Town planning model

Reviews:
NewBrain
Low-cost network
Superbrain II

Trend prediction
Galactic chess
Data ports explained
MicroCentre introduce Cromemco's new System One computer, available with an integral 5 megabyte Winchester hard disk, at a new low price.

The System One supports the full range of Cromemco interface cards, including high resolution colour graphics, and software packages. The choice of operating systems includes CDOS, CP/M and CROMIX—Cromemco's answer to Unix.

Call MicroCentre for Cromemco

MicroCentre Ltd
(Complete Micro Systems)

Britain's independent Cromemco importer

30 Dundas Street
Edinburgh EH3 6JN
Tel: 031-556 7354
CONTENTS

31 Editorial / Do not overestimate the expert system
33 Feedback / Prestel's future; Sinclair deliveries; WordStar on Apple

News
36 Printout / Low-cost printer; Cashbook on Pet; New Apple

Simulation
78 Town planning / A role-playing game where participants have to argue their cases, developed by Chris Harrison

Reviews
46 NewBrain / The NewBrain has been a long time coming, after a change of manufacturer and a total redesign; David Watt finds it was worth the wait
54 Superbrain II / Old computers never die, they are just “enhanced”; Ian Stobie looks at the Superbrain with quad-density floppy discs
61 Clearway / Chris Bidmead reviews a microcomputer networking system that will not cost you an arm and a leg
69 Superfile / Database management is fashionable these days; Chris Bidmead investigates a package with a difference
165 Books / My micro speaks Basex; Using microcomputers in business

Features
85 Cryptanalysis / Muriel Gilligan’s introduction to code-breaking techniques
93 Information technology and public privacy / Topical comment from Boris Allan
117 Applications / Martin Hayman visits a hospital where artificial intelligence is used to aid diagnosis
168 Game / Galactic chess

Programming
88 Time series / Tony Judge shows how a microcomputer can be used to predict future trends
96 Structured programming / Part 3 of Graham Beech’s series
108 Data-transmission protocols / Alan Clements describes how computers communicate
127 Moving objects in the mammoth maze / Graham Relf uses the mammoth maze to demonstrate the operation of hash tables
133 Open file / 14 pages of software for micros including Pet, Apple, Tandy, Sinclair and Forth machines
103 Fiction / Goto Hyperspace by Edmund Teague
167 Puzzle
172 Printers buyers’ guide
187 Users’ group index
193 Random access / Boris Allan solves the Towers of Hanoi puzzle using five different micros
The best value for money on the small business systems market

SUPERBRAIN

A smart, fully self-contained desk-top unit – that’s the SUPERBRAIN microcomputer. It will operate as a complete business system, as a word processor (allied to a high quality printer) and as an intelligent terminal.

- 320K, 680K and 1.5 MB disc drives
- Wide range of standard packages
- Full graphics facility
- Nationwide dealer network
- Hard Discs available too – integral or separate

SUPERBRAIN

is ideal for both first time buyers needing a general purpose machine, and for users wishing to upgrade from a personal microcomputer system. Its CP/M operating system will handle the most sophisticated programs. Twain Z80 microprocessors and an RS232 communications port make it easy to extend the system in the future.

The Icarus dealer network

LONDON

BUSINESS INFORMATION SYSTEMS, 462 Triumph House, 189 Bunper Street, LONDON W1. Tel: 01 437 1069
COMPUTECH SYSTEMS LTD, 168 Fincente Road, LONDON. Tel: 01 794 0326
DATA PROFILE, Lawerne Road, Green Lane, HOUNSLOW, Middlesex. Tel: 081 577 3381
ELSTREE COMPUTING LTD, 133 Elstree Way, borehamwood, HERTS. Tel: 01 207 2000
ENDEAVOUR, 48 Eaton Drive, Chelmsford, Essex. Tel: 0245 41 3919
EASIBEE COMPUTING LTD, Elstree Way, borehamwood, HERTS. Tel: 01 207 2000
ECHOSYSTEMS, 10 Maple Close, MAIDENHEAD, Berks. Tel: 0734 589068
FACILITRON, Long Road, Studham, DUNSTABLE, Beds. Tel: 0768 339262
FIELDING SYSTEMS, 602 Triumph House, 189 Bunper Street, LONDON W1. Tel: 01 944 6477
GROFFER LTD, 800 Elstree Way, borehamwood, HERTS. Tel: 01 572 6381
HUGH SIMMONS LTD, 53 Grafton Way, LONDON WI. Tel: 01 943 0777
Icarus

processor (allied to a high performance system)
320K, 680K and 1.5 MB disc drives
Full graphics facility
Wide range of standard packages
Programs. Twin Z80 microprocessors and an RS232 communications port make it easy to extend the system in the future.

Digital systems

Circle No. 102

Which Computer? Magazine

For further details, or if you want to become a dealer yourself, contact:

Icarus Computer Systems Ltd.

Icarus Computer Systems Ltd. Deane House 27 Greenwood Place London NW5 1NN Tel: 01-485 5574 Telex: 264209

PRACTICAL COMPUTING September 1982

4
Better trade with Cumana and get the choice of a whole range of Top Quality Disk Drives

A BIG PLUS! includes SWITCH UNIT for 80 or 35 track use

We offer a wide range of high quality disk drives for Apple, TRS-80 and many other popular computers including the BBC Micro (Model B), NASCOM, Genie and Superbrain. Our continued high reputation depends on supplying professional users with top quality trouble-free products, completely dependable and quiet in operation. And, Cumana make you a promise that when there are better products we will be supplying them; and at prices to keep our Dealers ordering!

CUMANA LTD

TRIDATA integrated business package now available on Cumana 40 and 80 Track Model III Drives. Contact TRIDATA: Tel. 021 622 6085.

CUMANA LTD
35 Walnut Tree Close, Guildford, Surrey GU1 4UN.
Telephone: (0483) 503121 Telex: 858306

Apple is the Registered Trade Mark of Apple Inc.
The best value in town is at
SILICON VALLEY
01-802 7186
278 6783
800 8185
Almost all makes of popular business micros available plus a wide range of software,
printers, disc drives & accessories at keenest prices.

Some of our special offers:
The IBM Personal Computer
The IBM name means quality and reliability and
their new personal computer fully justifies the
name. Features include *40K ROM, *64K RAM
(expandable to 1Mb. *Intel 8088 processor at
4.77Mhz *80 or 40 character display *full screen
editor *BASIC, Pascal, COBOL *Visicalc, Wordstar,
Easywriter. Add these to the latest in 16-bit
technology and you have the best micro around.
From £2,950 (or lease at £15.50 per week).

The Osborne 1
The Osborne is the only truly portable personal
computer available, included as standard are five
software packages with a retail value of over £800
– CP/M, Wordstar, Supercalc, M BASIC and C BASIC.
From £1,250 (or lease at £6.73 per week).

The Apple II
One of the most widely installed and best supported
machines in the world. A powerful low cost
solution to so many applications.
The vast range of supporting
software and hardware
add-ons ensure a system
that meets your
requirements.
Only £658 (or lease at
£3.67 per week)

Just in from America! All the latest IBM software now available.
GAMES
DEAD LINE • LOST COLONY • TEMPLE OF ASAKI • GALAXY •
MIDWAY CAMPAIGN • VOYAGER • CORK 10R 2
IBM BUSINESS SOFTWARE
STOCKS AND BONDS • WRITE ON • EASY SPELLER •
EASY FILER • EASY WRITER • SUPER CALC • SUPER WRITER •
TIM DATA BASE • MAD MAGIC • VERSA COMPUTING HARD
COPY GRAPHICS • VERSA COMPUTING • WRITE TABLET •
WORDSTAR PREMIUM PACK • VISICALC 64K • VISICALC 256K •
VISIFILE • VISIDEX • VISITREND/PLOT • DESKTOP PLAN
At low, low prices. Ring for listing and prices.

(open: Mon- Fri 10-6pm) Barclaycard and Access.
A GOOD DEAL MADE
A GOOD DEAL BETTER
The Silicon Valley Computer Centre
Group 18 Ltd 115 Craven Park Road LONDON N15
Telephone: 01-802 7186 278 6783 800 8185

Circle No. 104
The CompuStar 10 megabyte Disk Storage System (DSS) consists of read/write and control electronics, a track positioning mechanism, a spindle drive mechanism, dual disks, an air filtration system, and our exclusive 256 user controller — all packaged in a compact desktop enclosure. Although designed primarily to accommodate multiple CompuStar Video Processing Units (described at left), the unit can easily be connected to a single SuperStar Video System to facilitate additional disk storage. When used with CompuStar VDUs, however, the integral 250 based controls will permit up to 256 users to 'share' the resources of the disk with minimal CPU response degradation.

Read/Write Heads and Disk

The recording media consists of a lubricated thin magnetic oxide coating on a 200mm diameter aluminum substrate. This coating for modulation, together with the low load force/low mass Winchester type flying heads, permits reliable operation. The recording density of 240 tracks/inch, plus 10 Megabyte Winchester 51/2-inch hard disk (TS 954H)

TS 952 & 952H Features:
- 200A 6 MHz processor with direct memory access
- 64 Kbytes of RAM main memory
- 4 Kbytes of EPROM for system diagnostics and boot loading
- Dual floppy disk controller (TS 952), and hard disk controller plus floppy disk controller (TS 953H)
- Dual minifloppy disks: 1 Mbyte capacity (TS 952)
- Single minifloppy disk: 1.5 Mbyte capacity, plus 10 Mbyte Winchester 51/2-inch hard disk (TS 953H)
- Green phosphor CRT (25 rows by 80 columns)
- Typewriter-style dedicated keyboard
- Full-screen attributes; editing, smooth scroll, 29th status line, 11 function keys, numeric key pad
- 2 RS-232C serial ports. These are jumper selectable for any combination of modes or printers
- CP/M 2.2 operating system
- Attractive tabletop enclosure, fully integrated with CRT, CPU, RAM and disk drives
- 1 RS-422 high-speed port

**G. W. COMPUTERS LTD. 01-636 8210, 01-631 4818, TELEX 892031 TWCG

DATABASE MANAGEMENT + WORD-PROCESSING + MODELLING + DIY

INTERPRETER + SERVICE

MULTI-USER HARD DISKS

24 HOUR ANSWERPHONE/LEAVE ADDRESS FOR STANDARD INFORMATION DATA PACK

THE G.W. BEST SYSTEM DEAL IN THE U.K.

***ALL YOU NEED FROM A COMPUTER***

DATABASE MANAGEMENT + WORD-PROCESSING + MODELLING + DIY

INTERPRETER + SERVICE

01-CPM HANDBOOK 10.00
02-BASIC EXERCISES (BOOK) 10.00
03-BOX PAPER (200 sheets) 20.00
04-DBMS 3 (DATABASE) 575.00
05-MAGIC-WAND (IN PROCESSOR) 190.00
06-MICRO-BUSINESS (LANGUAGE) 150.00
07-MAGIC-CALC (MODELLING) 175.00
08-DIAGNOSTICS 125.00
09-MSORT & DSORT 75.00
10-RECOVER + AUTOLOAD 25.00
11-INSTITUTIONAL BASIC (BOOK) 10.00
12-DISKFULL OF GAMES 50.00
13-LIBRARY CASES (NOT IN VAT) 15.00
14-MSORT & DSORT 140.00

CHOOSE ANY COMPUTER TERMINAL
CHOOSE ANY PRINTER OVER 1000 PDNS
ADD 10% FOR 12 MONTH WARRANTY
ADD 175.00 FOR CABLES, DELIVERY AND INSTALLATION
ADD 150.00 FOR BLANK DISKETTES

THEN YOU GET THE LEFT-HAND LIST

***** FREE *****

TRAINING OPTIONALLY EXTRA 100.00

CALL ONLY BY PRIOR APPOINTMENT AT 55 BEDFORD COURT MANSIONS, BEDFORD AVENUE LONDON W.C.1
SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard SuperBrain features include: two double density mini-floppies with 350kbytes of disk storage, 32k of RAM memory (expandable to 64k) to handle even the most sophisticated programs, a CP/M® Disk Operating System with a high powered text editor, assembler, debugger and a disk formatter. And, with SuperBrain's S-100 bus adaptor, you can add all the programming power you will ever need... almost any type of S-100 compatible bus accessory.

SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL and APL. Whatever your application - General Ledger, Accounts Receivable, Payroll, inventory or Word Processing, SuperBrain is tops in its class. And the SuperBrain UD boasts the same powerful performance but also features a double-sided drive system to render more than 70kbytes of disk storage and a full 64k of RAM. All standard! Whatever model you choose; you'll appreciate the careful attention given to every engineering detail. A full ASCII keyboard with numeric pad and user-programmable function keys A non-planar, specially focused 12-inch CRT for sharp images everywhere on the screen. Twin Z-80 microprocessors to ensure efficient data transfer to auxiliary peripheral devices. Dual universal RS-232 communications ports for serial data transmission. And, a single board design to make servicing a snap!

Integrated Desk Top Computer with 12 Inch Bit-Mapped Graphics or Character Display, 160k RAM, 4 MB Z80A. Two Quad Capacity Floppy Disk Drives, Selectric Style 87 Key Keyboard, Business Graphics Software.

The North Star ADVANTAGE™ is an interactive integrated graphics computer supplying the single user with a balanced set of Business Data, Word, or Scientific data processing capabilities along with both character and graphics output. ADVANTAGE is fully supported by North Star's wide range of System and Application Software. The ADVANTAGE contains a 45MHz Z80A CPU with 64kbs of 200 nsec Dynamic RAM (with parity) for program storage, a separate 20kbytes 200 nsec RAM to drive the bit-mapped display, a 2k bootstrap PROM and an auxiliary Intel 8035 microprocessor to control the keyboard and floppy disks. The display can be operated as a 1200 (24 lines by 80 characters) character display or as a bit-mapped display (240x48 pixels), where each pixel is controlled by one bit in the 20k byte display RAM. The two integrated 5.25 inch floppy drives are double-sided, double-density providing storage of 360kB per drive for a total of 720kB. The new rollover Selectric style keyboard contains 49 standard typewriter keys, 9 symbol or control keys, a 14 key numerincal control pad and 15 user programmable function keys.

The DBMS III is an enhanced version of DBMS II with additional facilities that make it (we believe) unsurpassed in overall capability world-wide. For the first time, it is possible to pre-determine the entire route of this program from its own built in self-tellers. The notion of getting information "at the touch of a button" is rarely even achieved by other programs whereas in DBMS III it is surpassed. It will take you time to master the technique of setting up files that are particular to your activities, but when this is accomplished you will be able to 'clone-cop' the program DBMS III in such a manner that each copy may become dedicated functionaries to specific tasks for as long as you wish.

The end result will be a number of disks whose life is to be of specific tasks WITHOUT ever touching a single key. Say your company is a garage; you want stock-re-order reports; your stock file contains 20,000 records of parts where among other information you have 'MINIMUMS', 'MAXIMUMS', 'PRESENT STOCKS' and 'COST'. You design a report so that all records where stock is below minimum, the stock is subtracted from the maximum to produce a re-order report and the cost of such an order. Having set up the files and print report forms, you now enable the DBMS III SELF-DRIVERS, to pre-ignition. Every time you want a stock-re-order-cost-report you simply follow this procedure, with the computer and printer switched on:

Insert the 'STOCK-FILE DISK' and the 'DBMS III FUNCTIONARY DISK', close the drive doors, and walk away. On your return you will find your report ready for action. Image being able to do that for most of the tasks you have about you? Hospital serum analysis reports, Production control process reports, Ledger analysis reports, Client address reports, Housing management reports, In fact most anything whose nature concerns informations.

A leader in database and information processing at this time. The DBMS III ($75.00 exc vat and exc mbasic 80). Only from G.W. Computers Ltd.

24 HOUR ANSWERPHONE-LEAVE ADDRESS FOR STANDARD INFORMATION DATA PACK

IMPORTANT!!! No hardware is any value without the software, and our software is unequalled. Buy a complete system and get most of the software free.

SUPERBRAIN * CORVUS DSK

SUPERBRAIN 2 320K...1895.00
SUPERBRAIN 2 500K...1995.00
SUPERBRAIN 2 1000K...2295.00

COMPATIBLE 16 DK...1895.00
COMPATIBLE 20 DK...2195.00
COMPATIBLE 30 DK...1995.00

COMPATIBLE 10 DK...1995.00
COMPATIBLE 20 DK...2195.00
COMPATIBLE 30 DK...1995.00

COMPATIBLE 10 DK...1995.00
COMPATIBLE 20 DK...2195.00
COMPATIBLE 30 DK...1995.00

COMPATIBLE 10 DK...1995.00
COMPATIBLE 20 DK...2195.00
COMPATIBLE 30 DK...1995.00

COMPATIBLE 500K...1895.00
SUPERBRAIN 4 500K...3295.00

MICROSOFT...750.00

CALL ONLY BY PRIOR APPOINTMENT AT 55 BEDFORD COURT MANSIONS, BEDFORD AVENUE, LONDON W.C.1.

G. W. COMPUTERS LTD.
01-636 8210, 01-631 4818, TELEX 892031 TWCG

THE NEW DBMS III (DATABASE) ****

The DBMS III is an enhanced version of DBMS II with additional facilities that make it (we believe) unsurpassed in overall capability worldwide. For the first time, it is possible to pre-determine the entire route of this program from its own built-in self-tellers. The notion of getting information "at the touch of a button" is rarely even achieved by other programs whereas in DBMS III it is surpassed. It will take you time to master the technique of setting up files that are particular to your activities, but when this is accomplished you will be able to 'clone-copy' the program DBMS III in such a manner that each copy may become dedicated functionaries to specific tasks for as long as you wish.

The end result will be a number of disks whose life is to be of specific tasks WITHOUT ever touching a single key. Say your company is a garage; you want stock-re-order reports; your stock file contains 20,000 records of parts where among other information you have 'MINIMUMS', 'MAXIMUMS', 'PRESENT STOCKS' and 'COST'. You design a report so that all records where stock is below minimum, the stock is subtracted from the maximum to produce a re-order report and the cost of such an order. Having set up the files and print report forms, you now enable the DBMS III SELF-DRIVERS, to pre-ignition. Every time you want a stock-re-order-cost-report you simply follow this procedure, with the computer and printer switched on:

Insert the 'STOCK-FILE DISK' and the 'DBMS III FUNCTIONARY DISK', close the drive doors, and walk away. On your return you will find your report ready for action. Image being able to do that for most of the tasks you have about you? Hospital serum analysis reports, Production control process reports, Ledger analysis reports, Client address reports, Housing management reports, in fact most anything whose nature concerns informations.

A leader in database and information processing at this time. The DBMS III ($75.00 exc vat and exc mbasic 80). Only from G.W. Computers Ltd.

24 HOUR ANSWERPHONE-LEAVE ADDRESS FOR STANDARD INFORMATION DATA PACK

IMPORTANT!!! No hardware is any value without the software, and our software is unequalled. Buy a complete system and get most of the software free.

SUPERBRAIN * CORVUS DSK

SUPERBRAIN 2 320K...1895.00
SUPERBRAIN 2 500K...1995.00
SUPERBRAIN 2 1000K...2295.00

COMPATIBLE 16 DK...1895.00
COMPATIBLE 20 DK...2195.00
COMPATIBLE 30 DK...1995.00

COMPATIBLE 10 DK...1995.00
COMPATIBLE 20 DK...2195.00
COMPATIBLE 30 DK...1995.00

COMPATIBLE 10 DK...1995.00
COMPATIBLE 20 DK...2195.00
COMPATIBLE 30 DK...1995.00

COMPATIBLE 10 DK...1995.00
COMPATIBLE 20 DK...2195.00
COMPATIBLE 30 DK...1995.00

COMPATIBLE 500K...1895.00
SUPERBRAIN 4 500K...3295.00

MICROSOFT...750.00

CALL ONLY BY PRIOR APPOINTMENT AT 55 BEDFORD COURT MANSIONS, BEDFORD AVENUE, LONDON W.C.1.

G. W. COMPUTERS LTD.
01-636 8210, 01-631 4818, TELEX 892031 TWCG

THE NEW DBMS III (DATABASE) ****

The DBMS III is an enhanced version of DBMS II with additional facilities that make it (we believe) unsurpassed in overall capability worldwide. For the first time, it is possible to pre-determine the entire route of this program from its own built-in self-tellers. The notion of getting information "at the touch of a button" is rarely even achieved by other programs whereas in DBMS III it is surpassed. It will take you time to master the technique of setting up files that are particular to your activities, but when this is accomplished you will be able to 'clone-copy' the program DBMS III in such a manner that each copy may become dedicated functionaries to specific tasks for as long as you wish.

The end result will be a number of disks whose life is to be of specific tasks WITHOUT ever touching a single key. Say your company is a garage; you want stock-re-order reports; your stock file contains 20,000 records of parts where among other information you have 'MINIMUMS', 'MAXIMUMS', 'PRESENT STOCKS' and 'COST'. You design a report so that all records where stock is below minimum, the stock is subtracted from the maximum to produce a re-order report and the cost of such an order. Having set up the files and print report forms, you now enable the DBMS III SELF-DRIVERS, to pre-ignition. Every time you want a stock-re-order-cost-report you simply follow this procedure, with the computer and printer switched on:

Insert the 'STOCK-FILE DISK' and the 'DBMS III FUNCTIONARY DISK', close the drive doors, and walk away. On your return you will find your report ready for action. Image being able to do that for most of the tasks you have about you? Hospital serum analysis reports, Production control process reports, Ledger analysis reports, Client address reports, Housing management reports, in fact most anything whose nature concerns informations.

A leader in database and information processing at this time. The DBMS III ($75.00 exc vat and exc mbasic 80). Only from G.W. Computers Ltd.
### SOFTWARE FOR CP/M COMPUTERS

<table>
<thead>
<tr>
<th>Company</th>
<th>Name</th>
<th>Software</th>
<th>Manual</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micropro Inc.</td>
<td>Word-Master 1.7A</td>
<td>£83</td>
<td>£24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Text-Writer 2.6</td>
<td>£41</td>
<td>£19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wordstar 3.0</td>
<td>£27</td>
<td>£82</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mail MERGE 3.0 (requires Wordstar)</td>
<td>£83</td>
<td>£19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SPELLSTAR 1.2 (requires Wordstar)</td>
<td>£129</td>
<td>£20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wordstar Training Manual</td>
<td>£56</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wordstar CUSTOMIC Notes</td>
<td>£19</td>
<td>£82</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUPER-SORT 1.6 Version 1</td>
<td>£24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DATESTAR 1.10</td>
<td>£195</td>
<td>£19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DATESTAR CUSTOMIZATION NOTES</td>
<td>£56</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CALCSTAR 1.2</td>
<td>£167</td>
<td>£29</td>
<td></td>
</tr>
<tr>
<td>Apple Versions</td>
<td>W32</td>
<td>£209</td>
<td>£61</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAIL MERGE 3.0 (requires Wordstar)</td>
<td>£70</td>
<td>£11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SPELLSTAR 1.2 (requires Wordstar)</td>
<td>£109</td>
<td>£27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COMPART 1.6</td>
<td>£62</td>
<td>£97</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CALCSTAR 1.2</td>
<td>£109</td>
<td>£28</td>
<td></td>
</tr>
<tr>
<td>Microtech Exports</td>
<td>REFORMATTER</td>
<td>£109</td>
<td>£19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CP/M = DEC</td>
<td>£109</td>
<td>£19</td>
<td></td>
</tr>
<tr>
<td>Microsoft Inc.</td>
<td>Basic-80 5.21</td>
<td>£206</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Basic Compiler 5.3</td>
<td>£238</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fortran-80 3.44</td>
<td>£249</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cobol-80 5.84</td>
<td>£420</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M/SORT 1.02</td>
<td>£83</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EDIT-00 2.02</td>
<td>£71</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Macro-80 3.43</td>
<td>£117</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MULISP 2.02</td>
<td>£117</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MUMATH 2.12</td>
<td>£145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mt Microsystems</td>
<td>Pascal-MT 1.5</td>
<td>£38</td>
<td>£28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Basic-Pascal + 5.5 with SP</td>
<td>£201</td>
<td>£28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Library Sources</td>
<td>£122</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Speeded Programming (Sicolor)</td>
<td>£329</td>
<td>£28</td>
<td></td>
</tr>
<tr>
<td>Phoenix Software Associates (For Z80 only)</td>
<td>PLINK-Disc to disc link loader</td>
<td>£80</td>
<td>£17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PASM-Macro Assembler</td>
<td>£60</td>
<td>£17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEDIT-Line editor with Macros</td>
<td>£80</td>
<td>£17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RUG—Very powerful debugger</td>
<td>£80</td>
<td>£17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PDEVELOP Package with all the above</td>
<td>£215</td>
<td>£27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PLINK-2 Overlay Link Loader</td>
<td>£206</td>
<td>£17</td>
<td></td>
</tr>
</tbody>
</table>

### COMPUTER HARDWARE

- **CPI** 800
- **Comap** 800
- **CREM** 800
- **Micrology**
- **Microfocus**
- **MicroAp**
- **Cmp Ltd**
- **Klh Systems**
- **Magic Circle Software**
- **Byrom Software**
- **Cpm User Library**
- **Digital Research**
- **Fox & Geller**
- **Information Unlimited**
- **Telemetry**
- **PLink**
- **Software**
- **Visitors at the PCW Exhibition**

---

**ORDER INFORMATION**

* When ordering CP/M software please specify the format you require. All software items are subject to VAT.
* Manuals, when purchased separately, are not subject to VAT. Please add £4.00 (including VAT) for postage and packing on each item purchased. For overseas please add £5.00 per item. Most software in this advertisement is available from stock and a 72 hour return service is thereby offered on most prepaid orders. These details and prices are all current as of June 1982. Our prices reflect an exchange rate of U.S. $1.80 to £1.00. All payments must be in sterling and drawn against a U.K. bank.
* Mail, Order, Telephone Order, Visitor - Send Cash Cheque. Postal Order IMOS, Access or Barclays/Visa number to Microcomputer Products International Ltd., Room PC, 11 Cambridge House, Cambridge Road, Barking, Essex IG11 8NT.
MORE GOOD REASONS
TO RING 01-391 6511

TYPING TUTOR
by ANTHONY ASHPITEL

A terrific way to learn touch typing! This TYPING TUTOR is an effective teaching tool for correct and speedy typing. Many, many practical exercises which gradually increase in difficulty and speed so the learner builds up his or her skills in a solid and sustained manner.

Can you really bypass this new package? For a demonstration and discussion visit Anthony Ashpitel who will be on our stand at the coming PCW Exhibition.

There are two versions: The BASIC VERSION is a stand alone package. The BUSINESS VERSION includes a fully documented training manual and also incorporates full records of each student's development in relation to his or her own progress and the progress of the rest of the class, so effective comparisons can be made in a useful and helpful way.

BASIC VERSION £ 50
BUSINESS VERSION £ 125

MARS
HAVE YOU HAD A CLOSE ENCOUNTER OF THE 4th KIND (Financial Headache)? THEN CONTACT WITH MARS WILL SMOOTH YOUR ACCOUNTING FUTURE.

MAY THE MPI FORCE BE WITH YOU!

Until now, there has been a sharp distinction between packages which help a company manage its current operations, and those which help it look ahead. MARS offers a new approach, for it bridges the gap between accounting for the present and planning for the future.

MARS provides a full management accounting system that can be set up to accept live data from the computer's keyboard, or retrieve data from computer files produced by a company's existing accounting systems. This information can then be worked on and many different kinds of calculation performed. When all the results are ready, a detailed management report can then be printed, tailored exactly according to the user's specification. MARS can thus provide the right management information, in the right form, in the right place and at the right time.
"As a cost conscious businessman, how can you use a microcomputer easily, economically and efficiently to increase productivity and create greater profits?"

Choose from three alternatives;
(a) Customised programs - *costly, take days to write.*
(b) Off-the-shelf general purpose programs - *generally inflexible.*
(c) "Do-it-yourself" program generators - *the key to efficiency and ease of use, cost saving, and the ability to create greater profits. Even without experience you can write programs in minutes!*

Applications already in use include;
○ DATA ENTRY STORAGE and RETRIEVAL
○ STOCK CONTROL SYSTEMS
○ TECHNICAL and GRAPHICS PROGRAMS
○ HOTEL RESERVATIONS SYSTEMS
○ LABORATORY and MEDICAL APPLICATIONS
○ FIXED ASSETS ACCOUNTING
○ PROJECT RECORDS and CONTROL
○ MAILING and LABELLING SYSTEMS
... and this is just the tip of the iceberg!

The following program generators are available for the microcomputer systems indicated:
C.O.R.P. and Techwriter for the Apple II.
Codewriter for the CBM PET 8000 series, TRS 80 III, Sirius and IBM PC.
Techwriter for the Apple III and CP/M... with more to come.

C.O.R.P., Codewriter, Techwriter, Apple, CBM Pet, TRS, Sirius, IBM, CP/M are registered trademarks.
Micro Networks Ltd can now exclusively offer you a super Superbrain that includes either six or twelve megabytes, 5.25 inch Winchester Disk Drives interchangeable with floppies. The new system is supplied with customised version of CP/M that allows the user to treat the hard disc as single or multiple logical drives. Any of these drives can be of any size up to the maximum capacity of the disc drive involved, i.e. 150 up to 790 K bytes per single drive. They can be intermixed with each other or with the hard disc logical drive. Obviously, the incorporation of Winchester drives not only expands the bulk storage available but it also speeds up the access five times faster on floppies and ten times faster on hard disc than on ordinary Superbrain.

There's more very good news too! Superbrain and CompuStar prices have been reduced by 30% plus the NEW SUPERBRAIN II features, which include a faster enhanced disc operating system, a library of new visual attributes including below-the-line descenders, reverse video and impressive graphics capabilities.

Standard software in stock includes Wordstar, Mailmerge and Spellstar, BASIC-80, FORTRAN-80, COBOL-80, ALGOL-80, PASCAL M, CIS COBOL, plus many application packages.

If you already have a system – ask us about our service and maintenance schemes.

MICRO NETWORKS
60 PALL MALL LONDON 01-839 3701
Hazelvine VDU's

Save up to 51% on all Hazeline VDU's - an ideal opportunity for schools, colleges and business!

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAZELTINE 1510 (MLP £680)</td>
<td>Only £550</td>
</tr>
<tr>
<td>HAZELTINE 1520 (MLP £1050)</td>
<td>Only £625</td>
</tr>
<tr>
<td>HAZELTINE 1552 (MLP £860)</td>
<td>Only £395</td>
</tr>
<tr>
<td>HAZELTINE 1410 (MLP £475)</td>
<td>Only £295</td>
</tr>
</tbody>
</table>

Manufacturer's surplus — ALL BRAND NEW BOXED

Please note that these are limited stock items and are sold on a first-come, first-served basis.

**SA2 ROBOT**

Runs PET, APPLE and other microcomputers.

**ROBOT** £399

**CONTROLLER** £148

**INTELLIGENT ARTEFACTS LTD.**

A wholly owned subsidiary of Sands Whitley Research and Development Ltd.

**OPEN FRAME MONITORS AVAILABLE FOR OEM'S**

The 'PRINCE' of Monitors

offers better Monitoring.

24 MHz Bandwidth - ensures a clear crisp display.

Available with P4 White P31 Green AND L1 ORANGE

Scan: 625 lines/50 Hz, Deflection: 110°, Active raster: 240 x 222 mm. 80 characters x 24 lines, Horizontal frequency: 15625 Hz ± 0.5 KHz, Vertical frequency: 50 Hz. Horizontal linearity: ± 3%. Vertical linearity: ± 2%. Geometric distortion: ± 1.5%. EHT (at zero beam current): 136 V ± 0.5V. Power drain: 30 Watt approx. Voltage supply: 110 V A.C., 50 Hz, 240 V A.C. 50 Hz/10% upon request. Video input: 2 x BNC or Cinch or PL 259, (composite video) negative sync, Input 0.5-4V p.p. at 95 Ohms, X-Ray radiation: conforms to I.E.C. Spec. No. 65. Overall dimensions: 320 x 270 x 265 mm. Weight: 7.5 Kg. aluminium temperature: 0-40°C.

**OTHER CROFTON PRODUCTS INCLUDE:**

Computer peripheral equipment, frame grabber, floppy disk drives, floppy disk, computer power supplies, C.C.T.V. monitors, Unibored monitors, Monitor P.C.B.'s., Cathode ray tubes, VHF/UHF modulators, Video switchers, Video distribution amplifiers, Camera lenses, Pan and tilt units, Camera lens, Camera turrets, Printed circuit board service.

CROFTON ELECTRONICS LTD

35, Grosvenor Road, Twickenham, Middx, TW1 4AD.

Telephone: 01-891 1923/1513 Telex: 295093 CROFTN G

SA2 ROBOT

Circuit No. 110

**PRACTICAL COMPUTING** September 1982
A FREE 12" MONITOR WITH EVERY O S B O R N E 1

Personal Business Computer!
Available NOW from DATALINK the amazing Osborne 1 is the totally portable 64K personal business computer. An incredible breakthrough for mobile executives, sales personnel, engineers etc., Osborne 1 weighs only 24lb and fits under the standard airline seat!

And just look at DATALINK’s special introductory offer
WORTH NEARLY £200! —

— A FREE 12" QUALITY GREEN MONITOR
which interfaces with the Osborne for home use PLUS A BOX OF HIGH QUALITY BASF DISCS complete with SUPERIOR LIBRARY CASE! FREE!

Datalink’s price - £1250 + VAT!
The Osborne package also includes as standard: WORDSTAR,® SUPERCALC,™ MAIL MERGE,® MBASIC,® CBASIC® and CPM®

Take advantage of this superb offer while it lasts.
Cash with order - Personal buyers welcome. Post FREE in UK!

