC, XT & AT
SINGLE PIECE PRICE \$475

We manufacture a broad line of data acquisition and control hardware and software for Apple and IBM computers.

Call for quotes on custom hardware or complete systems.

LAWSON LABS, INC.
 5700 RAIBE ROAD
 COLUMBIA FALLS, MT 59912
 406-387-5355

Circle 141 on Reader Service Card

Dynamic Electronics CO.  **Where the CUSTOMER Comes First!**

8087 - 5, 8, 10 MEG
80287 - 6, 8, 10 MEG
80387 - 16, 20 MEG
64K • 256K • 128K
V20 • V30

No refund, only exchange.
 Exchange good for 30 days, unless manufacturer warranties merchandise longer

Phone: (714) 582-1224
FAX: (714) 582-3780
 27402 Camino Capistrano Suite 112
 Laguna Niguel, California 92677

Circle 85 on Reader Service Card

\$69.95 **PC-BANDIT**
(A STEAL!)



Affordable accelerator for IBM[®] PC and compatibles

- PC-BANDIT speed is user selectable at 7.4, 6.7 or 6.2 MHz
- Software selectable at 4.7 or BANDIT speed
- No expansion slot required
- Includes 3 software programs, including TSR Speed Select Software
- Maintains correct system clock speed
- Fully compatible with virtually all PC-based software
- Quick and easy to install
- Increases speed as much as 280%
- 8 MHz NEC V20 CPU option only \$16.95* (Plus shipping)

PRISM ELECTRONICS, INC.
 14882 NE 85th St., Redmond, WA 98052
(806) 881-1088
 (Dealer inquiries invited)

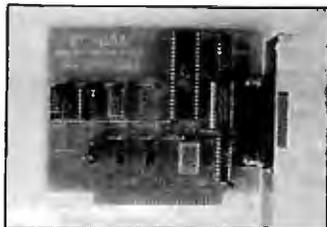
Circle 215 on Reader Service Card

DATA ACQUISITION PROCESSOR[™]

- onboard intelligence for IBM PC/XT/AT
- analog and digital I/O to 150,000 samples/second
- 80186 coprocessor — real time processing
- onboard software, incl. FFT
- run applications without programming
- direct access to Lotus 1-2-3
- manual with tutorial and sample applications — \$20
- digital I/O from \$995
- analog I/O from \$1695

MICROSTAR LABORATORIES  (206) 881-4286
 2863 152 Ave. N.E.
 Redmond, WA 98052
 Telex 510 601 3473

Circle 181 on Reader Service Card



PC488 \$145

LOW COST PC/XT/AT INTERFACE FOR IEEE-488 (GPIB/HPIB)

- SHORT CARD FOR PC/XT/AT & COMPATIBLES
- 1 OF 6 INTERRUPT LEVELS
- 1 OF 2 DMA CHANNELS
- UP TO 4 BOARDS PER COMPUTER
- CONTROLLER / TALKER / LISTENER
- INCLUDES SOFTWARE DRIVERS
- CUSTOM SOFTWARE SUPPORT AVAILABLE
- COMPATIBLE WITH MOST IEEE488 SOFTWARE PACKAGES FOR THE IBM PC
- QUANTITY DISCOUNTS

Call today for details!!

B&C MICROSYSTEMS

355 West Olive Ave, Sunnyvale, CA 94086
PH: (408) 730-5511 FAX: (408) 730-5521 TPLEX: 094185
VISA & MC accepted

Circle 25 on Reader Service Card

Products & Solutions for Electronic Information Delivery

- Digital Audio Record & Playback Systems
- Graphics Genlock
- CD-ROM Controllers
- CD-ROM & WORM Applications
- Optical Retrieval Systems
- Image Compression/Expansion Systems for Document Delivery
- LAN for Optical Media
- Multi-drive Optical Storage Units
- CD-ROM Premastering

Online is an authorized IBM Value Added Dealer (VAD) and Advanced Product Dealer (APD). OEM AND DEALER INQUIRIES ARE INVITED



Dept. B-2, 20251 Century Blvd.,
Germantown, MD 20874
(800) 922-9204 • (301) 428-3700
• Telex: 3746439 • Fax: (301) 428-2903

IBM is a registered trademark of the International Business Machines Corporation

Circle 194 on Reader Service Card

BULK DISKS

TDK	5 1/4" DS/HD	\$1.29
KAO	5 1/4" DS/HD	\$1.19
SONY	3 1/2" DS/DD	\$1.17
TDK	3 1/2" DS/DD	\$1.15
DATASAFE	5 1/4" DS/HD	99¢
MAXELL	5 1/4" DS/DD	64¢
VERBATIM	5 1/4" DS/DD	59¢
3M	5 1/4" DS/DD	57¢
DATASAFE	5 1/4" DS/DD	39¢

Price Based On Quantity of 200
Includes labels, sleeves & tabs.

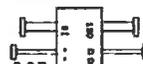
800-426-0247

In NJ (201) 840-8911

MC Smaller Qty. Avail. VISA

PRINCETON DISKETTE
415 CENTRAL BLVD BRICK, N J

Circle 211 on Reader Service Card



Not only a printer buffer!

DCB THIS IS THE MOST SOPHISTICATED PRINTER BUFFER - MULTIPLEXOR - SWITCH

WITH TWO SEPARATE INPUT (SERIAL AND PARALLEL) AND TWO SEPARATE OUTPUTS (SERIAL AND PARALLEL) CAN BE USED LIKE STANDARD BUFFER WITH ANY INPUT TO ANY OUTPUT. BUT ALSO YOU CAN CONNECT 2 COMPUTERS TO 1 PRINTER OR 1 COMPUTER TO 2 PRINTERS OR 2 COMPUTERS AND 2 PRINTERS AND MORE - 1 COMPUTER TO 2 PRINTERS OR 2 COMPUTERS TO 1 PRINTER. HIGH CAPACITY: 64 KB TO 256 KB AND 256 KB TO 1 MB (MODELS A AND B). PAUSE, COPY AND RESET FUNCTIONS. SERIAL PORTS WITH 1 OR A RITS WORD LENGTH, 1 OR 2 STOP BIT, PARITY XON/XOFF DTR, RTS.

DCB-A-64K \$ 195 DCB-B-256K \$ 255 (**)

(**) Power supply and parallel ribbon are included

ALSO, WE HAVE THE MOST COMPLETE DATA CONVERTER UNIT CONVERTS RS232 SERIAL TO CENTRONICS PARALLEL OR VICE VERSA. JUST BY MOVING JUMPERS BAUD RATE AND PROTOCOL FULLY PROGRAMMABLE FROM 100 TO 19900 BAUDS INCLUDES DTR, RTS, XON/XOFF PARITY, etc.

DCU \$ 80 (**)

(**) Power supply and ribbon NOT included



serial to parallel
bi-directional converter



INTECRA Inc Dept 272

2025 TERMINAL BLVD

MOUNTAIN VIEW CA 94043

(415) 967-8818 TX 345545

Serial Parallel



Convert What You Have To What You Want!

- RS232 Serial
- 8 Baud Rates
- Latched Outputs
- Centronics Parallel
- Handshake Signals
- Compact 3, 4, 5, & 15

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 (SerPar) or Model 775 (ParSer) Today!

WE'VE MOVED!!

tigertronics

only \$89.95

Connector Option \$10.00
CA Residents 6% Tax
UPS Shipping \$3.00

400 Dairy Lane

P.O. Box 5210

Grants Pass, OR 97527

Call (503) 474-6700 or 474-6701

For FAST Delivery

Circle 272 on Reader Service Card

TERMINAL EMULATIONS

NEW SOFTERM PC,
RELEASE THE LEADER IN EXACT
TERMINAL EMULATIONS

* OVER 30 EMULATIONS

- KEYBOARD MACROS
- VIRTUAL DISK CAPABLE
- KEYBOARD TRANSLATE
- CAPTURE FILES TO DISK OR PRINT
- FILE TRANSFERS WITH 7 PROTOCOLS (I.E. KERMIT, SERVER, Hayes, XMODEM, ETC.)
- CONCURRENT AND BACKGROUND COMMUNICATIONS AND MORE!!!

A COMPLETE EMULATION & COMMUNICATION PACKAGE

SEIFTRONICS

800/225-8590

CALL FOR INFORMATION

1303193 3540

TEL: 4-800-26

Circle 247 on Reader Service Card

9-Track Tape Subsystem for the IBM PC/XT/AT



Now you can exchange data files between your IBM PC and any mainframe or mini-computer using IBM compatible 1600 BPI 9-Track tape. Unit can also be used for disk backup. Transfer rate is up to 4 megabytes per minute on PCs and compatibles. Subsystems include 7" or 10 1/2" streaming tape drive, tape coupler card and DOS or XENIX compatible software. Prices start at \$2,995.

QUALSTAR

9621 Irontdale Ave., Chatsworth, CA 91311
Telephone: (818) 882-5822

Circle 224 on Reader Service Card

PC + MIDI = MUSIC

It's a simple equation. To plug your PC or PC-compatible into the modern world of music-making, use the complete line of MIDI software and hardware from VOYETRA TECHNOLOGIES.

- SEQUENCER PLUS: 65-track total MIDI recorder/editor
- CONVERSION PLUS: The converter for music notation programs
- PATCH MASTER: network organizer and sound librarian
- OP-4001 PC/MIDI interface card

"I've never seen a more powerful, easy-to-use music and recording system bug-free"

(PC COMPANION)

For more information contact VOYETRA TECHNOLOGIES, Dept. PC 426 MI Pleasant Avenue, Mamaroneck NY 10543, or call (914) 698-3377

Circle 287 on Reader Service Card

Quelo[™] 68000 Software Development Tools

First release 1983 - MOTOROLA compatible - produces ROMable code, S-records, extended TEK, Intel, UNIX COFF, Portable SOURCE CODE. Native and cross versions on: ATARI ST, AMIGA, Masscomp, Sun, Apollo, Charles River, VAX VMS and UNIX.

68020 Cross Assembler Package
Supports 68000 68010, 68020, 68881 and 68891
For CP/M-86K and MS/PC-DOS 3.50

68000/68010 Cross Assembler Package
For CP/M 80 85-86K and MS/PC-DOS 3.50

68000 "C" Cross Compiler
For MS/PC-DOS by Lantec Inc. 3500

68020 Disassembler
Supports 68000 68010 68020 68881 68891
For CP/M-86K and MS/PC-DOS 3.50/3.86
Amiga and Amn ST 3119/7P CROS UNOS 3860/380

68000/68010 Software Simulator
For MS/PC-DOS by Big Bang Software Inc. 3793 VAX 51600

Call Patrick Adams today. Quelo, Inc.
2464 33rd West, Suite #173
Seattle, WA USA 98199
Phone 206/265-2528
Telex 310-333-6171

Sale, Corporate, OEM licenses
ODD, Visa, MasterCard

The Quelo Quelo Inc. MS, Microsoft Corporation, CP/M Digital Research

Circle 228 on Reader Service Card

CROSS-16 META ASSEMBLER

- Table based 8 16 bit cross-assembler
- Uses manufacturer's assembly mnemonics
- Tables & Example Source files are included for ALL of the following processor families.

1802	3870	64180	6502
65816	6801	6805	6809
6811	68000	7000	8048
8051	8085	8086	8096
COP800	SUPER8	28	280

- Users may modify or create new tables for additional processors
- Produces listing symbol table and 8/16 bit binary, Intel and Motorola hexcode
- 5 DSDD for PC/MS-DOS 2.0 or greater
\$99.95 US \$139.95 CDN
- Portable C sourcecode is available

Worldwide shipping (AIRMAIL) & handling included. Credit Card orders (\$139.95 CDN) please specify Card number name on card and expiry date

Universal Cross-Assemblers
P.O. Box 384, Bedford, N.S.
Canada B4A 2X3

Circle 278 on Reader Service Card

P-tral
BASIC to Pascal

\$179

TRANSLATOR

Translate your BASIC source programs to Pascal source. P-tral, now available for the IBM PC and compatibles, will translate MS-BASIC/BASICA to Turbo Pascal (Req Dos 2.0 or later w/ANSI.SYS).

Also available for the Apple II series (incl. IIGS) and converts Applesoft to Apple Pascal.

(212) 206-6490 / 924-0576
WOODCHUCK INDUSTRIES
340 WEST 17TH STREET (#2B)
NEW YORK, NY 10011

Circle 296 on Reader Service Card

AVPROM[™]

\$295



For IBM-PC's & compatibles, menu-driven AVPROM programs EPROMs up to 8x faster than serially-connected units (20 sec. for 2764).

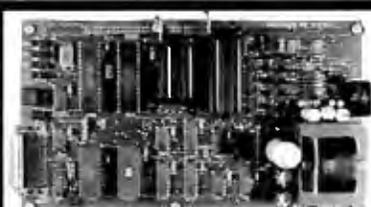
- Programs 2716 thru 27512A and CMOS variants
- 4- and 10 socket gang versions too. Call for prices.

For complete specs, free 32 pg. development tool catalog, call

800-448-8500
or 207-236-9055

AVOCET SYSTEMS, INC.

120 Union St., Rockport, ME 04856



UNIVERSAL E/EPROM PROGRAMMER KITS FROM \$95

- On board power supply (110/220V AC).
- No personality modules; Device selection by menu.
- Direct technical support; Full 1 year warranty.
- User friendly software; Complete help menu.
- Quick pulse algorithm (27256 under 60 sec).
- All 24/28 pin parts to 1 Mbit; CMOS; EEPROMS.
- Micros: 8741, 8742, 8748, 8748H, 8749, 8749H & more.
- IBM-PC, Apple, CPM or Unix driver; Autobaud RS232.
- Offset/split Hex, Binary, Intel & Motorola 8,16,32 bit.
- Manual with complete schematics.

Call today for datasheets !!

B&C MICROSYSTEMS
355 WEST OLIVE AVE. SUNNYVALE, CA 94086
PH: (408) 730-5511 FAX: 408-730-5521 TELEX: 984185
VISA & MC accepted.

Circle 26 on Reader Service Card

"D" SIZE PLOTTER

\$2295⁰⁰ RETAIL

\$1695⁰⁰ INTRODUCTORY OFFER



- Model PC 3600
- Repeatability .001"
- Speed at 7" Per Second
- Vacuum Paper Hold Down
- High Resolution Circles: Suitable for PCB Artwork

(415) 490-8380 **ZERICON**
4423 ENTERPRISE ST. • FREMONT, CA 94538

Circle 301 on Reader Service Card

MODEL ROMX-2 . EPROM EMULATOR

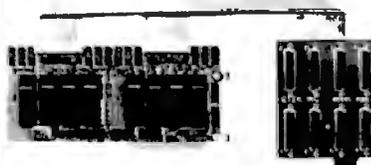
NEW!



- EMULATES 2716-27256 EPROMS.
- FAST 19,200 BPS TRANSFER RATE
- MENU DRIVEN EPROM SELECTION.
- AUTO EMULATION ON POWER-UP.
- BATTERY BACK-UP MEMORY.
- FACILITIES FOR FORMATTED CODE LISTINGS.
- PAYS FOR ITSELF WITH FIRST PROJECT.
- SOFTWARE INCLUDED, SUPPORTS SPLITS FOR 16 AND 32 BIT SYSTEMS.

MODEL PCSS-8X MULTIPOINT SERIAL BOARD

NEW!



- ALL EIGHT PORTS ARE DOS COMPATIBLE.
- EIGHT RS232 PORTS; CAPABLE OF SIMULTANEOUS OPERATION.
- ENHANCED INT 14H BIOS DEVICE DRIVER WITH INTERRUPT DRIVEN RECEIVE QUEUES AND AUTOMATIC HANDSHAKING.
- USED IN REAL TIME EVENT DRIVEN APPLICATIONS.
- OPTIONAL RS422 INTERFACES AVAILABLE.

MODEL 9000 (E)EPROM PROGRAMMER

NEW!



- SUPER FAST PROGRAMMING SPEED!
- QUICK AND INTELLIGENT PROGRAMMING ALGORITHMS.
- SUPPORTS MEGABIT EPROMS.
- PROGRAMS THE LARGEST VARIETY OF CHIPS, PROM REPLACEMENTS, EPROMS, EEPROMS, MPUs.

Distributor Inquiries Welcome!
P.O. Drawer 1346; 399 Hwy. 90
Bay St. Louis, MS 39520
601-467-8048 Telex: 315814 (GTEK UD)
FAX: 601-467-0935
Order Toll Free
1-800-255-4835

GTEK

PcPRIME Systems, Inc.

**30-DAY MONEY BACK
OPEN 7 DAYS**

Wire Transfer
Chemical Bank
305 Seneca Ave. NY, NY 10001
For the fees of PcPRIME Systems, Inc.
Acct. # 021 020877

Los Angeles
6651 Warner St. Suite 284
Huntington Beach, CA 92647
1-800-451-5279

New York
135 W 26th St. 8th Fl
New York, NY 10001
212-627-4485

Atlanta
5231 E. Memorial Drive, Suite 200
Smyrna, Georgia, GA 30083
1-800-451-5279

Boston
59 Prince St.
Brookline, MA 02146
1-800-451-5279



PcPRIME 88 640K 8 MHz 10 MHz Optional



\$650

- 100% IBM XT-Compatible
- Phoenix BIOS Installed
- One 12" High Res Amber Monitor (720x350)
- Hercules Graphics Emulation Card w/Printer Port
- Intel 16-Bit 8088-2 Running at 4.77/8.0 MHz
- 640K RAM on Board
- Two DS/DD 360K High-High Fujitsu Direct Drives
- 8 Fully IBM Compatible Expansion Slots
- Runs all MS-DOS Programs including 1-2-3 Flight Simulator, DBase III Plus, AutoCad, WordStar, Wordperfect, etc.
- Operates MS-DOS, PC-DOS, GW Basic, Novell, Xenix, Unix.
- Keyboard Selectable 4.77 and 8.0 MHz
- Accepts all IBM Parts
- 150 Watts 110/220 VAC Power Supply w/Four Cables
- Keyboard w/LEDs, Enlarged Return/Shift Keys w/84 Keys
- Two Printer Ports/One Serial Port/One Light Pen Port
- Multi I/O Card Controls Two Floppy Drives
- Printer Port/Game Port/Serail Port, 2nd Optional
- Battery Back-up w/Real-Time Clock/Calendar
- 80287 Math Co-Processor Socket Installed on Board
- 6 EPROM Sockets also installed on Board
- Power-on Self Testing of System Components
- Speaker for Audio or Music Use
- Nickel Plated, Enamel Coating Heavy Duty Metal Case
- Six Slots Still Left Open after Systems Configuration
- Optional 2.5 MB RAM Card for Expanding Memory
- Optional 14" Dual Frequency, Swivel-Based Monitor
- Optional 12" Swivel-Based Monitor
- Optional Black/White or Green Monitor
- Optional 10 MHz or NEC V-20 Microprocessor
- Optional Enhanced Keyboard w/101 Keys & 12 F Keys
- Optional 1200/2400 Internal/External Modem
- Optional 1.2 MB 5.25" Drive
- Optional 720K/1.44 MB 3 1/2" Half-Height Floppy Drive
- Optional Color Systems w/High-Res (640x200 or 640x400)
- Optional 20/30 MB Hard Disk Systems
- Optional Autoswitch EGA Systems/Printer of all Kinds
- Ready for Network/Multi-User/Mouse/Joy Stick Interface
- Ready for 20-80MB Tape Back-Up Installation

**PcPRIME 88 w/20 MB & 1 Floppy
Seagate ST 225, 65 MS \$900**
**PcPRIME 88 w/30 MB & 1 Floppy
Seagate ST 238, 65 MS \$950**