MICROCOMPUTER SYSTEMS (UK) LIMITED
10 Waring House, Redcliffe Hill, Bristol BS1 6TB Tel: Bristol (0272) 213427 Telex: DATAL G 44807

24 hr answering service

Circle No. 112
U-Net is a shared resources network system for Apple II, AIM65, VIC20, Acorn, ATOM and BBC micro. It allows up to 32 satellite microcomputers to share the disc drives and printers connected to a host microcomputer.

PROFESSIONAL FEATURES
A great deal of thought has gone into producing a robust and versatile system based on years of mainframe network experience.

Example: Printer Spooling
Multiple request to print simultaneously, result in the host buffering the data to be printed and finishing each print-out job before starting the next — no more mixed up print-outs!

Example: Security
Users at each work station are required to log-in. They can then access their files only and cannot corrupt or access files belonging to other users.
If required, a user can deliberately make his files available to other network users.

Example: Data Files
A full range of disk operating commands are available to each user for serial and random access data files, even Macros (EXEC) files. Of course, the more primitive binary SAVE and LOAD may also be executed.

U-Microcomputers Limited,
Winstanley Industrial Estate, Long Lane, Warrington, Cheshire, WA2 8PR, England. Tel: 0925 54117/8 Telex: 668920 U-ONE

U-MICROCOMPUTERS
a range of quality peripheral cards to enhance your Apple

We now make more Apple cards than Apple!
PRACTICAL COMPUTING September 1982

**Micro-Spares VALUE**

19 ROSEBURN TERRACE, EDINBURGH EH12 5NJ 031-337-5011

**PAYMENT AND DELIVERY**

Payment by Cheque, Postal Order, ACCESS, VISA etc.
PLEASE add postage and VAT. All in stock items sent same day. All non Kit items have a 1 year guarantee. ALL PRICES APPLY TO END SEPTEMBER 1982

**COMPONENTS**

| Description | VAT | Price
|-------------|-----|------
| 16K (256K) | £1.05 | £5.00
| 32K (512K) | £1.05 | £7.50
| 64K (1024K) | £1.05 | £15.00
| 128K (2048K) | £1.05 | £25.00
| 256K (4096K) | £1.05 | £45.00

**TOP VALUE PRINTERS**

Anadex DPE9000 B & O Matrix
Tec 45 & 55 Cps Daisy Wheel
Silver Reed Typewriter/Printer
RS232
RIQOH RP6100
Triumph Adler Stylist

**TERMINALS/MONITORS**

BMC 12v Green Screen Monitor £119 + VAT
Televideo 910 Terminal £425
Televideo 925 Terminal £615

**SYSTEMS**

Gemini MultiBoard concept is the logical route to install any microcomputer system you care to name. Whether you require a business system, an educational package, a home entertainment system or any other system, there is a combination of Gemini MultiBoard systems and accessories that will meet your requirements. All Gemini boards are tested and checklisted, which is finding increasing acceptance among other British manufacturers. This is broadening the product base.

**GET THE BEST OF BOTH WORLDS!**

WE CAN SUPPLY ALL YOUR 'PET' NEEDS AT CASH & CARRY PRICES

**COMES AND SEE THE NEW VIC-20**

FULLY WORKING AND OPERATIONAL

ASK US ABOUT ALL THE ADD-ON-GOODIES THAT GO WITH THE VIC . . . . . . .

**MASSES OF BOOKS ON THE PET & VIC**

Send us a large stamped addressed envelope (12 x 9) and we will be delighted to send you all our current information.

**PRICES DO NOT INCLUDE VAT**

**INTEREST FREE CREDIT AVAILABLE**

**Circle No. 114**

**Circle No. 115**

**PRACTICAL COMPUTING September 1982**
IF YOU'VE GOT ONE OF THESE

THEN YOU NEED ONE OF THESE

Transform your B.B.C. micro for only £995.

Increase your B.B.C. micro’s processing power by up to 2,000% and put professional computing power at your fingertips.

Designed specifically for the B.B.C. micro, the Torch Z80 will transform it into a powerful, low-cost Z80-based system, capable of running CP/M programs.

Easily installed, the unit comes with a Z80 processor board plus 64K of RAM, twin floppy disc drives giving 800K of storage and the Torch CP/N operating system which gives the user access to the vast range of CP/M software available.

Commands for formatting, copying and examining discs are built into the firmware plus commands which allow batch submission of files, reading into files and printing files.

Each disc pack comes complete with a system disc containing infrequently used utilities plus demonstration programs and two 8K ROMS containing the operating system. Disc interface components for the model 'B' B.B.C. micro are available as an option.

Applications software from Torchsoft include word processing, accounting and financial planning. Languages include FORTRAN, PASCAL, FORTH, LISP and COBOL.

Many more packages are under development and the user will be able to utilise the continually expanding range of CP/M software.


Technical Specification
Dual floppy disc drivers (total storage of 800K)
Z80 – processor board
64K – random access memory
CP/N – operating system (CP/M compatible)
Integral switched mode power supply
Robust aluminium case
Fully documented instruction manual complete with utilities disc

To: Torch Computers Ltd., Abberly House, Great Shelford, Cambridge. Please send me:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Cost</th>
<th>V.A.T. (4.5%)</th>
<th>TOTAL £</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Z80 Disc Pack</td>
<td>£995</td>
<td></td>
<td>£995</td>
</tr>
<tr>
<td></td>
<td>Disc interface kit</td>
<td>£70</td>
<td></td>
<td>£70</td>
</tr>
</tbody>
</table>

Postage & Packing £5.00

TOTAL £1,070

I enclose cheque/please debit my Access/Barclaycard to the value of £

No. __________________ Name __________________

Signature __________________

Address ____________________

PRACTICAL COMPUTING September 1982
The introduction of Wordcraft 20 for the VIC brings the benefits and advantages of full scale word processing directly to the general public. Until now only the business world could afford word processing systems but this amazing price breakthrough makes it available to everyone. Wordcraft 20 comes on a cartridge ready to plug into the back of the VIC. Included in the cartridge is an extra 8K of RAM that is also available for use with other programs – so not only do you get a word processor but you also get a memory expansion thrown in. The system also comes with complete documentation catering both for the inexperienced user and for those already familiar with Wordcraft 80.

Just look at these features:

* Full use of colour and sound.
* Full compatibility with VIC 1515 printer, parallel printers or RS232C serial printers.
* Full control over margins, document width, tab stops, decimal tabs, justified output, multiple copies. Complete control of the final output.
* Automatic underlining and emboldening.
* Full screen display with automatic paging.
* Full storage and retrieval facilities from disk and tape.
* Full compatibility with Wordcraft 80.
* Name and address capabilities – including labels.
* Full document merging facilities.

Wordcraft 20. The package that the VIC user has been waiting for. A word processor of proven quality at a low price.

For the first time ever, every home can have one.

Wordcraft 20: £125.00 inc. VAT and p&p. Available from all VIC dealers or direct from Audiogenic Ltd, PO Box 88, Reading, Berks. Tel: 0724 586334.

Wordcraft 20 is copyright P.L. Dowson 1982.
Please rush me my BYG BYTE 16k Ram Pack

NAME _________________________________
ADDRESS _______________________________

PLEASE MAKE ALL CHEQUES PAYABLE TO

Phoenix Marketing Services

Tel: (0252) 514990.
Oaklands House, Solartron Road, Farnborough, Hants. GU14 9QL.

Circle No. 118
If that Apple is just out of Reach....

Rent One!

If you have a short term requirement for a microcomputer system for evaluation, training or just hands-on experience — come to Atlanta Data!

Apart from Apples we have top quality printers, monitors, disk drives and a huge range of software including VisiCalc, Visiindex, Wordstar, Format-80, Magic Window, Micromodeller, APM, CIS COBOL and all accounting programs.

A complete system can be working for you within a few days of your enquiry with no capital expenditure!

Line plotters now available.

Rental Hotline 01-729 1411/2

Atlanta Data Systems
350/356 Old Street, London, ECI 9DT. 01-739 5889

ARE YOU A ZX81 USER WHO’S NOT PLAYING GAMES?

ECR 81 DATA RECORDER SAVES AND LOADS YOUR PROGRAMS EVERY TIME!

The ECR81 Enhanced Certified Recorder from MONOLITH is a major advancement in cassette recorder technology which minimises the problems associated with standard audio recorders. The unit is a high reliability program store for ZX computers based on a modified, proven cassette mechanism. The two sections of data recording circuitry automatically ensure precise levels are written onto the tape and that optimised signals are received by the computer.

THE ECR81 IS NOT SUITABLE FOR AUDIO REPRODUCTION
NO MANUAL VOLUME OR TONE CONTROL ADJUSTMENT PROVIDED

To: MONOLITH ELECTRONICS CO. LTD., 5/7 CHURCH STREET, CREWKERNE, SOMERSET

Please supply me with:

(Octy.) Monolith ECR 81 Enhanced Certified Recorder(s) £47.50 (Each)
to be used with my ZX81

I also enclose postage & packing per recorder £2.50

Please print

Prices include VAT £

<table>
<thead>
<tr>
<th>Name: Mr/Mrs/Miss:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
</tr>
</tbody>
</table>

£47.50
Including VAT.

Each ECR81 comes complete with its own individual certification tape, tested and serial numbered to prove your machine reliability.

Mains Operation only.

Mains & DIN connector leads provided.

Certification of tape head alignment · height and azimuth.

Certified tape tension, torque and speed.

Fast forward and rewind tape search controls.

The ECR81 is also suitable for Sinclair ZX80

Please allow up to 28 days delivery. The ECR81 is backed by our 14 day money-back option.

£47.50

£2.50

£47.50

£2.50

To: MONOLITH ELECTRONICS CO. LTD., 5/7 CHURCH STREET, CREWKERNE, SOMERSET

Please supply me with:

(Octy.) Monolith ECR 81 Enhanced Certified Recorder(s) £47.50 (Each)
to be used with my ZX81

I also enclose postage & packing per recorder £2.50

Please print

Prices include VAT £

<table>
<thead>
<tr>
<th>Name: Mr/Mrs/Miss:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
</tr>
</tbody>
</table>

£47.50
Including VAT.

Each ECR81 comes complete with its own individual certification tape, tested and serial numbered to prove your machine reliability.

Mains Operation only.

Mains & DIN connector leads provided.

Certification of tape head alignment · height and azimuth.

Certified tape tension, torque and speed.

Fast forward and rewind tape search controls.

The ECR81 is also suitable for Sinclair ZX80

Please allow up to 28 days delivery. The ECR81 is backed by our 14 day money-back option.

£47.50

£2.50

£47.50

£2.50

To: MONOLITH ELECTRONICS CO. LTD., 5/7 CHURCH STREET, CREWKERNE, SOMERSET

Please supply me with:

(Octy.) Monolith ECR 81 Enhanced Certified Recorder(s) £47.50 (Each)
to be used with my ZX81

I also enclose postage & packing per recorder £2.50

Please print

Prices include VAT £

<table>
<thead>
<tr>
<th>Name: Mr/Mrs/Miss:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
</tr>
</tbody>
</table>

£47.50
Including VAT.

Each ECR81 comes complete with its own individual certification tape, tested and serial numbered to prove your machine reliability.

Mains Operation only.

Mains & DIN connector leads provided.

Certification of tape head alignment · height and azimuth.

Certified tape tension, torque and speed.

Fast forward and rewind tape search controls.

The ECR81 is also suitable for Sinclair ZX80

Please allow up to 28 days delivery. The ECR81 is backed by our 14 day money-back option.

£47.50

£2.50

£47.50

£2.50

<table>
<thead>
<tr>
<th>Name: Mr/Mrs/Miss:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
</tr>
</tbody>
</table>
MEMOREX Mini Flexible Discs

5.25 SOFT OR HARD SECTORED

Single sided-Single density  £1.59
Soft  £1.65
With hub ring  £1.79

Single sided-Double density  £1.99
Double sided-Double density  £2.06

8" Single sided-Single density  £2.29
Reversible  £2.49
Single sided-Double density  £2.64
Reversible  £2.95
Double sided-Single density  £2.99
Double sided-Double density  £3.25
With hub ring

DYSAN DISKETTES

Telephone  01 272 6398
01 272 6237

MICROWARE

Microware (London) Ltd. 637a Holloway Road London N19 5SS.

Phone for unprintable Prices

CDC Disk Drives
250K — IMB

MX 80
MX 80ft
MX 100
IBM PC
320K Memory 700K Floppy

Telephone 01 272 6398
01 272 6237

Microware (London) Ltd. 637a Holloway Road London N19 5SS.

OSBORN 1
£1495
and 6 MB HARD DISK MODELS
(for £2795) (small)
STOP HERE
APPLE SYSTEMS

WANT TO BUY AN APPLE II
£550 ?

HERE'S HOW!!!
PURCHASE OUR HARDWARE PACKAGE

HARDWARE
* 48K APPLE II
* DISK W/CONTROLLER
* DISK W/OUT CONTROLLER
* BMC 12" GREEN SCREEN HI RES MONITOR
* MX80 F/T2 HI RES PRINTER
* PRINTER INTERFACE

SOFTWARE AVAILABLE
INVOICING
PURCHASE/SALES LEDGER
PAYROLL
VISICALC
VISIDEX
VISITREND/VIPILOT
WORD PROCESSING

HARDWARE PACKAGE PRICE £1699

PET SYSTEMS
IDEAL FOR: YOUR BUSINESS • EDUCATION • WORD PROCESSING

8032 32K Computer 80 column £755
8096 96K Computer 80 column £1040
8050 950K Dual Drive £755
8023 Tractor Feed Printer £785
NEW PRODUCTS NOW AVAILABLE
8422 22 Megabyte Winchester Disk POA
9000 SuperPet 134K

MULTI LANGUAGE POA

Choice of software packages available, such as:
WORD PROCESSING, INTEGRATED ACCOUNTS WITH STOCK, INVOICING & FINANCIAL PLANNING, AND MANY OTHER APPLICATIONS

LONDON'S MAIN EPSON DISTRIBUTOR

PRINTERS

EPSON MX100 £480
15½" carriage, 254 columns, hi res graphics, true descenders, bi directional.

EPSON MX80 £320
Dot-matrix printer Pet and Apple compatible. True bi directional, 80 cps.

EPSON MX82 £355
As MX80 plus high resolution graphics, parallel and serial interfaces.

EPSON MX80 FT/1 £340
Dual single sheet friction and tractor feed, 9 wire head, true descenders.

EPSON MX80 FT/2 £380
An FT/1 with high resolution graphics.

SEIKOSHA GP100 £189
 Dot matrix 5x7,80 columns, 30 cps graphics, double width characters.

TERMS
All items carry 1 year guarantee parts and labour. Delivery at cost. All prices exclusive of VAT. Please add 15% to total.
Telex 22568. Official orders welcome.
JUST PHONE FOR FURTHER DETAILS

CHROMASONIC electronics

48 JUNCTION ROAD, ARCHWAY, LONDON N19 5RD
TEL 01-263 9493 263 9495 TELEX 22568

100 yards from Archway Station and 9 Bus Routes

© Circle No. 123

PRACTICAL COMPUTING September 1982
SUMMER
APPLE PRICES
TURN OTHERS GREENER AND GREENER.

Taste a little summer madness with C/WP’s special sale. For September only we’ve cut the basic price of a standard factory-fresh 48K APPLE II with full 12 month warranty to £499 + VAT, and Apple disc drives are now only £270 for the first, £220 for the second. Just look at the prices – no wonder they call C/WP at Victoria the place where Apple computers cost less! And yet C/WP is a fully authorised level one service centre giving its customers both professional service and full maintenance back-up.

So for a taste of summer madness at a price that makes others green, call C/WP on 01-630 7444. C/WP, 108 Rochester Row, London SW1. C/WP where Apple computers cost less.

ALL MAJOR CREDIT CARDS ACCEPTED

C/WP

C/WP Computers
108 Rochester Row, London SW1P 1JP
Telephone: 01-630 7444

APPLE-CP/M OFFER

<table>
<thead>
<tr>
<th>EX-VAT PRICES</th>
<th>C/WP PRICE</th>
<th>TYPICAL PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple 48K Europlus</td>
<td>£499</td>
<td>£812</td>
</tr>
<tr>
<td>2 Apple disc drives with controller</td>
<td>£500</td>
<td>£650</td>
</tr>
<tr>
<td>Microsoft CP/M system with Z80A processor</td>
<td>£200</td>
<td>£200</td>
</tr>
<tr>
<td>16 K RAM card</td>
<td>£70</td>
<td>£106</td>
</tr>
<tr>
<td>Green screen monitor 24MHz</td>
<td>£90</td>
<td>£159</td>
</tr>
<tr>
<td>80 column card</td>
<td>£150</td>
<td>£200</td>
</tr>
<tr>
<td>Epson MX 80T printer</td>
<td>£300</td>
<td>£349</td>
</tr>
<tr>
<td>Printer interface</td>
<td>£80</td>
<td>£92</td>
</tr>
<tr>
<td>10 Floppy discs</td>
<td>£20</td>
<td>£31</td>
</tr>
<tr>
<td>1909</td>
<td>2599</td>
<td></td>
</tr>
</tbody>
</table>

Items available separately at same price.

SOFTWARE FOR CP/M

<table>
<thead>
<tr>
<th>C/WP PRICE &amp; EX. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wordstar 3.0</td>
</tr>
<tr>
<td>Wordstar training pack</td>
</tr>
<tr>
<td>Calcstar</td>
</tr>
<tr>
<td>dBase II</td>
</tr>
<tr>
<td>M Fortran</td>
</tr>
<tr>
<td>CIS COBOL + Forms-2</td>
</tr>
<tr>
<td>M Basic Compiler</td>
</tr>
</tbody>
</table>

PRACTICAL COMPUTING September 1982
The original 'personal computer'

Now with
Very high speed processor (70% faster)
16 Megabyte disk drive
10/20 Megabyte tape streamer
Mainframe communications software

01-836 6921

Available from
Acorn Microcomputers Wokingham Tel 0734 82220
ADP Innsite Ltd Hounslow Tel 01-897 3071
Bestmoor Ltd Nottingham Tel 0602 415315
British Micro Dursley Glos Tel 0453 3154
Claremont Memories Edinburgh Tel 031 228 6953
Data Exchange Ltd Birkenhead Tel 051 647 9185
Dataller Computer Services Ltd Wigan Tel 0942 334534
Derwent Data Systems Sunderland Tel 0734 652026
FBA Computer Services Ltd Guildford Tel 0483 105799
Gate Microsystems Ltd Dundee Tel 0382 28194
Gate Microsystems Ltd Glasgow Tel 041 221 9372
Gibson Computer Services Dudley West Midlands Tel 0384 236934
GMS Computing Sheffield Tel 071 239 6191
Johnson Microcomputers Camberley Surrey Tel 0276 20446
KPG Computer Systems Ltd London W4 Tel 01-935 3573
Lennox Computer Systems Ltd St Albans Herts Tel 056 68201
Lion Microcomputers Ltd London W1 Tel 01-580 4581
Metcall Microsystems Ltd London E11 Tel 01-980 0430
Omega Electric Ltd Mitcheldean Glos Tel 0452 765491
RHM Computing High Harlow Essex Tel 0793 216831
Rockmain Ltd London WC1 Tel 01-404 6920
Software Ireland Ltd Belfast Tel 0232 17633

UK Distributor—Thame Systems Ltd Thame Oxon Tel 084421 5471

O Circle No. 125
MIDAS S100 SYSTEMS

MIDAS 1: From £895
MIDAS 2: From £1,890
MIDAS 3D: From £3100
MIDAS 3HD: From £5,495
MIDAS 86 — 16 Bit: From £3520

- Our versatile Z80 Microcomputers are available as standard units or custom configured to your exact specification from a comprehensive range of stocked S100 boards.
- Disc storage capacity of the MIDAS 3 can be 2M Bytes, expandable to over 80M Bytes with a Winchester Hard Disc Unit in our MIDAS 3HD range.
- MIDAS runs CP/M and MP/M. Other Software includes M-BASIC, C-BASIC, FORTRAN, COBOL, CIS-COBOL, PASCAL and Word Processing.
- A MIDAS 3D with 64K RAM and 2M Bytes storage on two 8" drives with two Serial I/O Ports and CP/M only £3,200.
- Printers, VDUs and other peripherals stocked to give complete package system at keen prices.

BOARDS

We stock over 50 different S100 Boards all from quality manufacturers: Advanced Micro Digital, Godboat, SSM, Micromation. Dual. CCS, S.D. Systems, Morrow, Pickles & Trout, etc.

<table>
<thead>
<tr>
<th>PROCESSOR</th>
<th>RAM</th>
<th>I/O BOARDS</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z80 Starter Kit</td>
<td>Static RAM 16-64K 24 Bit addressing</td>
<td>2S/2P or 4S/2P or 3P/1S etc</td>
<td>Real Time Clocks</td>
</tr>
<tr>
<td>Single Board Computers</td>
<td>Static RAM 8x64K or 16x32K RAM/Battery</td>
<td>A/D &amp; D/A 8 or 12 bit</td>
<td>Graphics 512 x 256 (B/W)</td>
</tr>
<tr>
<td>8086/8088 CPU</td>
<td>Back-up</td>
<td>IEEE 488 Interface</td>
<td>Colour Graphics 312x250</td>
</tr>
<tr>
<td>Z80A CPU 4MHz (4 types)</td>
<td>Memory Manager</td>
<td>Maths Board AMD 9511</td>
<td>Maths Board AMD 9511</td>
</tr>
<tr>
<td>8086</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EPROM</th>
<th>VIDEO BOARDS</th>
<th>DISK CONTROLLERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2716 EPROM (2x16K)</td>
<td>24x80 I/O Drive</td>
<td>Single Density 8&quot; or 8</td>
</tr>
<tr>
<td>2708/2716/2732 Programmer</td>
<td>24x80 Memory Mapped</td>
<td>Double Density DMA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Floppy or hard Controllers</td>
</tr>
</tbody>
</table>

MAINFRAMES

We are the sole UK Distributor for Integrand Mainframes and Disc Enclosures, available in nine models including Desk Top and Rack Mounting, with or without provision for Disc Drives. All units totally enclosed, painted on all external surfaces and complete with power supply etc.

SOFTWARE

CP/M 1 & 2, MP/M, PL/1, C-BASIC 2, M-BASIC V5, XYBASIC, FORTRAN 80, COBOL 89, CIS-COBOL, PRO-PASCAL, Forth, MAC, ZSID, Disassembler, Wordstar, Datastar, Magic Wand, Wordmaster, Supersoft etc etc.

Prices exclusive of VAT

We are pleased to discuss your requirements and will advise you as to whether your needs can be met with one of our computers.

All of our systems are specials as they are configured to suit your specification, thus ensuring that you get what you want rather than what happens to be available.

Write or phone for a catalogue.

Unit 14, 29 Willow Lane, Mitcham, Surrey
Telephone: 01-640 6931/2/3

PRACTICAL COMPUTING September 1982
THE SHARP MZ80B SYSTEM

MZ80B
- 4 Mb Z-80A CPU • 64K RAM • 2K ROM • BASIC
- is provided • High Resolution Graphics • 9" High Focus Display
- Upper and Lower Case • 80x40 Characters • RS-232 interface
- Magnetic Cassette Deck included • ASCII/Keyboards • Numeric Keyboard
- Sound Output • Built-in Disk and Music.

Parallels Printer Interface Card £35.00
- Serial Dot Matrix • Tractor and Friction Feed
- 90 Characters per Second • 60 Print Capacity
- 80 col (Normal) 40 col (Double Size) 156 col (Reduction Size)
- Upper and Lower Case • Graphics

FLOPPY DISK DRIVE MZ80FB
- £699 + VAT
  • 10K Interface Card & Cable
  • Dual Drive Unit 5.25"
  • Dual Sided Density 72 Track, Soft Semicored
  • 16 Sectors per Track
  • 290K Bytes per Diskette

CENTRONICS DOT MATRIX PRINTERS

737 £369 + VAT

Standard Features
- Proportional Spacing
- Right Margin. Justification
- 3 way paper handling • Upper and lower case
- True Descenders • Bi-directional paper Mode
- Underlining capability
- Condensed/Expanded Print • Sub-Scripts and Sub-Superscripts
- Pin and Friction Feed • 110/132 Column

THE EPSON MX SERIES

MX80F/TZ £149 + VAT
MX80T £329 + VAT
MX80F/T £379 + VAT

HITACHI PROFESSIONAL MONITORS

9" £129 £99.95 + VAT
12" £149 + VAT

Standard Features
- Reliability Solid state circuitry using an IC and silicon transistors ensures high reliability
- 100 lines horizontal resolution. Horizontal resolution in excess of 500 lines is achieved in picture center
- 300 lines vertical resolution in excess of 500 lines is achieved in picture center
- Looped video input Video input can be looped through with built-in termination switch
- External sync operation available as option for U and E sync
- Construction Two monitors are mountable side by side in a standard 19-inch rack

All prices quoted are exclusive of VAT. Delivery is added at cost. Please make cheques and postal orders payable to COMP SHOP LTD., or phone your order quoting B.A.B.C.M.A. CREDIT CARDS AVAILABLE - send S.A.E. for application form.

MAIL ORDER SHOP

14 Station Road, New Barnet, Hertsfordshire. EN5 1QW
(Adjacent to New Barnet tube station - Moorgreen Lane) Telephone: 01-441 2922 (Sales) 01-449 6596 Telefax: 29935 TELECOM G
OPEN (BARNET) - 10am - 7pm - Monday to Saturday
311 Edgware Road. London W2 Telephone: 01-623 0387 OPEN (LONDON) - 10am - 6pm - Monday to Saturday

Circle No. 127
PRACTICAL COMPUTING September 1982
SOFTWARE FOR CP/M®
HIGH QUALITY SOFTWARE - WITH HIGH QUALITY SERVICE


WORDSTAR - Professional word processing software. On-screen formatting, wordwrap, pagination, line and character count on view, Micro-justification on solutions of printer. Search and replace. Block/paragraph manipulation. External file read/write. Background printing during editing etc.

MAIL- MERGE - Powerful Wordstar enhancement for file merging and document personalisation.

DATASTAR Screen oriented system for Data Entry, Retrieval and Updating.

SUPERSORT - Sort, merge and selection program.

CONFIGURABLE BUSINESS SYSTEM (CBS) - Unique information management system with user definable files, powerful report generator, menu-driven for ease of use. No programming experience necessary!

ACCOUNTING PACKAGES by Median - Tic: PAYROLL, SALES, PURCHASE, £300

MINIMALS - Speciality developed by UK software house to exacting specifications, each written in Microsoft Basic each package may be customised by end user, all are widely used. Ledgers are open item. Payroll caters for weekly and monthly pay.

PROJECT COST CONTROL/JOB ACCOUNTING - A comprehensive set of widely used. Ledgers are open item. Payroll caters for weekly and monthly pay.

DATASTAR Screen orientated system for Data Entry, Retrieval and Updating.

STATISTICS PACKAGE - Over 25 routines including Regression & ANOVA

MICROSOFT BASIC COMPILER

MICROSOFT BASIC INTERPRETER

MICROSOFT FORTRAN COMPILER

MIGRAS COMPILOR

MAGSMA - Versatile easy to use Keyed File Management System for

Microsoft Basic or CBASIC.

CIF - COBOL, ANSI 74 implementation to full level 1 standard. Supports random, indexed and sequential files, features for conversational working, screen control, interactive debugging, program segmentation etc.

FORMS 2 - Automatic COBOL code generator for screen formats.

PASCAL 2

STRUCTURED BASIC - Reusable compiler.

CBASIC 2 - Extended Disk Basic pseudo compiler and run-time interpreter.

SELECTOR III - C2 - Information management system written in CBASIC 2.

SELECTOR IV - Upward compatible version of III with enhanced reporting.

BSTM - Telecommunications facility for exchanging files between CP/M computers.

ASCOM - Facility for communicating with other computers.

TRANSFER - CP/M to CP/M file exchange - telecommunications source code.

MACRO 80 - Macro Assembler

CP/M 2.2 - Standard Version II Single Directory.

Please contact us for availability of other products

All orders must be PREPAID. Add £1 per item P & P (Minimum £2.00) and VAT

Please send your order to Computer Plus, 47 Queens Road, Watford.

COMPUTER PLUS, 47 QUEENS ROAD, WATFORD

TELEPHONE: WATFORD 33927
"...the quality of the colour display is excellent." Popular Computing Weekly.
"The graphics facilities are great fun." Personal Computer World.
"...the Spectrum is way ahead of its competitors." Your Computer.

"The world's best personal computer for under £500."

Sinclair ZX Spectrum
16K RAM £125, 48K RAM £175.

This is the astonishing new ZX Spectrum – a powerful professional's computer in everything but price!
There are two versions – 16K or a really powerful 48K. Both have a full 8 colours, sound generation, a full-size moving-key keyboard and high-resolution graphics. Plus established Sinclair features such as 'one-touch' keyword entry, syntax check and report codes!

Key features of the Sinclair ZX Spectrum
Full colour – 8 colours plus flashing and brightness-intensity control. Sound – BEEP command with variable pitch and duration.
Massive RAM – 16K or 48K.
Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
High resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
ASCII character set – with upper- and lower-case characters.
High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY and MERGE for programs and separate data files.

The ZX Printer – available now
The printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.
Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

ZX Microdrive – coming soon
Each Microdrive will hold up to 100K bytes on a single interchangeable microfloppy – with a transfer rate of 16K bytes per second. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum – they're available later this year, for around £50.

How to order your ZX Spectrum
BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.
BY FREEPOST – use the coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard. EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

Sinclair ZX Spectrum
Sinclair Research Ltd,
Stanhope Road, Camberley. Surrey,
GU15 3PS. Tel: Camberley (0276) 685311.

Order

Please tick if you require a VAT receipt □
* enlsoe a cheque/postal order payable to Sinclair Research Ltd for £
Please charge to my Access/Barclaycard/Trustcard account no.
*Please change to my Access/Barclaycard/Trustcard account no.
Please print

*Please delete/complete as applicable.
Mr./Mrs./Miss
Address

TOTAL £

FREEPST – no stamp needed. Prices apply to UK only. Export prices on application.

PRC 809
The patient has a splitting headache, spots on the ankles and a bad case of split ends. Is it that scourge of 18th-century mariners, dengue; or merely a hangover with fleas and a poor after-shampoo hair conditioner? The expert system recommends taking the patient’s temperature: if high, then quarantine is indicated, if low, a raw egg in Worcester sauce. Alternatively, you are master of an oil rig. You are woken in the middle of the night by a red glare at the porthole of your cabin, shouts and yells and explosions. What do you do? Naturally, with a single bound you are at the keyboard of your trusty micro, running an expert system set up to cope with the whole problem. “Is it November 5?” the shrewd little fellow asks. With a sigh of relief you sink back into slumberland as the gigantic structure slides hissing beneath the waves.

Dispensing for the moment with their aura of magic, what is happening here? Let us assume that we live in a logically perfect world where everything is either true or not true. The medical system could be set up as a database. It could have records in it like:

SYMPTOM = Headache
SYMPTOM = Spots on ankles
SYMPTOM = Split ends
SYMPTOM = High temperature
DISEASE = Dengue
SYMPTOM = Headache
SYMPTOM = Spots on ankles
SYMPTOM = Split ends
SYMPTOM = Low temperature
DISEASE = Fleas with hangover and poor hair conditioner

However, in real life classical logic seldom applies. You can hardly ever say: “If A then B,” and if you can do not need a computer to tell you what to do next. A slightly more realistic model of life would be “If A then 80 percent chance that B.” Classical statistics might make one think the converse: “If not A then 20 percent chance B,” and “If not A then 80 percent chance not B.”

Real life resolutely refuses to follow the 100 percent view of probability. Instead of jigsaw puzzle pieces of knowledge that interlock along infinitely thin saw cuts of conceptual distinction, real life is an uneasy sea of ignorance on which bob a few unrelated floes of meaning. If you are not standing on the foa marked “A” it does not mean, as classical statistics would have you think, that you must be standing on “not A”. In practice you are back where you started, dog-paddling in the sea of ignorance.

To illuminate this problem, think back to the troubled bunk of the oil-rig manager. A red glare at the porthole is a 99.999 percent certain indicator of trouble. A soothing black view of the night does not, on the other hand, give a 99.999 percent certain indication of a good sleep. To the experienced oil-rig manager, an absence of red glare means little or nothing. So far so good, and one can see that it will not be out of the question to write a program that accepts symptoms, asks for probabilities that they are real, follows up the clues and asks more questions before suggesting a number of diagnoses and possible actions to be taken. The symptoms may not, of course, be medical ones. They might be mechanical or economic or drawn from any field of expertise in which people are presented with ill-defined indicators on which action has to be taken.

From another point of view, an expert system is just a fuzzy index to an operator’s manual. “What do I do if I am 32 percent sure the core temperature is too high; 83 percent sure that the cooling water relief valve is jammed shut; 100 percent sure I’m at Three Mile Island?” Answer: “RUN”.

This is where the whole thing breaks down. An index is only a way to find information; if the information is no good, then the index is no good either. As one understands the current thinking on Three Mile Island, the operators would not have been able to cope even if they had understood the signs presented, and had been able to look up the appropriate page in the manual. The appropriate page was not there. The designers of the system had not foreseen the concatenation of mishaps that actually occurred.

All expert systems rely, for their most important part, on the actual information they contain about what to do, on human input — not to put too fine a point on it, they rely on experts. As life becomes more complicated one is more and more frequently reminded that the people most likely to get things wrong are experts. Moreover, they are experts asked not only about the significance of A and B and C and D, but also for statistical estimates of the reliability of these observations, as made by non-experts.