**Network/Multi-User
Installations**

PcPRIME 286 ONE MEGabyte 10 MHz 12 MHz/"0" Wait Optional



\$1,100

- 100% IBM AT Compatible
- Phoenix BIOS Installed
- One 12" High Res Amber Monitor (720x350)
- Hercules Graphics Emulation Card w/Printer Port
- Intel 80286 Running at Dual Speed 6 and 10 MHz
- Chip Technology VLSI Chip Set
- Runs all MS-DOS Programs including 1-2-3, Flight Simulator, DBase III Plus, AutoCad, WordStar, Wordperfect, etc.
- Operates MS-DOS, PC-DOS, GW Basic, Novell, Xenix and Unix
- One Megabyte RAM on Board
- 8 Expansion Slots Six 16-Bit/Two 8-Bit
- WD-Combined Hard Disk/Floppy Disk Controller Controls Two Hard Disks and Two Floppies
- Keyboard w/LEDs and Enlarged Return/Shift Keys w/84 Keys
- Accepts all IBM Parts
- 220 Watts 110/220 VAC Power Supply w/Four Cables
- Hardware Reset Button/Turbo Light Indicator Installed
- One Fujitsu 1.2 MB Half-Height High Density Floppy
- One RS-232 Serial Card w/2nd Port Optional
- Real-Time Clock & Calendar w/Battery Back-up
- Nickel Plated, Enamel Coating Heavy Duty Lockable Case Serve also as Keyboard Lock-Out
- Speaker for Audio or Music Use
- Power-on Self Testing of System Components
- 80287 Math Co-Processor Socket Installed on Board
- Power and Hard Disk Indicator Lights Installed
- Five Slots Still Left Open after Systems Configuration
- Ready for OS/2 Operating Systems
- Optional 3.5 MB RAM Card for Expanding Memory
- Optional 14" Flat Screen Swivel-Based Monitor
- Optional Black/White or Green Monitor
- Optional Enhanced Keyboard w/101 Keys & 12 F Keys
- Optional 720K/1.44 MB 3 1/2" Half-Height Drive
- Optional 360K DS/DD Half-Height Fujitsu Direct Drive
- Optional 1200/2400 Internal/External Modem
- Optional Color Systems w/High-Res (640x200 or 640x400)
- Optional 12"/10" Wait 1MHz Systems
- Optional Autoswitch EGA Systems/Printer of all Kinds
- Optional 35 MB RAM Card for Expanding Memory
- Optional 12" Swivel-Based Monitor
- Ready for 40-80 130 MB Hard Disk Installation
- Ready for 20-80MB Tape Back-Up Installation
- Ready for Network/Multiuser/Multi-Tasking Interface
- Ready for Mouse/Joy Stick Interface

**PcPRIME 286 Systems ... \$1,600
W/40 MB Seagate ST-251, 40 MS**

ALL PcPRIME SYSTEMS FEATURE:

- Operating Manual for Monitor, Keyboard, Motherboard
- IBM Multi I/O Serial Cards
- Fully Set-Up and Diagnostic Tested in America
- 72 hours Burn-in Period
- 30-Day Money Back Guarantee
- One Year Fully Warranted Labor & Parts
- Shipping Via UPS
- We Ship APDs and FPDs too
- Ready for Immediate Delivery

PcPRIME 386 ONE MEGabyte 16 MHz "0" WAIT



\$2,300

- 100% Compaq 386 Compatible
- Phoenix 386 or Award BIOS Installed
- One 12" Swivel-Based High Res (720x350) Amber Monitor
- Hercules Graphics Emulation Card w/Printer Port
- Intel 80386, 32-Bit Running at 16 MHz "0" Wait State
- Runs all MS DOS Software including Lotus 1-2-3, Wordstar, AutoCad, Flight Simulator, DBase III Plus, Symphony, etc.
- Operates MS DOS 2.1, 3.1, 3.2, 3.11 GW Basic, PC DOS, Unix, Xenix
- Keyboard Switchable between 16 MHz "0" Wait or 8 MHz
- One Megabyte Parity Checked Static Column RAM on Board
- 8 Expansion Slots 2 8-Bit, 5 16-Bit, 1 32-Bit
- 32-Bit Slot Can Support Up to 16 Megabyte of RAM
- Three Address Modes
 - 1 8086-Compatible Real-Address Mode
 - 2 Protected 80286 Virtual Address Mode
 - 3 Protected 80386 Virtual Address Mode
- Sustain Interrupts Seven Direct Memory Access (DMA)
- 64 Terabytes of Virtual Address Space
- 80287/80387 Math Co-Processor Socket Installed on Board
- Real-Time Clock & Calendar on Board w/Battery Back-Up
- Enhanced Keyboard w/LEDs and Enlarged Return Shift Keys
- Software Utility to Emulate Expanded Memory for Lotus 123, etc.
- WD-Combined Hard Disk/Floppy Disk Controller Controls Two Hard Disks and Two Floppies
- Hardware Reset Button/Turbo Indicator Light/Speaker Installed
- Internal Address Bus/Memory Interface/BIOS all 32-Bit
- Integrated Memory Management Unit/Virtual Memory Support
- Hardware Fixed-Point Multiplier and Divider
- Standard 8 MHz I/O Channel Timing/Pipelined Inst. Execution
- 220 Watts 110/220 VAC Power Supply w/Four Cables
- One Fujitsu 1.2 MB Half-Height High Density Floppy
- Optional 14" Flat Screen Swivel-Based Monitor
- Optional Enhanced Keyboard w/101 Keys & 12 F Keys
- Optional 720K/1.44 MB 3 1/2" Half-Height Floppy Drive
- Optional Color Systems w/High-Res (640x200 or 640x400)
- Optional 20/30 MB Hard Disk Systems
- Optional Autoswitch EGA Systems/Printer of all Kinds
- Ready for OS/2 Operating Systems
- Ready for 40-80 130 MB Hard Disk Installation
- Ready for 20-80MB Tape Back-Up Installation
- Ready for Network/Multi-User/Multi-Tasking Systems
- Ready for Network File Servers/Mouse/Joy Stick

**PcPRIME 386 Systems ... \$2,800
W/40 MB Seagate ST-251, 40 MS**

Terribly Fast.

- Enlarged Shift/Return Keys w/Tactile Feel
- Power Lock Key Installed
- Contrast Adjusting Knob
- Brightness Adjusting Knob
- Turbo Speed Light Indicator
- Hardware Reset Button
- 8" High Res. (720x350) Dual Frequency Amber Monitor Accepts Both Mono and Color Card
- Dimension 17.3" W x 8.2" H x 16.8" D
- Weights 26-28 LBS
- 150W or 200W Power Supply
- Turbo Speed Light Indicator
- Reinforced Aluminum Frame
- 7 Expansion Slots Available
- Optional EGA/Color Systems



PcPRIME 88 Portable	.....	\$1,000
Configured Same as PcPRIME 88 W/20 MB Seagate ST-225, 65 MS, One Floppy	.....	\$1,300
PcPRIME 286 Portable	.....	\$1,600
Configured Same as PcPRIME 286 W/40 MB Seagate ST-251, 40 MS	.....	\$2,150
PcPRIME 386 Portable	.....	\$3,000
Configured Same as PcPRIME 386 W/40 MB Seagate ST-251, 40 MS	.....	\$3,500

IEEE 488 (GPIB/HPIB)

- Controllers
- Buffers
- Converters
- Extenders
- Interface Boards



for PCs, Macintosh, HP plotters, instruments, printers, etc.

Call or send for your **FREE Technical Guide**

IOtech (216) 439-4091

23400 Aurora Road
Cleveland, Ohio 44146

Circle 122 on Reader Service Card

PAL/EPROM PROGRAMMER CARD

For PC/XT/AT Systems

NEW -- VERSION 2 OF SOFTWARE AND HARDWARE

Programs 20 and 24
Pin MM, NS, TI, AMD,
ALTERA, CYPRESS,
RICOH and PANATEC
PALS Supports EPLD,
polarity, RA, and shared
product term types
Functions include: Read,
Write, Verify, Protect
Erase, Print, and File load
and save of program.
JEDEC supported
Software included



100MHZ LOGIC ANALYZER CARD

For PC/XT/AT Systems

\$1199



24 Channels at 25Mhz 250ns
4 Channels at 100 Mhz
Internal Clock up to 100 Mhz
External Clock up to 25 Mhz
Threshold Voltage TTL ECL
or variable from 10 to +10v
Can Stack Multiple Boards
All Software Included

CALL NOW FOR ORDERS AND
TECHNICAL INFO (201) 994-6669

Link Computer Graphics, Inc. 4 Sparrow Dr.
Livingston, NJ 07039. TLX: 9102409305 LINK COMPUTER

Circle 144 on Reader Service Card

DISK FORMAT CONVERSION

XenoCopy-PC

PC DOS program
lets your PC

\$79.95
\$3.00 S. H.
\$5.00 S. H.

READ / WRITE /

FORMAT / DUPLICATE

Disks from over 300 other micros

Upgrades available from previous versions
for only \$26.00 Call for Authorization

To Order Contact

Xenocopy

1454 Sixth Street Berkeley, CA 94710

(415) 525 3113

Circle 300 on Reader Service Card

REAL WORLD I/O For PC/XT/ATs

AD200 - 4 channel
12-bit A/D board
10 kHz sampling
rate
Instrumentation
amp front
end



A0500

\$239

ADA300 - 8 channel, 8-bit A/D single D/A, 24
programmable digital I/O lines.

\$239

AD500 - 8 channel, 12-bit A/D board Software
programmable gains of 1, 10, and 100. Highly
accurate integrating converter

\$239

AD100 - Single channel version of AD500 10 digital
I/O lines Same accuracy and programmable
gains

\$149

DA600 - Fast settling 12-bit dual D/A converter

\$169

DG24 - Digital I/O board with 24 TTL lines
configurable in software

\$95

X840 - Easy connect extender prototype
board with terminal strips

\$49

OEM discounts available

Real Time Devices, Inc



1930 PARK FOREST AVENUE
P.O. BOX 906
STATE COLLEGE PENNSYLVANIA 16804

(814) 234-8087

Circle 235 on Reader Service Card

EPROM/PAL Programmer



- * PAL MODULE \$295
- Programs 20 & 24 pin MMI (A,B), NS TI PALS
- Read JEDEC file format
- Security, DIR, LOAD, SAVE, EDIT, READ, WRITE, VERIFY
- User friendly menu driven SW

* EPROM MODULE (1, 4, 8 socket) \$145

-16K to 1024K EPROM, CMOS EEPROM

-Read Intel, Motorola, TEK HEX file

-Very fast (Quick pulse), reliable, easy to use

* BIPOLAR ROM MODULE \$205

-MMI, NS, TI & Signetics parts

-Read Intel, Motorola, TEK HEX file

* 8741/42/48/49/50 Module \$195

-1, 4, 8 socket module available

-8748 Disassembler included

-Read Intel, Motorola, TEK HEX file

* 8751/52/252/44 Module \$245

-Normal, Intelligent programming algorithm

-Read Intel, Motorola, TEK HEX file

* TTL & MEMORY IC TESTER MODULE \$195

-Test almost TTL, CMOS, Dynamic, Static IC's

-Auto search for unknown IC part No.

-User can make his own test pattern

* INTERFACE CARD & CABLE \$50

-This card is common to all above modules

-Fits in any PC/XT/AT or compatibles

-Space saving half size

XELTEK

473 Sapena Ct., #24
Santa Clara, CA 95054
(408) 727-8995

CA residents
add 6.5% tax.
Add \$5 for SH

Circle 299 on Reader Service Card

DIGITAL and ANALOG I/O

for the
IBM PC, XT, AT



UNIVERSAL I/O

This board has three 8255 VIA's that make up the nine 8 bit I/O ports. That's 72 I/O lines! This board also has 16 ANALOG inputs. Each input has a 0 to 5 volt range, 8 bit resolution (256 steps), 20 meg input impedance. Conversion time is 200 us per channel. A DIP switch is used to select the I/O address. This board also has a prototype area.

ORDER part # 83-064A \$229.95

PARALLEL I/O

This board has two 8255 VIA's that make up six 8 bit parallel I/O ports. That's 48 I/O lines!

ORDER part # 86-108A \$99.95

ANALOG I/O

This board has 16 analog inputs. Each input is 8 bit resolution and 0 to 5 volt input range. Space is provided for resistors to change the input voltage range. Conversion time is 200 us per channel.

ORDER part # 87-016A \$99.95

ORDER BY MODEM

Now you can order by modem. You can check stock, check current prices, request a catalog, and leave a message to John Bell. Call (415) 591-3572 1200 baud N-8-1. On line 24 hours.

Free Catalog!

To get a FREE CATALOG of JBE products send a label with your name and address and I will stick it on a catalog and send it to you. I also make I/O boards for Apple computers and single board control computers.



JOHN BELL ENGINEERING, INC.

400 Oxford Way, Belmont, CA 94002

(415) 592-8411 9am to 4pm Pacific time.



EPROM & MC PROGRAMMER \$495

- No personality modules; Device selection by menu
- Built-in Eraser/Timer option (\$50); Foam pad.
- Direct technical support; Full 1 year warranty.
- Stand alone duplication & verify (24/28 pins).
- Quick pulse algorithm (27256 under 60 sec).
- All 24/28 pin parts to 1 Mbit, CMOS; EEPROMS.
- 8741, 2, 4, 8, 9H, 9, 9H, 51, C51, 52, 55, 9761 & more.
- IBM-PC, Apple, CPM or Unix driver; Autobaud RS232.
- Offset/split Hex, Binary, Intel & Motorola 8, 16, 32 bit.
- Kits from \$165. Manual with complete schematics.
Call today for datasheets !!

B&C MICROSYSTEMS

355 WEST OLIVE AVE. SUNNYVALE, CA 94086
PH: (408) 730-5511 FAX: (408) 730-5521 TELEX: 984185
VISA & MC accepted.

Circle 27 on Reader Service Card

TIMELINE INC.

HAPPY
NEW YEAR!

Continental U.S.A.
(800) 872-8878

ORDER DESK ONLY
Inside California
(800) 223-9977

L.A. & Technical Info
(213) 217-8912

OEM INQUIRIES
WELCOME

\$25

INCREDIBLE PRICE
← **BLOWOUTS!** →

\$99

(0-K MEMORY)

188 WATT SWITCHING POWER SUPPLY

What a DEAL at \$25.00!

On/off switch in the front. Built in filter for easy power cord plug-in. Two 4-pin power plugs for floppy and/or hard disk drives. Large quantity in stock, but **ORDER NOW: WHILE THEY LAST!**

Output: +5.05V at 22A
+12.02V at 4A
-12.0V at 1A
+12.59 Reg., 1.5A D.C.
Dim: 13½L X 5½W X 2¾H

AST™ ADVANTAGE!™

MULTIFUNCTION CARD

FOR YOUR IBM PC/AT

Serial, parallel and game port standard 128Kb memory expandable to 1.5 Mb Piggyback allows expansion to 3.0 Mb.

Board with: 512K Memory..... \$175.00
1Mb Memory..... \$235.00
1.5Mb Memory..... \$299.00

Option for 2nd Serial Port \$ 20.00

We bought these from an OEM — BULK PACK. So, no AST™ box or manual. We supply our own manual. 1 Year Warranty.

NIPPON PERIPHERALS

FULL HEIGHT HARD DISK DRIVE

WOW! \$7500

10 Mb Unformatted
8.2 Mb Formatted
75 ms average access time

WITH WESTERN DIGITAL ½ CARD

\$149.00

★ FLOPPY DRIVES ★

OLIVETTI

"The Quietest Drive"
DIRECT DRIVE

\$65.00

360K DS/DS 1/2 HT.

QUME

TRACK 142

\$65.00

360K DS/DS 1/2 HT.

REMEX

RFD 480

\$35.00

360K DS/DD 2/3 HT.



THE SPY IN THE SKY

NEC UPD791D

(CHARGE COUPLED DEVICE)
4096 ELEMENT

This unit is a 4096 element linear image sensor that comes with a pre-amplifier board and A/D board. The device can be used for optical character recognition, document scanning or as a spectrometer.

LINEAR IMAGE SENSOR

\$99.00

SCSI CONTROLLER ADAPTEC 4070A

\$99.00

I/O for the ST412-506 interface using RLL encoding

FULCRUM TRACK BALL

- Stationary Mouse
 - PC Magazine Editors
- First Choice for CAD Use
- # \$89

ORIG. PRICE ~~\$1300~~
NOW **\$499**

1-9 499
10-99 449
100-499 399
500-999 375
1000+ "Let's Talk"

(NO SHORTAGES HERE!)

NEED A
COLOR MONITOR
FOR YOUR
MAC II™?

"Makes all other Color
Monitors look like faded
curtains against this profes-
sional graphics display"

1 YEAR WARRANTY
ASK ABOUT OUR COLOR
MONITORS FOR IBM PS/2



1490 W. ARTESIA BLVD, GARDENA, CA 90247

Continental U.S.A.

(800) 872-8878

Inside California
(800) 223-9977



L.A. Area & Technical Info
(213) 217-8912

15% Restocking fee for returned orders.

Minimum Order: \$25.00. Shipping & handling charges via UPS Ground: \$.50/lb. UPS Air: \$1.00/lb. Minimum Charge: \$4.00. We accept cashiers checks, MC or VISA. No personal check COD's. Items reflect 5% cash or check discount. California residents add 6½% sales tax. We are not responsible for typographical errors. All merchandise subject to prior sale. Phone orders welcome. Foreign Orders require special handling. Prices subject to change without notice.

C.H.A.S.

MICROSYSTEMS, INC.
103 Route 46 West
Fairfield, NJ 07006
(201) 227-1565
orders only
1-800-543-CHAS
TELEX 6503141175

8088 Turbo Computer
• 4.77/10 MHz • 640K • AT Style Keyboard • 2 360K disk drives • 2 Parallel • Serial • Game • Clock & Calendar w/battery • Mono graphics card • Amber monitor • Word Perfect Executive • 1 YEAR WARRANTY \$839.00 (\$1,050.00 with 20 meg hard disk drive and 1 floppy) •

286 Turbo Computer
6/10 MHz • 640K • Enhanced keyboard • 1.2 MB FD • 360K FD • 2 Parallel • Serial • Game • Clock & Calendar w/battery • Mono graphics card • Amber monitor • Word Perfect Executive • 1 YR. WARRANTY • \$1300 (\$1600 w/40 meg hi-speed HD w/1.2 meg floppy)

** Color and EGA Systems Available **

- 20 MB HD Kit \$260 • 30 MB HD Kit \$275 •
- Hayes compatible modems start at \$75 •
- Printers start at \$180

Portable systems also available

WE CAN CUSTOM CONFIGURE ANY SYSTEM!
CALL FOR PRICE LIST! DEALER INQUIRIES WELCOMED!
(prices subject to change without notice)

Circle 44 on Reader Service Card

Add-Ons for the Blind

What you add on to your computer, if you're a blind operator, is almost more important than the computer itself.

Scanners, modems, braille printers, speech synthesizers, braille output devices and a host of other peripherals are described in "Add-Ons: The Ultimate Guide to Peripherals for the Blind Computer User."

The product reviews contained in this book are written by those who know them best—blind computer users.

\$16.95 for braille or cassette
\$19.95 for print.

Send orders to:
National Braille Press Inc.
88 St. Stephen Street, Boston, MA 02115
(617) 266-6160

Circle 44 on Reader Service Card

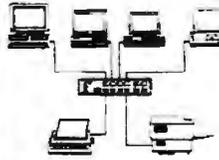
MODEM \$69

Internal/External

1200 . . . \$69/\$79 • Fully Hayes Compatible
• Auto Answer & Dial
2400 . . . \$159/\$179 • External with Aluminum Case & 8 LED Display
Internal (Made in U.S.A. with PC Talk or Bit Com Software)
External (Bit Com Software, \$10 Optional)

SWITCH BOX \$27/\$130 (Auto)

Auto scan switch 4 way/8 way \$130/\$170
Auto switch with buffer 256K (to 512K)
4 computers share 2 printers \$260
6 computers share 4 printers \$390



Switch Box DB25/Com \$27/\$29
2 way switch \$27/\$29
4 way switch \$39/\$42
2 way cross \$41/\$45

JACO Computer Products 528 Weddell Dr.
Tel: (408) 747-1100 Suite #7
Fax: (408) 446-3825 Sunnyvale, CA 94089

1 Year Warranty, Dealer Price Available

Circle 124 on Reader Service Card



E(E)PROM PROGRAMMER \$ 395

- No personality modules; Device selection by menu
- Built-in Eraser/Timer option (\$50); Foam pad
- User friendly software; Complete help menu
- Direct technical support, Full 1 year warranty
- Quick pulse algorithm (27256 under 60 sec).
- All 24/28 pin parts to 1 Mbit; CMOS; EEPROMS.
- Micros: 8741, 8742, 8748, 8748H, 8749, 8749H, & more.
- IBM-PC, Apple, CPM or Unix driver; Autoaud RS232
- Offset/split Hex, Binary, Intel & Motorola R,16,32 bit
- Manual with complete schematics.

Call today for datasheets !!

B&C MICROSYSTEMS

355 WEST OLIVE AVE. SUNNYVALE, CA 94086
PH. (408) 730-5511 FAX: (408) 730-5521 TELEX: 984185
VISA & MC accepted.

Circle 28 on Reader Service Card

IEEE488

Technology that hits the mark

- For IBM-PC/XT/AT/IC/RT6150 and all other compatible computers
- For PHILIPS PC :YES
- HP commands (enter, clear etc.) implemented
- SRQ/ASYST compatible
- 64 kByte memory capacity
- DMA and INTERRUPT can be activated by simple commands
- HELP functions, SYNTAX monitoring in clear text
- BASIC, BASIC(compiled), TURBO-BASIC, (TURBO-) PASCAL, MODULA-2, FORTRAN, C, ASSEMBLER

DEALER + OEM WELCOME



Ines GmbH
Neuenhofer Allee 45
5000 Köln 41
West Germany
Phone: 49-2 21-438659
Telex: 2627-221-4237 gaktin
FAX: 49-2 21-49 18 71

Circle 117 on Reader Service Card

JKL's JANUARY BARGAINS

JKL AT: 80386 (16 MHz)
w/case 200W P.S., Keyboard . . . \$2195.00

JKL AT 40: Above plus 40 Meg. HD, 1.2 Floppy, Graphics Card, & Monitor . . . \$3295.00

JKL AT 80: Above plus 80 Meg. HD, 1.2 Floppy, EGA Card, & Monitor . . . \$4495.00

JKL XT 30: 8088 (10 MHz), 150W, floppy, 30 Meg. HD, graphic, 640K RAM, monitor, par., ser., clock . . . \$1095.00

JKL ATP 30: 8286 (10 MHz), 640K RAM, 30 Meg. HD, 3 1/2" & 5 1/4" floppies, ega, vga, & mcga monitor, par., ser., clock . . . \$1695.00

VGA card with EGA & CGA graphics for XT & AT \$295
Price & availability subject to change without notice

Jack Krochmal, Ltd.

Computers,
Peripherals & Supplies
717 Ellsworth Drive
Silver Spring, MD 20910
(301) 565-2910 / 587-3232

Toll Free: 1-800-JK3-0386

Circle 128 on Reader Service Card

MUST SELL!



KENSINGTON SURGE PROTECTOR

Protection Plus! Switch on the all-in-one Kensington Surge Protector AND 5-outlet Power Control Center for your personal computer. Order now to protect your equipment from power surges, voltage spikes and line noise...that can cause malfunctions, memory loss, chip damage, and costly repairs. Our special buy means incredible savings for you! Buy now!

- Fast Acting Silicon Surge Suppressor Rated a Full 4500 Amps.
- Typical Response Time: 1 Pico Second.
- Line Noise, PI-Type Filtering System.
- Built-In 15 Amp. Circuit Breaker.
- Push Switches for Easy Control of Monitor, Computer, Printer, Etc.
- Master Switch Control with LED Indicator.
- Swivel Base Adjusts Your Monitor View.
- Built-In Static Protection Bar.
- Fits Between Your Monitor and System Unit.
- Meets IEEE Specs. U.L. Listed 8 1/2-ft. Power Cord. 1 1/2"H x 13 1/2"W x 13 1/4"D.

Mfr. List **\$149.00**
\$109

Item H-3095-7264-799 S/H: \$6.00 ea.
Plus 50¢ Ina. Charge Per Order.

Credit card customers can order by phone, 24 hours a day, 7 days a week.
Toll-Free: 1-800-328-0609

SEND TO:
COM Authorized Liquidator
1405 Xenium Lane N/Minneapolis, MN 55441-4494

Send Surge Protector(s) Item H-3095-7264-799 at \$109 each, plus \$6.00 each for ship, handling, Plus 50¢ ins. charge per order. (Minnesota residents add 6% sales tax. Sorry, no C.O.D. orders.)

My check or money order is enclosed (No delays in processing orders paid by check)

PLEASE CHECK VISA MC DISCOVER AMERICAN EXPRESS

Acct No _____ Exp. _____
PLEASE PRINT CLEARLY

Name _____
Address _____ Apt # _____
City _____
State _____ ZIP _____
Phone (____) _____
Sign Here _____

dysan **Dysan**
CORPORATION

Orders Accepted Worldwide

5 1/4" D-Side D-Density **1195** 5 1/4" HIGH Density **1395**

RX 50 Format **1395** S-Side 5 1/4" 96tpi **1295** D-Side 96tpi **1350**

8" S-Side **1795** S-Side **1995** D-Side **2295**
S-Den. D-Den. D-Den.

QUANTITY DISCOUNTS

Delaware: 1-800-451-1849
OKlahoma: 1-800-654-4058
NeVada: 1-800-621-6221

Diskette Connection

Minimum Order: \$25.00. Visa, MasterCard accepted. C.O.D. orders add \$3.00. Surface Shipping on 15 or 17" add \$3.00 per 100 disks. 8" add \$4.00 per 100 disks. UPS delivery only. US Mail on 5 1/4" 96tpi, 8" or 9" add an additional 5% for P&H. Prices subject to change without notice.

PC-LabCard SERIES
Lab, Industrial and Engineering I/O Cards for IBM PC/XT/AT

PCL-714 Super-Lab Card
5 powerful functions in one...

- A/D Converter : 14 bits, 16 differential channels
- D/A Converter : 14 bits, 2 channels
- Digital Input : 18 channels, buffered
- Digital Output : 18 channels, buffered
- Counter/Timer : 3 channels

Software & Daughter Boards

- PC-LabDAS : Menu driven data acquisition software
- UnitekScope : Oscilloscope/waveform analysis software
- Screw terminal board, relay output board and opto-isolated D/I board available.

AMERICAN ADVANTECH CORP.
6969 Dal Bon Ct
San Jose, CA 95119
(408) 224-6456

Circle 314 on Reader Service Card

PC-LabCard SERIES
Lab, Industrial and Engineering I/O Cards for IBM PC/XT/AT

PCL-714	(14 bits) A/D + D/A + D/I + D/O + Timer/Counter Card	\$495
PCL-712	(12 bits) A/D + D/A + D/I + D/O + Timer/Counter Card	\$295
PCL-720	Digital I/O & Counter Card	\$160
PCL-725	Relay & Opto-isolated D/I Card	\$240
PCL-738	Stepping Motor Control Card	\$395
PCL-742	RS-422 Interface Card	\$130
PCL-746	IEEE-488 Interface Card	\$395
PCL-750	Prototype Development Card	\$ 70
PCL-754	PC Slot Extension Kit	\$ 50
PCL-700	Data Acquisition & Control Software	\$195
PCL-705	Waveform/Oscilloscope Software	\$125

Dealer and OEM inquiries welcome
Call for free catalog!

AMERICAN ADVANTECH CORP.
6969 Dal Bon Ct
San Jose, CA 95119
(408) 224-6456

Circle 315 on Reader Service Card

maxell
FLOPPY DISKS

	5 Box	10 Box
D-Side	950	850
D-Den.	950	850
HIGH Density	1750	1600
3 1/2" S-Side	1080 (3 1/2")	1595 (3 1/2")
D-Side	1995 (8")	2195 (8")

International Orders Accepted
Telex #4933362 • Fax #405-495-4598

Delaware: 1-800-451-1849
OKlahoma: 1-800-654-4058
NeVada: 1-800-621-6221

Diskette Connection

Minimum Order: \$25.00. Visa, MasterCard accepted. C.O.D. orders add \$3.00. Surface Shipping on 15 or 17" add \$3.00 per 100 disks. 8" add \$4.00 per 100 disks. UPS delivery only. US Mail on 5 1/4" 96tpi, 8" or 9" add an additional 5% for P&H. Prices subject to change without notice.

SCR The Smart Cash Register

- Cash Register/Point of Sale/Inventory
- 100% dBASE III data files
- Import into 1-2-3, Accounting, and most other programs
- Interface to Bar Code, Receipt Printer, Cash Drawer, Register

WE CARRY ALL HARDWARE, TOO!!!

ORDER NOW
(915) 837-7180
SCR — Box 714
Alpine, TX 79831

Circle 241 on Reader Service Card

2400 BAUD INT. MODEM W/SOFTWARE \$149
Made in USA

2400 EXT. MODEM W/WSW	\$159
1200 INT. MODEM W/WSW	\$69
1200 EXT. MODEM W/WSW	\$89
MOUSE DELUXE W/DR. HALO III	\$60
SEAGATE 20M HD W/CONTL	\$269
SEAGATE 30M HD W/CONTL	\$289

10 MHZ TURBO-AT — \$699

- 6/10MHZ 80286 • 80287 SOCKET
- 512K (EXPANDS TO 1MB)
- 200W POWER SUPPLY • CLOCK/CALENDAR
- CLICK/TACTILE AT TYPE KEYBOARD
- PHOENIX BIOS • AT CASE W/KEYLOCK

HARD/FLOPPY DISK CONTL.	\$139
1.2M FLOPPY DISK DRIVE	\$109
TTL MONITOR + MGP CD	\$139
EGA MONITOR + EGA CD	\$489
MINISCRIBE 40M HD	\$359
SERIAL/PARALLEL/GAME	\$59

OCEAN INTERFACE CO.
PO. BOX 1666
MONTEREY PARK, CA 91754
(818) 282-0498

Circle 190 on Reader Service Card

Verbatim

5 1/4" DISKS	5 BOX	10 BOX
D-Side	950	850
D-Den.	950	850
High Den.	1750	1650
3 1/2" Diskettes	1195	1650
D-Side	1650	3995
H-Den	3995	
8" Diskettes	1540	1795
S-Side	1795	2095
D-Side	2095	

International Orders Accepted

Delaware: 1-800-451-1849
OKlahoma: 1-800-654-4058
NeVada: 1-800-621-6221

Diskette Connection

Minimum Order: \$25.00. Visa, MasterCard accepted. C.O.D. orders add \$3.00. Surface Shipping on 15 or 17" add \$3.00 per 100 disks. 8" add \$4.00 per 100 disks. UPS delivery only. US Mail on 5 1/4" 96tpi, 8" or 9" add an additional 5% for P&H. Prices subject to change without notice.

Telex #4933362 • Fax #405-495-4598

RS-232C/422A USERS: BI-DIRECTIONAL CONVERTER for EXTENDED USE

Convert RS-232C to RS-422A and/or RS-422A to RS-232C only **\$49.95**

Guaranteed satisfaction. Bi-directional first quality versatile converter. Extends cable lengths up to 4,000 feet. Rates up to 90K baud. Two 9 & 6 RS-422CON Converters can extend your RS-232C capability up to 4,000 ft.

Includes rear DB25P connector for RS-232C and includes female DB25S connector for RS-422A, no hardware lines connect.

Requires 12V DC at 100 ma. Optional power supply available for only \$14.95.

Order Direct from Manufacturer TODAY and SAVE! SAME-DAY SHIPMENT! MONEY-BACK GUARANTEE!

Request our FREE catalog listing B & B ELECTRONICS' comprehensive line of RS-232C interface and monitoring equipment.

*Form 1099-MISC cash orders postpaid. P.O. is from outside/road items accepted. It requires add 6% tax.

B & B Electronics
MANUFACTURING COMPANY
602A Boyce Memorial Drive • P.O. Box 1040 • Ottawa, IL 61350
Phone: 815-434-0846

Circle 24 on Reader Service Card

Advertise your computer products through **BYTE BITS** (2" x 3" ads)

For more information call Dan Harper at **603-924-6830**

BYTE
70 Main St.
Peterborough, NH 03458

Circle 322 on Reader Service Card

Solving your scientific and engineering problems just got simpler.

Science & Engineering Software Co. is the only source with all the software you need to solve your specialized problems. Statistical data analysis, circuit design, data acquisition and signal analysis, solving complex equations, 3D CAD/CAM design, high-tech graphics, technical word processing and more. Whether you're writing your own program or looking for a specific application,

our experts can help you choose the best programs for your needs. Call today and get our solutions working for you.

- No one offers you more variety.
- If you don't see a title, we'll special order it.
- If you don't know the publisher, we'll find it.
- Over 300 programs available.
- We offer a 30-day, money-back guarantee.

CIRCUIT DESIGN

EDA-2, Tatum Labs	849
HWMA, Writex Corp	849
MICRO-CAP II, Spectrum Software	759
PADE PCB CAD Software	CALL
m/PADE-Route	CALL
PCBICE, MicroSim	CALL
SMARTWORK, Writex Corp	849
TempPCB, ACCEL Tech	495
Temp Route, ACCEL Tech	495

DATA ACQUISITION/SIGNAL ANALYSIS

Avant 2.0, Macmillan Software	\$2,179
ASYSTANT, Macmillan	469
ASYSTANT+, Macmillan	849
DADISP, DSP Systems	749
Fourier PERSPECTIVE II, Alligator Trans.	329
HYPER SIGNAL, Hyperception	309
HYPER SIGNAL PLUS, Hyperception	439
ILS-PE, Signal Tech	2,495
ILS Starter, Signal Tech	995
Lab Microsystems Products (LMB)	CALL
Lexus Measure	445
Microlytics D. A. Teals, Quinn-Curtis	89
Prime Factor FFT, Alligator Transform	139
RED D.A. and Central, Hart Scientific	799
Respect Storage Scope, HEM Data Corp	495
Snap FFT, HEM Data Corp	295
Turbo Pascal S&E Tools, Quinn-Curtis	69
UnalScope Level 2+, Unikal Software	529
UnalScope Level 1	329

EQUATION SOLVERS

Esolve, The Behrer, Borland	\$ 119
MathCAD 2.0, MathSoft	279
matMATH, Microsoft	195
SolveIt!, Structured Scientific Software	79
Behrer-Q, SDDC	79
TKSolver Plus, Universal Tech Sys	395

FIRMWARE DEVELOPMENT

LINK & LOCATE, Systems & Software	\$ 329
PC LOCATE, Alda Systems	229
SOFTPROBE IUTX, Systems & Software	895

GRAPHICS/CAD

ATLAS GRAPHICS, STSC	\$ 399
AutoSketch by AutoCAD	85
Speed Enhanced Version	79
AutoECL, Systems Unlimited of PAO	279
AutoSHAPE, Systems Unlim	189
Beating Graphs	279
ChartMaster PC, Interchart Software	369
Design Graph, Miralisan Associates	239
Drafile 1 Plus, Foresight	239
Heaps, Ithaca Software	319
EASY CAD, Evolution Computing	139
FAST CAD, Evolution Comp	1,649
FBSIMPLEX, Systems Unlim	89
Generic CAD	89
HALOVISION, Media Cybernetics	399
Linear CAD, DSL Ltd.	89
HYPERPLOT JHM Int.	239
Int'A'vision, Micrograph	459
PC MAP II, Peerless Engineering Serv	949
PERSPECTIVE, Three D Graphics	229
Design CAD, American Small Bus Comp	219
TECHGRAPH, PAL, binary engineering	259
Turbo View, Sublogic Corp	449

SCIENTIFIC TEXT PROCESSING

CHEM-TEXT, Molecular Design Ltd	\$1,500
EXACT, Technical Support Software	419
EXP, Brooks/Cole Publishing	129
For Math, Shantha Software	379
Lexus Measure	445
PC TEX, Personal TEX	229
T3 Sci. Word Proc., TCI Software Res	499

STATISTICS

Abstat, Anderson Bell	\$ 315
CSB, StatSoft	489
Microstat, Ecosoft	318
MINI STATPAK, Northwest	418
SPSS, PC + Add-ons	749
StatPac, Welonic Associates	449
StatPac Data, Welonic Associates	539
STAT-2, StatSoft	135
SYSTAT	499

ADDITIONAL SEE PRODUCTS

Engineer's Aide, Eng Prog Concepts	\$ 649
LABTECH Notebook, Lab Tech Corp	759
LABTECH Real Time Access	269
LABTECH CHROM	709
PC-Math, The Math Works	559
POINT FIVE, Pacific Crest	279
The Professional Wheel, Gain Inc	89
The Scientific Wheel, Dain Inc	139
The System ID Toolbox, The Math Works	369

APL LANGUAGE

APL+PLUS/PC, STSC	\$ 439
Reactor APL, STSC	79

BASIC LANGUAGE

Microsoft, QuickBASIC	\$ 65
T BASIC, TransEra Corp	445
Turbo BASIC, Borland	85
Turbo BASIC Toolboxes	CALL

C COMPILERS

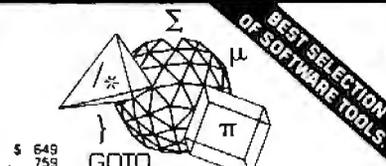
Lattice C	\$ 269
Microsoft C	269
QuickC, Microsoft	85
Turbo C, Borland	85

C UTILITIES/LIBRARIES

ADVANTAGE Graphics, Lifeboat	\$ 225
C Async Manager, B Wise	135
C Tools Plus, B O Blaise	99
C Utility Library, Essential Software	129
Essential Communications	129
Graphics/4 Data Windows	129
Greenleaf Data Windows	159
C/Pac (Pac/C, Pre-CI), Phoenix	349
TimeSlicer, Lifeboat	275
Windows for Data, Vermont Creative	235

DEBUGGERS

ProImage, all models	\$ CALL
PF188 Plus, Phoenix	225



GOTO

FORTRAN LANGUAGE	
Automated Programmer, K&G Automated	\$ 895
Grammatic/Pictomatic, Microcompatibles	119
GSS Graphics Dev. Toolkit	375
HALD, Media Cybernetics	215
Lobby FORTRAN	CALL
Lobby Personal FORTRAN	85
MathPac, Systolic Systems	445
Microsoft FORTRAN m/CodeView	279
RM/FORTRAN, Ryan McFarland	409
Speedrift Library, Laboratories LTD	135
BSP/PC, Lattice	278

GAUSS

GAUSS Prog. Lang., Aptach Sys	\$ 189
GAUSS Math & Stat System	339

PASCAL COMPILERS

Microsoft Pascal	\$ 189
Pascal-2, Gregson Software	325
Turbo Pascal, Borland	65
Turbo Pascal Dev. Lib	258

TURBO PASCAL ADD-ONS

Lattice, Data, RELM & Estwing Tech	CALL
------------------------------------	------

Call for your FREE catalog today!
In the U.S. CALL
1-800-333-3141
International Orders:
914-332-0756

Science & Engineering SOFTWARE CO.
55 South Broadway, Tarrytown, NY 10591

Ordering Information
We accept AMERICAN EXPRESS, MC, VISA and PERSONAL CHECKS. There is no surcharge on credit card or C.O.D. New York State residents must add sales tax. Shipping and handling \$3 per item. Rush service is available. International orders add \$10 for export preparation. Prices and policies may change without notice. A Corporate Buyers card for special rates. *Add for duties before you buy, some manufacturers don't take returns. I deal deals are broken.