The difficulty of collecting the necessary kind of information makes the software look easy. Yet, if expert systems are to play a useful part in human affairs it has to be done. It amounts to wiring every human being into a total on-line data-collection system, simply to acquire the information base you need in order to make sensible predictions. The alternative is to let the expert system learn as it goes along.

The drawback to that is obvious — how many oil rigs can you afford to burn while the computer learns its trade? The less obvious drawback is the volume of material it has to survey. After all, the diagnosis for dengue is the result of thousands of doctor-years of observation all over the world over three centuries or more. The mechanism for bringing this information together into one succinct line in a textbook may be crude and fallible but we have found out how to do it. We have not the slightest idea of how to make computers do the same thing, and none of the necessary machinery.

This is not a spiteful attempt to discredit expert systems as such. If they are regarded as soggy databases, there is no doubt that they can be made to be useful in many well-limited areas of human decision. The danger comes when they, and other AI techniques billed for stardom in the “fifth generation” machines are hyped up as the final solution to the world’s problems. The enthusiasts may be forgiven for overstating their case: one would hope that governments would realise that information of the sort these systems need just does not exist and will be very difficult to collect.

Charlatans appear whenever it is proposed to spend large sums of money on impossible objectives. Some quite impressive specimens are rallying to the cry of “fifth generation”; one hopes that, in its eagerness to be up with the hunt, our Government is not taken to the cleaners by them. It would not only be annoying to see money spent on silly jokes; in our enthusiasm to leapfrog over current technology into oblivion, we may neglect some perfectly worthwhile projects whose only drawback is their usefulness.
DE Dealers supply the lot!

Whatever your micro needs just look at the choice, just look at the prices. Everything you could need, and more!

**VIDEO MONITORS AND ACCESSORIES**

- **Kaga 12" B/W Monitor inc. Cable**  £122.00
- **Kaga 12" Green Monitor inc. Cable**  £99.50
- **Phillips 12" Amber Monitor inc. Cable**  £134.00
- **Kaga 14" Colour Monitor inc. Cable**  £249.00

**PRINTERS AND ACCESSORIES**

- **Anadex DP9000L (Serial/Parallel)**  £795.00
- **DP9000 (Serial/Parallel Graphics)**  £895.00
- **DP9500L (Serial/Parallel)**  £895.00
- **DP9500 (Serial/Parallel Graphics)**  £995.00
- **DP9001 (Serial/Parallel Graphics)**  £945.00
- **Ribbon for DP9000/9500 Series**  £12.14
- **Graphics for DP9500/1**  £14.00
- **Anadex Graphics Interface Card**  £140.00

**BASIC DATA**

- **5650 (Serial/Matrix)**  £620.00
- **5100 (Parallel/Matrix)**  £1385.00
- **5100 (Serial/Matrix)**  £1175.00
- **5200 (Serial/Matrix)**  £1250.00
- **6M80/16/85 (High Res. Serial/Matrix)**  £2275.00
- **DY21P (Parallel/Daisy Wheel)**  £985.00
- **DY311S (Serial/Parallel Daisy Wheel)**  £1250.00
- **DY61S (Ser./Par. Daisy Wheel inc. SPR)**  £2650.00
- **Olivetti Fabric Ribbon (Dy 6)**  £21.50
- **Olivetti M/Strike Ribbon (Dy 6)**  £36.00
- **Olivetti S/Strike Ribbon (Dy 6)**  £18.00
- **Various 10 or 12 pitch Olivetti Daisy Wheel (Dy 1)**  £14.00

**DAISY WHEELS**

Selected typefaces for both Diablo and Qume daisy wheels are available singly:

1 - 5  £5.50 (per unit)
6+  £4.75 (per unit)

**PAPER**

Selection of paper includes:

- **Order Codes**
  - **LP10**  Box of 11" x 14 1/2" 1pt (2000 sheets)  £12.55
  - **LP5**  Box of 11" x 15 1/2" 1pt (2000 sheets)  £15.01
  - **LP1**  Box of 11" x 14 1/2" 2pt (2000 sheets)  £14.55

**RIBBONS**

Complete range of printer ribbons are available to suit most makes of printers.

**Plus**

- **Apple Accessories/Interface Cards**
- **Supercalc®**
- **Dataplan®**
- **Floppy discs/storage**
- **Micro Systems furniture**

Ask your DE dealer for details of the latest promotional offers.

**Mountain Computer Hardware**

Data Efficiency is the sole appointed UK distributor of the Mountain Computer range of high-quality peripherals for the Apple Computer.

- **CPS Multifunction Card**  £127.00
- **RAMPlus+**  £100.00
- **ROMWRITER**  £93.00
- **COPYROM**  £111.00
- **Clock/Calendar Card**  £38.00
- **SUPERTALKER**  £149.00
- **A/D + D/A Channel Converter**  £141.00
- **1/0 Cable assembly for above**  £233.00
- **Music Systems Complete**  £35.00
- **Spare Music System Disk Pack**  £257.00
- **Spare Music System Manual**  £20.00
- **Expansion Chassis**  £10.00

**DAISY WHEELS**

Selected typefaces for both Diablo and Qume daisy wheels are available singly:

1 - 5  £5.50 (per unit)
6+  £4.75 (per unit)

**Ring for details of your nearest stockist (0442) 40571/2**

**For all your Micro needs...and more.**

Data Efficiency Ltd, Computer Division, Finway Road, Hemel Hempstead, Hertfordshire HP2 7PS Tel: (0442) 40571 /2 Telex: 825554 DATEFF G

- **Circle No. 132**
Prestel too expensive... 

MUCH AS I admire your erudite comment on the failure of Prestel I cannot but think the explanation is much simpler—it priced itself out of the market.

Who in his right mind is going to pay for a telephone connection charge, an expensive adaptor to the TV, and then a fee for the use of the service when they already have Ceefax and Oracle? The service should have been financed by the advertisers as is ITV.

John Caulfield,
London SW18.

Computers for handicapped

WE ARE a Cheshire home for the physically handicapped, and have recently bought an Apple II microcomputer, now being adapted for use by severely handicapped operators. It is to be used as an aid to solving some very basic problems and for recreation:

- Communication—between residents and staff, or between the residents themselves;
- Letter writing—through word processing, etc.;
- Games—from chess through to Space Invaders.

We intend to set up a central library of programs, specifically for use by handicapped operators, and adapt programs to suit their physical capabilities. The library will be available to all interested parties or who wish to donate and borrow programs. At present we are looking for programs in three formats: program listings; Apple II floppy discs; TRS-80 cassette.

Flxopy discs and cassettes will be returned.

The idea is to provide a link between all organisations and individuals who are working in the field of computing for the physically handicapped. We would welcome enquiries from schools, colleges and residential homes, etc.

If interested, please write to me, enclosing a stamped addressed envelope.

Robin Nixon,
Seven Springs Cheshire Home,
Pembury Road,
Tonbridge Wells,
Kent TN2 4NB.

Potential threat

I WAS INTERESTED to read the interview with Clive Sinclair in the July issue, particularly with regard to his Microdrive and portable machines. The Japanese are at present marketing a microdrive in the U.S.A. which uses 3in. discs with 0.5Mbyte capacity, unformatted, per disc.

There is an 18lb. portable, less than half the size of the Osborne 1, with integral discs giving 0.72Mbyte of disc space, formatted, and an 11.4in., by 8.5in., by 1.75 in. machine weighing less than 4lb., with integral disc and micro-cassette. The display is a flat screen 120-by-32 dot matrix, 20 by 4 characters.

It would seem that if the Japanese and Americans decide to import to Britain, Clive Sinclair's market could be severely dented before he even has his wares ready.

Cliff Burgess,
Bedford,
Texas.

Name finder

THE ONE-LINE program in June's "Open File: Tandy Forum" for finding the name of an unknown program ends with a new statement. This might be alright for readers with exceptional reflexes, but the rest of us should delete New from the program as it serves only to clear the screen.

P V Bamfield,
Brighton,
Sussex.

Unsatisfactory service

IN VIEW OF YOUR recent article on Clive Sinclair I thought you might be interested in my experience with his company and its so-called service department:

May 6, 1982 — despatched one non-working ZX-81 and printer power pack as the power pack had been found to be in excess of the voltage quoted on the circuit board and was showing signs of overheating.

May 17 — receipt acknowledged only after I had written to query it.

Whitburn — new power pack appeared in plain, brown, padded envelope; as not adequately packed it arrived chipped, and with no documentation whatever.

June — silence.

June 26 — rang number given on card enclosed with original packaging—ZX-81 purchased from W H Smith, printer from Sinclair; could not trace our computer, eventually located it listed as a printer repair. Said they would ring back.

June 29 — rang again, and was told I should have taken it back to Smith's and sent it to them. Asked to speak to supervisor who would not come to phone; no point, they had sent the computer on to Smith's repair department at Southend. Asked for phone number. Eventually extracted information that it had been sent in sack six. Refused to give date or why I had not been notified that computer had left their premises. Phone number unobtainable.

Immediately rang branch of W H Smith from where ZX-81 had been purchased—Hemel Hempstead — and explained to the manager the predicament. Very helpful, explained they did not have a service department but contracted out the repairs and said he would sort it out for me.

(continued on page 35)
Probably the fastest microcomputer in the universe
the JUPITER ACE only £89.95.

Key Features
- Revolutionary microcomputer language FORTH.
- Full-size moving-key keyboard.
- User-defined high-resolution graphics.
- Programmable sound generator.
- Fast cassette interface.
- Upper and lower case ascii character set.
- 24 x 32 character flicker-free display.

The Jupiter Ace uses FORTH

The Ace is set apart from all other personal computers on the market by its use of a revolutionary language called ‘FORTH’. Some computer languages are easy for humans to understand, others are easy for computers; FORTH is most unusual in being both. Its underlying principles are so simple that it takes even a newcomer to computers only a few minutes to learn how to do calculations on the Ace, yet the very same principles are powerful enough to allow you to invent your own extensions to the language itself.

At the same time, the memory-saving coded form used to store your programs inside the Ace allows it to obey them very fast — typically in less than a tenth of the time it would take to do the same thing using a different language. Amongst other things, this makes the Ace ideal for games.

FORTH’s unique combination of speed, versatility and ease of programming has already made it a prime choice for professional applications as diverse as pub games and radio telescopes, and gained it an enthusiastic national user group. Now the Jupiter Ace can bring this addictive language into your own home.

Designed by Jupiter Cantab

Leading computer Designers Richard Altasser and Steven Vickers have a reputation for pushing technology forwards. After playing the major role in creating the ZX Spectrum they formed Jupiter Cantab to develop their latest brainchild the Jupiter Ace.

Order Form

The Jupiter Ace is available only by mail order. Please allow up to 28 days for delivery.

Send cheque or postal order with the form to:-
JUPITER CANTAB, 22 FOXHOLLOW, BAR HILL, CAMBRIDGE CB3 8EP

Please send me:-

□ JUPITER ACE MICROCOMPUTER(S) @ £89.95.
Name. Mr/Mrs/Miss
Address

PRACTICAL COMPUTING September 1982
Manager rang back same day to say that contractors had seven unopened sacks of material received in last fortnight and no documentation from Sinclair. Were now opening sacks and dealing with those accompanied by correspondence, and would let me know if there were any further problems.

July 2 — surprise and delight, computer re-ran three Basic lines, but when I ran the program it had just come to my notice. I typed AN UNUSUAL visual effect that takes place with Sinclair at end of April. I cancelled an order for a Spectrum placed with Sinclair at end of April.

Moira Walker, Wheathampstead, Hertfordshire.

Visual phenomenon

AN UNUSUAL visual effect that takes place on the Commodore 4016 model computer has just come to my notice. I typed three Basic lines, but when I ran the program the characters displayed were wiped off the screen slowly, and reappeared slowly a couple of seconds later. Can anyone provide an explanation for this effect. Touching the space bar or shift slows this effect down, and inserting more or fewer characters in line 10 speeds it up.

Jayne Bartlett, Poole, Dorset.

Taxation pitfalls

I REFER to the article “Keeping Income Tax in Check” in the June issue, and must say that the errors and inadequacies reflect the hazards and pitfalls awaiting the programmer with little or no experience in this complicated subject. Many of the procedures in taxation are governed by written and unwritten rules of practice and it is too easy for a brave effort to come fundamentally adrift from established principles. There are technical inaccuracies in the article and the program, and I should like to point out the following general major errors and omissions:

- Working abroad: It is not necessary to work abroad for the whole tax year to qualify for the 100 percent deduction. If an individual leaves the U.K. in, say, September and is abroad for at least 365 days, a 100 percent deduction for the period to the following April is available. The program only allows a 25 percent deduction in such circumstances.
- Married during 1981/82: All the information given in relation to the treatment of wife's income for those married during 1981/82 is incorrect and applies only to the years up to 1976/77. Refer to section 36, Finance Act 1976 for further details.

- Treatment of married women: The program allows a married woman to be regarded as a single person, if she wishes. This is true regarding her earned income, but there is no possibility of treating the wife's unearned income as not belonging to the husband for tax purposes.
- Tax payable and recoverable: The object of the program is apparently to advise the individual of net tax payable/repayable for the year 1981/82. This figure is somehow calculated independently of tax deducted under PAYE or tax paid under direct assessment. The resulting figure is meaningless, and hopefully users would be aware that further calculations are necessary before writing to their Inspector of Taxes.

My own firm has been involved in writing tax programs, including personal tax, for the professional accountant who tends to be apprehensive that a micro-computer can cope with his complex work. Elizabeth Acraman's article shows how easy it is to be unaware of or overlook views which a tax practitioner would regard as fundamental.

James Ferguson, Paisley, Strathclyde.

BCPL correction

ONE LINE of the illustration of BCPL in Feedback, Practical Computing July 1982, was unfortunately incorrect. It should have read:

\[
\text{LET } \text{offgrid}() = \begin{cases} 0 & \text{xlen} < 0 \\ 16 & \text{ylen} < 0 \\ \text{xlen} > 16 & \text{ylen} > 16 \end{cases}
\]

John Richards, RCP Ltd, Blewbury, Oxfordshire.

WordStar on Apple

UNLIKE JACK MCLEISH — Feedback, Practical Computing, July 1982 — I have managed to install Wordstar 3.0 on an Apple II. The printer is a Centronics 737-2 connected by the Apple Centronics interface card A2B0007.

During installation I selected “Any Teletype-like printer”, “none” as the communications protocol and “CP/M list device” from the printer driver menu. This is the same selection as Jack McLeish made and yet all seems to be functioning perfectly for me.

The only obvious difference is in the use of parallel rather than Centronics card. But provided Jack McLeish has wired the jumper block on his card correctly in accordance with the instructions for Centronics printers on page 9 of the Apple parallel printer interface manual which comes with the card, this should work too.

If checking the jumper-block wiring does not help, he might try disconnecting and then reconnecting all connections between slot 1 of the Apple and the printer. Ours printed gibberish at first, simply due to a poor electrical connection.

Henry Brown, Newcastle upon Tyne.

Joystick modified

THOUGH A Shop Window advertisement the February 1982 Practical Computing I bought from T Garland & Son of Manchester, a joystick which I thought would work on all my games, instead of having to use arrows, space bar, etc.

It arrived and I loaded the software, but I was really disappointed when all it would do was draw lines vertically and horizontally. The accompanying limited instructions to convert existing programs were of no use since I am no expert, and could not attempt any alterations. So I wrote to the makers and received a telephone call from Mr Garland who offered to modify some of my software to work with the joystick. Since then, the firm has modified my joystick and most of the software I have.

To my amazement this was all done free of charge, and they should be complimented.

Marcel Hudson, Basford, Nottingham.

Learning to talk

THE APPROACH to natural language by Chris Naylor in Practical Computing, June, may be able to derive a lexicon, but I doubt it will ever derive any semantic rules. He claims to simulate continuous speech but fails to use phonetics, and omits spaces and punctuation, which represent clear audio cues in real speech.

Another problem is the idea that humans learn a language simply by being exposed to it. Babies learn their phonetic alphabet this way, but at the “mama” stage adults start teaching nouns by pointing at objects and naming them. Adjectives and verbs are later combined with known nouns, and by the age of five a child knows conjunctions, prepositions, etc., but may be unsure of their correct use. From this time professionals expand the lexicon and teach syntax and semantics.

An important area not addressed is the relation of language to reality. To his program, “dog” is a three-character string occurring more often than it would in a random stream. To a human, it is the sum of all previous experiences involving dogs. We use a huge on-line relational database to give meaning to words; computers will need a similar structure to work in natural language.

David Budd, Hulme, Manchester.
Plain paper printer

A £70 printer which prints on to plain paper rolls is available from Amber. Up to now, low-cost printers have generally used thermal or electrostatic paper, which makes them quite costly to run and the material does not appeal to everyone. The Seikosha at about £230 was previously the cheapest to use normal white paper.

The secret of the Amber 2400's low cost is in the logic used to drive the printing mechanism. Only four needles are used. These are widely spaced and oscillate horizontally across the paper to build up each line of dots. A character line is constructed over several passes; 24 characters, the normal line length, take 0.7 seconds.

The paper roll is only 58mm wide, but the printer can do lower and upper case, expanded characters and dot graphics. Acorn, BBC, Pet, TRS-80, UK 101 and ZX-in-

Mini-winnie extended

TWO NEW DRIVES extend the Rodime mini-winnie range to include 40 and 53Mbyte versions. The two new drives are designated the RO-206 and the RO-208 respectively. The sizes quoted by Rodime are slightly misleading as the capacities of the drives become 31.5 and 42Mbyte respectively when formatted in the industry standard of 256 bytes per sector and 32 sectors on each track.

The 206 and 208 are enhanced versions of the RO-200 series, and use Rodime's two-chamber design. They can be incorporated in a microcomputer, taking up the same amount of space as a mini-floppy drive. The higher capacity has been achieved by use of a high-resolution stepper motor giving a track density of 600 tracks per inch. The units also use more of the disc surface.

For further details contact Rodime, Nasmyth Road, Southfield Industrial Estate, Glenrothes, Fife. Telephone: 0592 774704.

Traditional clock

THE MURRELL CLOCK SYSTEM is a patented liquid-crystal analogue clock. It displays the traditional hands that have been associated with clocks for hundreds of years. However, just because it is traditional it does not mean that the clock face is old-fashioned. A clock face with hands is a far more efficient way of displaying time than the supposedly modern digital display.

This particular clock face has the added advantage of interfacing to most small computer systems, enabling the time/calendar to be read and used within the computer for various tasks. The clock supplies hours, minutes, seconds, day, date, and month.

The Murrell clock has been developed by Murrell Dynamics Limited, a development company which is looking for interested companies to make licensing agreements. For more details about such agreements, or the clock itself contact, N J Murrell, Murrell Dynamics, 9 Haston Crescent, Kinnoull, Perth PH2 7XD. Telephone: 0738 38276.

English financial system

PLANNERCALC is a computerised financial-modelling system, available for only £39. The system is apparently easier to use than competing systems because the rules are entered in easy-to-use English, the highest-level language of all.

The system uses the now familiar spread-sheet approach, with a window that can be rolled in any direction. The user can enter new figures or rules, and their effects can be seen immediately.

Comshare, the system developer, sees Plannercalc as the entry point into Comshare's micro software range; a more sophisticated system called Masterplanner is the next step up. Models developed on Plannercalc can be transferred directly across to Masterplanner, and the extra features then become available.

Both systems will run on most micros which operate under CP/M. However they need 64K of memory, an 80-column screen, and either 5.25in. or 8in. floppy discs. Because of the low price, Plannercalc will be supplied via mail order and bulk purchases. For details contact Comshare, 32/34 Great Peter Street, London SW1P 2DB. Telephone: 01-222 5665.

Newsagents' package

SUPERNEWS is a computer system for newsagents, and it retails for only £990. The package is based on the Newsround package produced by the same company for the Superbrain computer and is aimed at the smaller newsagent who cannot justify the capital costs involved in purchasing such a system. The system comprises a Vic-20 computer, memory expansion, disc drive, and printer. It will plug into any TV set which then becomes the system monitor.

Facilities provided by

齉

The Computer Room will maintain the equipment and will lend a replacement machine in the event of a breakdown. The Computer Room is located at 87 High Street, Tonbridge, Kent. Telephone: 0732 355962.
Micros and the disabled

MICROCOMPUTERS have turned out to be a boon to the handicapped, or so we are told. Whenever prizes are handed out by this or that au-

tomobile or by some other group, the disabled will figure among the winners and on the subsequent flurry of press releases arriving in our office. It is a safe and

worthy area for sponsors to be involved in, and clearly a welcome opportunity to associate new technology with some-thing other than unemployment in the public mind.

But do any of these systems work? Can you deliver usable, practical improvements to people's daily life with the stuff this magazine is about? For the first time disabled people will be giving their views at a one-day course which is to be run by the Spastics Society.

The course is aimed at technical people interested in using their time and experience to make or modify aids for the disabled. The location is Neath Hill Professional Work-

shop in Milton Keynes, which is itself a business venture run by severely disabled people, producing a variety of software products and trading as an Apple dealer.

The course is on Saturday, September 25 and costs £6.50. More details can be obtained from The Spastics Society at Castle Priory College, Thames Street, Wallingford, Oxfordshire OX10 0HE. Telephone: 0491 37551.

Pet package is used to simulate Simplex D

ONE APPROACH to making the process of computerising as painless as possible is to closely simulate a familiar and well-tried manual system. The Simplex D cash book has been around for years and is used in many small businesses, especially in the retail sector. The user of the Micro-Simplex package, which runs on the 8000-series Pet, enters figures into an exact screen replica of the Simplex D cash-book page.

Once the data has been loaded on to the machine, summary and year-end accounts can be readily produced, something it is difficult to do manually. Receipts can be analysed over 10 departments and the package can handle any of the nine VAT schemes currently available for retailers.

The basic software package costs £395, with additional modules to handle VAT reporting, unpaid bills and outstanding invoices at £50 each. Leasing the whole system including Pet and printer would work out around £15 per week. Micro-Simplex is working on connecting the system up directly to the TEC MA 19 cash register.

Details from Micro-Simplex, 8 Charlotte Street West, Macclesfield, Cheshire, SK11 6EF. Tel: 0625 61500.

ERA launch is no handicap

THE GOLF WORLD is about to be plunged into turmoil with the introduction of new handicapping rules, probably from January 1, 1983. This will impose a sizeable workload at the 2,750 golf clubs around the U.K., as golf handicaps are calculated from the results of past competitions. So it is a convenient time for ERA Consultants to launch its Clubmaster package, based around the portable Osborne micro-computer.

For £2,500 you buy the Osborne itself, an Epson MX-80 printer, all the usual Osborne software such as WordStar and SuperCalc, and the Clubmaster package. Clubmaster can be used to record scores during competi-
tions, print out scoresheets and update and report handicaps.

The system was designed by Keith Roberts, a category 1 amateur golfer based at Disley Golf Club, Cheshire.

For major events the system can display a comprehensive Leader Board, and with a £50 adaptor the Osborne will display this on up to 12 TV sets. The membership and subscription side of the system can handle 26 categories of member and 10 methods of payment, and will cope with 700 to 1,000 members on an expanded Osborne. Subscription bills, membership lists and reminder letters can be produced.

In addition, ERA has set up various golf-club oriented financial applications on SuperCalc. More details can be obtained by contacting Keith Roberts, ERA Consultants, 4 Devonshire Park Road, Davenport Park, Stockport SK2 6JW. Telephone: 061-480 8927.
Good News
For Programmers!

DUE TO CONTINUED PRODUCT ACCEPTANCE AND SALES SUCCESS DATAVIEW HAVE SLASHED THE PRICE OF THE D.T.L. BASIC COMPILER now £99.50 + VAT FOR A LIMITED PERIOD

*COMPILING & LANGUAGE SYSTEMS FOR THE COMMODORE RANGE OF MICROCOMPUTERS. * UP TO 20 TIMES FASTER WHEN COMPILED. * MORE COMPACT OBJECT CODE, e.g. A 2K PROGRAM WHEN COMPILED WOULD RUN ON A 16K MACHINE. * AVAILABLE ON COMMODORE 3000, 4000 AND 8000 SERIES MACHINES INCLUDING 8096. * HANDLES FULL ARITHMETIC EXPRESSIONS. * COMPILED CODES WITH NESTED LOOPS, HANDLES ARRAYS AND VARIABLES DYNAMICALLY ALLOY AND ACCEPTS EXTENSIONS TO BASIC. * THOROUGHLY SUPPORTED BY A COMPREHENSIVE MANUAL AND FULL BACK-UP FROM DATAVIEW. * SYSTEM 96 WILL ALLOW YOU TO UTILISE THE POTENTIAL POWER OF THE 96K RAM USING THE BASIC PROGRAMME LANGUAGE.

PLEASE RING OR WRITE TO:
DATAVIEW LIMITED
PORTREEVES HOUSE
EAST BAY
COLCHESTER
CO1 2X6
TELEPHONE: (0206) 865835

Please Tick
Send details of the DTL Basic Compiler
Send the DTL Basic Compiler.
I enclose a cheque for £116.00 including VAT and p & p.

Name
Company
Address
Tel
Ref. P.C. 1

S-100 MULTI-USER MULTI-PROCESSOR HARDWARE

SuperStar

Each user running standard CP/M 2-2 or CP/M 86 with zero CPU degradation.

DESKTOP COMPUTER PACKED WITH

PROCESSING POWER
Up to 16 users each with its own private card which contains Z80A, 64 Kbytes, VDU I/O and printer I/O, is total of 16 Z80s and 1024 Kbytes of RAM. (Optional 16 bit 8006 processors with 128 Kbytes).

STORAGE
Integral 5.25" Winchester Disc with up to 15 MByte capacity and integral 5.25" Floppy Disc with up to 660 KByte capacity. Optional - 16 MByte cartridge tape back-up unit, up to 80 MByte Winchester Disk Unit.

HIGH PERFORMANCE
Unlike single - CPU multi-user systems e.g. MP/M, MVT, OASIS, etc, where system throughput degrades as additional users are added, Superstar has no CPU degradation at all. Each user has its own private processor and memory and VDU I/O running at 4 MHz.

PRINTER INTERFACE
1 serial and 1 parallel printer ports shared by all users plus a private printer for each user.

16 BIT 8086 PROCESSOR
More powerful and faster processing time is offered through 16 bit private processor card based on 8086. CPU and 128 KByte RAM expandable to 1 MByte. The system automatically loads CP/M 80 to the 16 bit private processors.

NEW FEATURES YET LOWER PRICES
Upgrade package is available for:
— North Star Horizon
— Comart Communicator
— Vector Graphics and other S-100 systems

SYSTEM SOFTWARE
Each user processor runs its own dedicated copy of the industry standard CP/M 2.2 or CP/M 86. Shared resources (Disks and Systems Printers) are controlled by DPC/OS which supports file/record locking, print spooling, multiple printer and interprocessor communications. Language available: BASIC, COBOL, PASCAL, FORTRAN, PL/1, API.

APPLICATIONS SOFTWARE
Word Processing, Sales, Purchase, Nominal Ledger, Payroll, Order Processing/Invoicing, Stock Management, Job Costing, Mailing System, Insurance Brokers System etc.

LOW COST (FROM £1750) AND EXPANDABLE (AS YOUR NEEDS GROW)
Superstar starts at £1750 for single user system Quad density floppy drives are field upgradable to hard disk system of up to 80 Mbyte capacity and by simply adding a private processor card for each user the system can be configured into multiple users as and when required. The 16 bit processor is fully compatible within the standard Superstar multiprocessor system permitting efficient upgrading as future needs develop, without sacrificing any of your extensive hardware and software investment.

CP/M MULTI-USER MULTI-PROCESSOR SOFTWARE

Bromley Computer Consultancy

PROFESSIONAL APPROACH TO MICROS
244A High Street, Bromley, Kent BR1 1PQ.
Telephone: 01-464 8080 Telex 896691 TLXIR G (Attn. "BROMCOMP")

OEM, DEALERS AND OVERSEAS ENQUIRIES WELCOME

Superstar is a trade mark of Bromley Computer Consultancy. CP/M is a trade mark of Digital Research. Horizon is a trademark of North Star Computer Inc. DPC/OS is a trademark of ACE Inc.
ATARI PRICES REDUCED! We at Silica Shop are pleased to announce some fantastic reductions in the prices of the Atari 400/800 personal computers. We believe that the Atari at its new price will become the U.K.'s most popular personal computer and have therefore set up the Silica Atari Users Club. This club already has a library of over 500 programs and with your purchase of a 400 or 800 computer we will give you the first 100 free of charge. There are also over 350 professionally written games and utility programs, some are listed below. Complete the reply coupon and we'll send you full details. Alternatively give us a ring on 01-301 1111 or 01-309 1111.

ATARI 400
with 16K £199
ATARI 400
with 32K £248
ATARI 800
with 16K £449

400/800 SOFTWARE & PERIPHERALS

Don't buy a T.V. game! Buy an Atari 400 personal computer and a game cartridge and that's all you'll need. Later on you can buy the Basic Programming cartridge (CBS) and try your hand at programming using the easy to learn Basic language. Or if you are interested in business applications, you can buy the Atari 800 + Disk Drive + Printer together with a selection of business packages.

Silica Shop have put together a full catalogue and price list giving details of all the peripherals as well as the extensive range of software that is now available for the Atari 400/800. The Atari is now one of the best supported personal computers. Send NOW for Silica Shop's catalogue and price list as well as details on our users club.

THE FOLLOWING IS JUST A SMALL SELECTION FROM THE RANGE OF ITEMS AVAILABLE:

SOFTWARE & PERIPHERALS

SOFTWARE

- 100 FREE PROGRAMS

Terror 01 AM 1111 or 01 309 1111.
Dept PC9

- 1 FREE LITERATURE

Write for details

FREE LITERATURE

We are interested in quality literature for our shop and would like to offer free copies of any literature which you believe may interest our customers. Just send us a brief note outlining your book and we will be happy to email you further details.

NAME

Address

Silica Club
Over 500 programs for free details

FREE BROCHURES

FOR FREE BROCHURES – TEL: 01-301 1111

SILICA SHOP

PRACTICAL COMPUTING September 1982
A NEW BRITISH PRINTER TO BEAT THE WORLD!

UNBEATABLE VALUE!

- 80/132 column dot matrix printer
- 120 characters per second
- 9 wire ballistic, bi-directional logic seeking print head
- High Resolution and Block Graphics
- and more!

The Walters 120 sets new standards in quality and value for money in the dot matrix printer market.

Just check the specification and you’ll find there’s never been a better time to buy British!!

And the price - an amazing £395.00

(£25.00 extra for Serial / 20mA current loop, £33.00 extra for I.E.E.E. 488) All prices quoted exclude VAT.

For full details and the name of your nearest dealer contact:

IMPACT DATA

16 Putnoe Lane, Bedford. MK41 9AB Telephone: 0234 62288
1 Chilton Road, Edgware, Middx. HA8 7NJ Telephone: 01-952 7956

Circle No. 137

PRACTICAL COMPUTING September 1982
A taste of Apple IV?

TOP APPLE people were around recently in London for a series of briefings to prepare the way, John the Baptist fashion, for what they term their Fourth Generation machines. The only revelation to emerge was that Keith Hall, Apple's new U.K. marketing boss and formerly with Commodore, had slashed 231 dealers out of approaching 600 from Apple's approved list in his first six weeks in an effort to tighten up the dealer network.

Rumour has it that the new Apple IV will be a 68,000-based 16-bit machine, clearly aimed well up-market for Apple. It comes with 1 Mbyte of RAM and 1.5 Mbyte of built-in floppy storage. With printer and screen the system will sell for around £5,000, placing it at the top of the professional-executive market slot which Apple sees as the growth area for personal computers.

The most interesting thing about it is the operating system, which is not the ubiquitous Unix but a special Apple-written product. The user interface resembles that of the cult language Smalltalk, developed at Xerox's Palo Alto Research Centre and currently available only very minimised on the Xerox Star executive work station. Keyboard strokes are minimised by having the user control the system with a hand-held mouse; everything is made ultra simple by simulating sheets of paper on the screen and pointing with the mouse to graphically descriptive function boxes.

The very high-resolution graphics are not in colour. Apple thinks only 10 percent of the potential users are interested in colour, and in this they take issue with the Japanese, whose new machines all seem colour. But the Apple printer will be able to dump the 400-by-800 resolution graphics directly to paper, which may be more important to professional users.

The system is likely to come with a considerable body of software included in the price, continuing the trend of the Apple III; this probably means word processing, spreadsheet, communications, and some accounting applications, as well as software development aids.

Apple believes that fourth-generation machines will only sell on the back of good software. "Hot hardware won't win the battle", as European vice president and manager Tom Lawrence said at a recent briefing.

The launch date is unlikely to be before February 1983. Shadowy machines exist now, but Apple does not intend to go off at half-cock as — it half-acknowledged — with the Apple III.

If this is true it is to be welcomed. Apple is not going to waste the capabilities of 16-bit CPUs and cheap memory by emulating CP/M or some other historic artifact. It introduces a bit of excitement after the bog-standard CP/M box, and the now endless rows of Unix look-alikes, which may well end up appealing more to programmers than to the end-user. Apple is sticking with its original personal-computer concept — the machine you would like to own yourself to do business on — though unfortunately you do need to be a rather up-market person to afford one.

The CX-80 Colour printer can now be provided with an optional interface which allows hard copy to be printed, in colour, from a Prestel terminal. Fitting the interface does not interfere with the printer's operation, which is as a computer colour output printer connecting to the computer via the RS-232 or parallel interface. Black-and-white Prestel printers are also available. For details contact DN Computer Services on 061-643 0016.

Long-term program storage

MANY PROGRAMMERS want a simple way of permanently storing a program in memory. Obvious applications are to keep a favourite piece of system software in ROM or to build very cheap turnkey systems which do not need discs. A convenient way of doing this for one-off or low-volume systems, which does not involve using any PROM programming hardware or special software routines, is available from Cambridge Microelectronics.

The Memic L costs £30 and will work with most popular microcomputers. To use it you replace a 24-pin memory chip with the Memic. Inside is 2K of CMOS RAM and a lithium battery, good for several years of use. Programming is simply a matter of writing to the appropriate address space exactly as if it were ordinary RAM.

When the machine is turned off you flick a switch on the Memic to put it into reduced power-consumption mode, and the contents will still be there next time you power on. The Memic can replace most 24-pin chips, either ROM or RAM. The only restriction is that the system must not assume an access time much faster than 200ns.

The unit comes in two packaging styles, a 3in. high tower-block version which fits directly into the socket on the PCB, or a low-profile version for machines like the Apple where boards are closely stacked together, where the works live outside the system box at the end of a ribbon cable.

More details from Cambridge Microelectronics, 1 Milton Road, Cambridge CB4 1UY. Telephone: 0223 314814.
WE PUT CP/M TO WORK ON SHARP

Micro Technology, the people who put CP/M on the Sharp MZ-80B, and on the all-new MZ-80A, have achieved the near impossible and produced CP/M on the PC 3201; plug our board into the back of your PC 3201 and you can run standard 64k CP/M and use the vast library of CP/M software that Micro Technology can supply.

Now look at Sharp equipment, with all machines offering CP/M and integration using CP/NET and MP/M, you can network together the economy of the MZ-80A, the speed and graphics capability of the MZ-80B and the superbly attractive business presentation of the PC 3201.

SHARP MZ80B Highly flexible micro computer with 64k RAM, disks or tape; high resolution graphics and CP/M.

SHARP PC3201 And newly available from Micro Technology, a plug-in board that allows you to run your PC 3201 with standard 64k CP/M. All CP/M products on our list are now available, including the superb new Padmede/Micro Technology business packages, all making the PC 3201 an excellent business machine.

SHARP MZ80A The newest Sharp machine, bristling with features, equally at home in a domestic or a business environment. Now with CP/M.

If you're interested in the hardware as well - then please call us.
Just check through our list of software

WORDSTAR Powerful word-processing package, makes easy to use by full function key support on the MZ-80B.

SPELLSTAR Add on to WORDSTAR, provides mail-shot and text inclusion.

DISPLAY ACCEPT Powerful screen facility for use primarily with COBOL.

TEX Text for mailshots and similar documents. Now this is not screen based.

MICROMERGE Integrate and merge facility for use with BASIC.

ZIPSOO Super symbolic debugger, with full Z80 mnemonic support. Works well with BASIC.

STOCK CONTROL SYSTEM Full stock control system with minimum stock levels and re-order levels.

SALES INVOICING SYSTEM Automatic invoice system.

SALES LEDGER SYSTEM Fully integrated, secure, parameterisable with full report facilities.

MICRO IMAGE Text for mailshots and similar documents. Now this is not screen based.

MICRO TECHNOLOGY MICROTEXT Easy to learn and easy to use text editor, with full facility for mailshots and similar documents. Now this is not screen based.

MICRO TECHNOLOGY MICROTEXT Easy to learn and easy to use text editor, with full facility for mailshots and similar documents. Now this is not screen based.

MICRO TECHNOLOGY MICROTEXT Easy to learn and easy to use text editor, with full facility for mailshots and similar documents. Now this is not screen based.

NOW WE HAVE ADDED THE 24 MB WINCHESTER VMS, MP/M AND NETWORKING ON SHARP AS WELL!

MZ-80A

PC 3201

6 Mb Winchester hard disk - £1930
12 Mb Winchester hard disk - £2475
16 Mb Winchester hard disk - £3020
24 Mb Winchester hard disk - £3565
*Integral floppy back-up unit - £400
*Clock option (improves MP/M performance) - £25
RS232C card for MZ-80A or MZ-80B
Fully program controlled up to 19,200 baud.
PC 3201

MZ-80B

PC 3201

6 Mb Winchester hard disk - £1930
12 Mb Winchester hard disk - £2475
16 Mb Winchester hard disk - £3020
24 Mb Winchester hard disk - £3565
*Integral floppy back-up unit - £400
*Clock option (improves MP/M performance) - £25
RS232C card for MZ-80A or MZ-80B
Fully program controlled up to 19,200 baud.

MP/M - £350
CP/M - £350
CP/N - £180
CP/M
P/M

Micro Technology LIMITED

51/53 The Pantiles, Tunbridge Wells, Kent TN2 5TH.
Telex 95441 MICRO-G

Ask your dealer for details or call us on Tunbridge Wells (0892) 45344.
We now have one with real time and a battery back up for around £50. Write or phone for details.

Until now it has been costly to have a clock card in your APPLE. £46.50 inclusive of VAT, postage, etc. (including Applewriter conversion, etc). Complete with manual, fitting instructions and software on disk any existing hardware or software. Plug-in fitting, with enable/disable switch, so no conflict with shift-key operation.

Until now it has been costly to have a clock card in your APPLE. £46.50 inclusive of VAT, postage, etc. Complete with manual, fitting instructions and software on disk any existing hardware or software.

The book may be useful on its own; the disk is invaluable. The programs which are described in detail in the comprehensive book. There is new information on DOS and handholding tutorials. It can examine, modify, disassemble, step and trace any interrupted program. The program, which may be in any language, can be repeatedly interrupted, examined, dumped to disk, and restarted from the point of interruption. Snapshot costs £95 (inclusive of VAT p&p)

VISICALC USERS

BENEATH APPLE DOS

MICROSOURCE
Wherever you are in the UK there's a Genie dealer nearby

Genie I & II Approved Dealers

AVON
Microstyle, Bath, 0225 334659/319705. BEDFORD
Conserve, Bedford, 0234 216742. BERKSHIRE
P.C.P., Reading, 0743 588249. Castle Computers (Windsor), 0753 56115. BIRMINGHAM
Photo Acoustics, Newport Pagnell, 0968 105825. CAMBRIDGESHIRE
Cambridge Micro Computers, Cambridge, 0223 48966. CHERISH
Newt Electronics Macclesfield, 0625 22030. Mid Shores Computer Centre, Crew, 0270 211086. CORNWALL
A & C Computers, 11 Brockstone Road, St. Austell, Cornwall, St. Austell 64463. CUMBRIA
Kendal Computer Centre, Kendal, 0539 22559. DORSET
Blandford Computers, Blandford Forum, 0258 53773. Parkstone Electrics, Poole, 0202 748555. ESSEX
Emprise, Colchester, 0206 865996. GLOUCESTERSHIRE
HAMPSHIRE
Fareham Computer Centre, Fareham, Hampshire, Fareham, 02392 745555. HERTFORDSHIRE
Swaryle Electronics, Swarkestone, 0332 48965. LANCASTER
Kram
Electronics, Leicester, 0533 27955. LONDON
City Microsystems, EC2, 01 698 7272/4. Wason Microchip, N18, 01 817 1572/2230. MANSFIELD
Anglia Computer Centre, Norwich, 0603 29652. Bennett's, Dereham, 0362 24889. OXFORDSHIRE
Micro Business Systems, Whitney, 0993 73145. Pebbleglow Ltd., Thame, 0644 2541. SCOTLAND
Elco Computing, Edinburgh, 01 447 9447. Edinburgh: 01 547 3857. SHROPSHIRE
Thorn Microcomputer Centre, Newport, 0692 20425. SOUTH WEST
Diskwise, Plymouth (0752) 267000. West Devon Electronics, Yeovilton, 082 285 3545. Bits and Bytes, Barnstaple, 0727 2728. SYOUTOLK
Citigigan Ltd, Ipswich, 0473 711184. SURREY
Cartronics, Wallingford, Surrey, 01 699 6700/1. Croydon Computer Centre, Thornton Heath, 01 869 1280. WALES
Tryfan Computers, Bangor, 0496 2542. WEST MIDLANDS
Allen TV Services, Stoke on Trent, 0752 615626. WILTSHIRE
Everyman Computer, Westbury, 0373 82764. B&D Computing (Swindon), 0793 682249. YORKSHIRE

Sole Importers:

LOWE
electronics
Chesterfield Road, Matlock, Derbyshire DE4 5LE.
Telephone: 0629 4995. Telex: 377482 Lowlec G.
David Watt looks at the micro which was announced two years ago but has seen the light of day only in the summer of '82.

The NEWBRAIN computer was first announced during 1980, more or less when the Acorn Atom and the Sinclair Z-80 were being launched. At the time there was great excitement, but people lost interest as months went by and no machine appeared. In August 1981 Newbury Laboratories, the NewBrain's originator, sold the project to Grundy Business Systems, who finally launched the first two models in May this year.

Model A is the simpler version with 32K of RAM and 29K of ROM at a price of £199, while Model AD has a single-line 16-character display for an additional £30. Also available is a battery back-up module costing £59, which will provide an hour's continuous operation in the event of a power failure.

A machine with integral rechargeable batteries, designated ADB, is promised for the second half of 1982. Grundy claims the batteries should provide up to four hours of life when using the display, and will preserve memory for up to 20 hours. The standard software supplied in ROM includes enhanced ANSI Basic, a versatile screen editor, floating-point mathematics routines which are accurate to 10 significant figures, and powerful graphics.

A model AD machine was supplied for this review. The first thing that catches the eye is the styling and the quality of construction. In a two-tone brown, moulded ABS case the machine has been designed to take up as little space as possible on the laboratory table or office desk. It measures 11in. by 6in. by 2in. It has a separate power supply in a sturdy metal case which is obviously designed to stand up to accidental knocks if placed on the floor.

**Keyboard pattern**

The keyboard is laid out in the usual QWERTY pattern, with extra cursor-control keys at the bottom to either side of the space bar. The keys have an excellent feel and are mounted with the standard typewriter spacing so it is possible to touch-type.

The extra keys are marked as follows: Control, Graphics, Repeat, Insert, Home, →, ←, ↑, ↓, Escape, Video Text, and Stop. The Graphics key allows additional characters to be generated including the standard viewdata characters.

The Video Text key, not used at present, is designed to be used in conjunction with a teletext module which is to become available some time in the future.

Above the keyboard, on the right, is a 16-character vacuum fluorescent display, giving an excellent range of viewing angles. At one point during the review a problem arose with the display. Two segments in each character glowed continuously and with varying intensity, but the problem was rectified of its own accord.

The display may be used as a window on a line of up to 288 characters, the → and ← keys being used to scroll horizontally. The display line may be used by itself or together with the full screen display. The quality of the screen display is excellent. A small 10in. monitor was provided with the system, but the NewBrain may also be used with an ordinary TV set. These will display 40- or 80-character lines, and the clarity of 80 characters per line is comparable with a standard VDU. Characters are easy to read on the television, the only problem being the loss of lines at the top and bottom of the screen, which is a common problem when using televisions. It is usually possible to adjust the set to restrict oneself to using the visible lines. There is no loss of characters to either side.

At the back of the machine are a variety of connectors. From left to right these are: the power input; a 50-pin expansion bus; UHF TV and monitor; RS-232C printer; bidirectional RS-232C Modem and two tape cassette recorders. The Modem has software-selectable speeds between 15 and 9,600 bits per second. The connectors are a special design and it will only be possible to obtain plugs and leads from the supplier. There are no power or reset switches either on the power supply or the computer. If you crash the system, which is possible by opening the tape cassette as the main input stream, you have to reset by pulling the power plug out of the NewBrain.

Internally the components are packed very neatly on two and a half boards. The boards attach to a black metal plate, which acts as an efficient heat sink, stretching the entire width and depth of the NewBrain and bent at the back to form a backplate holding all the connectors. The plate becomes very warm if the machine is left on for a while, showing that it acts as an efficient method of transmitting heat away from the internal circuits.

**Communications options**

The NewBrain has been designed for expansion. A module may be attached which provides additional communications in the form of four input and one output analogue ports, a parallel-input and parallel-output port and two additional RS-232 bidirectional ports. This module must be used if you wish to attach additional memory or other modules, the exception being the battery module. Additional memory modules will be available in sizes of 64K, 128K, 256K or 512K, and a total of four modules may be attached giving over 2Mbytes of memory. The additional memory is addressed by paging. This is all controlled by the expansion module.

A variety of additional software will also be available in ROM, including: a statistical package; text processing; CP/M; Comal; and Z-80 assembler. An enhanced version of ANSI Basic has been provided in ROM. The Basic is unusual in being, as termed by Grundy, a dynamic compiler. This means each line is immediately compiled into tokenised form when the Newline key is pressed, and is stored in this form. No compilation is done when the program is run. However the Basic still acts like an interpreter in other respects, allowing statements to be executed immediately if no line num-
ber is input, or the program to be interrupted, amended and then to continue executing at will.

There are none of the structured programming constructs which have now become popular with many programmers, such as Do-Until, While-Wend, Case or If-Then-Else, and variable names are restricted to one or two characters. A mathematics package handles floating-point arithmetic accurate to 10 significant digits. Strings may be up to 32,767 characters long, and numerical string arrays may have one or two dimensions and have up to 5,375 elements subject to there being enough memory.

A useful feature is the capability of trapping interrupts, which are caused by pressing the Stop key, but using On Break Goto. It means it is possible to prevent programs from being accidentally interrupted. The standard facilities for examining, changing and executing machine-code routines are provided in the shape of Peek, Poke and Call, and machine-code routines are provided in

Error messages are of the form: ERROR 70 AT 50:2
which means an error occurred in the second statement of line 50. The line: statement feature is useful, but explicit error messages would be better than numbers. It is difficult to remember the

Specifications
Microprocessor: Z-80A running at 4MHz
Memory: 32K RAM expandable to 2Mbytes; 29K ROM expandable to 2Mbytes
Keyboard: QWERTY with 62 full-size standard-pitch keys
Display:
TV or monitor, 40 or 80 columns by 25 lines. Graphics: low resolution 256 or 320 by 250; high resolution 512 or 640 by 250. Vacuum fluorescent 16 character 14 segment display line, 320 by 250. Vacuum fluorescent 16 character 16 segment display line, 320 by 250. High resolution 512 or 640 by 250. Vacuum fluorescent 16 character 14 segment display line, 320 by 250. High resolution 512 or 640 by 250. Vacuum fluorescent 16 character 14 segment display line, 320 by 250. High resolution 512 or 640 by 250. Vacuum fluorescent 16 character 14 segment display line, 320 by 250. High resolution 512 or 640 by 250.

Software:
ANSI Basic, editor, graphics included in price
Additional software: assembler, Comas, statistics
Prices:
Model A £199
Model AD £229
Expansion module £80
Battery module £59
Model ADB, available later £345
RAM Modules 64K, available later £75
128K £135
256K £245
1M £445
Input/Output modules:
eight V24 channels £145
16 V24 channels £225
32 V24 channels £395
Monitor £120

The graphics package is impressive, although it was only a pre-release of the software and several facilities were not available. Opening a graphics display is a complex procedure as it must be linked to an already open edit screen display. Low or high resolutions are available depending on whether 40- or 80-character lines have been specified for the edit display, and a wide or narrow graphics display may be selected.

Four-colour plotting
A narrow display only occupies the central four-fifths of the screen, which can save a certain amount of space in memory. The height of the graphics display is specified by selecting from 10 to 250 graphics lines in multiples of 10, 10 graphics lines being equivalent to one normal line. The maximum number of displayable points is 640 by 250. High resolution is excellent, the one problem being that the contrast has to be turned to maximum in order to display vertical lines. Plotting is executed by manipulating a pen, which has one of four colours, and a direction. The colours can be 0 to leave the point alone, 1 to set it to the foreground colour, 2 to set it to background and 3 to invert the point.

Two Basic commands have been provided to make the use of graphics easier. Plot followed by a series of statements called the plot list enables manipulation of the pen, and Pen can be used to determine the current status of the pen. When the screen is opened horizontal and vertical ranges may be defined, then all plotting is done with reference to the specified units. This means that the resolution selected does not affect the scale of a drawing.

There are 21 commands available for use with Plot. Fill, Arcs and Arc were not implemented in the pre-release software. The commands ending in By allow movement of the pen relative to the current position, whereas the other commands move the pen to an absolute position.

Conclusions
• The NewBrain is a well designed and constructed machine which should easily stand up to the rigours of home, office, laboratory or school use.
• The small size of the computer makes it attractive to the business user who does not want to lose too much valuable desk space. At the moment, the lack of disc drives makes the NewBrain unsuitable for general business use, but disc drives and CP/M are promised for the future.
• The NewBrain could be used as a data-entry device or terminal to a host computer. The power of the NewBrain means it could do much more than the typical VDU.
• Although only the pre-release version of the graphics package was available, the high-resolution display was excellent.
Two for price of

What would you expect to pay for a printer that *either* gave you impressive DP speed or high WP quality?

For anything between £1500 - £2200 you can purchase a printer which will give you superb DP speeds but no real WP quality.

On the other hand, in a similar price range, you can achieve immaculate WP quality, but miss out on the DP speed.

Now, in a special summertime offer, CPU Peripherals are offering TWO high performance and quality printers for the price you would expect to pay for ONE!

For less than the cost of a quality matrix or daisy-wheel CPU bring you two outstanding printers for only £1599*

CPU Peripherals, Rodd Industrial Estate, Govett Avenue, Shepperton, Middlesex, TW17 8AQ.
Telephone: (09322) 46433/4/5/6 Telex: 922637

PRACTICAL COMPUTING September 1982
The Prima 165
British built in our Woking factory to a proven design, this outstanding dot matrix printer offers:
- 165 cps bi-directional printing
- 80 cps correspondence quality print
- 9 x 9, 96 character sets with lc descenders
- Downline loading of special character sets
- Pin addressable graphics
- Tractors (1 + 5 copies)
- Superscript/Subscript
- 7 channel VFU
- Serial and parallel interface (switchable)
  - Buffering up to 3K
  - Low noise (58 db)

The new Daisywriter 2000
A most advanced microprocessor controlled serial impact printer giving quality output QUIETLY.
- up to 20cps bi-directional
- 96 character interchangeable cartridge wheel element
- snap on/off tractor and sheet feed options
- 4 switchable interfaces – EIA RS-232C/CCITT V.24, ETX/ACK and DC1/DC3 (XON/OFF)
- Centronics 8 bit parallel, TTL logic levels
- Current loop, 20 ma ± VDC
- IEEE-488, 8 bit ASCII parallel
- IBM Selectric type cassette film
- 1 + 5 Copies
- 16K - 48 Kbyte
- Character buffer
- 10, 12, 15 characters per inch
- Forward/reverse paper movement
- Automatic proportional spacing
- Paper-out sensor
- Forms length control
- Horizontal and vertical tab

* Offer open to orders received by August 31st 1982.
Price exclusive of carriage and VAT.

Circle No. 142
Better buy Cumana strictly dependable top Quality Products like TEAC... like no one else for price!

Cumana Ltd. offer you a dependable flow of exceptionally high quality DISK DRIVES from TEAC of Tokyo featuring high reliability and compatibility. Cumana have an enviable reputation and aim to continue giving you the best service in the business. These mains powered Disk Drive units are designed to interface to a wide range of computers such as TRS 80 models I and III, Genie I and II, SWTP, Heathkit, Superbrain, Nascom and the BBC Micro, Model B.

Floppy Disk Drives 40 and 80 Track Cased Units

<table>
<thead>
<tr>
<th>Single Disk Units</th>
<th>Dual Disk Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x40 Track single sided Drive</td>
<td>2x40 Track single sided Drives</td>
</tr>
<tr>
<td>£199</td>
<td>£369</td>
</tr>
<tr>
<td>1x80 Track single sided Drive</td>
<td>2x80 Track single sided Drives</td>
</tr>
<tr>
<td>£265</td>
<td>£495</td>
</tr>
<tr>
<td>1x80 Track double sided Drive</td>
<td>2x80 Track double sided Drives</td>
</tr>
<tr>
<td>£429</td>
<td>£799</td>
</tr>
</tbody>
</table>

CUMANA LTD
35 Walnut Tree Close, Guildford, Surrey GU1 4UN. Telephone: (0483) 503121. Telex: 858306.

Call your nearest dealer for a demonstration: Write or phone for Data Sheets - Dealer and O.E.M. enquiries welcome.

PRACTICAL COMPUTING September 1982
GUESTELCARE
more than just hardware and software at good prices.

We supply Apple hardware and software to care for your financial modelling, accounting, word processing etc.

But at Guestel that’s not the end of the story. We supply GUESTELCARE - care to ensure that the system you chose is tailored to meet your specific requirements. We also train all operators to achieve maximum efficiency from the system.

After you have purchased your system Guestel care continues with night and day technical and operational support.

Our care also extends to our prices, we take care to keep them as competitive as we can.

Clip the coupon or call into our showrooms and let Guestel care for you and your micro.

NEW ENHANCED SOFTWARE FOR GRAPHICS TABLET AVAILABLE EXCLUSIVELY FROM GUESTEL
Compsoft's DMS is everything you ever dreamed possible in computer software. Fast, efficient and reliable, DMS is the only complete integrated system for information management. No matter how unusual your record-keeping problem, DMS will help you to solve it.

DMS needs no programming. Working in conversational English, it creates files, stores records, searches and sorts on multiple criteria, calculates, writes letters, and prints lists, reports, and self-adhesive labels.

Full guides are available for DMS in the Medical World, Personnel, Client Records, Subscription Records and Mailing, Stock, Job costings, Library Records, etc. etc.

Running on the Commodore Pet and virtually any micro running CP/M and MP/M II, all systems cost £400 or less. Every version now includes the DMS letter writer option as standard.

THE COMPSOFT HEADQUARTERS AND TRAINING CENTRE, HALLAMS COURT

Compssoft Limited
Hallams Court
Shamley Green
Nr Guildford, Surrey
England GU4 8QZ
Telephone: Guildford (0483) 898545
Telex: 859210 CMPSFT
CIDER CARDS FOR THE APPLE/PET

EPROM PROGRAMMER/VA BOARD - £21.10  
Save your important BASIC and MACHINE CODE program on EPROMS. Programs are pin compatible 2716/2532 systems. Easy to use - just follow VDU instructions. It is also a powerful VIA interface card - see VIA BOARD below. 31F socket. Just plug into any Apple slot and go. To store BASIC programs must use CIDER-SOFT BASIC MANAGER into 32K MEMORY BOARD.  
*Please specify diskets (3.2 or 3.2.11) or cassette for programs.

32K MEMORY BOARD - £62.00  
Can R/W to RAMS tool (APPLE) Reads EPROMS/ROMS/RAMS in any combination, 8 sockets to store up to 32K bytes of BASIC and MACHINE CODE programs. Sockets are software selected by ONE instruction. 2716/2532 pin compatible EPROMS/ROMS/RAMS.

VIA BOARD - £45.00  
Parallel/Serial/Timers all in 1 APPLE  
Single VIA £55.00 has 2x8-bit programmable bidirectional ports, 4 control lines, 2 programmable timers and 8-bit shift register.

DOUBLE VIA BOARD (APPLE)  
£35.00  
Plugs into Apple sockets for prototype design.

WIRE WRAP PROTOTYPE BOARD  
£55.00  
As above but with 2 VIA chips giving TWICE the power.

CIDER-SOFT - BASIC MANAGER ROM (APPLE)  
Contains programs for the 32K MEMORY BOARD which LOAD/CATALOGUE/MANAGE Apple/1 basic programs from memory board.  
£25.00

SWEET 16-16 BOARD - £135.00  
Battery Back-Up RAM/EPROM  
16K bytes of G-ROM (16K Back-Up RAM) and 16K bytes of EPROM (not included) for ACORN - APPLE - PET. Plugs into any 2532 pin compatible ROM socket. 8x4k sockets - sockets are SOFTWARE selected by ONE instruction. Board with 16K C-ROM  
£95.00

25K VERSATILE MEMORY BOARD - £135.00  
For ACORN/APPLE/PET  
Plugs into any 2532 pin compatible ROM socket. 8x4k sockets - sockets are SOFTWARE selected by ONE instruction.

4K C-ROM - £48.00  
For ACORN/APPLE/PET - BATTERY BACK UP RAM  
Plugs into any 2532 pin compatible socket.

IC and MEMORIES  
£45.00

CIDER CARDS FOR THE APPLE/PET

SYMBfile

5½" WINCHESTERS FOR APPLE II®  
3, 5, 6, 12, 21 MB DRIVES NOW AVAILABLE  
COLD BOOTING FACILITY  
1 YEARS FULL WARRANTY

Symbiotic Computer Systems Ltd.  
32 Elmwood Road, Croydon, CR9 2TX

Apple is a Trade Mark of Apple Computer Inc.
Son of Superbrain

THE ORIGINAL Superbrain from U.S.-
based manufacturer Intertec represented
startling value when it was introduced
into the U.K. at the end of 1979. Then,
for just under £2,000, users got a neat
CP/M-running Z-80 based microcompu-
ter, with 12in. 80-by-24-character screen,
64K RAM, full keyboard with numeric
keypad and two double-density 5.25in.
floppies, all neatly packaged in a single
box. Moreover, the Superbrain boasted
the innovation of a second Z-80A to look
after the discs, which made overall opera-
tion of the system exceptionally quick.

Changing market

The Superbrain has subsequently
established itself as a standard, budget
CP/M machine, and there are now some
5,000 Superbrains in use in the U.K. Yet
technical advances have continued and
the face of the market has been changed
by the entry of the giants of the comput-
ing and office-equipment industries. The
Superbrain was good value when it was
launched. Is the Superbrain II equally
good value now?

The Superbrain II has several improve-
ments and new features, but in concept
and appearance it is clearly the same
machine. The new features are an im-
proved display, a built-in battery-oper-
ated real-time clock, and repricing of the
whole package.

The displayed character set incorpo-
rates true descenders on letters like g, j
and p, for the first time. This merely puts
right what was a deficiency in the original
display. Blinking, underlining, half in-
tensity and reversed characters can be
displayed. A range of optional character
sets in Eprom chips is available from
Intertec. One of these can now be instal-
led to function as an alternate character
set, selectable on a character-by-charac-
ter basis under program control. It is also
possible for the user to define special
character sets and save them on disc,
though the process is rather laborious.
These features may well be of greater
interest to system builders than to the
ordinary user.

Microsoft Basic 80 as well as CP/M 2.2
is now provided as standard in the price,
which has been dropped by about 25
percent: the cheapest model JD has 350K
of disc space, equivalent to the original
Superbrain, and costs £1,550. The 700K
model QD costs about £1,800 and the 1.4
Mbyte model SD is £2,095.

Several different hard-disc units are
available from independent suppliers.
Icarus, for instance, has a 5.75Mbyte
hard disc which fits in the space usually
taken up by one of the floppy drives. This
brings the cost of the model QD up to
£3,950. Intertec's own hard discs are link-
ed to its Compustar multi-terminal net-
work, and are not yet available for the
Superbrain. A10Mbyte hard disc and two
terminals cost around £4,500.

Although the outside of the new
machine looks like the old one, internally
it has been completely redesigned, with
all new circuit boards. The result is a
lower component count, and the similar-
ity, already apparent, between the Super-
brain and the Compustar terminal is in-
creased to the point where they are
almost identical. An upgrade kit to
actually make the Superbrain II into a
Compustar terminal has not yet been
announced but it looks like a simple and
intended step.

Tidy appearance

Setting up and using the Superbrain is
easy; since it all comes in one box it is
simply a matter of plugging a single 13A
plug into the wall. The Superbrain retains
its appeal as a kind of CP/M Pet, with no
trailing cables or installation problems. A
printer can be attached via one of the two
RS-232 ports provided.

Once the machine is switched on, the
system loads CP/M from the disc in the
left-hand drive or, if the drive is empty,
displays a message to insert a disc. The
current time, provided by the battery-
driven clock, is displayed at top right.
The clock also keeps track of the date
while the machine is turned off, and
typing Date will display today's date on
the screen. The day-date clock can be used, for instance, for timing events in seconds or checking if a year is a leap year.

Characters are made up of white dots on a seven-by-five matrix against a black background. The display does not match up to the standards of, say, the ACT Sirius, which costs only a few hundred pounds more. The Superbrain design does betray its age when such ergonomic features are considered. Brightness can be adjusted, but not contrast.

The keyboard is built into the same box as the screen and cannot be detached and moved to a comfortable viewing distance. Most modern machines allow this, even the Osborne 1, and where unionised workers will be operating the machine it is likely to be an obligatory demand.

The keys themselves feel good; touch typists seemed to find them comfortable, and the keyboard light and fast to use. Construction seems generally robust although the machine does have a slightly budget feel about it. The discs make a groaning noise when accessing data. The floppies rotate all the time, whether or not they are being accessed, which may mean increased disc wear. On the review machine the power on-off switch came away from its mounting on a couple of occasions, and was left hanging by two wires.

Terminal emulation

CP/M 2.2 is the current release and a very wide range of software is available in Superbrain format. The Superbrain II is completely software compatible with the earlier machine. For some reason specialist engineering and construction-industry software suppliers have found the Superbrain an attractive machine to write for, and a number of companies are listed in Practical Computing’s Software Buyers’ Guide servicing this market. Communications software is available to make the Superbrain emulate many popular terminals, and the machine is widely used as an intelligent work station linked to a company’s mainframe computer.

The system under review was provided by GST Computer Systems and came with Wordbrain, GST’s version of WordStar, which is optimised to take advantage of the Superbrain’s hardware features. WordStar has become the dominant word-processing package by virtue of its ability to run on almost any CP/M machine. By the same token it takes little account of the particular opportunities each machine offers, and the user interface is therefore rather poor. With Wordbrain, GST has set many of the WordStar operations as single-key commands, making use of the Superbrain numeric keypad as a set of function keys. A novice might find this useful, but to those already familiar with WordStar it would not seem helpful.

GST has also rewritten the screen I/O routines, while preserving compatibility with files set up with other versions of WordStar, making the screen operations much faster. WordStar normally treats screen display as if it were dealing with a terminal, sending over a line at a time along with control characters. GST makes use of the fact the screen is directly mapped from RAM memory to speed up this process up dramatically, writing purpose-designed screen-refresh routines in machine code.

These are fairly superficial changes to WordStar, but if you are going to use the Superbrain in this role you might as well have WordStar properly installed. Any user intending to do a substantial amount of word processing may do better to consider a machine with fundamentally better ergonomic features, most importantly a detachable keyboard and a clearer screen display.

Several dealers import the Superbrain into the U.K. direct from Intertec; among them Encotel, GST, Icarus, KGB and Sun; there is no single sales structure in the U.K. It is worth shopping around for the best terms, as prices do vary slightly; more importantly the arrangement for maintenance and repair differs.

Conclusions

- The Superbrain II belongs firmly to the world of eight-bit Z-80 based CP/M machines. It is an evolution on a design with a proven track record and, with a start price of £1,550, it is still cheap.
- If you want the cheapest CP/M system to run WordStar on then the portable Osborne 1 is also worth a look, considering all the software included in the price, although it is a very different sort of machine.
- The inability to detach the keyboard from the screen is becoming increasingly unacceptable, and despite improvements the screen display is not outstanding.
- In terms of value for money the new 16-bit machines like the ACT Sirius do represent significantly better performance for their higher price, around the £2,200 to £2,500 mark — providing the software you want is available for them. Among the many competing eight-bit CP/M machines the Televideo 802, NEC PC-8000 and Xerox 820 are examples which you may decide have better ergonomic features, worth the extra you have to pay.
- The Superbrain II scores through the considerable body of software which is available for it, covering both standard and highly specialised applications.
- There is a lot to be said for the view that first-time users should look for the software first and not worry too much about the machine they use to run it. The Superbrain II is a competent enough machine that does work, although the design is a little dated.

Specifications

CPU: Twin Z80-As running at 4MHz; one performs all processing and screen-related functions, the other handles disc I/O.

Memory: 64K RAM

Ports: Two RS-232C interfaces

Display: Monochrome 12in. screen with white P4 phosphor, allowing 24 lines of 80 characters; characters formed from five by seven dots on a seven by 10 field and have true descenders, upper and lower case.

Keyboard: QWERTY layout generating full ASCII upper and lower-case set

Clock: Battery-operated, providing day, date and time

Bus: Connector for optional S-100 adaptor

Discs: Integral dual 5.25in. floppies, capacity 350K, 700K or 1,400K, depending on model

Size: 15in. high by 21.5in. wide by 23in. deep, weight 45lb.

Software included in price: CP/M 2.2, assembler, debugger, Microsoft Basic 80

Other languages: Fortran, Cobol, APL, etc.

Price: £1,550 for Model JD with 350K disc space £1,750 for Model QD with 700K disc space £2,095 for Model SD with 1,400K disc space

U.K. suppliers: Encotel 01-820 5701; GST 0954-81991; Icarus 01-485 5574; KGB 0753-38581; Sun 01-751 6695; and others.

PRACTICAL COMPUTING September 1982
Outstanding Software from Apple Orchard

Six unique products which will open up new frontiers for you – and your Apple

Top of the Charts.

THE HOME ACCOUNTANT
from Continental Software
Fire your accountant – save £££££!
A comprehensive and powerful Personal Financial System.
- Runs up to 5 cheque-books, as well as cash and credit cards
- Up to 100 budget categories
- Flag taxable items
- Graph actuals v. budget
- Printer optional – can print reports if desired
- Easy-to-use – less than an hour a month to maintain.