COMPUTER RECEIPT CASH DRAWER/PRINTER

Single RS 232 interface controls both

M-S CASH DRAWER
10711 Flower St., Stanton, CA 90680
(800) 544-1749
In California Call:
(714) 821-1133

GRAPHICS TOOLKIT
COMPATIBLE WITH PC/XT/AT AND NEW PS/2
\$59.95 LIMITED INTRODUCTORY OFFER (900 83 5/74)

- SUPPORTS NEW VGA GRAPHICS MODES
- 50+ FUNCTIONS
- SUPERFAST SAVE/RESTORE FUNCTION
- FREE LISTING UTILITY
- DATA COMPRESSION ALGORITHM
- ALL SOURCE CODE INCLUDED
- ROUTINES WRITTEN IN MICROSOFT C AND ASSEMBLER
- NO ROYALTIES
- PROGRAMMER SUPPORT PROVIDED

DEVTRONICS, INC.
1571 MAIN STREET
ATLANTIC BEACH, FLA. 32223

ORDERS ONLY: 1-800-332-4238 VISA/MC/AMEX
TECHNICAL INQUIRIES: (904) 241-3281

EVEREX AT 1900 Basic System 3899 (MADE IN U.S.A. WITH QUALITY)

- new 80386 CPU
- Fully compatible with IBM AT
- 66 MHz ultrarapid 10 MHz System Bus
- 512K on the master board
- 100 word power supply 10000
- Color/Color, Everse HDPD 200
- FCC class "B" approved
- All four factory high level System Support
- 1.2 MEG. 5.25" Dr. Disc. with AI Keyboard
- Fully Automatic Load, Save, Backup and Print Software
- 200 pages of documentation written in U.S.A.
- 386/387 processor socket
- 40000 word installed with customer report on the back
- Made in U.S.A. by Everse with 1 year warranty.

Mini System (Basic Sys. + Monographics card) retail price \$1999
EGA System (Basic Sys. + Hi-Res. EGA mon. (232nm) Everse Micro Enhancer) \$1799
Super EGA System (EGA System with NEC Multi-sync or Hi-Res. 800MHz. Hi-Res. 800MHz. Logitech Mouse (Call for separate list price))

A. Everse 20480N/17296g Keyboard: \$200/475/5640 B. 870MHz: \$100
C. 232nm: \$275 D. 1 MEG upgrade: \$ 89
E. 3 1/4" - Disc: \$115 F. E-verse Keyboard: \$ 35

Everex 386 AT (Intel 80386), 0 unit stock, \$2 = 18.4 From \$1900 (when 20MEG 5700)

System 800 Turbo XT \$488 (when 20MEG 5700)

- Fully 80486 XT compatible
- 80486 on Mother Board
- 386XT 4MHz
- 80287 4.75MHz
- 80486 16.6MHz 1MHz 10MHz
- Monographics card per
- All drive Software
- 100K power supply
- Add \$25. List of Super 80486 AT for 8700 system

The Everse Store™ - Authorized Everse Dealer
3282 St. Charles Road, Santa Clara, CA 95051
808-211 1790
M-F 10-6, SAT 11-5

IC's, Parts, Components... Shipped Fast!

West Coast's Largest Selection... Call for More

RAM Upgrades!

...priced in sets of 9

- 64K/120ns \$13.75
- 64K/150ns 10.88
- 256K/120ns 45.95
- 256K/100ns 34.95
- 256K/150ns 29.95

DYNAMIC RAMS

4116/200ns	\$1.29	4464/150ns	\$5.49
MK4332/200ns	5.95	41256/100ns	5.45
4164/200ns	1.25	41256/120ns	3.99
4164/150ns	1.35	41256/150ns	3.45
4164/120ns	1.60	41264/150ns	11.95
4164/PIN ONE	2.75	4128/150ns	4.19
4116/200ns	3.75	8118/4517-150ns	1.19
4416/150ns	4.19	1 MEG/100ns	24.95
4464/120ns	6.49	TMS 4161/150ns	6.95

STATIC RAMS

2102LP/450ns	\$9.99	6116/120ns	\$2.95
2101/450ns	1.79	6116LP/150ns	1.95
2112/450ns	2.69	6264LP/120ns	3.95
2114/450ns	89	6264LP/150ns	3.65
21142	1.19	6264/150ns	3.50
2114L/2	1.99	62256/120ns	12.85
6116/150ns	1.95	62256/100ns	19.95

74 HCT SERIES

74HCT00	\$2.25	74HCT161	\$6.65	74HCT540	\$1.99
74HCT02	25	74HCT183	65	74HCT541	1.99
74HCT04	25	74HCT164	65	74HCT563	2.99
74HCT06	25	74HCT175	65	74HCT573	1.99
74HCT10	25	74HCT240	1.29	74HCT574	1.99
74HCT12	30	74HCT241	1.29	74HCT574	1.99
74HCT14	49	74HCT244	1.29	74HCT640	1.99
74HCT17	49	74HCT245	1.29	74HCT646	2.99
74HCT138	50	74HCT257	65	74HCT563	2.99
74HCT157	65	74HCT259	1.10	74HCT564	2.99

LINEAR

CA3086	\$1.19	LM566	\$1.10	LM3900	45
CA3089	1.19	LM567	75	LM3909	1.25
CA3403	1.19	LM723	30	LM3911	1.95
LF347N	1.49	LM733	30	LM3914	2.75
LF348N	1.49	LM741	30	LM3915	2.75
LF356H	1.99	LM747	60	LM3916	2.75
LF441	1.69	LM748	65	LM4024	3.95
LM301	30	LM1414	1.49	LM4044	3.95
LM309K	1.00	LM1886	3.29	LM4136	1.50
LM317K	2.95	LM1330	1.95	LM4558	75
LM3177	1.75	LM1350	1.25	LM7555	2.50
LM318	1.15	LM1358	1.95	LM7556	2.50
LM319	95	LM1372	2.25	LM7680	2.95
LM320T-XX	60	LM1408L8	2.50	LM7683	2.95
LM320K-XX	1.35	LM1458	40	LM78H05	6.95
LM322K	4.25	LM1488	60	LM78H12	6.95
LM324	35	LM1489	60	LM8039	3.75
LM33502	1.19	LM1889	2.50	MC3423	1.49
LM33602	1.19	LM2003	75	MC3459	2.69
LM337H	2.49	LM2206	3.75	MC3470	2.99
LM337K	4.95	LM2111	1.19	MC3480	6.99
LM339H	6.95	LM2211	2.75	MC3487	1.69
LM340T-XX	60	LM2240	1.15	MC3497	1.99
LM340K-XX	1.35	LM2901	1.19	LM3254	1.99
LM355	45	LM2917	1.19	TDA1170	5.49
LM375	1.69	LM2917	1.29	TDA1180	5.99
LM380	95	LM3045	1.19	TL074	1.85
LM385	95	LM3054	1.99	TL081	75
LM393	95	LM3079	1.49	TL082	85
LM497	2.50	LM43130	95	TL084	1.25
LM565	30	LM43140	95	ULN2003	1.19
LM566	45	LM43160	95	ULN2004	1.79
LM568	85	LM43161	95	ULN2074	1.99
LM564	2.75	LM43162	95	ULN2081	1.99
LM565	1.50	LM43852	1.49	ULN2981	1.99

74HC SERIES

74HC00	\$2.25	74HC125	\$5.50	74HC174	\$6.65
74HC02	25	74HC132	50	74HC175	65
74HC04	25	74HC133	50	74HC240	1.29
74HC06	25	74HC138	55	74HC244	1.29
74HC09	25	74HC139	55	74HC245	1.29
74HC10	25	74HC148	75	74HC246	65
74HC11	25	74HC151	65	74HC373	1.29
74HC14	25	74HC153	65	74HC374	1.29
74HC20	25	74HC154	3.75	74HC4020	99
74HC32	25	74HC157	65	74HC4060	99
74HC74	35	74HC161	65	74HC4066	99
74HC85	65	74HC166	1.15	74HC4075	89
74HC12	65	74HC173	65	74HC4078	1.49

7400 SERIES

7400	\$1.18	7474	\$3.35	74157	\$5.65
7402	18	7475	35	74158	65
7404	18	7476	35	74173	65
7405	18	7485	35	74174	65
7406	35	7486	35	74175	65
7407	35	7490	35	74176	65
7408	25	7493	35	74181	1.75
7410	25	7495	35	74189	2.95
7414	35	74121	35	74193	65
7420	25	74123	45	74195	65
7426	25	74125	45	74198	1.65
7427	25	74126	45	74221	75
7430	25	74148	65	74273	1.75
7432	25	74150	1.20	74365	50
7438	25	74151	65	74366	50
7442	30	74153	65	74367	50
7446	85	74154	1.20	74368	50
7447	95				

74C CHIPS

74C00	\$2.25	74C154	\$2.65	74C374	\$1.69
74C02	25	74C173	99	74C303	1.19
74C04	25	74C174	99	74C306	1.19
74C08	35	74C175	99	74C312	6.95
74C10	35	74C221	1.25	74C322	3.95
74C14	49	74C240	1.69	74C323	3.95
74C32	35	74C244	1.69	74C329	4.89
74C90	1.19	74C373	1.69	74C332	14.89

Partial Listing Only!!!
Call us for components...

74LS SERIES

74LS00	\$1.19	74LS125	\$4.45	74LS241	\$9.99
74LS02	19	74LS126	49	74LS242	99
74LS03	19	74LS138	45	74LS243	99
74LS04	19	74LS139	45	74LS244	99
74LS05	19	74LS153	59	74LS245	99
74LS06	19	74LS154	1.29	74LS257	69
74LS09	19	74LS157	40	74LS258	69
74LS10	19	74LS158	40	74LS259	99
74LS14	25	74LS161	49	74LS273	99
74LS12	28	74LS163	49	74LS322	1.79
74LS32	28	74LS164	49	74LS323	1.79
74LS33	28	74LS165	49	74LS365	59
74LS47	99	74LS166	99	74LS366	59
74LS73	35	74LS173	49	74LS367	59
74LS74	35	74LS174	49	74LS368	99
74LS75	35	74LS175	49	74LS373	99
74LS76	35	74LS189	3.95	74LS374	99
74LS85	49	74LS190	49	74LS393	99
74LS86	28	74LS191	49	74LS624	1.89
74LS90	45	74LS192	49	74LS629	1.89
74LS93	45	74LS193	49	74LS640	1.89
74LS107	45	74LS195	49	74LS641	1.89
74LS109	45	74LS221	65	74LS670	99
74LS123	49	74LS240	99	74LS688	1.89

74F SERIES

74F00	\$3.35	74F153	\$5.50	74F243	\$1.29
74F02	35	74F157	59	74F244	1.29
74F04	35	74F158	59	74F245	1.29
74F08	35	74F160	59	74F251	79
74F10	35	74F161	59	74F252	79
74F11	35	74F163	59	74F280	2.89
74F20	35	74F174	69	74F373	1.49
74F32	35	74F175	69	74F374	1.49
74F64	49	74F181	1.99	74F379	1.99
74F74	49	74F189	2.99	74F399	2.99
74F86	49	74F219	4.99	74F521	2.99
74F109	49	74F240	1.29	74F533	2.99
74F139	49	74F241	1.29	74F534	2.99
74F151	59				

IC SOCKETS

SOLDBERTAL	HR16S/T	59	22PIN/W/W	1.29	
8PIN/LP	\$10	HR18S/T	60	24PIN/W/W	1.29
14PIN/LP	12	HR20S/T	79	28PIN/W/W	1.50
16PIN/LP	12	HR22S/T	89	40PIN/W/W	1.99
18PIN/LP	16	HR24S/T	99	NI RES W/W	
20PIN/LP	20	HR28S/T	1.19	HR8W/W	\$7.79
22PIN/LP	22	HR40S/T	1.49	HR14W/W	\$1.99
24PIN/LP	25	HR64S/T	4.99	HR16W/W	\$1.29
28PIN/LP	27	WIREWRAP		HR18W/W	\$1.39
40PIN/LP	29	8PIN/W/W	\$5.59	HR20W/W	\$1.69
48PIN/LP	99	14PIN/W/W	\$5.99	HR22W/W	\$1.79
64PIN/LP	2.49	16PIN/W/W	69	HR24W/W	\$1.99
NI RES		18PIN/W/W	99	HR40W/W	\$2.29
HR8S/T	\$3.39	20PIN/W/W	1.19	HR40W/W	\$3.49
HR14S/T	.49				

SPECIAL FUNCTION

VOICE RECOGNITION	16450 - 16 BIT	
CHIP SET	USART	\$16.95
YAMAHA DXY	8250 - 8 BIT	
CHIP SET	USART	6.95
TMS 6100	5832 - CLOCK	3.95
SPEECH CHIP	58167 - CLOCK	8.95
TMS S200 SPEECH CHIP	7.95	

CMOS

CD4001	\$1.18	CD4017	\$5.99	CD4047	\$5.65	CD4069	\$2.99	CD4510	\$6.99	CD4543	\$8.99
CD4002	18	CD4018	59	CD4048	75	CD4070	29	CD4511	69	CD4555	.99
CD4007	59	CD4020	59	CD4049	29	CD4071	29	CD4512	69	CD4556	.99
CD4008	59	CD4024	49	CD4050	39	CD4072	29	CD4518	79	CD4584	69
CD4009	59	CD4025	59	CD4051	39	CD4073	79	CD4519	79	CD14409	6.95
CD4010	29	CD4									

256K STATIC

32K x 8 \$1295
150ns

256K DRAM

41256 \$295
150ns

STATIC RAMS

2112	256x4 (450ns)	2.99
2114	1024x4 (450ns)	.99
2114L-2	1024x4 (200ns)(LOW POWER)	1.49
TMM2016-100	2048x8 (100ns)	1.95
HMM6116-4	2048x8 (200ns)(CMOS)	1.79
HMM6116-3	2048x8 (150ns)(CMOS)	1.85
HMM6116LP-4	2048x8 (200ns)(CMOS)(LP)	1.90
HMM6116LP-3	2048x8 (150ns)(CMOS)(LP)	2.45
HMM6116LP-2	2048x8 (120ns)(CMOS)(LP)	2.45
HMM6264LP-15	8192x8 (150ns)(CMOS)(LP)	3.95
HMM6264LP-12	8192x8 (120ns)(CMOS)(LP)	4.49
HMM43256LP-15	32768x8 (150ns)(CMOS)(LP)	12.95
HMM43256LP-12	32768x8 (120ns)(CMOS)(LP)	14.95
HMM43256LP-10	32768x8 (100ns)(CMOS)(LP)	19.95

DYNAMIC RAMS

4116-250	16384x1 (250ns)	.49
4116-200	16384x1 (200ns)	.89
4116-150	16384x1 (150ns)	.99
4116-120	16384x1 (120ns)	1.49
MK4332	32768x1 (200ns)	6.95
4164-150	65536x1 (150ns)	1.29
4164-120	65536x1 (120ns)	1.55
MCM6665	85536x1 (200ns)	1.95
TMS4164	65536x1 (150ns)	1.95
4164-REFRESH	65536x1 (150ns)(PIN 1 REFRESH)	2.95
TMS4416	16384x4 (150ns)	3.75
41128-150	131072x1 (150ns)	5.95
41128-120	131072x1 (120ns)	6.95
41256-150	262144x1 (150ns)	2.95
41256-120	262144x1 (120ns)	3.95
41256-100	262144x1 (100ns)	4.95
HMM51256-100	262144x1 (100ns)(CMOS)	6.95
1MB-120	1048576x1 (120ns)	31.95
1MB-100	1048576x1 (100ns)	34.95

EPROMS

2708	1024x8 (450ns)(25V)	4.95
2716	2048x8 (450ns)(25V)	3.49
2716-1	2048x8 (350ns)(25V)	3.95
TMS2632	4096x8 (450ns)(25V)	5.95
2732	4096x8 (450ns)(25V)	5.95
2732A	4096x8 (250ns)(21V)	3.95
2732A-2	4096x8 (200ns)(21V)	4.25
27C64	8192x8 (250ns)(12.5V CMOS)	4.95
2784	8192x8 (450ns)(12.5V)	3.49
2764-250	8192x8 (250ns)(12.5V)	3.89
2764-200	8192x8 (200ns)(12.5V)	4.25
MCM68766	8192x8 (350ns)(21V)(24 PIN)	15.95
27128	16384x8 (250ns)(12.5V)	4.25
27C266	32768x8 (250ns)(12.5V CMOS)	7.95
27256	32768x8 (125ns)(12.5V)	6.95
27512	65536x8 (250ns)(12.5V)	11.95
27C512	65536x8 (250ns)(12.5V CMOS)	12.95

≡V Program Voltage

★★★ HIGH-TECH ★★★
MCT-ATFH-RL \$199
FLOPPY/HARD CONTROLLER FOR AT
IMPROVE THE SPEED AND STORAGE CAPACITY OF YOUR AT COMPATIBLE

* RLL (RUN LENGTH LIMITED) ENCODING PUTS 50% MORE DATA IN THE SAME SPACE AS PREVIOUS METHODS WITH A CORRESPONDING INCREASE IN DATA TRANSFER
* SUPPORT FOR 2 RLL DRIVES SUCH AS ST-236 or ST-277
* PLUS SUPPORT FOR 2 FLOPPY DRIVES
* ACCOMMODATES 1.2M, 2.2M & 360K DRIVES IN BOTH 5 1/4" & 3 1/2" SIZES

★★★ SPOTLIGHT ★★★

8000		8200	
8031	3.95	8203	14.95
8036	1.49	8205	3.29
8039	1.95	8212	1.49
8052AH BASIC	34.95	8216	1.49
8080	2.49	8224	2.25
8085	1.95	8228	2.25
8086	6.49	8237	3.95
8088	6.99	8237-5	4.75
8088-2	7.95	8243	1.95
8155-2	2.49	8250	6.95
8741	3.95	8251	1.29
8746	7.95	8251A	1.69
8749	9.95	8253-5	1.95
8755	14.95	8255	1.49

int. MATH COPROCESSORS

8087	\$99.95	80287-8	\$249.95
8087-2	\$159.95	80287-10	\$309.95
80287	\$179.95	80287-16	\$499.95

TOLL FREE
800-538-5000
U.S. AND CANADA

74LS00

74LS00	.16	74LS112	.29	74LS241	.69
74LS01	.16	74LS122	.45	74LS242	.69
74LS02	.17	74LS123	.49	74LS243	.69
74LS03	.18	74LS124	2.75	74LS244	.69
74LS04	.16	74LS125	.39	74LS245	.79
74LS05	.18	74LS126	.39	74LS251	.49
74LS08	.18	74LS132	.39	74LS253	.49
74LS09	.18	74LS133	.49	74LS257	.39
74LS10	.16	74LS135	.39	74LS259	.49
74LS11	.22	74LS138	.39	74LS259	1.29
74LS112	.22	74LS139	.39	74LS260	.49
74LS113	.26	74LS145	.99	74LS266	.39
74LS114	.29	74LS147	.99	74LS273	.79
74LS115	.26	74LS148	.99	74LS279	.39
74LS120	.17	74LS151	.39	74LS280	1.95
74LS121	.22	74LS153	.39	74LS283	.59
74LS122	.22	74LS154	1.95	74LS289	.89
74LS127	.23	74LS155	.39	74LS283	.89
74LS128	.26	74LS156	.49	74LS289	1.49
74LS130	.17	74LS157	.35	74LS322	3.95
74LS132	.18	74LS158	.29	74LS323	2.49
74LS133	.28	74LS160	.29	74LS365	.39
74LS137	.26	74LS161	.39	74LS367	.39
74LS138	.26	74LS162	.49	74LS368	.39
74LS142	.39	74LS163	.39	74LS373	.79
74LS147	.75	74LS164	.49	74LS374	.79
74LS148	.85	74LS165	.65	74LS375	.95
74LS151	.17	74LS166	.95	74LS377	.79
74LS173	.29	74LS169	.95	74LS390	1.19
74LS174	.24	74LS173	.49	74LS393	.79
74LS175	.29	74LS174	.39	74LS541	1.49
74LS176	.29	74LS175	.39	74LS624	1.95
74LS181	.49	74LS176	.39	74LS625	.99
74LS185	.49	74LS192	.89	74LS645	.99
74LS186	.22	74LS193	.69	74LS670	.89
74LS189	.39	74LS194	.69	74LS682	3.20
74LS192	.49	74LS195	.69	74LS688	2.40
74LS193	.39	74LS196	.59	74LS783	22.95
74LS195	.49	74LS197	.59	25LS221	2.80
74LS197	.39	74LS221	.59	26LS31	1.95
74LS107	.34	74LS240	.69	26LS32	1.95
74LS109	.36				

7400

7400	.19
7402	.19
7404	.19
7406	.29
7407	.29
7408	.24
7410	.19
7411	.25
7414	.49
7417	.49
7417	.25
7420	.19
7430	.19
7432	.29
7438	.29
7442	.49
7445	.69
7447	.89
7473	.34
7474	.34
7475	.45
7476	.35
7483	.50
7485	.59
7486	.59
7489	2.15
7489	.39
7493	.35
74121	.29
74127	.49
74125	.45
74150	1.35
74151	.55
74152	.66
74154	1.49
74157	.55
74159	.65
74161	.69
74164	.95
74165	1.00
74175	.89
74387	.65

LINEAR

LM7071	.69	LM567	.79
LM7072	1.09	NE570	2.95
LM7074	1.95	NE592	.98
LM7082	.39	LM723	.49
LM7084	1.49	LM733	.98
LM7091	.34	LM741	.29
LM309K	1.25	LM747	.69
LM311	.69	MC1330	1.69
LM311H	.89	MC1350	1.19
LM317K	.39	LM1565	.95
LM317T	.69	LM1488	.49
LM318	1.49	LM1489	.49
LM319	1.25	LM1496	.85
LM320	7900	ULN2803	3.95
LM321	3.49	KR2203	3.79
LM324	.34	KR2211	2.95
LM331	3.95	LM2917	1.95
LM334	1.19	CA3046	.89
LM335	1.79	CA3146	.29
LM336	.59	MC1373	1.29
LM338K	4.49	MC3470	1.95
LM339	.59	MC3480	6.95
LM340	7900	MC3487	2.95
LF352	.69	LM3900	.49
LF353	.69	LM3901	1.29
LF357	.99	LM3909	.98
LM358	.59	LM3914	1.69
LM380	.89	MC4024	3.49
LM383	1.95	MC4044	3.99
LM390	.69	RC4134	1.25
LM393	.45	RC4558	.69
LM394H	5.85	LM13600	1.49
TL494	4.20	75110	1.49
TL497	3.25	75110	1.49
NE555	.29	75150	1.95
NE556	.49	75154	1.95
NE558	.79	75158	1.25
NE564	1.95	75169	1.25
NE565	.95	75181	.35
LM566	1.49	75482	.35
NE590	2.50	76477	1.25

H-TO-5 CAN. K-TO-3. T-TO-220

CMOS/HIGH SPEED CMOS

4001	.19	4068	.29	74HC154	1.09
4002	.19	4070	.29	74HC157	.85
4011	.25	4072	.29	74HC244	.85
4013	.35	4081	.22	74HC245	.85
4015	.29	4093	.49	74HC273	.69
4016	.29	14411	3.95	74HC373	.69
4017	.49	14413	14.95	74HC374	.69
4020	.59	4503	.49	74HC700	.29
4021	.69	4511	.69	74HC704	.27
4023	.25	4518	.85	74HC708	.89
4024	.49	4528	.79	74HC732	.27
4025	.25	4538	.95	74HC774	.45
4027	.39	4702	8.95	74HC7138	.55
4028	.85	74HC00	.21	74HC7139	.55
4040	.69	74HC02	.21	74HC7161	.79
4042	.85	74HC04	.25	74HC7240	.89
4044	.69	74HC08	.25	74HC7244	.89
4046	.69	74HC10	.25	74HC7245	.95
4047	.69	74HC14	.35	74HC7273	.95
4049	.29	74HC32	.35	74HC7373	.95
4060	.29	74HC38	.45	74HC7374	.95
4061	.69	74HC86	.45	74HC7393	.99
4062	.69	74HC138	.45	74HC74017	1.15
4063	.69	74HC139	.45	74HC74046	.95
4069	.69	74HC151	.59	74HC74060	1.45

6500 1.0 MHz

6502	2.25
65C02 (CMOS)	7.95
6520	1.65
6522	2.95
6526	13.95
6532	5.95
6545	2.95
6551	2.95

2-80 2.5 MHz

Z80-CPU	1.25
Z80A-CPU	1.29
Z80A-CTC	1.69
Z80A-DART	5.95
Z80A-DMA	5.95
Z80A-PID	1.89
Z80A-SIO 0	5.95
Z80A-SIO 1	5.95
Z80A-SIO 2	5.95

6.0 MHz

Z80B-CPU	2.75
Z80B-CTC	4.25
Z80B-PID	4.25
Z80B-DART	6.95
Z80B-SIO 0	12.95
Z80B-SIO 2	12.95
Z8671 ZILOG	9.95

6800 1.0 MHz

6800	1.95
6802	2.95
6803	3.95
6805	2.95
6809E	2.95
6810	1.95
6820	2.95
6821	1.25
6840	3.95
6843	4.95
6844	6.95
6845	2.75
6847	4.75
6850	1.95
6853	22.95

GLOCK CIRCUITS

MM58167	9.95
MM58174	9.95
MM58532	2.95

20 MEG HARD DISK DRIVE ON A CARD \$349!

BARGAIN HUNTERS CORNER

10 MEG HARD DISK SYSTEM

INCLUDES DRIVE, DRIVE CONTROLLER, CABLES AND INSTRUCTIONS
PRE-TESTED WITH A ONE YEAR WARRANTY

\$189

SPECIAL ENDS 1/31/88

CAPACITORS

TANTALUM			
1.0µf	15V	.12	1.0µf 35V .45
6.8	15V	.42	2.2 35V .19
10	15V	.45	4.7 35V .39
22	15V	.99	10 35V .69
DISC			
10µf	50V	.05	001µf 50V .05
22	50V	.05	005 50V .05
33	50V	.05	01 50V .07
47	50V	.05	05 50V .07
100	50V	.05	1 12V .10
220	50V	.05	1 50V .12
MONOLITHIC			
01µf	50V	.14	1µf 50V 18
047µf	50V	.15	47µf 50V 25
ELECTROLYTIC			
RADIAL		AXIAL	
1µf	25V	1µf	50V 14
4.7	50V	10	50V 16
10	50V	11	22 16V 14
47	35V	13	47 50V 19
100	16V	15	100 35V 19
220	38V	20	470 50V 29
470	25V	30	1000 16V 29
2200	16V	70	2200 16V 70
4700	25V	1.45	4700 16V 1.25

SOLDER STATION

UL APPROVED
• ADJUSTABLE HEAT SETTING W/ TIP TEMP READOUT
• QUICK HEATING & RECOVERY
• RANGE: 200°-900°F

\$49.95

EXTENDER CARDS FOR IBM

EXT-8088 \$29.95
EXT-80286 \$39.95



WIREWRAP PROTOTYPE CARDS

FR 4 EPOXY GLASS LAMINATE
GOLD PLATED EDGE CARD FINGERS



XT

BOTH CARDS HAVE SILK SCREENED LEGENDS & MOUNTING BRACKET

IBM-PR1 WITH -.5V AND GROUND PLANE \$27.95

IBM-PR2 AS ABOVE WITH DECODING LAYOUT \$28.95

AT

IBM-PRAT LARGE -.5V & GROUND PLANES \$29.95

SOLDERLESS BREADBOARDS

WBU-D	100 TIE POINTS	2.95
WBU-T	630 TIE POINTS	6.95
WBU-204-3	1360 TIE POINTS	17.95
WBU-204	1660 TIE POINTS	24.95
WBU-208	4390 TIE POINTS	29.95
WBU-208	3220 TIE POINTS	39.95

PAGE WIRE WRAP WIRE PRECUT ASSORTMENT

IN ASSORTED COLORS \$27.50
100m: 5.5", 6.0", 6.5", 7.0"
250m: 2.5", 4.5", 5.0"
500m: 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

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

36 PIN CENTRONICS

ICEN36	RIBBON CABLE	3.95
CEN36	SOLDER CUP	1.85
ICEN36/F	RIBBON CABLE	4.95
CEN36PC	Rt Angle PC Mount	1.85

EDGE CARD CONNECTORS

100 Pin ST	S-100	1.25	3.85
100 Pin WW	S-100	1.25	4.95
82 Pin ST	IBM PC	1.00	1.95
50 Pin ST	APPLE	1.00	2.95
44 Pin ST	STD	1.56	1.95
44 Pin WW	STD	1.56	4.95

VOLTAGE REGULATORS

7805T	.49	7812K	1.39
7808T	.49	7905K	1.89
7812T	.49	7912K	1.49
7815T	.49	78L05	.49
7905T	.59	78L12	.49
7908T	.59	78L08	.89
7812T	.59	79L12	1.49
7915T	.59	LM323K	4.79
7805K	1.59	LM338K	6.99

DISCRETE

1N751	.15	4N28	.69
1N4148 25/110	1.19	4N33	.89
1N4004 10/110	1.19	4N37	1.19
1N5402	.25	MCT-2	.59
KBPO2	.55	MCT-6	1.29
N2222	.25	TIL-111	.89
PN2222	1.0	2N3906	1.10
2N2907	.25	2N4401	.25
2N3055	.79	2N4402	.25
2N3904	1.0	2N4403	.25
4N26	.69	2N6045	1.75
4N27	.69	TIP31	.49

BYPASS CAPACITORS

01 µf CERAMIC DISC	100/45.00
01 µf MONOLITHIC	100/110.00
.1 µf CERAMIC DISC	100/46.50
.1 µf MONOLITHIC	100/612.50

SHORTING BLOCKS 5/\$1.00



WHY THOUSANDS CHOOSE JDR

- QUALITY MERCHANDISE
- COMPETITIVE PRICES
- MOST ORDERS SHIPPED IN 24 HOURS
- FRIENDLY, KNOWLEDGEABLE STAFF
- MONEY BACK GUARANTEE (ASK FOR DETAILS)
- TOLL FREE TECHNICAL SUPPORT
- EXCELLENT CUSTOMER SERVICE



DATASE

- ERASES 2 EPROMS IN 10 MINUTES
- VERY COMPACT, NO DRAWER
- THIN METAL SHUTTER PREVENTS UV LIGHT FROM ESCAPING

\$34.95



IDC CONNECTORS/RIBBON CABLE

DESCRIPTION	ORDER BY	CONTACTS					
		10	20	26	34	40	50
SOLDER HEADER	IDHxxS	.82	1.29	1.68	2.20	2.58	3.24
RIGHT ANGLE SOLDER HEADER	IDHxxSR	.85	1.35	1.76	2.31	2.72	3.39
WIREWRAP HEADER	IDHxxW	1.86	2.98	3.84	4.50	5.28	6.63
RIGHT ANGLE WIREWRAP HEADER	IDHxxWR	2.06	3.28	4.22	4.45	4.80	7.30
RIBBON HEADER SOCKET	IDSxx	.63	.89	.95	1.29	1.49	1.69
RIBBON HEADER	IDMxx	---	5.60	6.25	7.00	7.50	8.50
RIBBON EDGE CARD	IDExx	.85	1.26	1.35	1.75	2.05	2.45
10' GREG RIBBON CABLE	RCxx	1.80	3.20	4.10	5.40	6.40	7.50

FOR ORDERING INSTRUCTIONS SEE D-SUBMINIATURE CONNECTORS, BELOW

SPECTRONICS CORPORATION EPROM ERASERS

Model	Timer	Chip Capacity	Intensity (µW/Cm ²)	Unit Cost
PE-140	NO	9	8,000	\$89
PE-140T	YES	9	8,000	\$139
PE-240T	YES	12	9,600	\$189

LIGHT EMITTING DIODES

LED DISPLAYS

FND-367(359)	COM CATHODE	362"	1.25
FND-500(503)	COM CATHODE	5"	1.49
FND-507(510)	COM ANODE	5"	1.49
MAN-72	COM ANODE	3"	.99
MAN-74	COM CATHODE	3"	.99
TIL-313	COM CATHODE	3"	.45
TIL-311	4x7 HEX W/LOGIC	270"	10.95

DIFFUSED LEDS

JUMBO RED	T1 1/4	1.99	100-UP
JUMBO GREEN	T1 1/4	.10	.09
JUMBO YELLOW	T1 1/4	.14	.12
MOUNTING HOW	T1 1/4	.14	.12
MINI RED	T1	.10	.09

3 VOLT LITHIUM BATTERY \$1.95
HOLDER \$1.49



SWITCHES

SPDT	MINI-TOGGLE ON-ON	1.25
DPDT	MINI-TOGGLE ON-ON	1.50
DPDT	MINI-TOGGLE ON-OFF-ON	1.75
SPST	MINI-PUSHBUTTON N.O	.39

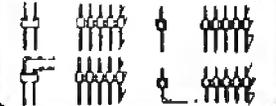
DIP SWITCHES

4 position	.85	7 position	.95
5 position	.90	8 position	.85
6 position	.90	10 position	1.29

"SNAPABLE" HEADERS

CAN BE SNAPPED APART TO MAKE ANY SIZE HEADER.
ALL WITH .1" CENTERS

1x40	STRAIGHT LEAD	.99
1x40	RIGHT ANGLE LEAD	1.49
2x40	2 STRAIGHT LEADS	2.49
2x40	2 RIGHT ANGLE LEADS	2.99



25 PIN D-SUB GENDER CHANGERS \$7.95



EMI FILTER \$4.95
LINE CORDS

2 conductor 39c	3 conductor 39c
3 conductor w/female socket	\$1.49

D-SUBMINIATURE CONNECTORS

DESCRIPTION	ORDER BY	CONTACTS						
		9	15	19	25	37	50	
SOLDER CUP	MALE	DBxxP	.45	.59	.69	.69	1.35	1.85
	FEMALE	DBxxS	.49	.69	.75	.75	1.39	2.29
RIGHT ANGLE PC SOLDER	MALE	DBxxPR	.49	.69	---	.79	2.27	---
	FEMALE	DBxxSR	.55	.75	---	.85	2.49	---
WIREWRAP	MALE	DBxxPWW	1.69	2.66	---	3.89	5.60	---
	FEMALE	DBxxSww	2.76	4.27	---	6.84	9.95	---
IDC RIBBON CABLE	MALE	IDBxxP	1.39	1.89	---	2.25	4.25	---
	FEMALE	IDBxxS	1.45	2.05	---	2.35	4.45	---
HOODS	METAL	MHOODxx	1.05	1.15	1.25	1.25	---	---
	GREY	HOODxx	.39	.39	---	.39	.89	.75

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

MOUNTING HARDWARE 59c

IC SOCKETS/DIP CONNECTORS

DESCRIPTION	ORDER BY	CONTACTS								
		8	14	16	18	20	22	24	28	40
SOLDER TAIL SOCKETS	xxST	.11	.11	.12	.15	.18	.15	.20	.22	.30
WIREWRAP SOCKETS	xxWW	.59	.69	.69	.99	1.09	1.39	1.49	1.69	1.99
ZIF SOCKETS	ZIFxx	---	4.95	4.95	---	5.95	---	5.95	6.95	9.95
TOOLED SOCKETS	AUGATxxST	.62	.79	.89	1.09	1.29	1.39	1.49	1.69	2.49
TOOLED WW SOCKETS	AUGATxxWW	1.30	1.80	2.10	2.40	2.60	2.90	3.15	3.70	5.40
COMPONENT CARRIERS	ICCxx	.49	.59	.69	.99	.99	.99	.99	1.09	1.49
DIP PLUGS (IDC)	IDPxx	.95	.49	.59	1.29	1.49	---	.85	1.49	1.59

FOR ORDERING INSTRUCTIONS SEE D-SUBMINIATURE CONNECTORS ABOVE

I would like you to know that I think you have a special employee in Helen M... giving the usual courteous and competent service that I have come to expect from JDR. Keep up the good work.