No. 2 US Best Seller* Only £75

Castle Wolfenstein
by MUSE
The first game to successfully combine the best elements of adventure and real-time arcade action.
- With nothing but a smuggled pistol and 10 bullets you must escape from a Nazi castle, after first finding and taking secret war plans.
- You actually hear goosestepping guards challenge you – in German of course!
Addictive and challenging – the most interactive game so far.
No. 1 Strategy game in the US* Only £20

Time Zone

- Make an epic journey through the past and future history of the world and universe.
- Cast of thousands includes Cavemen, Julius Caesar, Christopher Columbus – and You.
- Took over a year to develop – takes longer to play!
Comes on eight double sided disks – the ultimate adventure from On-line Systems.
No. 1 US Adventure* £50

Tomorrow's Software Today

GraFORTH
from insoft – specially created to get the most out of the graphics capabilities of your Apple.

- draws 3D images in colour, at rates that make animation easy
- user defined character sets (any size, colour or typeface)
- text and graphics can be mixed on any part of the screen
- music can be included in programs
- excellent built-in demo shows the full capabilities of the system
Ideal for entertainment, software development, and any application where sophisticated graphics are required.

Incredible value at £65

Electric Duet
from insoft
The only music synthesiser for the Apple that plays two part music without the need for expensive extra hardware.
- Play music at the Apple keyboard
- Play tunes from the "jukebox"
- Create tunes and build them into other programmes

£25

Protect your valuable software investment – make backup copies for everyday use and keep your originals safely locked away. With Copy II Plus you eliminate the time, expense and worry of costly accidental damage. Easily pays for itself. £50

* As reported in Softalk magazine June 1982. Please write for full list of US Best Sellers.

All products require Apple II, 48K and DOS 3.3.

Dealer enquiries welcome. Send cash with order, or phone or write for more details to:
Apple Orchard Ltd
17 Wigmore Street
London W1. 01-580 5816.

© Circle No. 148
SUPERBRAIN II features:
* LOWER prices
* Reverse Video
* True Descenders
* Continuous Clock
* Graphics
* Optional Green Screen

Available with:
* 300k, 750k and 1.5m bytes of floppy disk storage

SUN supply:
* Full range of SOFTWARE including WordStar, DataStar, Supersort, CalcStar, Supercalc, DMS, Basic, Cobol, Fortran, Pascal, etc.
* NEC, Qume, Epson, Oki, Anadex, IDS, Paper Tiger, Tally etc.
* AND

COMPUSTAR™
MULTI-USER SYSTEM

SUN FULLY INTEGRATED BUSINESS SYSTEM — £395 + VAT
FOR MOST CP/M and CP/M 86 SYSTEMS

SUN COMPUTING SERVICES LTD.
Concorde House, St. Anthonys Way, Middlesex TW14 0NH. Tel: 01-890 1440 Telex: 8954428
SUNCOM G
Don't let its size fool you.
If anything, NewBrain is like the Tardis.
It may look small on the outside, but inside there's an awful lot going on.
It's got the kind of features you'd expect from one of the really big business micros, but at a price of under £200 excluding VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.
NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.
What's more, you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.
We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.
Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.
Far from it.
It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.
And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

NO OTHER MICRO HAS THIS MUCH POWER IN THIS MUCH SIZE FOR THIS MUCH MONEY.
So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9" 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and 5½" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy. It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and OOM/AI, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit. Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

However, if you're feeling practical you can always tackle household management, statistics and educational packages. And because NewBrain isn't all work and no play, there's the usual range of mind-bending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Price per item (Inc. VAT &amp; p&amp;p)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NewBrain A</td>
<td>£233.00</td>
</tr>
<tr>
<td></td>
<td>NewBrain AD with onboard single line display</td>
<td>£267.50</td>
</tr>
<tr>
<td></td>
<td>Printer</td>
<td>£142.50</td>
</tr>
<tr>
<td></td>
<td>Monitor 12&quot;</td>
<td>£466.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>£1,418.50</td>
</tr>
</tbody>
</table>

I enclose a cheque/Postal Order for £________payable to Grundy Business Systems Reader Account.

NewBrain, Grundy Business Systems Ltd., Grundy House, Somerset Road, Teddington TW11 8TD.

Please send me the following:

Please debit my Access Card No.:________________________ my Barclaycard No.:________________________

Signature:__________________________________________________________

Name:____________________________________________________________

Address:___________________________________________________________

Postcode:__________________________________________________________

Registered Number 1522978
VAT Number 358661618
Please allow up to 28 days for delivery.
The complete multi-purpose, multi-terminal desktop computer system for business.

Now you can get the world's most powerful, reliable, easy-to-use, multi-user microcomputer system at an affordable price. The ALTOS® Series 5-5D computer (including 5 MByte Winchester hard disk and the MP/M II™ operating system)*, which will support up to three smart terminals and a printer, for only £4440.

Our new Altos smart terminals function as independent work stations. Whilst your bookkeeper prepares payroll, other users can be checking inventory, computing cost estimates, doing word processing and performing hundreds of other business operations.

We can provide all the system software you need, too. Because we support hundreds of CP/M®, MP/M II and OASIS applications programs for Altos computers.

You can also add software that allows you to communicate with other computers and networks. Thousands of business users throughout the world have improved their productivity with Altos computer systems.

For more information, call or write today: Altos Computer Systems, Index House, Ascot, Royal Berkshire, UNITED KINGDOM SL5 7EU. Telex 849426.

Please ring operator for free phone 3003 (24 hours), or ring direct on ASCOT (0990) 26824.

*Series 5-5D includes Z80A processor, 192KB of RAM, one 1MB minifloppy and one 5MB micro-Winchester. Series 5-15D includes Z80A processor, 192KB of RAM, and two 1MB minifloppys for £2200. ALTOS is a registered trademark of Altos Computer Systems. CP/M is a registered trademark and MP/M II is a trademark of Digital Research, Inc. OASIS is a product of Phase One Systems, Inc. Z80 is a trademark of Zilog, Inc.
IN AN OFFICE of our acquaintance two computers currently share two daisy-wheel printers and a printer/plotter. Actually, the word “share” puts the case a little too simply, and other users whose computer hardware has been bought in piecemeal will be only too familiar with the situation.

One of the daisywheel printers has a Qume Sprint 3 interface, and will only connect with one of the computers. The two other printers are each driven by standard RS-232 lines and are nominally plug-compatible. The snag is that they need careful baud-rate and handshaking resetting when shifted from one computer to another. Connectors have to be unplugged and re-plugged and DIL switches tickled with propelling pencils or other sharp devices. And every time you need to connect the two computers together, out comes the soldering iron.

This is typical of small-scale information technology as it is practised in the early 1980s, and the reality should give some comfort to those who lament the theoretical ruthless onslaught of the microchip. The truth is that the computerised office is recognisably the same chaos as the office of the typewriter and paper-clip. Only the hum is different, and the electricity bills are larger.

It would be a massive stride forward if the many disparate devices could be threaded together like beads on a string, and text sent to printer A, B or C from computer D or E at will. It would also be handy if, with due copyright circumspection, code and text could be exchanged between the two computers. Joy would be complete if there were some assurance that future hardware could be slotted into the system simply and cheaply.

There is a solution, or more properly, a raft of solutions, which are genetically labelled “networking”. In the simplest terms the idea is that you hook a series of intelligent “nodes” on a length of common cable, either open-ended or joined up into a ring, and hang your printer terminals and computing equipment off the nodes. While communicating with the local device or devices attached to it, each node must be capable of sending out and receiving data through the communal network, as well as — and this is the clever part — distinguishing from the general traffic along the network those data items intended for it alone.

Each node has some form of address. The general principle is that the nodes time-share the network by sending out or receiving data in short bursts or packets. If that makes you think of the parcel post, the analogy is not at all remote, because each quantum of data has to be wrapped between header and trailer information, with an address somewhere on the front where the nodes can read it. When the parcel arrives at its destination these outer layers are disposed of so that the unwrapped contents can be passed back to the local device in a form it can handle.

There is one very good reason why small offices are not already wired up with a ring of coaxial cable piping round information as readily as the mains ring pumps out electrical power. You can pick up a four-way mains socket in your local electrical store for around £8; the information technology equivalent might cost you £1,000 for just one of the nodes. One figure we were quoted for a typical start-up system was in the region of £12,000.

Such is the price of fully fledged networking with a system like Ethernet. For your money you are given more than just harmony between your in-house Epsons and Osbornes; it buys you the ability to exchange data with the rest of the computing universe — or at least that section of it that has not preferred the other incompatible network systems like Econet and the Cambridge Ring.

Ordinarily hardware reviews need no preamble: readers who do not share some sense of the general desirability of products like computers and printers have probably picked up this magazine in mistake for Horse and Hound. But a low-cost local networking system with a price tag of £10 a node needs to be placed in perspective.

Clearway, as designer Greg Walker calls his brainchild, grew out of the tangle of 9-232 cables that began to choke the offices of Real Time Developments of Farnborough. The systems house had been expanding under his managing directorship through the late 1970s. In addition to a computer bureau business, it was marketing a new range of dot-matrix printer and finding time to help a rock band, the Who, with the software and hardware to weave laser patterns around live performances.

**Intelligent boxes**

The logistics of hooking up the various hardware acquisitions at the home base was beginning to be a problem. The problem became a department, and the department rapidly took on the dimensions of a new product development.

The minimal Clearway system comprises a pair of white nylon-coated metal boxes, each taking up approximately 12cm. by 30cm., of desk space, allowing for protruding connectors front and rear and standing 8cm. high. The front panel consists of a rim-guarded, red reset button, and a small red LED that watches over a standard female V-24 socket. The mains lead and a length of grey coaxial cable terminate at an ordinary stereo jack plug run off from the rear, while between them is a jack socket compatible with the plug.

The first evidence of the intelligence of the device appears on powering up. The LED begins a rapid flickering, described in the manual as the configuration mode pattern, one of 11 diagnostic or informative visual “ringing tones” in its repertoire.

The idea behind the patterns is that the
FOOTNOTE: £125-
Automatically numbers and formats footnote calls, footnote and text, placing footnotes on the bottom of the page. Requires CP/M and 48k RAM. At the buyer's option, the footnotes can also be removed from the text file to a separate note file. Footnotes can be entered simply in groups, in the middle or at the end of paragraphs. After running FOOTNOTE again to re-number and re-format, the field companion £210-
Advanced report generator: writing on screen, printer or disk of all or a subject of records, or a user defined subset of data. 
- Error messages for fast eliminating of bad entries. 
- Two special utilities for error check. 
Menu selection with one key-commands. Full data independence from third programs. Full data sharing for different programs and other applications. Requires CP/M and 48k RAM. Formats: 8, NS, MB, APPL, TRS-80, CB, XX, IPC, IDW.

MAIL ORDER SOFTWARE

THE MORE YOU BUY FROM COMPUTING

MILESTONE: £190
Manual alone: £20-
"Critical path" network analysis program for scheduling manpower, dollars and time to maximise productivity. NEW IMPROVED. Interactive project management program runs under CP/M. MILESTONE can be used to track paper flow, build a computer, check a department's performance, but may also be used to solve production problems. Use by executives, engineers, managers, and small businesses.
- Produces PERT chart in minutes. 
- Best critical tasks that must be done at once. 
- Investigate tradeoffs between manpower, dollars and time. 
- Give plans to others using a printed project chart. 
- Change details and immediately see the results completely.
- Balance time, manpower and costs
Requires 56k RAM and CP/M. Specify 280 or 80B. Also available for Apple Pascal, UCSD Pascal or CP/M-86 operating systems. (Milestone 66 version 2.6) Formats: 8, NS, MB, APPL, TRS-80, CB, XX, IPC, IDW.

ACCESS/80-
A report generator and cross-tabulator. Virtually any report that can be described on paper can be generated by using your existing ASCII data files. Produces exactly the kinds of tables that would take hours to program in BASIC.
- Level I — Report Generation and Cross-Tabulator — £210-
- Manual alone: £40
Read ASCII files and create sorted reports with subtotals and grand totals. Produces multi-dimensional cross tabulation and computation. Includes operating system commands.
- Level II — Output and Logic Programmer — £135-
- Manual alone £45
Everything in Level I plus, write out new files in any sorted order (including subtotals). Load arrays from files. Performs binary search on sorted arrays in memory. Includes cross referenced commands and report applets.
Requires CP/M and 48K RAM. Formats: 8, NS, NP, CP/M-86, APPL.

DATEBOOK II: £190
Manual alone £18-
- Schedule appointments for up to 27 different doctors, lawyers, rooms, etc.
- Full day schedules for appointments up to one year in advance.
- Searches for openings that fit time of day, day of the week, and /or day of year constraints.
- Appointments made, modified or cancelled centrally
- Copies of day's appointments can be printed quickly.
Requires 56k RAM and CP/M, Specify 280 or 80B. Also available for Apple Pascal, UCSD Pascal or CP/M-86 operating systems.
*Formats: 8, NS, NP, APPL, TRS-80, CB, XX, 1.5, CP/C, IDW.

QUEST II: L685
Manual alone £350
QUEST II is a database management system for customer lists, inventory lists, employee lists or any kind of list. It may be used in any area of business on many computers simultaneously.
- Up to 55 databases within a record.
- Inserting new databases in an existing file.
- Databases can be disjointed in the way of Pascal.
- 8 database types including Date, Longmath (long precision integer and real), Table (one or two dimensional).
- Control of screen and printing modes.
- Access on any desired keyboard using up to 15 commands. 
- Sorting in ascending or descending order on up to 15 keyfields.
- Default or user defined printing mask.

THE FIELD COMPANION £210-
Manual alone £20-
Created for the needs of the travelling Salesmen or Professional. Allows you to track the time spent with your customers. Works on almost any computer that underline and BOLDFACE commands are properly supported. Price includes PAIR, a companion program that checks for spelling errors.
COPYRIGHT:
Applets/RF Friends Software; Pearl Relational Systems; MILESTONE: £45. Format: APPL, TRS-80, CP/M-86 Digital Research; Superbrain Interface Data Systems; S-Base Tooz Programming; Superbrain Lessoft; Selectr; Selectr; Selectr; Superbrain. 3.0 Format: SB.

ORDERS must specify disk type and format. Add 15% VAT to orders. Add £1 per item for postage and packing. All orders must be prepaid by cheque or money order to HITEC company, Ast. 14-18 Brompton Road, London SW7 7OX. COD will also be accepted. Manual costs are deductible from subsequent software purchase. Prices do not include installation and training. Dealers enquiries welcome.

FOOTNOTE: £125-
Automatically numbers and formats footnote calls, footnote and text, placing footnotes on the bottom of the page. Requires CP/M and 48k RAM. At the buyer's option, the footnotes can also be removed from the text file to a separate note file. Footnotes can be entered simply in groups, in the middle or at the end of paragraphs. After running FOOTNOTE again to re-number and re-format, the field companion £210-
Advanced report generator: writing on screen, printer or disk of all or a subject of records, or a user defined subset of data. 
- Error messages for fast eliminating of bad entries. 
- Two special utilities for error check. 
Menu selection with one key-commands. Full data independence from third programs. Full data sharing for different programs and other applications. Requires CP/M and 48k RAM. Formats: 8, NS, MB, APPL, TRS-80, CB, XX, IPC, IDW.

SPELBLENDER: £260 Manual alone £35-
Full feature word processing system with Office Management capabilities. Its special features include: Spellchecking (including 3 ?5000 word English dictionary), automatic capitalization, automatic period and comma, formatting A, output, and powerful macro capability which allows features to be added to the unique requirements of each user. 

PASCAL/M: £280-
Manual alone £15-
Full feature PASCAL/M for the 8080 and 8086 processors running under CP/M-86. Requires CP/M-86 and K RAM. Formats: 8, 1-5, CP/C, IDW.

PASCAL/M Sort: £140-
Manual alone £14-
Fully automatic PASCAL/M Sorter that lets you type in the computer using which the simple words particular the file description and sequence requirements to obtain the desired sort. Can run stand-alone or as an overlay segment of larger programs. Uses indeed S/IBM-MAS in Rambler, interlace polyphase sort (exceptionally good on disk, full buffer sorting and short test logic). Can match machine language sorts even with the 45 extensions to Standard Pascal including random access files, 40 segment processors and 16 16-bit ECD real type. Also includes symbolic debugger which features trapping on short, examining to determine variables, and a language program execution. Requires CP/M-2 and 66K RAM. Formats: 8, NS, APPL, TRS-80, CP/M-86.

SUPERDOS: £100-
NOTE: does not run for Superbrain. Includes ADM/31 Hazeletter, or Superbran Terminal emulation mode. Other features include: 128 disk supported, 80x120 character keyboard buffer, 30% disk read/write improvement, real time clock, baud rates to 19,2K for RS232 ports, printer hard shake modes; 4 new utilities, and 4 fixes Requires Superbrain 3.0 Format: SB.

SUPEREDOS: £100-
NOTE: does not run for Superbrain. Includes ADM/31 Hazeletter, or Superbran Terminal emulation mode. Other features include: 128 disk supported, 80x120 character keyboard buffer, 30% disk read/write improvement, real time clock, baud rates to 19,2K for RS232 ports, printer hard shake modes; 4 new utilities, and 4 fixes Requires Superbrain 3.0 Format: SB.
LED is lit steadily if the unit is idle and is off if it is busy disconnected from the mains; it gives an occasional blink on certain normally encountered conditions, and becomes agitated should things start to go seriously wrong. Elegant variations on this basic theme give the user a very full idea of the status of each node — see figure 1.

The care with which the diagnostic patterns have been devised was the first clue to the generally thoughtful design of the product as a whole. No doubt a liquid-crystal alphanumeric display would have spared the unfamiliar user the occasional dip into the manual to check the status, but a single LED keeps the manufacturing cost down — which was one of the prime design objectives — without stinting too much on the friendliness of the device.

Real Time Developments lent us four Clearway units for our review. In a permanent installation each node is plugged into socket fixtures wired together in a ring running around the walls. There are no special constraints on the conducting material. The Clearway standard is ordinary UHF TV aerial coax, but even three-core mains flex would do.

For our purposes it was enough to daisy-chain the nodes together by inserting the jack plug of one into the socket of the next until the ring is completed — see figure 2. The 9ft. coax lead the manufacturer supplies with each node gives ample spread around a medium-sized room. Supplying the mains power for each node is less convenient, and there were moments when we wished the boxes could have been battery-driven, or somehow fed from the 12V offered up on the RS-232 lines, though with a 30W thirst per box this would hardly have been realistic.

Kicking the straggling mains leads to one side, we were able to survey a room humming with computer power, with a pair of printers on standby — the Qume Sprint 3 type of printer is a parallel terminal, and so out of the game. The Clearway boxes' little red eyes were flickering rapidly, waiting to be configured.

For this process a terminal is needed, though a full duplex printer with a keyboard or a computer with a CRT monitor will do. Making the initial life-giving connection does demand some elementary knowledge of RS-232 theory.

The minimum you need to know about RS-232 full-duplex theory is that data is sent out along one wire and read in along another, the fluctuating voltages being measured with respect to a third wire, known as Signal Ground. The connected devices are looking at the same lines from different ends — the receive line of one is the send line of the other, so the communications have to decide who is to do what and to whom.

**Transmit or receive**

There are thus two classes of data devices: data communications equipment, or DCE for short, also known as Modsens, or data sets; and data terminal equipment, DTE. Printers are almost always DTE, and as microcomputers spend much of life communicating with printers, the micro is usually treated as a DCE device.

RS-232 theory starts with terminals, and the lines are named from that point of view. A corollary of this is that the micro is pictured as sending out its data on the receive line, usually known as Rx, and receiving data on the transmit line, Tx. This sounds foolish enough to be memorable, and should save you a lot of heartache when it comes to making your own connections.

The initial hook-up of the Clearway node was to the RS-232 external communications port of a Vector Graphic computer. When, as in this case, two devices think they are DCE the simple solution is to cross over the Tx and Rx lines. Thus wired, with the flickering LED indicating Setup mode, the Clearway unit will always make sure what the device can do. The two digits that define baud rate and handshaking for data transmissions from the terminal to the Clearway unit, and the two digits that follow establish the address by which this present node will be known to the rest of the system — in this case it is to be set to "10".

The A at the end of the command string indicates that a Control-A character is to be treated by Clearway as a cue to go into reset mode, a convenience that...
allows the unit to be reconfigured from software without recourse to the red reset button on the front. This works for text transmissions because the ASCII control characters, with the exception of Carriage Return, Line Feed, Tab, and possibly Backspace, are not expected in the data stream.

Of course, if you anticipate running across Control-A in the data, as you certainly will if you are transmitting or receiving object code, a reversion to Reset mode in mid flow is the last thing you want. For this reason Clearway allows you to alter the Reset character to any other control code, or disable software reset altogether by putting an @ into this field; Control-@ is ASCII 0.

Intelligible labels

The control string has managed to compress a lot of information, but is not very expressive to the human user. For this reason the dots that follow offer a very expressive to the human user. For compress a lot of information, but is not intelligible labels.

Heavy print head and the responsibility of whose task is patterning tiny electrical wire is a computer, an ethereal device them from their neighbours.

Signals bat around the ring without hopeross, the Clearway nodes have a data validation agreement that goes something like this:

• no packet of data is to be transmitted unless the previous packet has been destroyed;
• no packet of data is to be destroyed unless it has been labelled as correctly received;
• only the original sending unit is allowed to destroy a packet.

A fairly complicated requirement is thus reduced to three simple rules. Only one small amendment is needed to prevent the ring filling up with garbage packets: under certain conditions each packet is given an "age counter" in the header that is decremented every time it passes a node. If a packet has been round the ring 256 times without being claimed it is destroyed by the next node that handles it.

Simple approach

The manipulation of the packets is made possible because the Clearway units are small computers, each with its own Z-80 processor, a 32K PROM chip and 2K of battery-backed CMOS memory that can hold its data for over a year without external power. A Zilog Dart chip, which consists of a pair of serial-to-parallel protocol converters, takes each packet off the line and brings it on to the internal bus, where the Z-80 can examine it to see whether the data it holds should be passed to the local terminal. If not, the packet is simply returned to the ring with its age-count decremented.

This approach has the advantage of simplicity. Additional rules have to be introduced to define when new packets can or cannot be introduced into the ring. If the Z-80 is examining an incoming packet it will automatically hold up introduction of its own local data until the process is complete. The result is that the gap between packets becomes evenly filled as the traffic increases, and the best use is always made of the line.

Full-scale commercial networks go to expensive lengths to avoid what the Clearway units are doing. To insist that each unit computes every packet slows down the traffic, and also means that if one node fails the whole system grinds to a halt. On the basis of our trials it is impossible to pronounce on the first point. According to Greg Wilson, the presence of each unit slows down transmission by two characters per packet, with four nodes in a ring the system suffers an indetectable overhead equivalent to having to process an extra 64 bits at 36,000 bits/s.

Wilson maintains that even with a load exceeding 50 active nodes the ring should show little sign of sluggishness. With the four devices we were lent for review running at full tilt, the network seemed effortlessly transparent, despite the formidable amount of computation going on inside those innocent-looking white boxes.

One-off failure

Disappointingly an RS-232 driver chip on one of the units failed during the course of our trials. Yet it was an easy matter to remove it from the ring and close the other nodes around it, and because of the three data validation rules no data was lost in the process. If this sort of thing happened daily the replugging might become tedious, but the units appear to be built to a very robust standard, and there is no reason to believe that the failure was anything more than a "one-off."

While getting the feel of the system the Vector Graphic was used at Monitor level to readdress the units. For ordinary redirection of output in daily use a simple Basic program easily copes with this under CP/M:

10 INPUT "Select CLEARWAY destination:
20 PRINT CHR$(125);" Select CLEARWAY destination&M
30 PRN"CHR$(125);"V:PRN;"Select CLEARWAY destination":&M
40 PRINT "You have selected CLEARWAY
destination:"&M

Acknowledgements are due to Jerry Karlin and Peter Chesswright of Microcosm, whose experience in designing full-scale networks for industry helped us put this low-cost system into perspective.

Conclusions

• At £100 a node, Clearway is the cheapest local area network system we know of.
• The system proved surprisingly simple to set up.
• Once in use it should be very easy to extend, up to the logical limit of 99 nodes, although some degradation will become apparent as the load is increased.
• If you want to access remote, fast data transfer devices such as disc drives in real time Clearway alone is not enough, and you will probably have to pay a lot more.
• The system is made and supported in the U.K.
HOW TO CHART YOUR COMPANY'S FORTUNE WITHOUT SPENDING ONE.

● Circle No. 153

It's a fact. A single chart or graph can tell you instantly what it takes hours to interpret from printouts or other raw data.

Now, with the Strobe 100 Graphics Plotter and Software package, you can create superb hardcopy graphics or overhead projection transparencies directly from your computer. And you can do it for a fraction of the cost of most other systems - from only £576 excluding VAT.

The Strobe System transforms complex data into dynamic, colourful visuals with a few simple commands from your computer. Charts and transparencies that once took hours to produce are plotted within minutes.

Information can be presented as bar charts, pie charts, curves or isometrics in a variety of colours. And with a resolution of 500 points per inch, the Strobe 100 matches or surpasses the quality of plotters costing much more.

You can also save and modify your graphics through Strobe's menu-driven programs. A broad selection of software - including one for interfacing with VisiCalc* files - is now available.

For more information and details of your nearest stockist, telephone: (0442) 40571/2

Trade and OEM enquiries welcome.

The Strobe Graphics System
Seeing Is Believing

Prices correct at time of going to press. *VisiCalc a trademark of VisiCorp.
# INTRODUCTION OFFER

**BRITISH MANUFACTURE**

**WD SERIES WINCHESTER DISKS**

+  

**CT17 START-STOP 17MB**

**CARTRIDGE TAPE BACK-UP**

*Will colour-match your computer*

<table>
<thead>
<tr>
<th>Disk/Tape</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mb disk + 17 mb tape</td>
<td>£2876</td>
</tr>
<tr>
<td>10 mb disk + 17 mb tape</td>
<td>£3098</td>
</tr>
<tr>
<td>15 mb disk + 17 mb tape</td>
<td>£3292</td>
</tr>
<tr>
<td>21 mb disk + 17 mb tape</td>
<td>£3602</td>
</tr>
</tbody>
</table>

Disk units only — from £1567 for 5 mb. Tape unit only £1775

VAT extra. P&P £8.50 per unit

Interfaces £75 state computer. High quality tapes £25

Send off for full product list

---

**SYSTEMS OF TOMORROW LTD**

COMPUTER CONSULTANTS

109c, HIGH STREET, CHESHAM, BUCKS, HP5 1DE.

CHESHAM (0494) 786989

---

## LET ACORNSOFT OPEN THE DOORS TO YOUR IMAGINATION

**BBC Microcomputer or Acorn Atom**

Acornsoft is the software division of Acorn Computers, designers and manufacturers, of the BBC Micro and Atom. We know better than anyone the capability of the machines, we know how to get the very best from the hardware. And we have produced a range of exciting games, exacting business and useful household software.

**The Biggest Range Available**

Acornsoft software ranges from authentic arcade games like Snapper to Algebraic Manipulation to Desk Diary to other languages like FORTH and LISP. Striking colour, amazing sound effects and powerful graphics are all used to the full. And it does not stop there. There is a complete range of manuals, accessories and plug-in ROMs.

**Free Brochures**

Just clip the coupon or write to us and we will rush our catalogue absolutely free. Can't wait for the post?
AGA HAVE NOW ADDED RGB COLOUR TO THEIR RANGE

The new, neat and compact Kaga 12" RGB Colour Monitor gives brilliant definition and precise colour registration. It is the ideal monitor for all modern micro computers with RGB output.

Interface modules for the Apple III and IBM personal computers are incorporated within the monitor, permitting simple plug in compatibility. For the Apple II a Kaga RGB Convertor Card is available.

From only £235 the Kaga 12" RGB Colour Monitor is the desk-top bargain of the year.

- The newest 12 inches 90° deflection CRT display.

The newest 12 inches 90° deflection CRT display.

### SPECIFICATIONS

**KAGA 12" RGB MONITOR**

- SYNC INPUT SIGNAL: Composite Negative. – H/V Separate negative. – H/V Separate positive (only for IBM P/C)
- VIDEO INPUT SIGNAL: RGB separation/Linear / 18MHz
- DISPLAY AREA: 216 mm x 161 mm
- HORIZONTAL RESOLUTION (AT CENTRE): 400 dots (Model 101S) 640 dots (Model 201S)
- DISPLAY FORMATS: 1,600 characters/5x7 dots (Model 101S) 2,000 characters/5x7 dots (Model 201S)
- POWER SOURCE: AC220V-240V/50Hz
- POWER CONSUMPTION: 60W
- DIMENSIONS: 320(W)x384(D)x290(H)mm
- WEIGHT: 12.5kg

All Kaga Monitors are equipped with solid state circuitry to ensure utmost reliability. Available nationwide from Data Efficiency dealers, the range includes:

- **KAGA 12" RGB (101S) MONITOR**
  - £235.00
- **KAGA 12" RGB (201S) MONITOR**
  - £365.00
- **KAGA RGB CARD FOR APPLE II**
  - £50.00
- **KAGA 12" GREEN DISPLAY MONITOR (INC. CABLE)**
  - £99.50
- **KAGA 12" AMBER DISPLAY MONITOR (INC. CABLE)**
  - £99.50
- **KAGA 12" B/W DISPLAY MONITOR (INC. CABLE)**
  - £99.50

RING 0442 40571/2 FOR DETAILS OF YOUR NEAREST STOCKIST

Trade and OEM enquiries welcome

Prices exclusive of VAT and correct at time of going to press.

For all your Micro needs... and more.

Data Efficiency Ltd

Sole UK Distributors, Data Efficiency Limited, Computer Division, Finway Road, Hemel Hempstead, Herts. HP2 7PS.
The new PULSAR business software is 16-bit software specially developed for new generation 16-bit personal computers. It's inherently faster and more powerful than traditional 8-bit software. The result: More and more business users are choosing PULSAR, making it one of the industry standards on 16-bit personal computers. Only PULSAR meets the five key requirements for 16-bit business software:

**PORTABILITY**
PULSAR is primarily written in the PASCAL portable language. So your investment in software is protected, regardless of how often you change your system.

**PEDIGREE**
PULSAR has been developed by ACT's own software engineers as a true 16-bit system. And ACT has more than 15 years experience in business software — computer bureaux using ACT programs produce more than 3 million statements every year and handle business applications for more than 2000 companies. PULSAR incorporates many facilities that were previously available only on large mainframe computers.

**INTEGRATION**
ACT supplies integrated business software, linking every aspect of business accounting. Now with PULSAR, this integration is taken a stage further with word processing and business management tools able to share information and files with accounting applications.

**USER-FRIENDLY**
PULSAR is really easy to use. Documentation is to the highest standards in the industry, taking the operator step by step through the system. A simple question and answer routine on the computer screen prompts the user at every turn.

**TOTAL SUPPORT**
ACT is used to providing on-going support for its users. Not only is there a "hot-line" to resolve queries, but also a fully equipped training school open to all PULSAR users.

---

**THE PULSAR RANGE...**

**PULSAR ACCOUNTING**
Pulsar Sales Ledger
Pulsar Purchase Ledger
Pulsar Nominal Ledger
Pulsar Payroll

**PULSAR ORDER PROCESSING**
Pulsar Stock Control
Pulsar Invoicing
Pulsar Order Handling

---

Circle No. 157

For more information on 16-bit Pulsar Software complete the coupon and post to ACT (Microsoft) Ltd., FREEPOST Birmingham B16 8BR or phone 021-454 8585

---

The ACT octagon encapsulates our philosophy of providing users with a single source for their computing solutions. ACT products include personal computers — network micro-computer systems — turnkey mini computers and a complete range of services, including software development, computer field engineering, computer supplies, and a complete range of bureau services.

The eight specialist ACT companies are each leaders in their field and are wholly owned by Applied Computer Techniques (Holdings) P.L.C., one of Britain's largest and most successful computer companies.

---

Circle No. 157

I'm buying a 16-bit personal computer. Tell me more about the new 16-bit PULSAR software.

Name: ____________________________
Position: __________________________
Company: __________________________
Address: __________________________
Telephone: _________________________
Application: ________________________

PC9
Chris Bidmead finds his ambition to rule the world brought one step nearer by this unusual database-management package.

SUPERFILE

KNOWLEDGE, they say, is power. When office information technology first appeared a couple of years ago it brought the exhilarating feeling of being on the point of taking over the universe. A few weeks getting up to speed, and we would be able to release a New Order upon the world.

It has not yet happened. The only reason Reagan and Thatcher are being allowed to carry on in the interim is that we have hit something of a snag. The truth is, we were badly let down by the software.

With Superfile we may at last be making some progress in the database stakes and, interestingly enough, it did not have to wait for the power of the 16-biters. The package runs on a Z-80, and does plenty in the way of gobbling up the data you throw at it, and regurgitating the parts you need when you need them. What is really good about it is what it does not do.

Specifically, it does not do, as other database-management systems do:

- Ask you the date whenever you enter new data and ask you the date again when you go on to look something up, even though you have not yet returned to the CP/M command line.
- Insist before you start to build your database that you define the total number of fields and the maximum length of every field. Some packages are happy to let you add more fields later — as long as you are happy to go back and type in all the data again.
- Require you to define a field or fields as the key field. With Superfile all the fields are key fields automatically.
- The other thing it does not do is run up bills for cables to the States if you hit any snags. SuperFile loads with a logo that says:

  SuperFile
  Made in England

There is an obvious advantage in getting your software from close to home. Precisely how close to home, it should be explained, is that the Superfile package was developed by the software house of Southdata, under the inspiration and direction of Practical Computing editor Peter Laurie.