John Medcalf

CALL FOR VOLUME QUOTES

COPYRIGHT 1987 JDR MICRODEVICES

Circle 131 on Reader Service Card

64K DRAM 4164 150ns **\$129**

256K DRAM 41256 150ns **\$295**

MONITOR STANDS

MODEL MS-100 \$12.95

- TILTS & SWIVELS
- STURDY PLASTIC CONSTRUCTION

MODEL MS-200 \$39.95

- TILTS AND SWIVELS
- BUILT-IN SURGE SUPPRESSOR
- BUILT-IN POWER STATION INDEPENDENTLY CONTROLS UP TO 5 120 VOLT AC OUTLETS
- UL APPROVED



MONITORS

SAMSUNG MONOCHROME

- IBM COMPATIBLE TTL INPUT
- 12" NON-GLARE, LOW DISTORTION, AMBER SCREEN
- RES: 720 x 350
- SWIVEL BASE
- 1 YEAR WARRANTY



\$129.95

MULTISYNC BY NEC \$549.95

- ORIGINAL CGA/EGA/PGA COMPATIBLE MONITOR
- AUTO FREQUENCY ADJUSTMENT
- RESOLUTION AS HIGH AS 800 x 560

EGA BY CASPER \$399.95

- 15.75/21.85 KHz SCANNING FREQUENCIES
- RES: 640 x 200/350
- 14" BLACK MATRIX SCREEN
- .31mm DOT PITCH
- 16 COLORS FROM 64

RGB BY CASPER \$279.95

- COLOR/GREEN/AMBER SWITCH
- RES: 640 x 240
- RGB/IBM COMPATIBLE
- 14" NON-GLARE SCREEN
- .39mm DOT PITCH
- CABLE FOR IBM PC INCLUDED

MONOCHROME BY HYUNDAI \$69.95

- IBM COMPATIBLE TTL INPUT
- 12" NON-GLARE AMBER SCREEN
- ATTRACTIVE CASING WITH A TILT/SWIVEL BASE

NASHUA DISKETTES

BOXES OF 10

5 1/4" DS/DD 360K	\$9.95	5 1/4" DS/DD SOFT SECTOR	
5 1/4" DS HD 1.2M	\$24.95	49¢ ea	39¢ ea
3 1/2" DS/QD 720K	\$16.95	BULK QTY 50	BULK QTY 250

5 1/4" DISKETTE STORAGE FILE \$8.95

- HOLDS 70 5 1/4" FLOPPIES
- STURDY, ATTRACTIVE SMOKE ACRYLIC CASE
- COMPLETE WITH HINGED DIVIDERS



VERSION FOR 3 1/2" FLOPPIES AVAILABLE \$9.95

2 WAY SWITCH BOXES \$39.95

- CONNECT 2 PRINTERS TO 1 COMPUTER OR VICE VERSA
- SERIAL & PARALLEL MODELS AVAILABLE
- ALL LINES SWITCHED
- GOLD PLATED CONNECTORS & QUALITY SWITCHES

6' INTERFACE CABLES

MEETS FCC REQUIREMENTS 100% SHIELDED

- IBM COMPATIBLE PARALLEL PRINTER \$9.95
- CENTRONICS (MALE TO FEMALE) \$15.95
- CENTRONICS (MALE TO MALE) \$14.95
- IBM COMPATIBLE MODEM CABLE \$7.95
- RS232 SERIAL (MALE TO FEMALE) \$9.95
- RS232 SERIAL (MALE TO MALE) \$9.95
- COILED KEYBOARD EXTENDER \$7.95

JOYSTICK \$19.95

- SET X-Y AXIS FOR AUTO CENTER OR FREE MOVE-MEN
- FIRE BUTTON FOR USE WITH GAME SOFTWARE
- INCLUDES ADAPTOR CABLE FOR IBM



TOLL FREE 800-538-5000 U.S. AND CANADA

20MB HARD DISK ON A CARD



- SAVES SPACE AND REDUCES POWER CONSUMPTION
- IDEAL FOR PCs WITH FULL HEIGHT FLOPPIES
- LEAVES ROOM FOR A HALF LENGTH CARD IN ADJACENT SLOT

\$349

DISK DRIVES

5 1/4" SEAGATE HARD DISK DRIVES

ST-225	HALF HEIGHT 20MB	65ms	\$259
ST-238	HALF HEIGHT 30MB	65ms (RLL)	\$299
ST-251	HALF HEIGHT 40MB	40ms	\$469
ST-277	HALF HEIGHT 60MB	40ms (RLL)	\$649
ST-4038	FULL HEIGHT 30MB	40ms	\$559
ST-4096	FULL HEIGHT 80MB	28ms	\$895

1/2" HEIGHT FLOPPY DISK DRIVES

5 1/4" TEAC FD-55B DS DD 360K	\$99.95
5 1/4" TEAC FD-55F DS QUAD 720K	\$119.95
5 1/4" TEAC FD-55G DS HD 1.2M	\$129.95
5 1/4" FUJITSU M2551A DS DD 360K	\$89.95
5 1/4" FUJITSU M2553K DS HD 1.2M	\$119.95
5 1/4" DS DD 360K	\$69.95
5 1/4" DS HD 1.2M	\$109.95
3 1/2" MITSUBISHI DS DD (AT OR XT)	\$129.95

DISK DRIVE ACCESSORIES

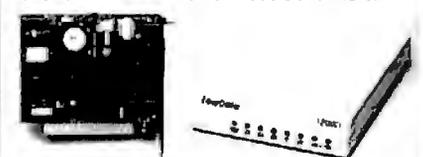
1/2" HT MOUNTING HARDWARE FOR IBM	\$2.95
MOUNTING RAILS FOR IBM AT	\$4.95
"Y" POWER CABLE FOR 5 1/4" FDDs	\$2.95
5 1/4" FDD POWER CONNECTORS	\$1.19

DRIVE ENCLOSURES WITH POWER SUPPLIES

CAB-25V5	DUAL SLIMLINE FOR 5 1/4"	\$49.95
CAB-1FH5	FULL HEIGHT FOR 5 1/4"	\$69.95
CAB-25V8	DUAL SLIMLINE FOR 8"	\$209.95
CAB-2FH8	DUAL FULL HEIGHT FOR 8"	\$219.95

EASYDATA MODEMS

All models feature auto-dial/answer/redial on busy, power up self test, touchtone or pulse dialing, built-in speaker, Hayes and Bell Systems 103 & 212A compatible, full or half duplex, PC Talk III Communications software with internal models and more.



INTERNAL

12H	1200 BAUD 1/2 CARD	\$69.95
24B	2400 BAUD FULL CARD	\$179.95

EXTERNAL

(NO SOFTWARE INCLUDED)

12D	1200 BAUD	\$119.95
24D	2400 BAUD	\$219.95

SWITCHING POWER SUPPLIES

PS-135 \$59.95

- FOR IBM XT COMPATIBLE
- UL APP., 135 WATTS
- 5V 15A, 12V 4.2A
- 5V 5A, 12V 5A
- ONE YEAR WARRANTY



PS-150 150W MODEL \$69.95

- FOR IBM AT COMPATIBLE
- 200 WATTS
- 5V 22A, 12V 8A
- 5V 5A, 12V 5A
- ONE YEAR WARRANTY



PS-A \$49.95

- FOR APPLE TYPE SYSTEM
- 5V 6A, 12V 3A
- 5V 1A, 12V 1A
- APPLE CONNECTOR



PS-1558 \$34.95

- 75 WATTS, UL APPROVED
- BY POWER SYSTEMS
- 5V 7A, 12V 3A
- 12V/250mA, -5, 300mA



RITEMAN II PRINTER



- 180 CPS DRAFT, 32 CPS NLQ MODE
- SUPPORTS EPSON/IBM GRAPHICS
- 9 x 9 DOT MATRIX
- FRICTION AND PIN FEEDS
- VARIABLE LINE SPACING & PITCH

\$219.95

IBM COMPATIBLE PRINTER CABLE \$9.95
REPLACEMENT RIBBON CARTRIDGE \$7.95

COMPUTER CASES

Attractive, sturdy steel cases fit the popular sized motherboards and include speakers, faceplates, expansion slots and all necessary hardware



XT STYLE FLIP-TOP \$34.95
XT STYLE SLIDE-TOP \$39.95
AT STYLE SLIDE-TOP \$89.95

- FRONT PANEL KEYLOCK AND LED INDICATORS
- JR. AT STYLE FLIP-TOP \$149.95**
- INCLUDES 180 WATT POWER SUPPLY
- FRONT PANEL KEYLOCK AND LED INDICATORS



Visit our retail store located at 1256 S. Bascom Ave. in San Jose, (408) 947-8881

JDR Microdevices

110 Knowles Drive, Los Gatos, CA 95030
Toll Free 800-538-5000 • (408) 866-6200
FAX (408) 378-8927 • Telex 171-110

COPYRIGHT 1987 JDR MICRODEVICES

THE JDR MICRODEVICES LOGO IS A REGISTERED TRADEMARK OF JDR MICRODEVICES. JDR INSTRUMENTS AND JDR MICRODEVICES ARE TRADEMARKS OF JDR MICRODEVICES. IBM IS A TRADEMARK OF INTERNATIONAL BUSINESS MACHINES CORPORATION. APPLE IS A TRADEMARK OF APPLE COMPUTER.

ALL MCT PRODUCTS CARRY A 1 YEAR WARRANTY

INTERFACE CARDS

FROM MODULAR CIRCUIT TECHNOLOGY



MCT-EGA

DISPLAY CARDS

MCT-MGP MONOCHROME GRAPHICS \$5995

- TRUE HERCULES COMPATIBILITY SUPPORTS LDTUS 123
- SOFTWARE DRIVER ALLOWS COLOR GRAPHICS PROGRAMS TO RUN ON A MONOCHROME MONITOR
- PARALLEL PRINTER PORT

MCT-EGA ENHANCED GRAPHICS ADAPTOR \$14995

- 100% IBM COMPATIBLE PASSES IBM EGA DIAGNOSTICS
- 256K OF VIDEO RAM ALLOWS 640 x 350 IN 16 OF 64 COLORS
- COMPATIBLE WITH COLOR AND MONOCHROME ADAPTORS

MCT-CG COLOR GRAPHICS ADAPTOR \$4995

- COMPATIBLE WITH IBM COLOR GRAPHICS STANDARDS
- SHORT SLOT SUPPORTS RGB, COLOR & COMPOSITE MONOCHROME
- 640/320 x 200 RESOLUTION, LIGHT PEN INTERFACE

MULTIFUNCTION CARDS

MCT-MF MULTIFUNCTION \$7995

- ALL THE FEATURES OF 8 PACK AT HALF THE PRICE
- 0-384K DYNAMIC RAM USING 4164s
- SERIAL PARALLEL, GAME PORTS, CLOCK/CALENDAR

MCT-MGMIO MONOGRAPHS I/O \$11995

- TOTAL SYSTEM CONTROL FROM A SINGLE SLOT
- 2 FLOPPY CONT, SERIAL, PARALLEL, GAME PORT, CLOCK CAL
- RUN COLOR GRAPHICS SOFTWARE ON A MONOCHROME MONITOR

MCT-MIO MULTI I/O FLOPPY \$7995

- A PERFECT COMPANION FOR OUR MOTHERBOARDS
- SERIAL, PARALLEL, GAME PORT, CLOCK, CALENDAR
- SUPPORTS UP TO 2 360K FLOPPIES, 720K WITH DOS 3.2

MCT-IO SERIAL 2nd SERIAL PORT \$15"

MCT-IO MULTI I/O CARD \$5995

- USE WITH MCT-FH FOR A MINIMUM OF SLOTS USED
- SERIAL PORT, CLOCK, CALENDAR WITH A BATTERY BACK-UP
- PARALLEL PRINTER PORT ADDRESSABLE AS LPT1 OR LPT2

MCT-ATMF AT MULTIFUNCTION \$13995

- ADDS UP TO 1 MEGABYTES OF RAM TO THE AT
- USER EXPANDABLE TO 1.5 MB OF MEMORY (ZERO K INSTALLED)
- INCLUDES SERIAL PORT AND PARALLEL PORT

MCT-ATMF-MC PIGGYBACK BOARD (NO MEMORY) \$29"

MCT-ATIO AT MULTI I/O \$5995

- USE WITH MCT-ATMF FOR A MINIMUM OF SLOTS USED
- SERIAL, PARALLEL AND GAME PORTS
- USES 16450 SERIAL SUPPORT CHIPS FOR HIGH SPEED OPERATION

ATIO-SERIAL 2nd SERIAL PORT \$24"

MEMORY CARDS

MCT-RAM 576K RAM CARD \$5995

- A CONTIGUOUS MEMORY SOLUTION IN A SHORT SLOT
- USER SELECTABLE CONFIGURATION AMOUNTS UP TO 576K USING 64K & 256K RAM CHIPS (ZERO K INSTALLED)

MCT-EMS EXPANDED MEMORY CARD \$12995

- 1 MB OF LOTUS INTEL MICROSOFT COMPATIBLE MEMORY FOR XT
- CONFORMS TO LOTUS INTEL EMS - USER EXPANDABLE TO 2 MB
- EXPANDED CONVENTIONAL MEMORY, RAMDISK AND SPOOLER

MCT-ATEMS AT VERSION \$139"

DRIVE CONTROLLERS

MCT-FDC FLOPPY DISK CONTROLLER \$2995

- QUALITY DESIGN OFFERS 4 FLOPPY CONTROL IN A SINGLE SLOT
- INTERFACES UP TO 4 FDDs TO AN IBM PC OR COMPATIBLE
- SUPPORTS BOTH DS DD AND DS QD WITH DOS 3.2

MCT-HDC HARD DISK CONTROLLER \$7995

- NO CONTROL FOR WHAT OTHERS CHARGE FOR FLOPPY CONTROL
- SUPPORTS 16 DRIVE SIZES INCLUDING 5, 10, 20, 30 & 40 MB
- DIVIDE 1 LARGE DRIVE INTO 2 SMALLER, LOGICAL DRIVES

MCT-FDC-1.2 12MB FLOPPY CONTROLLER \$6995

- ADD VERSATILITY & CAPACITY TO YOUR XT
- SUPPORTS 2 DRIVES, BOTH MAY BE 360K OR 1.2 MEG
- ALLOWS DATA TO FLOW FREELY FROM XTs TO ATs

MCT-FH FLOPPY/HARD CONTROLLER \$13995

- SYSTEM STARVED FOR SLOTS? SATISFY IT WITH THIS TIMELY DESIGN
- INTERFACES UP TO 2 FDDs & 2 HDDs, CABLING FOR 2 FDDs & 1 HDD
- SUPPORTS BOTH DS DD & DS QD WITH DOS 3.2

MCT-ATFH AT FLOPPY/HARD CONTROLLER \$14995

- FLOPPY HARD DISK CONTROL IN A TRUE AT DESIGN
- SUPPORTS UP TO 2 360K 720K 1 2MB FDDs
- AS WELL AS 2 HDDs USING STANDARD CONTROL TABLES



1/2 HEIGHT HARD DISK DRIVES

40 MB \$469

60 MB \$649

Drives are Seagate models ST-251 (40 MB) & ST-277 (60 MB RLL) 5 1/4" half heights FAST 40ms access time!

1/2 HT HARD DISK SYSTEMS

20 MB \$289

30 MB \$329

Systems include Seagate 1/2 height hard drive, drive controller, cables & instructions. All drives are pre-tested & warranted for 1 year.

IBM COMPATIBLE MOTHERBOARDS

FROM MODULAR CIRCUIT TECHNOLOGY

MCT-TURBO TURBO 4.77/8 MHz \$9995

- 4.77 OR 8 MHz OPERATION WITH 8088-2 & OPTIONAL 8087-2 CO-PROCESSOR
- FRONT PANEL LED SPEED INDICATOR AND RESET SWITCH SET SUPPORTED
- CHOICE OF NORMAL TURBO MODE OR SOFTWARE SELECT PROCESSOR SPEED

MCT-ATMB STANDARD MOTHERBOARD \$8795

MCT-ATMB 80286 6/8 MHz \$37995

- 8 SLOT (2 EIGHT BIT, 6 SIXTEEN BIT) AT MOTHERBOARD
- HARDWARE SELECTION OF 6 OR 8 MHz
- 1 WAIT STATE
- KEYLOCK SUPPORTED, RESET SWITCH, FRONT PANEL LED INDICATOR
- SOCKETS FOR 1 MB OF RAM AND 80287
- BATTERY BACKED CLOCK

MCT-BATMB MINI 80286 \$38995

- REPLACEMENT BOARD FOR XT STYLE CHASSIS
- OPERATE AT 6-10 MHz; WITH UP TO 1MB ON-BOARD MEMORY (ZERO K INSTALLED)
- SOCKET FOR 80287 MATH CO PROCESSOR
- BATTERY BACKED CLOCK
- 8 SLOTS: 2 EIGHT BIT, 6 SIXTEEN BIT
- USES CHIPS & TECHNOLOGY CHIP SET FOR RELIABILITY AND SMALL SIZE

IBM COMPATIBLE KEYBOARDS

FULL ONE YEAR WARRANTY



MCT-5339 \$7995

- IBM ENHANCED STYLE LAYOUT
- SOFTWARE AUTOSENSE FOR XT OR AT COMPATIBLES
- LED INDICATORS
- AUTO REPEAT FEATURE
- SEPARATE CURSOR PAD

MCT-5060 \$5995

- IBM AT STYLE LAYOUT
- SOFTWARE AUTOSENSE FOR XT OR AT COMPATIBLES
- LED INDICATORS
- AUTO REPEAT FEATURE

MCT-5150 XT STYLE LAYOUT \$4995

MCT-5151 K85151™ EQUIV. \$8995

WHY BUY A SYSTEM FROM JDR?

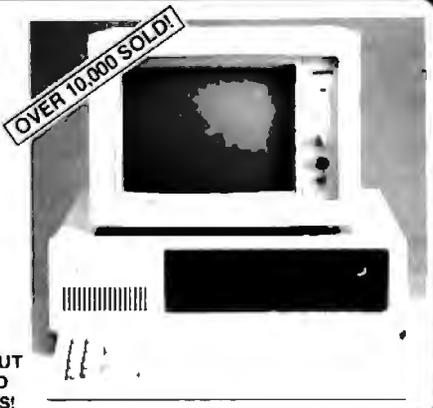
- BUILD IT YOURSELF AND SAVE!
- MONEY BACK GUARANTEE (ASK FOR DETAILS)
- LEARN ABOUT THE INNER WORKINGS OF A COMPUTER
- YOU CAN ASSEMBLE A SYSTEM IN ABOUT 2 HOURS WITH A SCREWDRIVER & OUR EASY-TO-FOLLOW INSTRUCTIONS
- MOST ORDERS SHIPPED IN 24 HOURS
- QUALITY COMPONENTS AND COMPETITIVE PRICES
- TOLL FREE TECH SUPPORT IN THE U.S. AND CANADA

BUILD YOUR OWN 256K XT COMPATIBLE

- MOTHERBOARD
- 256K OF MEMORY
- 135 WATT POWER SUPPLY
- FLIP-TOP CASE
- XT STYLE KEYBOARD
- 360K FLOPPY DRIVE
- DRIVE CONTROLLER
- MONOCHROME MONITOR
- GRAPHICS ADAPTOR

FOR ONLY \$489¹⁵

ANYONE CAN BUILD A SYSTEM IN ABOUT 2 HOURS USING A SCREWDRIVER AND OUR EASY-TO-FOLLOW INSTRUCTIONS!



DEVELOPMENT TOOLS

FROM MODULAR CIRCUIT TECHNOLOGY

MCT-EPROM PROGRAMMER \$12995

- PROGRAMS 27xx & 27xxx EPROMS UP TO 27512
- SUPPORTS VARIOUS PROGRAMMING FORMATS AND VOLTAGES
- SPLIT OR COMBINE CONTENTS OF SEVERAL EPROMS OF DIFFERENT SIZES
- READ, WRITE, COPY, ERASE CHECK AND VERIFY
- SOFTWARE FOR HEX AND INTEL HEX FORMATS

MCT-EPROM-4 4 GANG PROGRAMMER \$18995

MCT-EPROM-10 10 GANG PROGRAMMER \$29995

MCT-PAL PAL PROGRAMMER \$26995

MCT-MP PROCESSOR PROG. \$19995



PARTIAL LISTING ONLY-CALL FOR A FREE CATALOG!

COPYRIGHT 1987 JDR MICRODEVICES

Circle 132 on Reader Service Card

EDITORIAL INDEX BY COMPANY

Index of companies covered in articles, columns, or news stories in this issue.
Each reference is to the first page of the article or section in which the company name appears.