It began life as an ingenious 12K of code that matches itself into the operating system and then disappears, letting CP/M run normally until a certain range of non-CP/M function numbers call it into being to create and manipulate a large, indexed database file on the logged-on disc.

Southdata affectionately called this 12K CP/M add-on "Dub'em", after the driver DBM.COM — standing for Data-Base Manager. It was chiefly designed as a programmer's tool, but there was a no-frills database manipulation module built in, called by writing:

A</look

into the CP/M command line.

Once inside /look you find a number of simple tools to inspect all or any of the records and create new ones. DBM thinks of the data in terms of equations between a set of tags — which it owns permanently, but can be renamed to suit you — and the fields of data that you enter.

Enter a partial equation, and DBM does its best to fill out the whole record. So DBM will respond to:

NAME=harry

by rattling off all the records in the database with a Name tag of Harry. Mercifully, DBM is not a stickler about upper and lower case.

The Southdata team has polished DBM and added a smart software front panel in the shape of a pair of programs called Forms and CForms. The thing now looked a little like DataStar, a file-management system usable by the non-programmer. Yet at the same time, DBM was still there as a programmer's tool if you wanted to build your own hand-tailored system.

Left to itself, DBM runs on any CP/M machine, including CP/M 1.4, by dint of not caring very much how it presents the data on the screen: everything just scrolls. But with the full Superfile package there is now a routine called Setup.Com for organizing the necessary adjustments for proper cursor-controlled display on your terminal, rather like the Install.Com routine in WordStar.

Setup is a delightful introduction to the package. It asks you to define how your terminal likes its cursor addressed, and how the screen is cleared, and so forth.

As you reply, it tests your answers by moving the cursor into a little box of asterisks that appears in different places around the screen. Somebody at Southdata has put a lot of thought into making the essentially boring business of software installation as interactive as possible.

That done, you are ready to build your first form. Like DataStar the CForms program is used to create a data-entry form on the screen that can, if you like, be used to check that you are entering the right sort of data. You can make the form insist, for example, that certain fields should be numeric only, and that other fields be automatically checked against a list of valid entries before they are accepted.

The forms idea is a graphic representation of the way most database-management systems keep track of data. They store fields in records and string the records together into files. Consider the blank form in figure 1.

The dots represent fields, and a completed box is a single record. A file will consist of an indefinite number of such records. A typical database-management system operates with separate main files for each database. If you start a second database — on 19th-century novelists perhaps — the system will create another main file and another raft of little index files.

Suppose that in setting out the form of the novelists database you did not realise you were going to be interested in their birth dates. Once the thing is under way and bulging with information on Dickens and the Brontes it is no good trying to

(continued on page 71)
SUCCESS BREEDS SUCCESS!

As authorised dealer and service centre for Apple computers we have acquired extensive experience of users' needs and the most cost effective means of satisfying them from the considerable resources of this popular and reliable machine. Over 1,000 of our financial accounting packages have been installed. In the process we have detected areas of special need and opportunities for enhancing these resources. Our own manufactured hardware and system software have been produced to meet these requirements. As a result we have compatible products for all configurations of Apple II and ITT 2020 installations - and the new Apple ///!

Apple /// now on demonstration - systems from £1,645
Pro-File 5 MB mass storage for Apple /// £2,256
Computech mass storage for Apple II and Apple ///, up to 12 MB, from £1,950

COMPUTECH SOFTWARE AND HARDWARE INCLUDES:

Payroll for 350 employees, 100 departments, all pay periods, printed payslips, approved year end documents, very quick and easy to use, £375. Payroll, Purchases and General Ledgers £295 each, detailed statements, Job Costing and Group Consolidation are amongst many and various applications of the General Ledger package, which supports values to totals of one thousand million accurate to a penny! Our Utilities Disk available like other packages in 13 sector or 16 sector format, is widely used for reliable, error checking, copying, including single drive, and the renowned DPATCH program beloved of programmers for £20. We have developed a Terminal Utilities package which enables Apple to Apple and Apple to mainframe communications with local processing and storage as well as Apple to host communications from the amazingly low price of £130. Our Graphics Utilities program for use with the Microline and Epson families of printers enable the plain paper production on low cost printers of high resolution screen pictures, graphs etc. - free with Microlines or £30 separately. Keyboard Driver enables the use of our Lower Case adaptor with BASIC programs and Applewriter Patches supplied. FREE with our character generator package (total cost £50) is separately available on disk with documents for £10. At the same price CAI (convert Apple pictures for ITT) makes binary high resolution picture files display properly on the ITT 2020. We sell the famous VisiCalc for £130 and have delivered systems using it to do amazing things like production control, shipping accounts and stocks and shares valuations! The versatile Applewriter word-processing package at only £39, especially employed with our Lower Case Character Generator is widely used by people who cannot type to produce word-perfect copy! Experience with Apple systems has led to the design and manufacture of compatible products with enhanced features at very favourable prices to satisfy users' needs. These include the Diplomat Serial Interface which has handshaking capability and switchable options (£80), the Diplomat Parallel Interface which enables the direct use of text and graphics with the Microline and Epson printers and is a complete plug-in and go item with gold-plated edge-connector at £80 and has optional direct connection for Centronics 730/737 printers. Our new Diplomat Communications Card at £95 is a sophisticated peripheral especially suitable for Apple to mainframe communications at high speeds in full duplex mode with switch selectable bit rates and other options. The Lower Case adaptor is available for Apples (revision 7 and earlier) as well as ITT 2020, complete with diskette software for £50. It offers true descenders on screen and the £ sign. We also have an Optional Character Generator for the ever popular Microline M80 at £15. This provides £ sign and improved digits and lower case characters with USASCII special symbols. Our price for the Microline M80, with graphics, 40, 80 and 132 characters per line, friction, sprocket and teleprinter feed, is only £230, amazing for this small, quiet reliable 'look alike' printer. Tractor option is £40 and Serial Adaptor £80. The Microline M82A, bidirectional printer with both parallel and serial input is only £345, it can have an optical 2K buffer, while the Microline M83A full width adjustable tractor 120 cps printer with similar specification is only £495. Then for all computer users there is the unique Micromux which from £800 provides up to 16 ports for simultaneous independent serial asynchronous communications! Telephone for data sheets or to arrange a demonstration or for the address of our nearest dealer. Please hurry - the demand for our products has been such that some have been temporarily out of stock. We offer the effective low cost solutions you need. Prices exclude V.A.T., carriage and packing.

COMPUTECH SYSTEMS
168, Finchley Road, London NW3 6HP. Tel: 01-794 0202

AGENTS THROUGHOUT THE UK AND OVERSEAS

● Circle No. 158
press the Birthdate field of the Name and Address database into service. Superfile handles things differently, with one big database covered by a single index file. There are 250 tags, you can give them whatever names you like, and the forms you create with CForms may use the tag names to identify its fields, quite different tag names, or no tags at all. Imagine you are filing in the form in figure 1. As you do this for a series of names and addresses the database-manager establishes a set of internal pointers for each record. Pointers are values that connect fields to tags, and tags to records. The system now has to index these pointers against the fields, so that when you are interrogating the database you only have to throw it the contents of a field to get back a record.

Up to this point Superfile follows the conventional wisdom. But instead of indexing all the characters in the field — Jenkins in the example above — Superfile condenses the name on the basis of the first few consonants. The index then records the whereabouts of a field identified as something like JNK, although the internal representation is in an even more compressed binary form. When you come to look up Jenkins the index will return the locations of all the First Name fields that match the compressed representation. This technique makes it possible to index every field and get back one big database for all the records.

There is a spin-off, too: being able to pull out a family of similar names means that even if you are not sure of the spelling you stand a good chance of identifying a field.

Normally Superfile intervenes and does a second rapid selection to sort out the Jenkinses from the Jankers, Johnkers and Johannkowitzkies before returning the Jenkins from the Jankers, Johnkers and Johannkowitzkies before returning the exact record. You can use the symbol @ to switch off the secondary selection and select from all the look-alikes the index throws up.

Southdata calls this the Fuzzy Matching search mode. There is a numerical search mode on similar lines — although using quite different techniques internally — that enables you to look for numbers lying within specified ranges. Another major difference from traditional micro database management is the way Superfile allows you to search for any string contained in a field. Suppose you have the bright idea of adding a field called Action to your Name and Address file. Actually Names and Addresses is just a selection of tags from the big database, but you tend to think of it as a separate file because Forms filters out the other tags you do not want to look at. Action contains plans, promises and aspirations involving each of your acquaintances. It will be full of fields like "Promised to phone her about lunch". An ambiguous string search, called by entering *

Figure 3. Eight-bit memory map.

Complicated code

The code that makes all this possible is complicated stuff, though the user is doubly shielded from its internal workings. It is hidden first by the elegant DBM module with its operating-system calls, and secondly by the well-designed Forms and CForms, which allow you to use the system almost as if it were an intelligent word processor. The Forms/CForms programs can also be made to do arithmetic — calculating prices, say, from data in the database, and working out the total.

I found Superfile very impressive. Those coming fresh to micros will, I suspect, simply take it for granted, ignorant of the contortions that older database-management systems demanded of the user. With them in mind, I had better spell out one or two minor irritations lurking in this early version of the DBM/CForms/Forms package:

DBM is written in Z-80 machine code. The package will not run on an 8080 or 8085 processor. Rair Black Box owners are out of luck.

Forms and CForms are written in C, with a view to future transference to 16-bit machines. The word-processing package I use is also a C product, and suffers from the same snags: on an eight-bit processor the code is bulky compared to properly optimised machine code. The disadvantage in the case of CForms and Forms is that with DBM added to the operating system there is no room left for them in our 56K Vector Graphic. The Superfile suite of programs needs at least that, and we had to borrow a Xerox 820 to run it.

The database can only be scanned forwards. To look at the record you have just passed you have to go back to the menu and start again. Superfile works fast enough to make this less of a nuisance than it might be.

The present version of Forms has only a limited editing facility. To alter any record you have to rewrite at least one whole field. Confusingly the old field remains on the screen while you write in the new line, tempting you to think you can perform a partial edit on the field by overwriting some of the characters.

Of course Superfile is still not a true relational database; the records exist as fixed relationships inside the system. But the ability to search on any combination of fields, and even on the partial contents of fields, gives the system a flexibility that extends well beyond the simple card-index concept.

Relational searches can be done, the manual suggests, by using the data from one record as a criterion for finding another. It is clear that to do this the Forms/CForms interface to DBM would have to be replaced by a specially written high-level language program. The package goes half-way to meet you on this point by providing a Microsoft Basic routine called DBMskel.BAS, a skeleton program that organises the business of calling DBM from within the Basic interpreter. The arithmetic capabilities of Superfile, the otherwise lucid documentation is a little obscure around the subject of creating formulae to calculate fields from other fields. Setting up simple totals is easy, but deriving figures from other calculated fields — as you might if your form calculated VAT-Add prices, and then totalled those prices — seems to present problems. Forms is marked as Version 0.1; presumably later versions will cope with this.

Conclusions

Superfile is a welcome release from the straitjacket of older micro data handlers. For example, you are free to add new fields as your database grows.

Forms and CForms are easy to use, but take up a great deal of space. Forms could use a few more editing facilities; at the moment the only way of correcting a line is the destructive backspace.

The handling is very "natural" and direct, with little of the user-frustration that often accompanies ingenious software. The inability to search backwards as well as forwards through the database is an irritating shortcoming.

The Superfile package is a remarkable example of what can be done on an eight-bit processor; 16-bit machines are full of promise, but Superfile does it now, on the Z-80.

Southdata Limited is at 10 Barley Mow Passage, London W4. Telephone: 01-994 6477.
IBIS SOFTWARE SPECIALISTS FOR PRACTISING ACCOUNTANTS

* ACCOUNTS PREPARATION
* INTEGRATED WORD PROCESSING
* PAYROLL (BUREAU SYSTEM)
* TIME RECORDING
* MANAGEMENT ACCOUNTING

IBIS software for accounting practices is amongst the finest available. But no matter how fine the product, the personal touch cannot be beaten. We provide a friendly service which includes full training of your staff on your premises. Costs typically range from £3,500 to £6,000, including hardware, software and user training.

IBIS software is now available on the

ACT SIRIUS 1

CP/M Dealer Enquiries Welcome

Please send me details of IBIS services:
Name .................................................................
Position ............................................................
Address ..................................................................
Tel: .................................................................

IBIS Business Information Systems Ltd,
Parkgate House, Cross Road, Chorlton-cum-Hardy, Manchester M21 1DH. Tel: 061-881 0585

Be honest. When was the last time you could tear yourself away from the tedium of the office, and fly off to another part of the world to secure a new order, investigate a new business opportunity, or simply enjoy yourself? If you’ve become your own worst paid executive working all hours on paperwork, book-keeping or general administration, the chances are it’s longer than you care to remember.

COMPLETE SOLUTION

So isn’t it time you met the Genie III? A business system specifically designed to meet the requirements of those businesses employing less than 250 people. Anyone from a corner shop keeper to a wholesaler, or an engineer. The Genie III will help them all, and it will help you, providing the complete solution for sale/purchase, sales ledger and nominal ledger. In addition, the system can be expanded to other functions, such as stock control, invoice reminders and word processing - in fact generally help you run your business much more effortlessly.

RELEVANT SOFTWARE

The package consists of a powerful, compact and reliable microcomputer, with a full-size keyboard, built-in screen, 64K of RAM, and dual disk drives as standard. Also included is a quality matrix printer giving a choice of 60 or 136 characters per line, three different typefaces, and the option of using roll paper, single sheets or even multiple copies. Relevant software programmes for the Genie III have been specially produced by TABS, one of Britain’s largest suppliers of business software packages, and the complete system is covered by a special one-year maintenance contract for around £3,250.

EXPERT INSTALLATION

If by now all this sounds too good to be true, come and see for yourself. You can meet the Genie III at one of the specially selected SUPERDEALERS, whose technical expertise and experience in the fields of installation, software and maintenance is proven. It could be the first step towards a more successful future for you and your business.

U.K. SUPERDEALERS

We have a network of superdealers throughout the U.K. (including Northern Ireland). For advice on your nearest stockist, ring our SUPERDEALER MANAGER on 0629 4995.
Please send me full details of the Genie III Business System and my nearest Superdealer.

Name: 
Company: 
Position: 
Address: 

Tel. No. 

Chesterfield Road, Matlock, Derbyshire DE4 5LE. Telephone: 0663 4995. Telex: 377482 Lowlec G.
THE GENIUS YOU CAN TAKE TO BREAKFAST.

Now, at last, real portable computer power. The new Sharp PC1500 pocket computer. A pocket-sized genius that will travel with you to conferences, seminars and business breakfasts.

The PC1500 has the capacity and BASIC language usage that is very nearly that of the desk-size Personal Computer. When fitted with the optional 4-colour graphic printer, it is one of the most powerful pocket computers on earth.

Chores can be handled swiftly and accurately any time of day, wherever you happen to be. Estimates, records and charts of sales, billings and other important data can be re-programmed, calculated and summoned at the touch of a button. It can even play blackjack, analyse your biorhythms or give you a beeped reminder of a scheduled meeting.

Large memory capacity, up to 11.5K bytes. 4-colour print-out. Six user-programmable keys.

The incredible new PC1500. A revolution in pocket computers. From Sharp. Where great ideas come to life.

SPECIFICATIONS PC 1500

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of calculations</td>
<td>10 digits (mantissa) + 2 digits (exponent)</td>
</tr>
<tr>
<td>Program language</td>
<td>BASIC</td>
</tr>
<tr>
<td>CPU</td>
<td>C-MOS 8-bit CPU</td>
</tr>
<tr>
<td>Capacity</td>
<td>ROM: 16K bytes, RAM: 3.5K bytes expandable to 11.5K bytes</td>
</tr>
<tr>
<td>Memory protection</td>
<td>C-MOS battery back-up</td>
</tr>
<tr>
<td>Display</td>
<td>7 x 156 dots mini-graphic display</td>
</tr>
</tbody>
</table>

CE 150 Colour Graphic Printer/Cassette interface (Optional)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power source</td>
<td>Built-in rechargeable battery</td>
</tr>
<tr>
<td>Printing digits</td>
<td>Standard 18 digits (36, 18, 12, 9, 7, 6, 5, 4 digits selectable)</td>
</tr>
<tr>
<td>Printing system</td>
<td>X-Y axis plotter system</td>
</tr>
<tr>
<td>Printing mode</td>
<td>Graph/Text switchables</td>
</tr>
<tr>
<td>Character sizes</td>
<td>9 different sizes from 1.2 x 0.8 mm to 10.8 x 7.2 mm (from 1/16&quot; x 1/32&quot; to 7/16&quot; x 9/32&quot;)</td>
</tr>
<tr>
<td>Printing colours</td>
<td>Red, blue, green, black</td>
</tr>
<tr>
<td>Printing directions</td>
<td>Right, left, up, down</td>
</tr>
<tr>
<td>Minimum step width</td>
<td>0.2 mm (1/64&quot;)</td>
</tr>
<tr>
<td>Cassette Interface</td>
<td>Up to two cassette tape recorders can be connected</td>
</tr>
</tbody>
</table>

CE 151 Memory Module (Optional)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>4K-byte C-MOS RAM</td>
</tr>
</tbody>
</table>

CE 155 Memory Module (Optional)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>8K-byte C-MOS RAM</td>
</tr>
</tbody>
</table>
### BASIC LANGUAGE SPECIFICATIONS

<table>
<thead>
<tr>
<th>Commands</th>
<th>Statements</th>
<th>Functions</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN, NEW LIST, CONT, TR, TR ON, TR OFF, LOCK, UNLOCK, STATUS, MEM</td>
<td>INPUT, PRINT, GPRINT, CURSOR, GCURSOR, PAUSE, USING, WAIT, CLS</td>
<td>位置...</td>
<td>GOTO, ON ERROR GOTO, FOR... TO... STEP, NEXT, END, DIM, LET, REM, DATA, READ, RESTORE, BEEP, AREAD, ARUN, CLEAR, RANDOM, DEGREE, RADIAN, GRAD</td>
</tr>
</tbody>
</table>

### Cassette Interface

<table>
<thead>
<tr>
<th>Commands</th>
<th>Statements</th>
<th>Functions</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>LLIST, TEST</td>
<td>LPRINT, TAB, LF, ROTATE, COLOR, GLCURSOR, SORGN, LINE, RLINE, CSIZE</td>
<td>TEXT, GRAPH, LCURSOR</td>
<td></td>
</tr>
</tbody>
</table>
THE MICROPUTE CHALLENGE:—FIND A COMPUTER TO COMPARE WITH THE sig/net ... NEVER.

... Because the SIG/NET offers the price advantage of the low cost systems together with the flexibility and infinite expansion capabilities of the high cost systems. Or in other words a great deal more for a great deal less.

For just £1,299.00 the standard SIG/NET offers the flexibility to choose the terminal best suited to your requirements, the printer to give the speed and quality you need and disk capacity from 400,000 to 40 Million characters.

The standard SIG/NET 2025 £1,299.00
5 Megabyte hard disk system £3,100.00
10 Megabyte 4 User £6,000.00
10 Megabyte 10 User £9,500.00

FOR FURTHER TECHNICAL DATA AND THE NAME OF YOUR NEAREST DEALER SEND THE COUPON NOW!

THERE'S JUST NONE TO COMPARE.

• Unbeatable value for money.
• Advanced and innovative BRITISH design.
• BRITISH BUILT.
• Unrivalled expansion.
• Faster than comparable systems.
• Full 64K of memory.
• Sold only through approved dealers.
• CP/M compatible.

MICROPUTE
microcomputer systems
Catherine Street, Macclesfield, Cheshire, SK11 6QY. Tel: (0625) 612759.

Dealer enquires invited for certain areas of the Midlands and North.

Circle No. 161
The Seikosha GP100A
Manufactured by the Seiko Company, Japan.

The micropriced microprinter

80 col dot graphics for around £215

Seikosha introduce the GP100A. A wider and updated version of the highly successful GP80. Now able to take standard width paper, the amazingly compact GP100A offers big printer performance at a fraction of the cost.

With a high quality output that includes full graphics capability, the Seikosha’s proven reliability and variety of interfaces make the GP100A the ideal choice for hobbyists, educationalists and businessmen. Full service support is provided by DRG Business Machines’ nationwide distributor network.

FEATURES INCLUDE:
- 80 col. 30 cps.
- Dot Matrix unihammer action.
- ACSII standard. 116 characters.
- Full graphics.
- Upper and lower case.
- Double width printing.
- Up to 10" paper width.
- Original + 2 copies.
- Tractor feed.
- Self testing.

INTERFACING for most systems:
- Standard: Centronics.

DIMENSIONS:
- Depth – 9½" (234mm)
- Width – 17¼" (420mm)
- Height – 5¼" (136mm)

OPTIONS:
- Pinch feed.

Liverpool: Microcomputers at Laskeys, (051) 2362828. London: Microcomputers at Laskeys, (W1), (01) 6360015.
Manchester: Microcomputers at Laskeys, (061) 4362277. Preston: Microcomputers at Laskeys, (0772) 59264.
Sheffield: Microcomputers at Laskeys, (0742) 759071. Swansea: Computer Supplies, (0792) 29047.
Watford: Watford Electronics, (0923) 40588.
ROLE PLAY was originally tried out in industrial and managerial training, but it is now widely used in foreign-language learning. Activities range from participation in everyday situations in which learners play themselves to participation in specific dramatisations in a setting in which the learner plays a definite role and is assigned definite ideas and attitudes.

The main aims of these activities are:
- to provide the learner with a rehearsal for real life,
- to provide intensive oral practice in a relatively free and creative manner,
- to provide an opportunity to develop and test communicative competence.

In Town Planning a group of up to six take on the roles of individuals in a town, planning the siting of a new factory. They take into account the increased traffic flow by deciding on zebra crossings and overpass and underpass locations, and by creating one-way systems.

Role assigment
A map of the town is displayed, followed by reasons for the need for a factory in the town. Roles are assigned to a car driver, a bus driver, the factory owner, an allotment tenant, the librarian, and a shopkeeper — see lines 490-1000. Each player has conflicting wishes and needs, and each has the task of ensuring that their own views are adequately represented, and that if compromises are made, as they have to be, they are made with sufficient recompense.

There is, of course, no way of pleasing everyone all the time, and so there is no fixed result in this role play. Different groups will reach different conclusions, none of which will be perfectly satisfactory to all participants. In the process, however, the language of persuasion, negotiation, argument and compromise will be well practised, and inappropriate utterances will meet with real-life responses. In many respects the program could be useful outside the language class, particularly in areas such as social or local studies.

The program itself contains a sub-game called Shopping, which is a timed activity giving familiarity with the town plan. The Rems clearly label this game where it surfaces in the various routines of the main program, and it can be left out if desired.

The map of the town is produced using Animate, a drawing utility from Molimerx, and is held in machine code and called as in line 2000. The printout of this map, done on a Line-Printer VII, has doubled up on all horizontal graphics to give an idea of what it looks like on the screen, but users of the program can easily generate their own maps, perhaps in other, more imaginative ways.

A flashing hash sign CHR$(95) begins at the east end of Manor Drive, representing a vehicle which can be driven along any of the roads. One-way streets, overpasses, underpasses and zebra crossings can be inserted on all east-west streets. The vehicle will not pass over a one-way street sign.

Active screen locations are 15423 to 16383, and Peek and Poke references to these are in order to insert and delete standard ASCII symbols. The lines from 2000 to 2130 are included in the listing only as a help to the development of the town plan. Line 2000 calls up the plan, 2010 to 2080 print out each line and 2090 to 2130 repeat the graphics of each line in order to extend the printout vertically.

Animate routine
The Basic program was written for a 16K Video Genie, and uses about 6,155 bytes. The Animate plan routine appears to use up most of the rest of 16K memory, so all Rems and lines 2000 onward should be omitted. To insert road features the @ sign is pressed, or Return to go back to the display of roles. Arrow keys control the cursor movement, and the cursor will not cross kerbs.

So why use a computer instead of cards or toy cars? First, the micro offers a tidier medium — there are no cards or items to be lost or displayed, and exact states of play can be recalled later on if the activity has to be interrupted.
Role playing is now widely used in foreign-language learning. It promotes day-to-day conversation rather than mastery of complex grammatical translations. Chris Harrison looks at how a town-planning simulation can promote an understanding of the language of persuasion, negotiation, argument and compromise. The computer is now rapidly taking its place alongside the teacher as informant and helper.

The computer can be seen as informant and helper, where cards and boards give a far more inanimate impression. Less time is spent on setting the activity up before action can take place and, perhaps most importantly, the computer is impartial, hiding little from the players, giving them a confidence impossible in most board games.

The computer helps learning in several ways, varying from activities which the computer controls completely, to activities in which the students appear to have complete control over what happens. Examples of the former might be reading passages presented on the screen at a predetermined speed.

Just down the scale, with the machine still controlling the dialogue, are multiple-choice questions, much used in maths, geography and history programs, as well as many of the more commercial reading comprehension suites and language-learning packages. These activities are no less controlled when they are dressed up with fancy graphics and musical interludes. All the Yes/No games are located here.

Next in line is the kind of program which contains data of its own, but also manipulates data provided by the student. Examples of this kind are my plurals program, available from the TRS-80 Educational Library, my Cloze in

(continued on next page)
complex grammatical transformations. Ability to use the language to achieve some sort of useful meaningful communication often seemed irrelevant to teachers.

However, it does not take an academic argument to show the point of learning through a combination of translation and the learner’s progress was monitored was done by using a grammatical model, and the student actually teaches the computer “how it's done” provides excellent motivation for learning, these are the most satisfactory bounds, allows the student complete creative freedom — drawing, art and pattern-making clearly fit in here.

Many decades language teaching was done by using grammatical models, and the learner’s progress was monitored through a combination of translation and argument to show the point of learning French, Maori or Estonian is not to become an expert in knotty grammatical problems, but to be able to perform something in the language in question. Can the learners communicate their needs and thoughts effectively? Can they argue appropriately? Can they tell a joke? Can they understand the language they are exposed to and use it with reasonable ease?

Several new techniques have been developed over the last 10 years or so to ensure this. The silent way, community language learning, role play and several others demand a very high degree of participation in which the learning aid — blackboard, tape recorder, teacher, text book, chart, computer — plays only a helping role. Note the place of the teacher and the computer as learning aids, informants and helpers. Such humanistic and student-centred techniques are the subject of intense research and discussion today, and it is interesting to know how rapidly the microcomputer is taking its place alongside the more traditional aids.

Background reading

K Morrow and K Johnson, Communicate, Centre for Applied Linguistics, University of Reading (1976)


Communication games in a language programme (film or video cassette). The British Council (1979)

A full bibliography Using drama, roleplay, games and songs in foreign language teaching may be obtained from the Language Teaching Library, 20 Carlton House Terrace, London SW1Y 5AR.
The new generation that interfaces with most microcomputers

Mannesmann-Tally's new MT100 series of matrix serial printers for microcomputers is now available from local computer shops and suppliers.

MT100 series printers are utterly reliable. They're a new generation of Europrinters made in West Germany with full technical and service back-up from our headquarters here in the UK.

They give high performance at a very reasonable price. Ideal for professional businesses. Or educationists. Or enthusiasts who value the latest technology.

**Two basic models — MT120 and 140**

Main difference is in column width. The MT120 is the 80 columns version whilst the 140 features 132 columns.

Both models come in three variants giving a range of standard features which normally are beyond the scope of microcomputer orientated printers.

- **9 x 7 matrix, 160 cps high speed output** — often doubled by microprocessor control choosing shortest possible print path in either direction.
- **Selectable 18 x 40 matrix for high definition correspondence quality.**
- **10 different character sets, 96 characters each.**
- **OCR A and B character fonts using 9 x 9 matrix.**
- **Four different character pitches between 10 and 20 cpi, each of which can be printed in double width.**
- **Two colour printing.**
- **All MT100 series printers are small, quiet and highly versatile.**

End user prices start at £390.

For further pricing and availability use the MT100 hotlines on Reading (0734) 586446/7/8 or look in at your computer shop. Alternatively write to us for full details.

Mannesmann Tally Limited, 7 Cremyll Road, Reading, Berkshire RG1 8NQ. Tel: Reading (0734) 580141. Cables: Tally-Reading. Telex: 847028.
How long before your new computer system turns out to be one of these?

Well, it won't if it's from Logitek. Because Logitek now offer a wider range of products to meet your expanding DP needs, backed by greatly enhanced support services. With over 80 dealers nationwide making us the largest ALTOS distributor in Europe and now distributing PEACHTREE software on Altos.

Our offices in London and Manchester hold service and software staff, where you'll see new Logitek special application packages and Logitek kit.

So don't let your system leave a bitter taste. Phone our sales office now on (0257) 426644 or send in the coupon.

Send to Sales Office, Logitek, Logitek House, Bradley Lane, Standish, Greater Manchester, WN6 OXQ
Transformer provides the answer to a very simple yet aggravating problem, offering the following benefits to safeguard your supply from hiccups:

- **Fast voltage stabilisation** - prevents VDU screen drift and complete system failure.
- **Isolated secondary circuitry** - gives complete electrical isolation between mains interruptions and system crashes.
- **Transient suppression** - gives software protection against damage during a fault condition.
- **Automatic overload current limited** - protects equipment against damage during a fault condition.
- **Low frequency mains harmonics removed** - preventing VDU flicker and circuit overload.

The complete range of Reguvolt "P" models, from 1/2 to 2 amp ratings (ie. 120VA to 500VA) are available from stock.

Should you require further details, please fill in the coupon, or, if you prefer, give us a call.

**Simulation**

Does your microcomputer suffer from hiccups?

If so, quite often the cause of irregular performance or breakdown is very simple. It's probably a high voltage spike in the electricity supply, called a transient, affecting the performance. Heavy electrical loads in the vicinity of your microcomputer (from domestic electrical appliances to office photo-copiers) can often cause voltage transients, which in turn, play havoc with both hardware and software.

The Reguvolt "P" Model Constant Voltage Transformers provides the answer to a very simple yet aggravating problem, offering the following benefits to safeguard your supply sensitive computer and equipment.

- **Transient suppression** - gives software protection against damage during a fault condition.
- **Brownout protection** - prevents micro interruptions and system crashes.
- **Isolated secondary circuitry** - gives complete electrical isolation between mains and computer.
- **Fast voltage stabilisation** - prevents VDU screen drift and complete system failure.

Even more customers buy...

1. **Print**
   - ZEBRA CROSSING = "CHR$(95)"
   - OVERPASS = "CHR$(41)"
   - ONE WAY STREET = "CHR$(40)"
   - LEAVE PLAIN ALONG = "CHR$(42)"

2. **Delete obstacle**
   - "CHR$(42)"

3. **Print insertion of road features routine**
   - "CHR$(95)"

4. **Print National Railways route**
   - "CHR$(41)"

5. **Print your favourite tea break terminus outside the school**
   - "CHR$(40)"

6. **Print library in case the pollution spoiled your treasures.**
   - "CHR$(128)"

**Note**

Send me further information on your range of Reguvolt "P" Model Constant Voltage Transformers.

Name: __________________________

Company: _______________________

Address: _________________________

Telephone: _______________________

PRACTICAL COMPUTING September 1982
LDOS is an advanced and sophisticated disk operating system for the TRS-80 Models I and III, the original Video Genie, the Genie I and Genie II. It comprises some 113K of code. It was over a year in development and cost in excess of ¼ million dollars to write. It contains an advanced Disk Basic Interpreter enhancement, a complete Job Control Language compiler and many other features.

Obviously it is also complex. This is why it is accompanied by some four hundred pages of manual. It is not the best system for beginners.

On the other hand, LDOS contains so many important features that if a person is just starting out with disks he should be aware of them and, if you like, raised in the right habits. Presently available lower cost disk operating systems are all "first generation" and are primitive. Indeed, they tend to train a person in the wrong direction.

For those people who are either just starting with disks or who wish to get an insight into a full scale first quality disk operating system, smal-LDOS has been produced. It is a sub-set of LDOS and has a manual of 160 pages. It is not an exaggeration to say that it contains most of the advantages of LDOS but still maintains an utter simplicity in use. It is, if you will, a sampler for the main system.

It is also, to the best of our knowledge, the first DOS for these machines that can be upgraded to the larger version at a very reasonable cost. This is because with every smal-LDOS is supplied a coupon to the value of £15. This is redeemable against the purchase of a brand new full LDOS. There are only two stipulations. The first is that the redemption must be through us, not one of our dealers, and secondly the coupon can only be used for the purchase of an LDOS.

Smal-LDOS contains 21 Library Commands, 7 Utilities, 2 Device Drivers or Filters, and Disk Basic as follows:

- APPEND
- ATTRIB
- AUTO
- CLOCK
- COPY
- DATE
- DEVICE
- BACKUP
- CONV
- FORMAT
- LBASIC
- DIR
- DO
- FILTER
- KILL
- LIB
- LIST
- LOAD
- HITAPE
- POUBL
- PR/FLT
- MEMORY
- RENAME
- RUN
- SET
- SYSTEM
- TIME
- VERIFY
- RDUBL
- REPAIR
- KKI/DVR

For those of you not familiar with the features mentioned above, a brochure is available on either or both smal-LDOS and LDOS. On the other hand you may wish to order immediately, in which case:

£38 + V.A.T.

Plus £1 shipping

MOLIMEX LTD
A J HARDING (MOLIMEX)
1 BUCKHURST ROAD, TOWN HALL SQUARE, BEXHILL-ON-SEA, EAST SUSSEX.