INQUIRY #	COMPANY	PAGE	INQUIRY #	COMPANY	PAGE	INQUIRY #	COMPANY	PAGE
801	3D SCIENCE LABORATORIES	67	770	DELKIN DEVICES U.S.A.	67	805	LEGAL KNOWLEDGE SYSTEMS	67
	3M	11	754	DELTA TECHNOLOGY			LETRASET	151
	ACIUS	151		INTERNATIONAL	67		LIVING VIDEOTEXT	151
	ACORN COMPUTER	285	777	DICONIX	67		LOTUS DEVELOPMENT	11, 67, 133, 151, 173, 251
	ADDISON-WESLEY	51	807	DIGIDESIGN	67		MAITREYA DESIGNS	151
	ADOBE	151, 205	810	DIGITAL EQUIPMENT	113, 141		MANSFIELD SOFTWARE	
786	ADVANCED COMPUTER			DIGITAL LEARNING SYSTEMS	67		GROUP	161
	TECHNOLOGY	67		DIGITAL RESEARCH	127, 185	766	MARION SYSTEMS	67
790	AHEAD SYSTEMS	67		DYSAN	11		MARK WILLIAMS	51
774	ALDUS	67, 151		ELECTROHOME	185		MASSCOMP	215
	AMDEK	185	763	ELECTRONIC INFORMATION			MAXELL	11
	AMSCO PUBLICATIONS	51		TECHNOLOGY	67	798	MEMOCOM	67
752	AMSTRAD	67	756	EVEREX	67		MEMOREX	11
	ANN ARBOR SOFTWORKS	151	789	FACIT	67		MEMORY CONTROL	
	AOX	67	939	FARALLON COMPUTING	205		TECHNOLOGY	11
956	APPLE COMPUTER	51, 141, 151, 161, 173, 185, 205, 251, 263		FOREMOST FURNITURE	185		MERIDIAN DATA	251
	ASHTON-TATE	151, 263		FRACAL SOFTWARE	151	895	MICRO CAD/CAM	173
759	ASK LCD	67		FRANZ	161	785	MICRO SYSTEMS GROUP	67
	AST RESEARCH	161		FUJI	11	935	MICROILLUSION	185
	AT&T	51, 141	792	FUJITSU AMERICA	97	853	MICROLYTICS	97
	ATARI	51, 185		FUTURE DOMAIN	67	948	MICROMINT	271
	ATLANTIC AEROSPACE			GENERAL COMPUTER	151		MICROPRO	133
	ELECTRONICS	215		GEORGIA TECH RESEARCH	215	966	MICRORIM	263
762	AUTODESK	67		GOLDSTAR	11	894	MICROSOFT	51, 67, 97, 127, 151, 173, 185, 205, 251
800	AUTOROUTER	67	769	GREAT PLAINS	151	757	MICROSOFT PRESS	51
	BAEN BOOKS	185	942	GRID SYSTEMS	67	797	MICROWAY	67
	BASF	11	767	GUPTA TECHNOLOGIES	113, 263		MINDWORK SOFTWARE	151
	BLYTH	151		GW INSTRUMENTS	67		MIT PRESS	161
	BORLAND		775	HAYES	11		MOUSE SYSTEMS	173
	INTERNATIONAL	11, 127, 133, 141, 151, 173, 185, 205, 215	794	HEATH/ZENITH	67		MULTITECH	173
791	BRODERBUND SOFTWARE	151, 171, 185	854	HEATHKIT	67	765	NANTUCKET	67
893	BRUBAKER & ASSOCIATES	173		HERCULES	11, 173		NASHUA	11
	C.ITOH	97	809	HEWLETT-PACKARD	97, 151, 185, 225	758	NATIONAL DESIGN	67
795	CALCTECH	67	804	HILCO SOFTWARE	67		NATIONAL SEMICONDUCTOR	141
	CANON	151		HITACHI	185, 271	773	NEC HOME ELECTRONICS	67, 97, 133
	CENTRONICS	141	808	HOOPER INTERNATIONAL	67	855	NETWORK TECHNOLOGIES	97
	CHIPS & TECHNOLOGIES	11		HUBBARD FURNITURE	185		NISSHO	97
949	CIRCUIT CELLAR	271	808	IAM	67		NOVELL	113
784	CITIZEN AMERICA	67		IBM	11, 51, 97, 113, 127, 133, 141, 151, 161, 173, 205, 251	938	OASIS SYSTEMS	185
787	CMS ENHANCEMENTS	67	943	INFORMIX SOFTWARE	113, 263		ODESTA	151
958	COGNITION TECHNOLOGY	263		INTEL	127, 251, 271	944	ORACLE	113, 263
791	COMMODORE BUSNISS			ITERATED SYSTEMS	215		ORANGE MICRO	151
	MACHINES	11, 51	802	JDL	97		ORCHID	185
	COMPAQ	97, 127, 133, 141, 151, 205, 251		JIM LANG	67	955	OWL INTERNATIONAL	263
791	COMPLETE LOGIC SYSTEMS	67	957	JVC	11		PARAGON COURSEWARE	151
	COMPU-ARCH	173		KNOWLEDGE GARDEN	263	856	PARALAX SOFTWARE	
803	COMPUTER ASSOCIATES		760	KODAK	11		PUBLISHERS	97
	INTERNATIONAL	67	768	KOWIN COMPUTER	67	885	PC DESIGNS	127
965	CONDOR COMPUTER	263	751	KYOCERA UNISON	67		POLAROID	11
	COOPERS & LYBRAND	11		LASERGRAPHICS	67		PRENTICE-HALL	161
883	CORAL SOFTWARE	161		LATTICE	51		PROJECT XANADU	185, 225
	CRICKET SOFTWARE	151		LAYERED	151	780	PROSPERO SOFTWARE	67
	DATA TAILOR	151					PROVUE	151
781	DATA/VOICE SOLUTIONS	67					QMS	151, 205
	DATAPRODUCTS	151				772	QUANTUM	67
771	DATAVUE	67						

EDITORIAL INDEX BY COMPANY

INQUIRY #	COMPANY	PAGE	INQUIRY #	COMPANY	PAGE	INQUIRY #	COMPANY	PAGE
783	QUME.....	67	779	STERLING CASTLE	67	753	TRAVELING SOFTWARE	67
962	RATLIFF SOFTWARE PRODUCTION	263	857	SUN MICROSYSTEMS	11, 141		UNIVERSAL TECHNICAL SYSTEMS	215
945	RELATIONAL TECHNOLOGY.....	113, 263		SYBASE.....	243, 263		USROBOTICS	11
	RICOH	151	937	SYDNEY DEVELOPMENT	11	811	VEN-TEL.....	84
	ROCKWELL INTERNATIONAL	11	886	SYMANTEC	185		VERBATIM	11
	SANYO.....	151		SYMMETRIC COMPUTER SYSTEMS	141	889	VERMONT MICROSYSTEMS.....	151
	SENTINEL	11		SYMMETRY.....	151	890	VERTICOM	151
	SIGMA DESIGN	11, 97		T/MAKER	151		VERY VIVID	11
	SILICON BEACH SOFTWARE.....	151		TANDON	205	776	WESTERN DIGITAL.....	11
778	SKOK.....	67		TDK	11	799	WINDJAMMER SOFTWARE	67
806	SNOW SOFTWARE.....	67		TELOS	151		WYSE	67
946	SOFTCRAFT	113		TEXAS INSTRUMENTS	151		XEROX	51
892	SOFTLOGIC SOLUTIONS.....	173	793	THE AUTOMATION GROUP	67		XIDEX	11
947	SOFTWARE SYSTEMS TECHNOLOGY	113	788	THINK TECHNOLOGIES	151	761	XYQUEST.....	133
	SOFTWARE VENTURES	151	941	THUMBSCAN.....	67	764	ZENITH DATA SYSTEMS	67, 185
	SONY	11	782	TOPS	205		ZENOGRAPHICS	67
				TOSHIBA AMERICA.....	67, 127, 133		ZILOG	271
				TRANSIMAGE.....	11, 97			

COMING UP IN BYTE

Products in Perspective:

Next month, we'll have a Group Review you'll want to keep on hand for permanent reference: Using state-of-the-art lab equipment, we objectively rate 15 multiscan monitors. Of course, we'll also include an associated BIX Product Focus discussion.

System reviews: the Compaq Deskpro 386 running at 20 MHz; Tandy's new model 4000; and two laptop portables, the Spark and the Snap 1 + 1, both from Datavue. Hardware reviews include evaluations of five optical disk drives and another one on six new memory boards for the IBM PS/2 machines.

Software reviews detail the latest Pascal from Borland—Turbo Pascal 4.0 and MPW's C for the Macintosh. Application reviews include a comparison of McMax with dBASE for the Macintosh, MathCAD, and RS/1, a modeling and statistical-analysis program from BBN Software.

Columnists Jerry Pournelle and Ezra Shapiro present their unique perspectives in Computing at Chaos Manor and Applications Only, respectively.

In Depth:

The In Depth section focuses on the Lisp programming language. Individual articles will be "Lisp: A Language for Stratified Design," "The Semantics of Scheme," "How Lisp Has Changed," "Lisp Implementation and Performance," "Parallelism in Lisp" and a Resource Guide pointing out Lisp sources of supply and information.

Features:

Articles in the lineup for February include a discussion of "EMS 4.0," "The Definicon Transputer Multiprocessor," and a method for achieving "Fast Hartley Transforms."

Steve Ciarcia presents Part 2 of his multitasking computer/controller construction project. Dick Pountain's contribution will be a piece on methods for producing "Multicolumn Paged Text."

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 MAGAZINE
ATTN: SUBSCRIBER SERVICE
P.O. BOX 6821
PISCATAWAY, NJ 08854



BYTE ADVERTISING SALES STAFF:

Dennis J. Riley, Advertising Sales Manager, One Phoenix Mill Lane, Peterborough, NH 03458, tel. (603) 924-9281

NEW ENGLAND
ME, NH, VT, MA, RI, ONTARIO
CANADA & EASTERN CANADA
Paul McPherson Jr. (617) 262-1160
McGraw-Hill Publications
575 Boylston Street
Boston, MA 02116

ATLANTIC
NY, NJ, CT, NJ (NORTH)
Leah G. Rabinowitz (212) 512-2096
McGraw-Hill Publications
1221 Avenue of the Americas—
39th Floor
New York, NY 10020

Dick McQuirk (203) 968-7111
McGraw-Hill Publications
Building A—3rd Floor
777 Long Ridge Road
Stamford, CT 06902

EAST
PA, 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
Carolyn P. Lovett (404) 252-0626
McGraw-Hill Publications
4170 Ashford-Dunwoody Road
Suite 420
Atlanta, GA 30319

MIDWEST
IL, MO, KS, IA, ND, SD, MN,
KY, OH, WI, NB, IN, MI, MS
Bob Denmead (312) 751-3740
McGraw-Hill Publications
Blair Building
645 North Michigan Ave.
Chicago, IL 60611

**SOUTHWEST,
ROCKY MOUNTAIN**
CO, WY, OK, TX, AR, LA
Karl Heinrich (713) 462-0757
McGraw-Hill Publications
7600 W. Tidwell Rd.—Suite 500
Houston, TX 77040

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

Tom Harvey (213) 489-5243
McGraw-Hill Publications
3333 Wilshire Boulevard #407
Los Angeles, CA 90010

NORTH PACIFIC
HI, WA, OR, ID, MT,
NORTHERN CA,
NV (except LAS VEGAS), UT,
W. CANADA
Mike Kisseberth (415) 362-4600
McGraw-Hill Publications
425 Battery Street
San Francisco, CA 94111

Bill McAfee (415) 349-4100
McGraw-Hill Publications
951 Mariner's Island Blvd.—
3rd Floor
San Mateo, CA 94404

BYTE BITS (2x3)
Dan Harper (603) 924-6830
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

The Buyer's Mart (1x2)
Mark Stone (603) 924-3754
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Regional Advertising
(So. CA, Mid-Atlantic, Southeast,
New York/New England)
Ellen Lister (603) 924-6830
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Regional Advertising
(Pacific NW, Midwest, Southwest,
New York/New England)
Scott Gagnon (603) 924-9281
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

BYTE Deck Mailings
National
Ed Ware (603) 924-6166
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

A/E/C Computing Deck
Computing for Engineers
Mary Ann Goulding
(603) 924-9281
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

International Advertising Sales Staff:

Mr. Hans Csokor
Pubimedia
Reiznerstrasse 61
A-1037 Vienna, Austria
222 75 76 84

Mrs. Gurit Gopper
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 I
Madrid 4, Spain
1 45 52 891

Mr. Gert Moberg
Andrew Karnig & Associates
Finnbodavägen
S-131 31 Nacka, Sweden
8-44 0005

Mr. Alain Faure
McGraw-Hill Publishing Co.
128 Faubourg Saint Honore
75008 Paris
France
(1) 42-89-03-81

Mr. Arthur Scheffer
Karen Lemie
McGraw-Hill Publishing Co.
34 Dover St.
London W1X 3RA
England 01 493 1451

Mamela Capuzzo
McGraw-Hill Publishing Co.
Via Flavio Baracchini 1
20123 Milan, Italy
(2) 89010103

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

Mr. Ernest McCrary
Empresa Internacional de
Comunicacoes Ltda.
Rua de Consolacao, 222
Conjuno 103
01302 Sao Paulo, S.P., Brasil
Tel: (11) 259-3811
Telex: (100) 32122 EMBN

READER SERVICE

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

* Correspond directly with company

Alphabetical Index to Advertisers

Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.
4 ACER/MULTITECH	232	44 C.H.A.S. MICRO	329	153 MARKENRICH	318	306 QUANTUS MICROSYSTEMS	47
5 ADOBE	262,263	* C.O.M.B. DIRECT MARKETING	329	154 MATHSOFT	69	307 QUANTUS MICROSYSTEMS	48
6 ADVANCED COMPUTER	332,333	75 DATA ACCESS	263	* MAXELL CORPORATION	7	308 QUANTUS MICROSYSTEMS	49
7 AK SYSTEMS	322	77 DATA TRANSLATION	37	155 MAXTECH	314	319 QUARTERDECK	107
8 AL MEIER VOGT	129	78 DB FAST	60	156 MAY COMPUTER	250	228 QUELO	325
9 ALF	314	82 DCS	318	157 MAY COMPUTER	250	229 RADIO SHACK	46
10 ALPHA PRODUCTS	315	309 DEVTRONICS	331	* MCGRAW-HILL NRI	273	230 RADIO SHACK	CIV
11 ALPS AMERICA	148,149	80 DIGITALK	108,109	158 MEAD COMPUTER	321	* RAIMA	35
12 ALPS AMERICA	148,149	81 DISKCOTECH	320	159 MEGASOFT	316	231 RAINBOW	145
314 AMER. ADVANTECH	330	317 DISKETTE CONNECTION	330	160 MERIDIAN TECHNOLOGY	249	232 RAINBOW	145
315 AMER. ADVANTECH	330	83 DISKMASTER	322	161 MERIDIAN TECHNOLOGY	249	233 RAINBOW	288
* AMER. DESIGN COMPONENTS	323	84 DRESSSELHAUS	171	162 MERRITT CORP.	102	234 RAINBOW	288
14 AMER. SEMICONDUCTOR	298,299	84 DRESSSELHAUS	223	163 MICRO ELECTR. PRODS.	314	235 REAL TIME DEVICES	327
15 AMERICAN SMALL BUSINESS	53	85 DYNAMIC ELECTRONIC	322	164 MICROCOM	20	236 ROSE ELECTRONICS	320
* ANTHRO	18	86 DYNWARE, CO.	93	* MICROMINT	295	237 SAFEWARE	322
16 APROTEK	316	87 ECOSOFT	192	165 MICRON TECHNOLOGY	89	238 SANTA CRUZ OPERATIONS	254
17 AST RESEARCH	137	88 ELEXOR	318	166 MICROPLOT	312	239 SCHWAB COMP	331
18 AST RESEARCH	137	89 ELLIS COMPUTING	146	316 MICROPORT	293	240 SCIENCE & ENGINEERING SAW331	
275 AT&T PHOTO & IMAGING	131	90 ENGINEERS COLLABORATIVE	316	167 MICROPROCESSORS UNLTD.	312	241 SCR	330
19 ATI TECHNOLOGIES INC.	183	91 EVEREX	25	168 MICRORIM	40,41	243 SEAGULL SCIENTIFIC	260
20 ATRON	66	92 EVEREX	25	169 MICROSOFT	62,63	244 SILICON SPECIALTIES	219
21 ATRONICS	117	93 FLAGSTAFF	184	170 MICROSOFT	62,63	245 SILICON SPECIALTIES	219
22 AUTODESK	199	94 FLAGSTAFF	184	171 MICROSOFT	157	246 SOFTRONICS	52
304 AVOCET	197	95 FOSTER TECHNOLOGY	106	172 MICROSOFT	157	247 SOFTRONICS	324
305 AVOCET	197	96 FOX SOFTWARE	115	173 MICROSOFT	231	248 SOFTWARE DEV. SYS.	159
* AVOCET	325	97 FTG DATA	316	174 MICROSOFT	231	249 SOFTWARE LINK, THE	31
24 B & B ELECTRONICS	330	98 FUJITSU AMERICA	132	175 MICROSOFT	233	250 SOFTWARE LINK, THE	31
25 B & C MICRO	324	99 FUJITSU AMERICA	132	176 MICROSOFT	233	251 SOFTWARE PRODUCTS INT'L	39
26 B & C MICRO	325	101 GENOA	71	177 MICROSOFT	235	252 SOFTWARE PRODUCTS INT'L	39
27 B & C MICRO	327	102 GLORIOUS UNION	30	178 MICROSOFT	235	253 SOLUTION SYSTEMS	190
28 B & C MICRO	329	103 GOLD HILL COMPUTERS, INC.	99	179 MICROSOFT	237	254 SORD	196
29 B & W SYSTEMS, INC.	224	104 GOLDEN BOW	320	180 MICROSOFT	237	255 SOURCE ELECTRONICS	52
30 BARRINGTON SYSTEMS	95	105 GRAFFPOINT	318	161 MICROSTAR LABS	322	256 SPECTRUM	227
31 BAY TECHNICAL ASSOC.	246	106 GTEK, INC.	325	182 MICROWAY	201	257 SPSS, INC.	105
32 BAY TECHNICAL ASSOC.	245	107 GTEK, INC.	325	183 MITSUBISHI	50	258 SUNCOAST SYS.	102
* BINARY TECH	312	* HARMONY COMPUTERS	32	184 MITSUBISHI	50	260 SWEET ELECTRONICS	146
450 BIX	282,283	108 HAYES MICROCOMP. PROD.	207	185 MIX	181	261 S'N/W ELECTRONICS	248
33 BLAISE COMPUTING	33	109 HERCULES	90,91	186 MONTGOMERY GRANT	319	262 S-100	313
34 BORLAND INT'L	CII	110 HERCULES	90,91	310 MS CORP.	331	263 S-100	313
35 BORLAND INT'L	CII	111 HEWLETT PACKARD	251	312 M.H.I.	261	264 TALKING TECH	320
36 BORLAND INT'L	1	112 HEWLETT PACKARD	122,123	187 NATIONAL INSTRUMENTS	116	265 TALL TREE SYSTEMS	120
37 BORLAND INT'L	1	114 HITECH EQUIPMENT	314	188 NEC INFO SYSTEMS	CIII	266 TANDON	43
38 BORLAND INT'L	187	115 IC EXPRESS	314	189 NPS, INC.	100	267 TANDON	43
39 BORLAND INT'L	187	116 IMSI	195	190 OCEAN INTERFACE	330	268 TANDON	268,267
40 BP MICRO	314	117 INES GMBH	329	191 OKIDATA	10	269 TANDON	268,267
* BUYERS MART	300-308	118 INNER LOOP	318	192 OKIDATA	193	270 TELVIDEO	22,23
* BYTE BACK ISSUES	130	* INNOVATIVE SOFTWARE	160,161	193 ON-LINE STORE	312	271 TIGERTRONICS	58
322 BYTE BITS	330	* INTECTRA	324	194 ON-LINE SYS.	324	272 TIGERTRONICS	324
* BYTE MARKETING	204	121 INTEGRAND RESEARCH CORP.	200	* ORACLE	87	273 TIMELINE	328
* BYTE SUB. MESSAGE	340	* INTERN'T'L PREVIEW SOC.	240,241	195 ORION INSTRUMENTS	110	* TIME-LIFE BOOKS	81
* BYTE SUB. SERVICE	166	122 IO TECH	327	196 OSBORNE MCGRAW-HILL	230	* TINNEY, ROBERT GRAPHICS	26
41 BYTEK	24	I.B.M. CORP.	28,29	197 PATTON & PATTON	154	* TINNEY, ROBERT GRAPHICS	297
* CALIFORNIAL DIGITAL	317	123 J & F MUSIC	208	198 PC DESIGNS	268	* TOSHIBA	143
42 CAPITAL EQUIPMENT	44	124 JACO	329	199 PC NETWORK	27	* TOSHIBA	247
43 CASIO	289	125 JAMECO	310,311	200 PC PRIME	326	274 TRI-STATE	308
45 CITIZEN AMERICA	19	126 JAWIN	318	201 PC TEMPLATE	44	276 TURBO POWER	196
* CLEO SOFTWARE	212	127 JAWIN	318	202 PEACHTREE SOFTWARE	15	277 TUSSEY COMP. PRODUCTS	58,57
46 CLUB AMERICAN TECH.	138,139	128 JKL	329	203 PERCON	315	278 UNIV. CROSS ASSEMBLERS	326
47 CMS	242	129 JOHN BELL ENGINEERING	327	* PEROSOFT, INC.	79	279 UNIVERSAL DATA SYSTEMS	85
48 CMS	242	130 J.D.R.	45	204 PERSTOR	262	280 U.S. ROBOTICS	140
51 CNS, INC.	294	131 J.D.R.	334,335	205 PERSTOR	262	281 U.S. ROBOTICS	140
52 CNS, INC.	294	132 J.D.R.	338,337	320 PETER NORTON	124,125	282 VEN-TEL	13
311 COEFFICIENT SYSTEMS	298	133 KADAK	104	321 PETER NORTON	124,125	283 VERBATIM CO.	210,211
53 COGITATE	316	134 KAO CORP.	147	206 PETER NORTON	239	284 VERMONT CREATIVE SFTWR.	229
54 COGITATE	314	135 KEA SYSTEMS	190	207 PETER NORTON	239	285 VICTORY ENTERPRISES	34
55 COMPACT DISC PRODUCTS	38	136 KEA SYSTEMS	312	208 PRECISION DATA	312	286 VISIFLEX SEELS	314
* COMPAQ	82,83	137 KEELE CODES LTD	314	209 PRIME SOLUTIONS	179	287 VOYETRA TECH	324
58 COMPLETE PC	77	138 KNOWLEDGE GARDEN, INC.	150	210 PRIME SOLUTIONS	179	288 WAREHOUSE DATA	55
59 COMPUSAVE	309	139 LAHEY COMPUTER SYSTEMS	193	211 PRINCETON DISKETTE	324	289 WESTEX	318
60 COMPUSERVE	119	140 LASCAUX GRAPHICS	58	212 PRINCETON GRAPHIC SYS.	81	290 WHITE CRANE SYSTEMS	104
62 COMPUTER BOOK CLUB, THE	257	141 LAWSON LABS	322	213 PRINCETON GRAPHIC SYS.	259	291 WHITE WATER GROUP, THE	198
* COMPUTER CONTINUUM	324	142 LIGHTGATE	64	214 PRINTERS PLUS INC.	188	292 WHOLE EARTH ELECTRONICS	230
63 COMPUTER MAIL ORDER	8,9	143 LIGHTGATE	64	215 PRISM ELECTRONICS	322	293 WILEY	261
64 COMPUTER PARTS GALORE	106	144 LINK COMP.	327	216 PROGRAMMERS CONNECTION	21	294 WINTEK CORP.	5
65 COMPUTER SURPLUS STORE	318	145 LOGICAL DEVICES	248	217 PROGRAMMER'S PARADISE	202,203	295 WINTEK CORP.	320
66 COMPUTER WAREHOUSE	172	146 LOGICAL DEVICES	248	218 PROGRAMMERS SHOP	189	296 WOODCHUCK IND.	325
67 COMPUTER WAREHOUSE	172	147 LOGITECH	73	219 PROTEUS TECHNOLOGY CORP.	209	297 WORDTECH SYSTEMS	101
68 CONCENTRIC DATA SYSTEMS	126	148 LOGITECH	73	220 QUA TECH	34	* WORTHINGTON DATA SOL.	42
318 CONSOLINK	287	149 LOGITECH	74,75	221 QUA TECH	312	298 WYSE TECHNOLOGY	236
69 CONTECH	316	150 LOGITECH	74,75	222 QUA TECH	312	299 XELTEK	327
70 CTX	234	* LOTUS MANUSCRIPT	103	223 QUA TECH	312	300 XENOSOFT	327
71 CTX	234	* MACMILLAN BOOK CLUBS, INC.	17	* QUAID SOFTWARE	54	301 ZERICON	325
72 CUESTA SYSTEMS	171	151 MANX SOFTWARE SYSTEMS	191	224 QUALSTAR	324	302 Z-WORLD	320
73 CURTIS, INC.	316	152 MARK WILLIAMS CO.	59	225 QUANTUM	162	303 Z-WORLD	320