TEL: [0424] 220391/223636
TELEX 86736 SOTEX G

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus £1 postage.
The art of breaking codes and ciphers, referred to as cryptanalysis, is based on some well-defined mathematical techniques, explained by Muriel Gilligan.

CODES AND CIPHERS are usually associated with the clandestine operations of government and military organisations which want to communicate in a secret manner and yet read the secret communications of their competitors.

A message written in open English that anyone can read is said to be in clear or plain text. A prescribed set of instructions called a cipher can convert this into an apparently unreadable form known as the cryptogram. Although there are numerous ciphers, they are all based on only two principles which can be illustrated by enciphering the simple text.

THE CAT SAT ON THE MAT

by both methods:

EHT TAG TAS NO EHT TAM
Ulf DBU TBU PO Ulf NBU

It is obvious that each word of plain text has been written backwards.

In the second example each letter of the original plain text has been substituted by the corresponding next letter of the alphabet. The letter T has been replaced by U, H by I, and so on. This is called a substitution cipher.

Studying the characteristics of simple ciphers reveals their weaknesses, which can then be used to develop methods of breaking the cipher and developing better ones. In general,

- In a transposition cipher the original letters of the message are retained.
- The cipher retains the original word lengths, and hence two-letter cryptogram words actually stand for two-letter words in the plain text.
- In the substitution cipher the word "THE" which is enciphered as "Ulf" is seen to be repeated in both texts, hence common words and common letters will appear repeatedly in the cryptogram.
- In the original text every word contains a vowel; and if Y is regarded as a vowel you could go further and say that every word in the English language must contain at least one vowel.

These principles can be used when attempting to solve a cryptogram, for example,

CPUI ZPV BOE J TIBMM HP UP Ulf HBNF
PO XFOEFTEBZ

The first problem is to decide whether it is a transposition or substitution cipher. If the frequency of occurrence of the letters in the cryptogram is roughly the same as the frequency distribution of letters in normal English text, then it is likely to be a transposition cipher. You can construct a frequency table for the letters of the cryptogram by counting the number of times that each letter occurs. This can easily be programmed for a computer, but for this simple example writing out the alphabet in a horizontal line will suffice.

Work through the cryptogram letter by letter, placing a tick or tally mark under the letter for each time that letter occurs in the cryptogram. This yields

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

The letters can then be sorted according to the number of times which they occur:

P(5), B(4), F(4), U(3), I(3), O(3), Z(2), T(2), M(2), H(2), C(1), V(1), N(1)

A similar exercise carried out on a piece of normal English such as a novel or newspaper article usually puts letters in the order

E, T, A, O, N, I, R, S, H...

This is obviously quite different from the order found from the cryptogram, so it is likely that it was coded from a substitution cipher. Furthermore, the letters P, B, F, U, I, E, O in the cipher probably correspond to E, T, A, O, N, I, R, S, H in the plain text.

The next problem is to find out what substitutions are involved. Since J occurs in the cryptogram as a single-letter word it must stand for either A or I in the plain text. Similarly the two-letter words HP, UP and PO must each stand for plain text words like AM, AN, AS, AT, BE, BY, etc. All three words contain the cryptic letter P, and this reduces the possible substitutions to those that can read something like

HP, UP, PO = AT, IT, TO

P appears frequently, which suggests that it is likely to stand for a vowel rather than a consonant and that H, U and O are consonants. The plain text must therefore be in the form

HP, UP, PO = (blank) vowel, (blank) vowel, vowel blank

Most forms can be eliminated except

HP, UP, PO = -0, -0, 0-

which can be developed to

HP, UP = DO, SO; NO, GO; TO, GO; SO, GO; GO, TO; etc.

PO = OF or OR or ON

One of the three-letter words is probably something common like THE, AND, YOU, HIM or HER. The group HP UP Ulf could be TO GO AND or DO TO THE, and you can try the particular substitutions in the cryptogram in turn until you find what could be consistent plain text. The version GO TO THE with H=G, P=O, U=T, I=H and F=E yields

O TH . O ... H... GO TO THE G.E O.

E.E....

(continued on next page)

CODING

cipher: F H I P U

Figure 1.
Then for the Caesar cipher there is a shift of three places forward, so $S = 3$ and the cipher instructions can be formerly stated as

$$\text{Ciphertext} = \text{Plain text} + 3 \pmod{26}$$

To encrypt the plain text AND:

- A implies $P = 1$, hence $C = 1 + 3 = 4$ and the cipher letter is D
- N implies $P = 14$, hence $C = 14 + 3 = 17$ and the cipher letter is Q
- D implies $P = 4$, hence $C = 4 + 3 = 7$ and the cipher letter is G

so the cipher for AND is DOG.

These ideas can be developed to deal with more complicated ciphers. If you suspect that you are faced with a direct standard alphabet cipher you only need the substitution letter for one plain text letter to be able to solve the equation $C = P + S$.

Another application concerns the transformation for a shifted inverse alphabet which can be represented as

$$C = (1 - P) + S \pmod{26}$$

or

$$C = (1 - P) + S \pmod{26}$$

This can be interpreted as meaning that the inversion of the cipher text with a positive shift will produce plain text.

In the case of an inverse alphabet with shift you can use the technique of running down the alphabet, provided that you invert the cipher text first. Consider the following cipher,

Plain: $\text{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$

Ciphertext: $\text{WVUTSRQPONM}$

Enciphering plain text THE gives the cryptic form DPS. Now use the following inversion scheme to invert DPS

<table>
<thead>
<tr>
<th>Text</th>
<th>Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPUJ</td>
<td>one place</td>
</tr>
<tr>
<td>DOVJ</td>
<td>two places</td>
</tr>
<tr>
<td>ERWK</td>
<td>22 places</td>
</tr>
<tr>
<td>YLQO</td>
<td>23 places</td>
</tr>
<tr>
<td>ZMMF</td>
<td>24 places</td>
</tr>
<tr>
<td>ANSG</td>
<td>25 places</td>
</tr>
<tr>
<td>BOTH</td>
<td>26 places</td>
</tr>
</tbody>
</table>

This gives WKH to which we now apply the technique of running down the alphabet,

$$WKH \rightarrow A$$

Identifying weaknesses, helps to produce better ciphers. In this case it is obvious that the cipher would be improved by omitting the word spaces or by disguising the word spaces in some way. Often the cryptogram is split up into groups of five-letter blocks. Using this technique on the cipher used in the previous example gives

CPUJ ZVBOE JTIMB MHPPU UFIFH NFPOX FEOFT EBZAB
Tomorrow you could have more at your fingertips

Simply plugs into your existing computer

Overnight, a massive increase in fast access storage capacity

A desk top sized unit using Rodime high performance Winchester disk

**WINCHESTER DISK SUBSYSTEM**

Nationwide service through Software Sciences — part of THORN EMI

Winchester disk subsystems for:

<table>
<thead>
<tr>
<th>Brand</th>
<th>Subsystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPLE</td>
<td>SUPERBRAIN</td>
</tr>
<tr>
<td>TRS-80</td>
<td>SIRIUS</td>
</tr>
<tr>
<td>XEROX 820</td>
<td>S-100</td>
</tr>
<tr>
<td>OSBORNE</td>
<td>IBM PC</td>
</tr>
</tbody>
</table>

5 MB ............. £1550
10 MB ............ £1740
20 MB ............ £2160
*25 MB ........... £3170
*40 MB ........... £3620

Encotel are one of Britain’s largest microcomputer distributors with full engineering technical support facilities and workshops.

**ENCO**

Britain’s specialist microcomputer distributors

<table>
<thead>
<tr>
<th>Location</th>
<th>Contact Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABERDEEN</td>
<td>ABBEY Computer Services Ltd 0224 55074/6</td>
</tr>
<tr>
<td>BRIGHTON</td>
<td>The Electronic Office 0273 722248</td>
</tr>
<tr>
<td>BRISTOL</td>
<td>Mercator Ltd 0272 731079</td>
</tr>
<tr>
<td>BURY ST. EDMUNDS</td>
<td>Rehavel Ltd 095 381316</td>
</tr>
<tr>
<td>BUSHEY HEATH</td>
<td>Rodime Microsystems Ltd 01 350 0033</td>
</tr>
<tr>
<td>CASTLEBAR</td>
<td>Delta Microsystems Ltd 0124 22632</td>
</tr>
<tr>
<td>DUBLIN</td>
<td>Gamma Data Products Ltd 0061 7718877</td>
</tr>
<tr>
<td>DUDLEY</td>
<td>Gibson Computer Services Ltd 0344 236934</td>
</tr>
<tr>
<td>EDENBRIDGE</td>
<td>Workload 034 286 357</td>
</tr>
<tr>
<td>GUILDFORD</td>
<td>AFR Associates Ltd 079 82 3758</td>
</tr>
<tr>
<td>GWYNEDD</td>
<td>C.P.L. Ltd 075 881 2053</td>
</tr>
<tr>
<td>HORSHAM</td>
<td>Sussex Microsystems Ltd 0403 66071</td>
</tr>
<tr>
<td>LONDON EC2</td>
<td>City Microsystems Ltd 01 628 6322</td>
</tr>
<tr>
<td>LONDON SE1</td>
<td>Inner Products 01 946 5568</td>
</tr>
<tr>
<td>LONDON WC1</td>
<td>Bondbest Ltd 01 580 7249/4273</td>
</tr>
<tr>
<td>LONDON WC2</td>
<td>Digits Ltd 01 379 6968</td>
</tr>
<tr>
<td>LONDON WC2</td>
<td>Systematics Ltd 01 836 9379</td>
</tr>
<tr>
<td>LONDON WC2</td>
<td>Mercury Ltd 06096 65117</td>
</tr>
<tr>
<td>LONDON W14</td>
<td>Advent Data Products Ltd 0225 706289</td>
</tr>
<tr>
<td>LONDON WC1</td>
<td>Inner Products 01 673 0303</td>
</tr>
<tr>
<td>SOUTHEND ON SEA</td>
<td>Direct Data Marketing Ltd (DOM) 0702 65797</td>
</tr>
<tr>
<td>ST. NEOTS</td>
<td>West Com Ltd 0490 217217</td>
</tr>
<tr>
<td>STAFFORDSHIRE</td>
<td>Computer Centre 0923 40601</td>
</tr>
</tbody>
</table>

* Circle No. 167
Table 1. Example data: fictitious sales figures in £,000s for wine and spirits.

<table>
<thead>
<tr>
<th>Year</th>
<th>Quarter</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>51</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>50</td>
</tr>
</tbody>
</table>

This series shows a marked seasonal pattern. The program estimates a seasonal increase in sales of £17.25 thousand above trend in quarter 4, with a drop of about £8.8 thousand below trend in quarter 1 and about £4 thousand below trend in quarters 2 and 3.

ECONOMIC VARIABLES whose values are monitored over time exhibit marked seasonal patterns. Unemployment, for example, tends to rise in the first and third quarters of the year and to fall below its trend value in the second and fourth quarters. Official statistics such as those appearing in Economic Trends, published monthly by HMSO, are usually seasonally adjusted so that regular seasonal changes are not confused with long-run trends.

Business firms too may find it helpful to seasonally adjust sales figures if the values show a noticeable seasonal pattern. Beer sales, for example, show seasonal increases in the summer months, while sales of other alcoholic drinks generally rise above trend values in December.

These Basic programs written for the ZX-81 and Pet micros produce seasonally adjusted values for quarterly data covering between three and 15 years, that is 12 to 60 quarters. The ZX-81 program requires a 16K RAM pack, and a printer version is also available to give a hard-copy output. No Poke or Peek instructions are used, so the program should be readily transportable to other machines. The Pet version is given as an illustration.

The program assumes an additive decomposition model and estimates the trend using a four-quarterly moving average. The actual value observed in any time period A(I) is assumed to be given...

---

Seasonal adjustment of time-series

In the real world, the analysis of statistical data is bedevilled with problems undreamed of by textbook authors. This program by Guy Judge helps you see the wood for the trees.

---

60

Sales (£,000s)

Seasonally adjusted series

Actual series

Year 1  Year 2  Year 3  Year 4
Statistics

by the sum of a trend component $T(I)$ and a seasonal component $S(I)$, plus a residual $R(I)$ to allow for any irregular random influences:

$$A(I) = T(I) + S(I) + R(I)$$

The series is decomposed into the three elements with $T(I)$ first estimated by a four-quarterly centred moving average.

By averaging the first four observations, where there is one value from each quarter, seasonal and random influences should tend to balance out. Dropping the first quarter for year 1 but including the first quarter for year 2 again provides one representative from each quarter, and by averaging should eliminate everything but the trend value.

Moving through the data set obtaining an average of each block four values provides a way of estimating the trend. Unfortunately, the moving averages found in this way would not correspond with any of the original time periods. For example, the first moving average would fall halfway between quarters 2 and 3.

The moving averages can be "centred" if neighbouring pairs are themselves averaged so that the resulting values can be aligned with the original time periods. Thus, for the example data, set the first two moving-average values

$$I (24 + 29 + 29 + 50)$$

plus

$$I (29 + 29 + 50 + 24)$$

Summed and divided by 2, gives a moving average of 33 centred on year 1 of quarter 3.

As this example illustrates, it is possible to proceed directly to the centred moving average for period 1 by taking

$$(A(I-2) + 2 \times A(I-1) + 2 \times A(I) + 2 \times A(I+1) + A(I+2))/8$$

as in line 390 of the program. The detrended series $D(I)$ is then found by subtracting $T(I)$ from $A(I)$:

$$D(I) = S(I) + R(I)$$

By taking all first-quarter values of $S(I)$ and averaging them, it should be possible to eliminate all the random effects to end up with a single estimate of the first-quarter seasonal effect. However, the sum of the season effects must be zero, that is,

$$S(1) + S(2) + S(3) + S(4) = 0$$

A correction to ensure this is made in lines 660 to 720.

ZX-81 program.

```plaintext
1 REM TIMESERIESPRINT
 0 LPRINT "***************
 20 LPRINT "* TIME SERIES "
 30 LPRINT "*
 50 LPRINT "*
 50 LPRINT "*
 70 LPRINT "***************
 80 LPRINT "ADDITIONAL DECOMPOSITION MODEL"
 90 LPRINT "FOUR PERIOD MOVING AVERAGE TREND"
 100 LPRINT "ALLOCATION SPACE FOR AR RAYS**
 120 REM **H=MAXIMUM NUMBER OF A RAYS**
 130 LET H=60
 140 DIM A(M)
 150 DIM T(M)
 160 DIM D(M)
 170 DIM S(M)
 180 DIM R(M)
 190 REM **DATA INPUT SECTION OF PROGRAM**
 200 LPRINT "MINIMUM OF 12, MAXIMUM OF 60 OBSERVATIONS"
 210 LPRINT "NUMBER OF OBSERVATIONS?"
 220 INPUT N
 225 LPRINT N
 230 IF N<=12 THEN LPRINT "TOO FEW OBSERVATIONS"
 240 IF N>60 THEN LPRINT "TOO MANY OBSERVATIONS"
 250 IF N(M) THEN GOTO 200
 260 LPRINT "INPUT DATA SERIES"
 270 FOR I=1 TO N
 280 INPUT A(I)
 285 NEXT I
 300 LPRINT "MOVING AVERAGE AND DETRENDED SERIES"
 350 LPRINT TAB 6;"MOVING";TAB 15;"SERIES"
 360 FOR I=3 TO N-2
 370 LET T(I)=(A(I-2)+2*A(I-1)+2*A(I)+2*A(I+1)
 +A(I+2))/8
 380 LET D(I)=A(I)-T(I)
 390 NEXT I
 500 REM **NOW COMPUTE SEASONAL COMPONENTS**
 510 LET P1=0
 520 LET P2=0
 530 LET P3=0
 540 LET P4=0
 550 LET Q=0
 560 FOR I=3 TO N-2
 570 LET T(I)=(A(I-2)+2*A(I-1)+2*A(I)+2*A(I+1)
 +A(I+2))/8
 580 LET D(I)=A(I)-T(I)
 590 NEXT I
 600 FOR I=3 TO N-2
 610 NEXT I
 620 FOR I=5 TO N-3 STEP 4
 630 LET P1=P1+D(I)
 640 NEXT I
 650 FOR I=6 TO N-2 STEP 4
 660 LET P2=P2+D(I)
 670 NEXT I
```

(continued on page 91)
Mailing Floppy Disks?

Use Swan Disk Mailers — and get Safety in the Mail
Now used by over 1,000 computer companies, Swan Disk Mailers provide outstanding postal security at economical prices.
Combining great strength with simplicity of use, Swan Disk Mailers are manufactured from rigid white corrugated, holding up to four disks.
There are two sizes available: 8.75" x 8.75" & 6" x 6"

Test-drive your software!

<table>
<thead>
<tr>
<th>Software</th>
<th>Rental</th>
<th>RRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microplanner</td>
<td>£99</td>
<td>£695</td>
</tr>
<tr>
<td>Decision Modeller</td>
<td>£99</td>
<td>£535</td>
</tr>
<tr>
<td>VisiSchedule</td>
<td>£38</td>
<td>£195</td>
</tr>
<tr>
<td>Micromodeller</td>
<td>£99</td>
<td>£595</td>
</tr>
<tr>
<td>dBase II</td>
<td>£70</td>
<td>£395</td>
</tr>
<tr>
<td>microFinesse</td>
<td>£70</td>
<td>£350</td>
</tr>
</tbody>
</table>

Our unrivalled list of business and technical software also includes accounting systems and expansion cards.

and if you decide to buy- the rental is free

The Software Rental Bank gives you the opportunity to evaluate software on your own machine, with your own data, before committing yourself to a purchase.

For more details phone Ruth Oliver on 0908 53491
The Software Rental Bank Ltd. 58 North Street, Leighton Buzzard, Beds. LU7 7EN.
The residuals are also provided: if their pattern is noticeably non-random, this would point to an inadequacy in the model. It is also possible to highlight periods where unusually large irregular effects occurred. A series of negative residuals followed by a series of positive residuals may point towards the need for a multiplicative model allowing seasonal effects to interact proportionally on the trend.

\[ A(I) = T(I) \times S(I) \times R(I) \]

In this situation the logarithms would be additively separable so without rewriting the entire program, lines could be inserted to convert values into logarithms after input, coupled with lines to convert values back from logarithms before output. Other embellishments to the program could be a subroutine for plotting both actual and seasonally adjusted values against time to give a visual interpretation of the results.

**Statistics**

**PRACTICAL COMPUTING September 1982**

91
Test drive our hot new daisywheelers

If you've always wanted letter-quality printing, but the cost has put you off, then the SPRINT 9 and SPRINT 10 are for you. Now you can have the same high quality print – usually only available on word processing systems – at prices that will let you forget all about dot-matrix terminals. With speeds of 35, 45 and 55 cps (average English text, not burst rate), the reliable high performance of SPRINT terminals leaves the crowd behind. Prove it to yourself with a test drive.

Call or write your Qume Distributor.

Qume (UK) Limited
Bridgewater Close, Reading, Berks. RG3 1JT
Tel: (0734) 584646. Telex: 849706

A British Company of ITT

Switch selection of interface parameters and forms handling allows simple OEM system integration.

Automatic proportional spacing, without decreasing system throughput, sets the new standard for print quality.

To cut service costs and reduce adjustments, the exclusive Kevlar® belt is stronger and lighter than steel, with virtually no stretch.

For the highest accuracy in the history of daisywheel printing, our Microdrive® carriage drive mechanism has no cables or pulleys.
INFORMATION TECHNOLOGY, IT, has fired many with a touching enthusiasm — unrealistic, but touching. Supposedly the world will be a very different place with the inevitable changes that technology will bring.

The brave new world assumes enormous changes in people and society. Most commentators who have questioned this inevitable change have concentrated on aspects such as employment, and are only too easily classed as modern Luddites. It can be argued that these changes will not easily occur; single-minded advocates have ignored elementary social and interactional aspects.

British governments successively support the need of the state to interfere in the public's private affairs. The opposition, expresses token worries about the depredations of the agents of the state, be it Customs and Excise, Inland Revenue, the police, or other more secretive agencies. However, as soon as the opposition becomes the government attitudes change. Surely, therefore, the need for individuals to protect themselves against such depredations in key areas of privacy must be seen to be highly rational.

The report Information Technology considered this to be an important question, saying: "Power from the use of information, which can now be provided by IT, is great and there is clearly potential for abuse." It felt that justifiable fears of abuse were a major reason for people's resistance to new ways of collecting and handling data, by both government and the private sector.

The minister of state concerned with IT, Kenneth Baker, told the Commons that the new TV services proposed in the Cable Systems report would "change the fabric of society". Baker amplified on this familiar statement by saying that the new TV services proposed in the Information Technology Advisory Panel, HMSO (1982).

Privacy is not at the top of any implementer's list, or that of the government, because the implementers will benefit from intrusions into our privacy, as will the state, whatever purit is in power.
New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available - direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumerics and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games
Cassette G1: Super Programs 1 (ICL)
Hardware required - ZX81.
Price - £4.95.
Description - Five games plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)
Hardware required - ZX81.
Price - £4.95.
Description - Five games plus easy conversion between inches/feet/metres/centimetres/meters.

Cassette G3: Super Programs 3 (ICL)
Hardware required - ZX81.
Price - £4.95.
Description - Five games plus currency conversion at will - for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)
Hardware required - ZX81.
Price - £4.95.
Description - Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)
Hardware required - ZX81 + 16K RAM.
Price - £4.95.
Description - Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)
Hardware required - ZX81 + 16K RAM.
Price - £4.95.
Description - Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)
Hardware required - ZX81.
Price - £4.95.
Description - Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)
Hardware required - ZX81 + 16K RAM.
Price - £4.95.
Programs - What are Biorhythms? Your Biorhythms. When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G9: Biorhythms (ICL)
Hardware required - ZX81 + 16K RAM.
Price - £6.95.
Programs - Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?

Cassette G10: Backgammon (Psion)
Hardware required - ZX81 + 16K RAM.
Price - £6.95.
Programs - Backgammon. Dice.
Description - A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)
Hardware required - ZX81 + 16K RAM.
Price - £6.95.
Programs - Chess. Chess Clock.
Description - Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.

Cassette G12: Fantacy Games (Psion)
Hardware required - ZX81 + 16K RAM.
Price - £6.95.
Programs - Perilous Swamp. Sorcerer's Island.
Description - Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13: Space Raiders and Bomber (Psion)
Hardware required - ZX81 + 16K RAM.
Price - £3.95.
Programs - Space Raiders. Bomber.
Description - Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)
Hardware required - ZX81 + 16K RAM.
Price - £5.95.
Program - Flight Simulation (plus blank tape on side 2).
Description - Simulates a highly manoeuvrable light aircraft with full controls, instrument panel, a view through the cockpit window, and navigational aids. Happy landings!

Education
Cassette E1: Fun to Learn series - English Literature 1 (ICL)
Hardware required - ZX81 + 16K RAM.
Price - £6.95.
Programs - Novelists. Authors. Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series - English Literature 2 (ICL)
Hardware required - ZX81 + 16K RAM.
Price - £6.95.
Programs - Poets, Playwrights. Modern Authors.
Description - Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?
Cassette E8: Fun to Learn series - Inventions 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Towns in England and Wales. Countries and Capitals of Europe.

Description - The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E7: Fun to Learn series

Circle No. 172

What was the 'dangerous Lucifer'?

Description - Who invented television?

Cassette E6: Fun to Learn series - Levels of difficulty.

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Addition/Subtraction, Multiplication/Division.

Description - Questions and answers on basic mathematics at different levels of difficulty.

Cassette E5: Fun to Learn series - Mathematics 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E4: Fun to Learn series - History 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Events in British History. British Monarchs.

Description - From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Business/household

Cassette B1: The Collector's Pack (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £9.95.

Program - Collector's Pack, plus blank tape or side 2 for program/data storage.

Description - This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £9.95.

Program - Club Record Controller plus blank tape on side 2 for program/data storage.

Description - Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, phone numbers plus five lots of additional information - eg type of membership.

How to order

Simply use the FREEPOST order form below and either enclose a cheque or give us your credit card number. Credit card holders can order by phone - simply call Camberley (0276) 66104 or 21282 during office hours. Either way, please allow up to 28 days for delivery, and there's a 14-day money-back option, of course.

Sinclair

ZX81 SOFTWARE

Sinclair Research Ltd,
Stanhope Road, Camberley, Surrey, GU15 3PS.

Tel: Camberley (0276) 66104 & 21282.

SOFTWARE

PRODUCTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>E2: English Literature 2</td>
<td>£6.95</td>
</tr>
<tr>
<td>E3: Geography 1</td>
<td>£6.95</td>
</tr>
<tr>
<td>E4: History 1</td>
<td>£7.95</td>
</tr>
<tr>
<td>E5: Mathematics 1</td>
<td>£7.95</td>
</tr>
<tr>
<td>E6: Music 1</td>
<td>£9.95</td>
</tr>
<tr>
<td>E7: Inventions 1</td>
<td>£9.95</td>
</tr>
<tr>
<td>E8: Spelling 1</td>
<td>£9.95</td>
</tr>
<tr>
<td>B1: Collector's Pack</td>
<td>£9.95</td>
</tr>
<tr>
<td>B2: Club Record Controller</td>
<td>£9.95</td>
</tr>
<tr>
<td>B3: VU-CALC</td>
<td>£7.95</td>
</tr>
<tr>
<td>B4: VU-FILE</td>
<td>£7.95</td>
</tr>
<tr>
<td>ZX16K RAM pack</td>
<td>£9.95</td>
</tr>
<tr>
<td>ZX Printer</td>
<td>£5.95</td>
</tr>
<tr>
<td>Post &amp; packing</td>
<td>£2.95</td>
</tr>
</tbody>
</table>

**TOTAL £**

I enclose a cheque/postal order to Sinclair Research Ltd for £

Please charge my *Access/Barclaycard/Trustcard no.

*Please delete as applicable.

Mr/Mrs/Miss

Address

N16 19
THE BASIC implementation of an independent program unit or procedure may be useful in the form of a subroutine. Yet Basic does not have a true subroutining capability, due in part to the requirements of line numbering. The line numbers in a subroutine must start after the highest numbered line in the main program, and this is very difficult to ensure unless the Basic system has a renumbering facility.

A further difficulty in Basic is that subroutines cannot have parameters, so you cannot write a Basic equivalent of the pseudocode: instead, you have to write something like:

```basic
100 A = 10 : B = 5 : C = 1
110 GOSUB 1000
120 PRINT X
```

in which a, b and c are variables which are local to the procedure called Solve. Instead, you have to write something like this:

```basic
1000 REM - SUBROUTINE 'SOLVE'
1000 X = (-B + SQR(B*B - 4*A*C))/(2*A)
1020 RETURN
```

The values of A, B, C and X are "global"; that is, they have the same meanings and values throughout the program. Though there are a few dialects of Basic which permit local variables to be used and also enable subroutines to be called by label — for example, the Acorn Atom — this is a very rare, if desirable, feature. For the majority of microcomputer users it is essential to use subroutines carefully.

One ploy is to use variable names that are meaningful inside each subroutine. For example, if your micro permits two-letter plus one-digit variable names, you could use variables AA1 to AA9 for subroutine 1, AB1 to AB9 for subroutine 2 and so on. Never use these variable names in a main program and never use variable names from one subroutine inside another. If you do this, you will avoid most of the programming pitfalls in subroutines. If you can renumber subroutines as well then most of your problems are over.

As a convention, whenever you wish to use a subroutine within a PDL description, you will write something like:

```pdl
call proc (list of variables)
```

where "proc" is the name of a subroutine or procedure, and the list of variables is that required for input or output purposes. It will always be implemented as a GOSUB when you do your PDL to Basic conversion.

Each of the five PDL constructs described in last month's article can be simulated in Basic or any other target language. The simple sequence, of course, translates directly.

The alternative clause is more troublesome, being capable of two implementations. In the sequence in figure 1, x is processed if t is equal to 10. There are two ways to translate this into Basic. Some people prefer the negative-logic approach of version 2 on the grounds that it appears before y. My preference is for version 1 because it maintains the logical test — in this case, equality.

Some dialects of Basic permit you to write:

```basic
100 IF T <> 10 THEN 130
110 IF T = 10 THEN 120
120 GOTO 140
130 statement x
140 REM
```

The first version permits some form of "exception routine" to deal with N having other than the expected value. The second approach is similar, but no Gotos are required except after the GOSUB, otherwise subroutine 1 will be entered illegally. It has greater modularity by allowing the independent development and maintenance of subroutines.

Repetition is achieved with an If statement; the terminating condition is a test for the expected value. The first version permits some form of "exception routine" to deal with N having other than the expected value. The second approach is similar, but no Gotos are required except after the GOSUB, otherwise subroutine 1 will be entered illegally. It has greater modularity by allowing the independent development and maintenance of subroutines.

Repetition is achieved with an If statement; the terminating condition is a test for the expected value. The first version permits some form of "exception routine" to deal with N having other than the expected value. The second approach is similar, but no Gotos are required except after the GOSUB, otherwise subroutine 1 will be entered illegally. It has greater modularity by allowing the independent development and maintenance of subroutines.

Repetition is achieved with an If statement; the terminating condition is a test for the expected value. The first version permits some form of "exception routine" to deal with N having other than the expected value. The second approach is similar, but no Gotos are required except after the GOSUB, otherwise subroutine 1 will be entered illegally. It has greater modularity by allowing the independent development and maintenance of subroutines.

Repetition is achieved with an If statement; the terminating condition is a test for the expected value. The first version permits some form of "exception routine" to deal with N having other than the expected value. The second approach is similar, but no Gotos are required except after the GOSUB, otherwise subroutine 1 will be entered illegally. It has greater modularity by allowing the independent development and maintenance of subroutines.

Repetition is achieved with an If statement; the terminating condition is a test for the expected value. The first version permits some form of "exception routine" to deal with N having other than the expected value. The second approach is similar, but no Gotos are required except after the GOSUB, otherwise subroutine 1 will be entered illegally. It has greater modularity by allowing the independent development and maintenance of subroutines.

Repetition is achieved with an If statement; the terminating condition is a test for the expected value. The first version permits some form of "exception routine" to deal with N having other than the expected value. The second approach is similar, but no Gotos are required except after the GOSUB, otherwise subroutine 1 will be entered illegally. It has greater modularity by allowing the independent development and maintenance of subroutines.

Repetition is achieved with an If statement; the terminating condition is a test for the expected value. The first version permits some form of "exception routine" to deal with N having other than the expected value. The second approach is similar, but no Gotos are required except after the GOSUB, otherwise subroutine 1 will be entered illegally. It has greater modularity by allowing the independent development and maintenance of subroutines.
In the final article of his series Graham Beech shows how structured elements are built up into a complete Basic program.

of equality between X and 10 in the Basic example in figure 3. As for the If-Then clause, the Until could also be formulated with negative logic — in this case, X <> 10.

Iteration also requires an If statement — see figure 4. Where appropriate, the For-Next construction can be used for repetition or iteration: surprisingly, it may be either of these, dependent on the software designer. Most microcomputer Basics, including Microsoft, implement For-Next as repetition.

A simple example program illustrates the use of PDL and implementation into Basic. Here is a goal statement relating to an investment problem:

Given:
- a capital sum (principal);
- annual rate of interest, expressed as a fraction;
- interest added monthly, quarterly or annually;
- all interest is reinvested;
- calculate the amount at the end of n years.

The outline design might be:
- Input all data from the keyboard.
- If interest is added quarterly or monthly divide the rate by 4, or 12, and multiply the investment period by 4 or 12.
- For each relevant investment period, compute the nett amount.
- Print the final amount.

In this simple case, you can now go straight to the detailed coding level — see figure 4 — there are no strong arguments for dividing the program into procedures. The program has a header of the form Program Investment, and a terminator, end name. Comments are enclosed by double slashes, //.

The next task is to translate this design into Basic. The dialect supplied on the Tandy TRS-80 has been chosen, its only machine-specific feature is the Input statement, which can include a prompting statement. Machines that do not have this feature require an extra Print.

The first section of the program — lines 100 to 200 — is a simple sequence, followed by If statement. The Goto statements are a consequence of the PDL-to-Basic translation process, not a violation of Goto avoidance.

The heart of the program is the iteration loop in lines 220 to 290. The final section consists of just two lines.

This information will be written as a "record" of the form

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Name</th>
<th>Sex (M or F)</th>
<th>Height (inches)</th>
<th>Like</th>
<th>Dislike</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>JOHN</td>
<td>M</td>
<td>22</td>
<td>music</td>
<td>sport</td>
</tr>
</tbody>
</table>

Given the list: 1) music; 2) sport; 3) travel; 4) theatre; 5) pets, choose one number for your main interest
- From the same list, choose a number for your main dislike.

This information will be written as a "record" of the form

Program Investment
Print What is the principal, interest rate, investment term?
Input Prin, rate, time
Print "which scheme''; input s
//Input and print have their usual meanings; s is 1, 2 or 3 depending on yearly, quarterly or monthly addition of interest/
If s = 2 then rate/4; time/4 * time end if
If s = 3 then rate/12; time/12 * time and if
Print "You will have"; Amt
Print Investment
Figure 5.

These are errors in the original design, but it is a simple matter to include suitable checks. For example,

| 100 | INPUT "PRINCIPAL, INTEREST, TERM"; P,R,T |
| 110 | INPUT "SCHEME? (1 = YRLY; 2 = ORTLY; 3 = MTHLY)"; S |
| 120 | IF S = 2 THEN 140 |
| 130 | GO TO 170 |
| 140 | LET R = R/4 |
| 150 | LET T = T*4 |
| 160 | GO TO 210 |
| 170 | IF S = 3 THEN 190 |
| 180 | GO TO 210 |
| 190 | LET R = R/12 |
| 200 | LET T = T/12 |
| 210 | REM - TO BE CONTINUED |

The task is to design a program for the bureau who happen to have a microcomputer — in this case, a Tandy TRS-80 — with disc drives. A suitable goal could be:
- Given the client data records, and a selected client, list prospective partners that satisfy all three criteria, followed by those that fail to satisfy criteria 2 and/or 3.