READER SERVICE

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

* Correspond directly with company

Index to Advertisers by Product Category

Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.
HARDWARE							
325	ADD INS	141 LAWSON LABS	322	190 OCEAN INTERFACE	330	254 SORD	196
10 ALPHA PRODUCTS	315	153 MARKENRICH	318	192 OKIDATA	193	260 SWEET ELECTRONICS	148
19 ATI TECHNOLOGIES INC.	183	181 MICROSTAR LABS	322	279 UNIVERSAL DATA SYSTEMS	85	266 TANDON	43
21 ATRONICS	117	195 ORION INSTRUMENTS	110	280 U.S. ROBOTICS	140	267 TANDON	43
275 AT&T PHOTO & IMAGING	131	220 QUA TECH	34	281 U.S. ROBOTICS	140	* TOSHIBA	143
* BINARY TECH	312	235 REAL TIME DEVICES	327	282 VEN-TEL	13	* TOSHIBA	247
42 CAPITAL EQUIPMENT	44	329	MASS STORAGE	332	MONITORS	292 WHOLE EARTH ELECTRONICS	238
101 GENOA	71	7 AK SYSTEMS	322	70 CTX	234	295 WINTEK CORP.	320
106 GTEK, INC.	325	58 COMPACT DISC PRODUCTS	38	71 CTX	234	298 WYSE TECHNOLOGY	236
107 GTEK, INC.	325	69 CONTECH	316	62 DCS	318	337	TERMINALS
114 HITECH EQUIPMENT	314	93 FLAGSTAFF	184	183 MITSUBISHI	50	135 KEA SYSTEMS	190
129 JOHN BELL ENGINEERING	327	94 FLAGSTAFF	184	184 MITSUBISHI	50	270 TELVIDEO	22,23
* MICROMINT	295	134 KAO CORP.	147	212 PRINCETON GRAPHIC SYS.	61	* WORTHINGTON DATA SOL.	42
165 MICRON TECHNOLOGY	89	* MAXELL CORPORATION	7	213 PRINCETON GRAPHIC SYS.	259		
187 NATIONAL INSTRUMENTS	118	224 QUALSTAR	324	333	NETWORK HARDWARE		
204 PERSTOR	282	268 TANDON	266,267	53 COGITATE	316		
205 PERSTOR	262	269 TANDON	266,267	58 COMPLETE PC	77		
213 PRINCETON GRAPHIC SYS.	259	283 VERBATIM CO.	210,211	193 ON-LINE STORE	312		
215 PRISM ELECTRONICS	322			334	PRINTERS/PLOTTERS		
220 QUA TECH	34	*	MISCELLANEOUS	4 ACER/MULTITECH	232	338	APPLE 2/MAC LANGUAGES
221 QUA TECH	312	24 B & B ELECTRONICS	330	11 ALPS AMERICA	148,149	248 SOFTWARE DEV. SYS.	159
222 QUA TECH	312	31 BAY TECHNICAL ASSOC.	245	12 ALPS AMERICA	148,149	339	IBM/MS-DOS APPLICATIONS—
223 QUA TECH	312	32 BAY TECHNICAL ASSOC.	245	45 CITIZEN AMERICA	19		Business/Office
265 TALL TREE SYSTEMS	120	43 CASIO	289	84 DRESSELHAUS	223	54 COGITATE	314
302 Z-WORLD	320	* COMPUTER CONTINUM	324	99 FUJITSU AMERICA	132	68 CONCENTRIC DATA SYSTEMS	126
326	DRIVES	316 CONSOLINK	287	98 FUJITSU AMERICA	132	75 DATA ACCESS	263
47 CMS	242	72 CUESTA SYSTEMS	171	111 HEWLETT PACKARD	251	77 DATA TRANSLATION	37
48 CMS	242	* C.O.M.B. DIRECT MARKETING	329	112 HEWLETT PACKARD	122,123	78 DB FAST	60
271 TIGERTRONICS	58	83 DRESSELHAUS	171	188 NEC INFO SYSTEMS	CIII	96 FOX SOFTWARE	115
327	HARDWARE PROGRAMMERS	* INECTRA	324	191 OKIDATA	10	* INNOVATIVE SOFTWARE	160,161
16 APROTEK	316	121 INTEGRAND RESEARCH CORP.	200	301 ZERICON	325	* LOTUS MANUSCRIPT	103
* AVOCET	325	142 LIGHTGATE	64	335	SCANNERS/DIGITIZERS	168 MICRORIM	40,41
25 B & C MICRO	324	143 LIGHTGATE	64	102 GLORIOUS UNION	30	169 MICROSOFT	62,63
26 B & C MICRO	325	149 LOGITECH	74,75	203 PERCON	316	170 MICROSOFT	62,63
27 B & C MICRO	327	150 LOGITECH	74,75	336	SYSTEMS	* ORACLE	87
28 B & C MICRO	329	155 MAXTECH	314	17 AST RESEARCH	137	197 PATTON & PATTON	154
40 BP MICRO	314	310 MS CORP.	331	18 AST RESEARCH	137	201 PC TEMPLATE	44
41 BYTEK	24	229 RADIO SHACK	46	21 ATRONICS	117	202 PEACHTREE SOFTWARE	15
106 GTEK, INC.	325	231 RAINBOW	145	46 CLUB AMERICAN TECH.	138,139	319 QUARTERDECK	107
107 GTEK, INC.	325	232 RAINBOW	145	* COMPAQ	82,83	* RAIMA	35
144 LINK COMP.	327	233 RAINBOW	288	44 C.H.A.S. MICRO	329	238 SANTA CRUZ OPERATIONS	254
145 LOGICAL DEVICES	248	234 RAINBOW	288	90 ENGINEERS COLLABORATIVE	316	251 SOFTWARE PRODUCTS INT'L.	39
146 LOGICAL DEVICES	248	236 ROSE ELECTRONICS	320	* I.B.M. CORP.	28,29	252 SOFTWARE PRODUCTS INT'L.	38
299 XELTEK	327	241 SCR	330	156 MAY COMPUTER	250	297 WORDTECH SYSTEMS	101
328	INSTRUMENTATION	243 SEAGULL SCIENTIFIC	260	157 MAY COMPUTER	250	340	IBM/MS-DOS APPLICATIONS—
314 AMERICAN ADVANTECH	330	258 SUNCOAST SYS.	102	198 PC DESIGNS	268		Miscellaneous
315 AMERICAN ADVANTECH	330	272 TIGERTRONICS	324	200 PC PRIME	326	87 ECOSOFT	192
88 ELEXOR	318	285 VICTORY ENTERPRISES	34	219 PROTEUS TECH. CORP.	209	109 HERCULES	80,81
117 INES GMBH	329	286 VISIFLEX SEELS	314	306 QUANTUS MICROSYSTEMS	47	110 HERCULES	80,81
122 IO TECH	327	287 VOYETRA TECH	324	307 QUANTUS MICROSYSTEMS	48	316 MICROPORT	293
130 J.D.R.	45	331	MS/MULTIPLEXORS	308 QUANTUS MICROSYSTEMS	49	264 TALKING TECH	320
		* CLEO SOFTWARE	212	230 RADIO SHACK	CIV		
		91 EVEREX	25				
		92 EVEREX	25				
		108 HAYES MICROCOMP. PROD.	207				
		124 JACO	329				

Continued

FREE Information Retrieval Service

To assist you in making your evaluations, purchasing decisions, or recommendations, you can request further information directly from the manufacturer or service company on products and services advertised in this issue. There is no charge, no obligation. Just complete and mail the attached post-paid, self-addressed reply card, and we'll do the rest.

- 1** Circle numbers on reply card which correspond to numbers assigned to items of interest to you.
- 2** Check all the appropriate answers to questions "A" through "F".
- 3** Print your name and address and mail.

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.

A. What is your primary job function? (Check one only)

- 1 Business Owner, General Management, Administrative
- 2 MIS/DP, Programming
- 3 Engineering/Scientific, R&D
- 4 Professional (law, medicine, accounting)
- 5 Other

B. How many people does your company employ?

- 1 25 or fewer
- 2 26-99
- 3 100-499
- 4 500-999
- 5 1000 or more

C. Reason for request: (Check all that apply).

- 1 Business use for yourself
- 2 Business use for your company
- 3 Personal use

D. Your next step after information is received:

- 1 Purchase order
- 2 Evaluation
- 3 Specification/Recommendation

E. Please indicate the product categories for which you influence the selection or purchase at your (or your client's) company or organization. (Check all that apply).

- 1 Microcomputers
- 2 Peripherals
- 3 Software
- 4 Accessories and supplies

F. For how many microcomputers do you influence the purchase of products at your (or your client's) company or organization?

- 1 1
- 2 2-4
- 3 5-9
- 4 10 or more

Name _____
 Title _____
 Company _____
 Address _____
 City _____ State _____
 Zip _____ Telephone _____

CIRCLE FOR FREE INFORMATION JANUARY 481RSU

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	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	51	52	53	54
55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108
109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162
163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189
190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216
217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243
244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297
298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324
325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351
352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378
379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405
406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432
433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459
460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486
487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513
514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540
541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567
568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594
595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621
622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648
649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675
676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702
703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729
730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756
757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783
784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810
811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837
838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864
865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891
892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918
919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945
946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972
973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999

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.

A. What is your primary job function? (Check one only)

- 1 Business Owner, General Management, Administrative
- 2 MIS/DP, Programming
- 3 Engineering/Scientific, R&D
- 4 Professional (law, medicine, accounting)
- 5 Other

B. How many people does your company employ?

- 1 25 or fewer
- 2 26-99
- 3 100-499
- 4 500-999
- 5 1000 or more

C. Reason for request: (Check all that apply).

- 1 Business use for yourself
- 2 Business use for your company
- 3 Personal use

D. Your next step after information is received:

- 1 Purchase order
- 2 Evaluation
- 3 Specification/Recommendation

E. Please indicate the product categories for which you influence the selection or purchase at your (or your client's) company or organization. (Check all that apply).

- 1 Microcomputers
- 2 Peripherals
- 3 Software
- 4 Accessories and supplies

F. For how many microcomputers do you influence the purchase of products at your (or your client's) company or organization?

- 1 1
- 2 2-4
- 3 5-9
- 4 10 or more

Name _____
 Title _____
 Company _____
 Address _____
 City _____ State _____
 Zip _____ Telephone _____

CIRCLE FOR FREE INFORMATION JANUARY 481RSU

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	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	51	52	53	54
55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108
109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162
163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189
190	191	192	193	194	195</																					



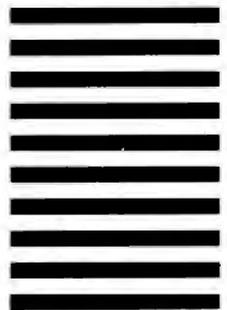
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 176 DALTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE

BYTE

READER SERVICE
PO Box 298
Dalton, MA 01227-0298
USA



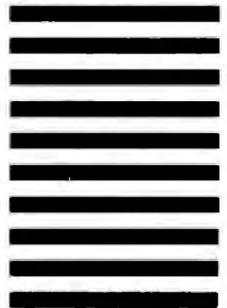
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 176 DALTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE

BYTE

READER SERVICE
PO Box 298
Dalton, MA 01227-0298
USA



IF THE REASON YOU HAVEN'T BOUGHT A 24-PIN PRINTER IS PRICE, YOU'VE LOST YOUR REASON.

You've also lost your last reason for buying a 9-pin printer. Our new Pinwriter® P2200 dot matrix printer is the first 24-pin printer that is priced lower than many of today's 9-pin printers.

However, we didn't strip the price by doing the same thing to features.

In fact, we gave the P2200 a few features you won't find on any other printers at any price.

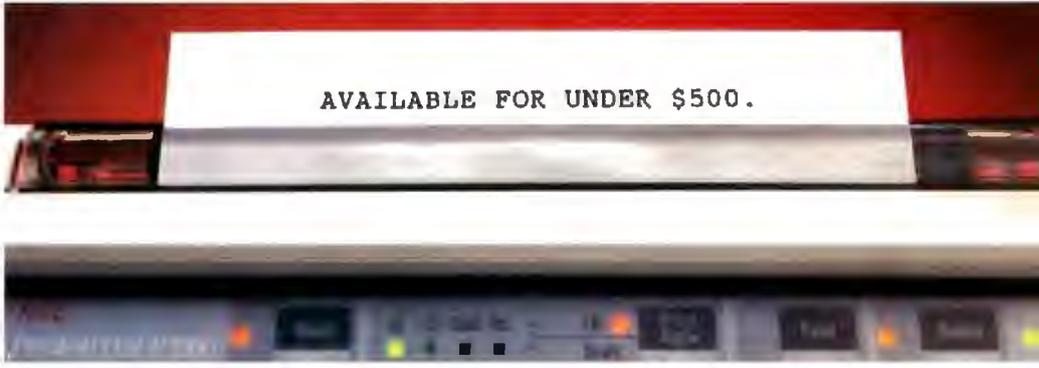
Like more software support than any other 24-wire printer and unrivaled paper-handling capabilities. It feeds from both the rear and the front. And you can print a single sheet without removing your continuous paper. You can also produce up to 128 type variations within a single document.

We also didn't get the price down at the expense of speed. The P2200 prints 55 cps in LQ mode – that's faster than any other printer in its price range. And in draft mode, it speeds along at 170 cps.

So see your NEC dealer today. Anything else would be thoroughly unreasonable.



For more information, and the name of the NEC/IS dealer nearest you, call 1-800-343-4418 in MA 617-264-8635). Or write: NEC Information Systems, Dept. 1610, 1414 Massachusetts Ave., Boxborough, MA 01719.



AVAILABLE FOR UNDER \$500.

NEC PRINTERS. THEY ONLY STOP
WHEN YOU WANT THEM TO.

NEC

NEC Information Systems, Inc.

Tandy Computers:
Because there is
no better value.TM

The Tandy[®] 1400 LT



A price breakthrough
in dual-disk MS-DOS[®]
portable computers.

Introducing a portable computer that is a true PC compatible. With a removable rechargeable battery pack built in, the Tandy 1400 LT is perfect for people on the go—like busy executives, sales personnel and journalists. Or you can use it in your office like a desktop computer.

The 8088-equivalent microprocessor has a 7.16 MHz clock speed (vs. 4.77 MHz for most other PC-compatible portables). Standard equipment includes two 720K 3 1/2" built-in disk drives and 768K RAM—ample memory to run today's powerful MS-DOS based programs.

The Tandy 1400 LT features a high-quality *backlit* liquid crystal display. The 80-character by 25-line resolution gives you the same display as a full-sized monitor. And it's remarkably clear, thanks to the latest "supertwist" LCD technology.

The Tandy 1400 LT also includes a parallel printer adapter, RGBI and composite monitor outputs, a real-time clock and an RS-232C serial interface. You even get MS-DOS 3.2 and GW-BASIC.

Come to Radio Shack and see the Tandy 1400 LT—only \$1599. (25-3500)

Price applies at Radio Shack Computer Centers and participating stores and dealers. MS-DOS/Reg. TM Microsoft Corp.

Circle 230 on Reader Service Card

Radio Shack[®]
The Technology StoreTM

A DIVISION OF TANDY CORPORATION