An outline design then follows:

(continued on next page)

100 REM - MAIN PROGRAM
102 REM - SET UP SPACE FOR STRINGS
105 CLS
120 INPUT"1: FILE SECTION. 2: HATCH. 3: DISPLAY. 4: STOP.";X
130 ON X GOSUB1000,2000,1800
140 IF X=4 THEN 160
150 COTO 120
160 PRINT"END OF PROGRAM"
170 END

1000 REM - FILE CONTROL MODULE
1002 CLS
1004 INPUT"DO YOU WANT TO Initialise (6 CLEAR) THE FILES";A$
1006 IF A$="YES" COTO 1010
1008 GOTO 1020
1010 OPEN"0",I,"FILE/A.TXT"
1011 OPEN"0",2,"FILE/B.TXT"
1012 OPEN"0",3,"FILE/C.TXT"
1013 OPEN"0",4,"FILE/D.TXT"
1015 CLOSE
1017 PRINT;PRINT
1020 INPUT"l: ADD TO FILE. 2:DELETE. 3: RETURN ";X9
1040 ON X9 GOSUB 1100,1500
1050 IF X9=3 THEN 1070
1060 GOTO 1020
1100 REM - ADD TO FILE
1105 CLS
1110 OPEN"I",I,"FILE/A.TXT"
1111 OPEN"0",2,"FILE/B.TXT"
1120 IF NOT(E0F(I)) THEN 1125
1122 GOTO 1130
1125 INPUT F1,A$,B$,H9,A9,L9,D9:PRINT #2,A$;",";B$;",";H9;A9;L9;D9
1127 GOTO 1120
1130 REM - FILE NOW COPIED
1140 INPUT"NAME ";A$: INPUT"SEX";11$: INPUT"HEIGHT (INCHES)";H9
1150 INPUT"AGE (YRS)";A9: INPUT"LIKE (1-6)";L9: INPUT"DISLIKE (1-6)";D9
1160 PRINT #2,A$;" ";B$;",";H9;A9;L9;D9
1170 PRINT;INPUT"ANY MORE ";R$

(continued from previous page)

1. Store the records in sequential file, on disc.
2. Find a particular record and copy into temporary storage.
3. Select from the remaining records:
   (a) those that match all three criteria,
   (b) those that fail on criteria 2 or 3,
   (c) store the contents of (a) and (b) in sequential output files.
4. Display the contents of either output file.

Stage 1 must be improved slightly to permit file manipulation:
(a) set up a new file,
(b) add new records,
(c) delete old records.

Stage 2 also requires decomposition:
(a) request a client name,
(b) scan the client file for the record associated with the chosen name,
(c) either copy the record into temporary storage, or report that no valid record exists.

The problem is now assuming a modular character; in fact, functions 1 and 2 are quite independent of each other. Figure 7 shows the main communications paths.

There is little chance of data corruption, since communication is enabled between the modules by selecting from options. In contrast, a bottom-up programmer may have started by requesting a client name, then adding "special" statements to indicate that file updating was required instead.

The simplest implementation is to design the records of the file thus:
(Name), (M or F), (Height), (Age), (Like), (Dislike)

Since the files are to be sequential, new records are added at the end of a file but unwanted records must, somehow, be deleted to make room for new ones. The design is oriented to disc storage but, being sequential, cassette tape could be used, though with slower access speed. Random-access files would be much faster but their implementation is very machine-specific.

The main module repeatedly calls one of three procedures until the user types a "4" to stop the program — see figure 8. It would be incorrect to include initialisation of, for example, the files. To do so would add unnecessary connections to this module.

WINNING APPROVAL

Through their powerful multi-processor operating systems Equinox professional microcomputers will grow and adapt in step with your Company.

Equinox systems are one of the few Government (CCTA) approved microcomputer systems with both CP/M and MICROCOBOL as standard.

Equinox systems are not just simple desk-top, single-user machines, so they can expand both storage capacity and number of users, and grow from single-user floppy based (5¼" or 8") to multi-user hard disc systems.

The S-100 bus structure, interfacing is possible to a wide range of component boards and interfaces, including PRESTEL/VIEWDATA, mainframe communication processors, floating point hardware, colour graphics cards, AID and DIA etc. In fact, the large number of component boards manufactured for the S-100 make it the most interesting and versatile bus around which to build your system.

POWERFUL

All this, plus two powerful multi-processor operating systems - TURBOdos (which will run your CP/M compatible software) and MICROCOBOL BOS/NET - make Equinox the systems for commercial
The filecon module is used to add to, delete from, or list the file of clients. It also initialises the files on the first time the program is used, effectively emptying them and preparing them to receive new data. File handling is the least standardised aspect of Basic, so the file-related statements are left deliberately vague.

Some terminology is introduced for convenience:

- **pointer** — the presently addressed record in a sequential file is located by a "pointer" variable. It is incremented to the next record position whenever a record is read from or output to a sequential file.
- **open** — a disc file must be opened to either receive data, or output, or to supply data to the program, input. close — disc files must be closed before being reopened.
- **end-of-file** — files have a marker, similar to the pointer which locates the end of a file. If you test for this marker, before attempting to read a record, you avoid falling off the end of the file.

The file-control module is shown in figure 9. In some implementations of Basic, the user can add extra records to the end of a sequential file. But in most cases, the action of opening such a file to receive output resets the record pointer to the beginning of the file, thereby effectively erasing its contents.

A more general solution is to use a work file Filb, make the additions or deletions to that, and then copy Filb to Fila, as in the procedures in figure 10.

---

Before writing the **match** procedure, you can write **display** so that it will list any of the sequential files — see figure 11. Next, the **match** procedure calls two procedures — one to select a record, another to compare that record against all of the others — see figure 12. The **select** procedure accepts "client-name" and returns "copy", consisting of the chosen records — see figure 13.

Finally, match "copy" against all of the other records and output the best matches to File, the second-best to Fild. Since male-male and female-female matches are excluded, you do not have to worry about matching "copy" with itself. This procedure uses abs meaning "absolute difference", which is widely available — see figure 14.

(continued on page 101)
**THE PROFESSIONAL'S CHOICE**

**Act Sirius 1**
16 Bit Stand Alone micro with superb features.
128K, 1.2MB Floppies, CPM86 as standard – £2395.

**Altos**
Up to 4 terminals and 40MB of Winchester Disc.
One of the biggest selling small business systems starting at £2350.
16 Bit system with 8 terminals available soon.

**OKI 1F800**
Quality graphics micro with full colour screen and integral printer.
64K and Basic are standard – £4750.
Wide range of peripherals available.

**LSI M3**
High specification Stand Alone micro. CPM, 64K and up to 10MB of Winchester in one package. Very easy to use. Detachable keyboard. User programmable function keys. From £2250.

**Superbrain**
Still a leader in 8 bit price performance. KGB having sold over 400 Superbrains has unbeatable experience on them. From £1875.

**Word Processing** - Wordstar £250, Mailmerge £75.
Full on-screen facilities enabling the printing of standard letters and preparation of mail shots.

**Accounting** - From £300 per module.
Integrated accounting systems with Invoicing, Sales, Purchase and Nominal Ledgers.

**Financial Modelling** - Micromodeller £1645.
Budgets, forecasts and accounting data become easy to prepare. Allows "what if" projections.

**Calculation** - Supercalc £175.
Electronic worksheet for preparation of budgets and tables of data.

**Record Keeping** - DMS £400.
Personnel, stock or any other records with quick retrieval, sorting and reporting.

**Sales Office Management** - Sales Desk £300.
For the busy sales office to manage sales leads and marketing lists.

**Accounts** - IRIS £750.
Incomplete records and time recording systems.

**Payroll** - Graffcom £500.
Up to 500 employees both weekly and monthly paid. Automatic deduction for items like company pensions.

**Graphics** - Price depends on application.
Full on-screen graphics both colour and black and white.

**Engineering** - SPERT £450.
Suite of programmes for PERT analysis and civil engineering applications.

**Communications** - Liberator £250.
Enables a micro-computer to act like a mainframe terminal and transfer data from Floppy disc to another computer.

**Languages** - From £175.
Most major computer languages are available: Basic, Cobol, Fortran, Pascal and Assembler.

**Solicitors** - Solace £1600.
Solicitors accounting, client accounting and time recording.

**Multi-terminals** - MP/M and Oasis from £350.
Multi-user systems available.

---

**TO: THE MICROCOMPUTER MARKET • STOP • KGB SUPERBRAIN SALES SUCCESS MEANS PRICE REDUCTIONS ON SUPERBRAIN • STOP • NOW FROM ONLY £1495 • STOP • CALL KGB NOW!**

---

**MICROS LIMITED**
14 Windsor Road, Slough SL1 2EZ. Tel: Slough (01532) 38581/38319 Telex: 847777

---

**PRACTICAL COMPUTING September 1982**
Program main-module

00 print type a number from 1-4; input number
  case of
    1: call filecon //file control module/
    2: call match //find client record/
    3: call display //list the matching clients/
    4: call compare
  end case
  until number = 4
end do
end main module

Figure 8.

procedure filecon
  print "initialise the files?" //if 'YES' set the record pointers of "fila", "filb", "file" and "fild" to the beginning in each case/
  do
    input 1, 2, 3 or 4
    1: call add
    2: call delete
    3: call list
    4: go to "end filecon"
  until 4 //is typed
end do
end filecon

Figure 9.

procedure add
  //open "fila" to supply input, "filb" to receive output. Copy "fila" to "filb", leaving the latter in the output state/
  do
    input new record; output new record to "filb"
    until no more additions
  end do
end procedure

procedure delete
  //open "fila" for input, "filb" for output/
  do
    input client-name
    white not at the end of "fila"
    do
      //copy "filb" to "filb", the string 'copy'
      to that file; hence the rather odd coding at the beginning of filecon,
      starting at line 1000.
    end do
  end procedure

Effortless Basic

File peculiarities aside, this program was coded effortlessly into Basic. It is not intended to be a sophisticated or user-proof program — for example, no error checking is included — but it does illustrate the main advantage of structured design for a program of moderate complexity.

Most of the effort is expended at the design stage — the Basic programming is straightforward. Indeed, this shifts the emphasis away from attempts to standardise the language, in favour of standardising the design procedure.

procedure display
  input filename //eg. "fila"/
  //open the file for input/while not at the end of the file
  do
    read record; print record
  end do
end procedure

Figure 11.

procedure match
  input client-name
  call select //to find record. 'Select' assigns 'blank' to
  the string 'copy'; if it cannot find the record/
  if copy <> 'blank' then
    call compare else print "not in list"
end match

Figure 12.

procedure select
  //open "fila" for input/while not at end of file and copy = 'blank'
  do
    read record
    if record-name = client-name
      then copy record
      end if
  end do
end procedure

Figure 13.

procedure compare
  //open "fila" for input; "file" and "fild" for output/
  do
    read record from "fila"/
    if sex1 <> sex2 then
      if (like1 <> dislike2 and like1 = dislike2) then
        output record to "fild" else
        output record to "file"
      end if
    end if
end procedure

Figure 14.
| Software for CP/M™ |

### MICROPRO

<table>
<thead>
<tr>
<th>Software</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>WORDSTAR</td>
<td>MICROPRO's comprehensive word processing system</td>
<td>£250.00</td>
</tr>
<tr>
<td>MAILMERGE</td>
<td>Added power to WORDSTAR for mailing lists, standard letters, etc</td>
<td>£60.00</td>
</tr>
<tr>
<td>SPELLSTAR</td>
<td>Dictionary on a disk for WORDSTAR spelling checking</td>
<td>£120.00</td>
</tr>
<tr>
<td>DATASTAR</td>
<td>MICROPRO's data entry, validation and retrieval system</td>
<td>£170.00</td>
</tr>
<tr>
<td>SUPERSORT I</td>
<td>Sorting, extracting and merging at high speed from MicroPro.</td>
<td>£120.00</td>
</tr>
<tr>
<td>CALCSTAR</td>
<td>MICROPRO's spread sheet and financial modelling system. Combine with WORDSTAR to get impressive end results.</td>
<td>£150.00</td>
</tr>
<tr>
<td>WORDDASTER</td>
<td>Video text editor for programmers and simple Word Processing</td>
<td>£60.00</td>
</tr>
</tbody>
</table>

### MISC

<table>
<thead>
<tr>
<th>Software</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBASIC-2</td>
<td>COMPILER SYSTEMS widely used</td>
<td>£65.00</td>
</tr>
<tr>
<td>CB-80</td>
<td>CBASIC compatible for BASIC</td>
<td>£280.00</td>
</tr>
<tr>
<td>PASCAL/M</td>
<td>SORCIM's PASCAL</td>
<td>£120.00</td>
</tr>
<tr>
<td>SUPERCALC</td>
<td>SORCIM's spread sheet and modelling system</td>
<td>£170.00</td>
</tr>
<tr>
<td>MILESTONE</td>
<td>Project Management and Scheduling</td>
<td>£160.00</td>
</tr>
<tr>
<td>dBASE II</td>
<td>Relational Database Management from Ashton Tate</td>
<td>£380.00</td>
</tr>
<tr>
<td>QUICKSCREEN</td>
<td>Screen formatter for dBASE II</td>
<td>£90.00</td>
</tr>
<tr>
<td>MICROSTAT</td>
<td>Statistical program library from ECOSOFT for (and needs) BASIC-80</td>
<td>£150.00</td>
</tr>
<tr>
<td>PLI-80</td>
<td>Digital Research PLI Compiler</td>
<td>£310.00</td>
</tr>
<tr>
<td>BT-80</td>
<td>Record Retrieval for PLI-80</td>
<td>£125.00</td>
</tr>
<tr>
<td>MAC</td>
<td>Digital Research 8080 Macro Assembler</td>
<td>£57.00</td>
</tr>
<tr>
<td>SID</td>
<td>8080 Symbolic Debugger</td>
<td>£47.00</td>
</tr>
<tr>
<td>ZSID</td>
<td>Z80 Symbolic Debugger</td>
<td>£63.00</td>
</tr>
<tr>
<td>DESPOOL</td>
<td>File Print Spooler for CP/M</td>
<td>£31.00</td>
</tr>
<tr>
<td>TEX</td>
<td>Tex editor</td>
<td>£63.00</td>
</tr>
<tr>
<td>SPELLBINDER</td>
<td>Lexisoft's Wordprocessing and Office Management System</td>
<td>£275.00</td>
</tr>
<tr>
<td>PRO PASCAL</td>
<td>Z80 True Pascal Compiler</td>
<td>£190.00</td>
</tr>
</tbody>
</table>

All products are available in 8" SD, SS, Superbrain 5" SS, North Star Horizon QD format except those marked * which are not available in North Star format.

---

**THIS ISSUE'S SPECIAL OFFER**

**FREE**

**WORDSTAR TAPE CASSETTE TRAINING PACK**

WITH EVERY WORDSTAR and MAILMERGE PURCHASE

(Offer ends 30th September 1982)

All products are supplied complete with full originators documentation. **TRADE ENQUIRIES WELCOME**

Ordering Instructions: Cash with order. Specify disk format. Add £3.00 per item P&P. Add 15% VAT

---

**the soft option (UK) LTD**

PO BOX 11 CRANBROOK KENT TN17 2DF Tel. (058 080) 310

© Circle No. 175

PRACTICAL COMPUTING September 1982
Fatal listing — Goto hyperspace

Melanie Fossett was absorbed in the morning paper when her concentration was broken by a lump of marmalade splattering on to the final paragraph of the article. She looked up sharply at her husband, whose gesticulations with a marmalade-laden kitchen towel had caused the news black-out.

"For God's sake Norman! Stop wittering on about your blasted computer!" Melanie raged at her husband who ignored her every word. With a heavy sigh she slapped her sticky newspaper on the table and screamed at him, "Norman, I swear I'll kill you if you don't do something about that computer — morning, noon and night you are at it - you don't live up to a man's name!

With tears brimming in her eyes, Melanie Fossett slammed out of the room, flung on her coat and stormed out of the house. Norman Fossett was aware but unimpressed by his wife's tantrum and angry exit.

The Pet that had been introduced to the drawing office of Fothergill & Bickerstaff, the engineering firm where Norman worked as a sales representative, was provided to assist draughtsmen in routine structural calculations but had initially proved to be a major lunchtime distraction for everybody in the company for games of Space Invaders.

Norman had started to haunt Tottenham Court Road and spend hours searching out new and ever more obscure programming guides. Many a night was spent explaining to his wife the need to buy a personal computer, the comparative merits of the Z-80 and 6502 processors, and whether it was worth buying two disc drives to enable fast copying of listings.

Melanie was not prepared for the change that overcame her partner after he finally decided which computer to purchase. Months spent in discussion with wild-eyed men along Tottenham Court Road and nights sitting up in bed reading the seemingly endless flood of publicity which had brought a decision.

One Saturday afternoon he bore home proudly a Genie computer with a single disc drive and printer. Three-o'clock the following morning found him still pecking away at the keyboard, trying to remove a system bug.

In the morning Melanie awoke at eight to hear a noise that sounded like a whining buzz-saw. She sat up with a start to find the bed empty. Rushing downstairs she found Norman crouched over a small box which was spewing paper. With the demonic gleam characteristic of the computer freak and the religious zealot alike, Norman looked up at her. "Just look at this darling, the first program. Isn't it fantastic?"

Melanie's eye bitterly surveyed the wreckage of the dining room. Norman had already been up for an hour and had his sleek new compact Genie computer with disc drive setting on the immaculately polished table. The screaming printer occupied the coffee table, which cables were strung across the room and magazines and piles of listing paper were strewn across the chairs. A neglected cup of coffee was congealing on top of the piano.

"Are you going to clear this mess up"? she shrieked.

"What mess darling"? Norman looked around helplessly, ineffectually trying to tidy the pile of magazines.

Like most people, Norman and Melanie Fossett had, as Lord Chesterfield remarked, married to find happiness and found that they had had to make do with contentment. Now Norman had found his happiness; Melanie's discontent was just about to start.

Norman's absorption with his computer became absolute. Every minute of his time and, increasingly, some of Fothergill & Bickerstaff's, was spent in contemplation of the sleek Genie monitor on lengthy and much scribed-on program listings. Their joint bank account bore testimony to Norman's lavish expenditure.

Melanie would call him for meals and he would not hear, appointments at the dentist were forgotten, and Norman's hair, once spruce and neat, became lank and long.

Norman and Melanie had met at Windsor. Both children of the Flower Power era, they had been arrested in the police swoop on the Jazz & Blues festival and shared the same police van.

The ertz mysticism of that period never left Norman and he had become fascinated with magic squares, those mathematical curiosities, matrices of whole numbers that showed certain strange regularities in the pattern of their numbers. He now became obsessed with writing a program to produce and print out magic squares. Using the elegant formula provided in Lancelot Hogben's Mathematics for the Million, he eventually succeeded. By entering the size of the matrix and the total that he wished each column and diagonal to be, he could generate the requisite magic square. It was a party trick that brought him admiration only from his fellow freaks.

Further research led him to Claude Bragdon, whose ideas on projective geometry he had first read about in an obscure American book first published in 1923. His quest for knowledge about four-dimensional geometry led him to read Howard Hinton's Fourth Dimension, and eventually the famous article in the American Journal of Mathematics by W S Stringham Regular Figures in n-dimensional space. Here he came to the breaking point: his sleek and thoroughly reliable Genie failed him. As does every other computer user, he soon discovered the limits of his machine.

Resorting to the Tottenham Court Road again, he saw what he wanted. It was love at first sight. One view of the sleek lines of the new Sharp MZ-80B sold it to him. Instantly smitten, he stroked the sensitive keyboard and opened the carefully dampered cassette deck. "Like to see the moving graphics sir?" asked the hovering salesman.

As soon as Norman arrived home with the new computer, Melanie knew exactly what had happened to their joint account. This time Norman had to listen. Finally Melanie cooled down, though not without a parting shot. She announced that she would be taking a couple of days off to stay with Cassandra, a fierce feminist friend from Melanie's university days. Cassandra lived up in Cheshire working at Jodrell Bank as an astrophysicist and dividing her time between looking for quasars and agitating for free creches.

It was with a cheery smile that he saw her off on the train to Crewe; cheer that vanished on his return home. His latest program listing, his most ambitious to date and involving the complete inversion of a sphere, was no where to be found. His printer had broken down and he could not print out another. There was nothing for it but to sit down and struggle with a screen display of the program listing all weekend.

(continued on next page)
The insistent bell of the telephone interrupted him and he went to answer it in the hall.

"Hello Norman, it's me Melanie, can you pick me up from the station at seven?"

"Certainly, darling"

"Everything OK, programming coming along?"

Norman was taken aback at this unprecedented interest, "Yes...er, fine dear. Funny thing, though, I don't seem to be able to find my latest listing."

"Oh yes, I'm sorry, I picked up some printout paper as a bookmark."

"Thank the Lord for that, I couldn't imagine where it was. OK, see you at seven".

Norman was relieved to see how relaxed and happy Melanie was; the journey back from the station was free of the manic feminism with which Cassandra usually stuffed her. He was also relieved to see that Melanie had his listing. Within minutes Norman was again engrossed in the program. With the printed listing he could at last make headway. He swiftly entered the lines of code. Finally everything seemed to be right, so he decided to run the program. He typed in Run and the scene flashed

The final solution

Copyright N Fossett

This program not to be copied for any purpose

The screen cleared and a prompt asked for the number of faces on the sphere he wished to invert. He tapped in 666, a number he liked to use because the first magic square he constructed had been based on a total of 666 for the columns and diagonals. Unknown to him it was also an exact reproduction of an antique Hebrew magic square.

The screen flashed a prompt, asking him for the size of incremental steps he wanted in units. He chose the lowest, which was one. The program should now run but to his surprise the screen now displayed

Do you wish to enter hyperspace?

Answer Y/N.

Norman gazed at the screen in disbelief. Where had this line come from? It was not an instruction he could recall. Frantically he scrambled through his listing, then in faint pencil he saw a line written in for the display he was looking at, with a Goto command to which he turned. Further lines of code, not immediately intelligible to him, were there. Curious to find out what happened, he tapped the Y key with his left index finger and hit carriage return with his right little finger.

Immediately the screen display showed a sphere which he recognised as being constructed with 666 faces. It slowly started to rotate as the faces inverted, and from the centre a growing dark area spread to the circumference. The circumference appeared to gather speed as the dark central mass grew bigger and darker. Faster and faster the circle flew.

Sweat broke out on Norman's face: the black central spot was becoming a void before his eyes. He sat transfixed as the phosphorescent green circle revolved and grew and the frightening black space appeared to grow over the screen and eventually over the computer. In fascinated horror Norman stood up and shrieked, "Melanie, Melanie come quickly, the computer..."

He stretched out his hand in disbelief at the computer, and felt the force tug his fingers, growing, irresistible, engulfing.

His final piercing shriek was quickly extinguished, but loud and long enough to wake Melanie, who was drowsing by the fire. She opened the door to the dining room. The polished dining table reflected the wall lights. Where the computer had previously stood was a clean, bare table. She walked over to it and picked up the listing, smiling as she noted Norman's handwriting where he had headed it "The final solution". Spelling had never been his strong point.

Switching off the light, she felt in her pocket for the car keys. Damn! Norman had had them. She would have to walk down to the police station to report him missing. But first she had better just phone Cassandra.

You'll be glad you chose a personal computer with power enough to grow with your needs.

The ICL Personal Computer with power to grow as you need it.

Choosing the wrong personal computer can work out very costly, because though they grow to meet your needs, they just don't grow enough.

The new ICL Personal Computer gives you more.

It's a versatile, professional personal computer. It can start with a single Visual Display Unit, naturally, and it has a wide range of functions to meet your increasing requirements. And it can grow larger than most other personal computer systems, because its capacity for additional hardware is greater.

Starting at £2,895 with one VDU

The ICL Personal Computer provides a range of options enabling you to have a system tailored to meet your changing needs.

For example, by adding a fixed-disc, you can have eight times the original storage capacity, and support up to 4 VDUs.

And there is an extensive range of Personal Computer hardware.

Wide range of integrated accounts and other application software available, providing limitless possibilities.

(See page 212)

So your secretary can do her word processing, you can do your forecasts, your accountant can do the invoicing, and your programmer can do his own thing, all at the same time.

That's what makes the ICL Personal Computer more than just a personal computer.

And because ICL is Europe's leading computer company, with thousands of satisfied users in over 80 countries worldwide, we can offer ICL Trader Point service and maintenance back-up that's second to none.

What more could you ask for, apart from a demonstration?

Copyright N Fossett
<table>
<thead>
<tr>
<th>Product</th>
<th>Price (Exc VAT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple II Europlus 48K</td>
<td>499*</td>
</tr>
<tr>
<td>Apple Disk Drive with Controller</td>
<td>270*</td>
</tr>
<tr>
<td>Apple Disk Drive</td>
<td>220</td>
</tr>
<tr>
<td>12&quot; Green Screen Monitor</td>
<td>90*</td>
</tr>
<tr>
<td>Epson MX80T (Type 3) Dot Matrix</td>
<td>290</td>
</tr>
<tr>
<td>Qume Sprint 9 Daisy Wheel Printer</td>
<td>1380</td>
</tr>
<tr>
<td>Videx 80 Column Card</td>
<td>200</td>
</tr>
<tr>
<td>Visicalc 3.3</td>
<td>110*</td>
</tr>
<tr>
<td>Graph Magic</td>
<td>50</td>
</tr>
<tr>
<td>Wordstar 3.0</td>
<td>170</td>
</tr>
<tr>
<td><em><em>Typical System Price (Marked</em>)</em>*</td>
<td><strong>£969</strong></td>
</tr>
</tbody>
</table>

ATA Systems
4 Albion House · 1 Back Hill · London · EC1
01-278 3838/01-278 5285
The **comart communicator**

**RELIABLE BRITISH MADE MICROCOMPUTER SYSTEMS**

from **JAROGATE**

**MODELS**

- **CP100** 2 x 390 K BYTE/DRIVE 5¼" FLOPPY DISK
- **CP200** 2 x 790 K BYTE/DRIVE 5¼" FLOPPY DISK
- **CP500** 1 x 790 K BYTE/DRIVE 5¼" FLOPPY DISK AND 4.8M BYTE 5" WINCHESTER HARD DISK

**SPECIFICATIONS**

- **Z80A PROCESSOR**
- **10 SLOT S100 BUS**
- **CP/M and MP/M OPERATING SYSTEMS**
- **2 SERIAL PORTS; 1 PARALLEL PORT**

**TYPICAL APPLICATIONS**

- ACCOUNTS
- WORD PROCESSING
- COMMUNICATIONS
- COLOUR GRAPHICS
- FINANCIAL PLANNING
- PROCESS CONTROL
- DATA BASE MANAGEMENT
- STOCK CONTROL
- PAYROLL

**OPTIONAL SUB-SYSTEMS**

- **HD200 18.7M BYTE 8" WINCHESTER DISK SYSTEM**
- **CB200 13.4M BYTE CARTRIDGE BACK UP UNIT**

**JAROGATE LTD.** is a Company that specialises in all areas of microcomputer applications. Due to this wide range of expertise, **JAROGATE LTD.** is swiftly becoming one of the leading names in the microcomputer industry.

**CONSULTANCY** Our services include:—

- system analysis
- software design
- programming
- hardware design
- hardware maintenance and systems integration

**SALES** As well as distributing a wide range of hardware, software and consumables,

**Also available for multi-user applications —**

**THE JAROGATE MP5 MULTI-PROCESSOR SYSTEM.**

Jarogate Ltd. are main dealers for Comart, Cromemco and North Star ranges of systems and boards.

**JAROGATE LTD.** also provide technical advice to all users, whether experienced or first time.

**SUPPORT and MAINTENANCE**

**JAROGATE LTD.**'s team of experienced engineers and programmers are available to give full after-sales support.

**JAROGATE LTD.** offer nationwide hardware maintenance of all products sold.

**JAROGATE LTD.** the microprocessor consultants

197-213 Lyham Road, Brixton, London SW2 5PY Telephone 01-671 6321

---

**PRACTICAL COMPUTING** September 1982
WHEN IT COMES TO MICROCOMPUTER SOFTWARE WE WROTE THE BOOK

How do you stay up-to-the-minute with the rapidly changing world of microcomputer software? Get the Lifeboat Catalogue.

The latest Innovations The new Lifeboat Catalogue is packed with the latest state-of-the-art software. And if we publish a new program after the latest catalogue has gone to press, we enclose a flash bulletin in your copy.

The greatest selection
Because Lifeboat is the world's largest publisher of microcomputer software, our catalogue offers you the greatest selection of programs for business, professional and personal use. Our more than 200 programs range from the integrated accounting and professional practice systems to office tools for book-keepers and secretaries to sophisticated tools for programmers. Included are business systems, word processors, programming languages, database management systems, application tools and advanced system utilities.

We specialise in software that runs on most small business computers. Our more than 60 media formats, including floppy disks, data cartridges, magnetic tape and disk cartridges, support well over 100 different types of computer.

Get full service
We give the crucial dimension of after-sales service and full support to everything we sell.

That includes:
- An update service for software and documentation.
- Telephone, telex and mail-order services in the London office and at overseas offices in the United States, France, Switzerland, West Germany and Japan.
- Subscriptions to Lifelines, the monthly magazine that offers comparative reviews, tips, techniques, identified bugs and updates that keep you abreast of change.

Get it now
Lifeboat now serves tens of thousands of satisfied customers with our breadth of up-to-date, fully tested, fully supported and competitively priced software. You may not need all we offer, but we offer just what you need. After all, we wrote the book.

Lifeboat Associates
World's foremost software source

Lifeboat Worldwide offers you the world's largest library of software. Contact your nearest dealer of Lifeboat.

USA Lifeboat Associates 1651 Third Ave. New York NY 10028 Tel (212) 860-0300 Telex 645693 (LBSOFT NY) TWX 710 581-2524 JAPAN Lifeboat Inc. OK Bidg. 5F 1-2-8 Shibuya Daimon Minato-ku Tokyo 150 Japan Tel 03-437-3901 Telex 241329 (LBSOFT) ENGLAND Lifeboat Associates Ltd PO Box 125 London WC2H 9LU England Tel 01-836 9028 Telex 893709 (LBSOFT)

SWITZERLAND Lifeboat Associates GmbH Hinterbergstrasse Postfach 251 6330 Cham Switzerland Tel 042-36-8686 Telex 865285 (LBSOFT CH) W GERMANY Intersoft GmbH Schlossgartenweg 5 D-8045 Ismaning W Germany Tel 089-996-444 Telex 5213043 (LBSOFT) FRANCE Lifeboat Associates S.A. 10 Grande Rue Charles de Gaulle 92600 Asnières France Tel 733-80-04 Telex 253030 (PUBLIC FRANCE)

PRACTICAL COMPUTING September 1982

Copyright © 1981, by Lifeboat Associates.
If mention of handshaking protocols, serial buses and IEE-488 ports fills you with confusion, help is at hand. Alan Clements reports on data-transmission lines.

In order to go from my home to work I must travel along a number of roads provided by courtesy of the local authorities. I would, of course, prefer a single, direct path between my home and work, along which only I am allowed to travel. Unfortunately, my own private road would be immensely costly, not to mention inefficient, but it would be fast.

A similar situation exists in digital systems. While it would be nice to connect each module, or functional part of the system, directly to every other module with which it communicates, it is not economically possible. Consequently a digital system of any complexity has a set of highways along which information moves from point to point. These highways are called buses — from the Latin word omnibus which means "for all" — and are normally labelled by the nature of the information they carry, such as data or address. Figure 1 illustrates how buses move information from one part of a microprocessor to another.

Returning to the analogy of the roads, it is necessary to devise a set of rules to be obeyed by all road users if an orderly flow of traffic is to be achieved. Such a set of rules is called a protocol and, in the case of road traffic, is enshrined in the highway code. Parallel buses move simultaneously a number of bits, often eight or 16, over parallel lines using one line per bit. Serial buses, more commonly called data links, move all data along one line a bit at a time.

There are two fundamental approaches to the transfer of information on buses: open-loop or synchronous, and closed-loop or asynchronous protocols. With an open-loop protocol data is transmitted from a source to its destination without any further communication between destination and source. When the source transmits the data it assumes that the destination has received the data after a suitable time has elapsed. The postal system normally operates this way: you pop a letter in a letter-box and assume that it will be delivered.

A closed-loop protocol operates in a more conservative mode. Information is transmitted from the source to the destination, but the source does not proceed to its next task until the destination has confirmed the receipt of the data. This mode requires two-way communication. Closed-loop protocols are similar to letters sent "advice of delivery": the recipient signs a slip of paper on receiving the letter, and the slip is returned to the sender confirming the safe delivery. The popular eight-bit microprocessors use open-loop protocols, while some of the more sophisticated 16-bit microprocessors rely on closed-loop protocols.

The simplest parallel bus designed to move m bits of data at a time would consist of m lines plus a ground return. It has no additional control lines — see figure 2. The timing diagram illustrates a time sequence of events.

By convention digital signals are represented by horizontal lines at a logical 0 to 1 level. In figure 2 the data on the bus is represented by two parallel lines because it is not the data itself that matters but the point at which the data changes. The shaded portion of the timing diagram represents data which is in the process of changing and is therefore invalid. Between the shaded regions the data is constant and stable.

The device which puts data on a bus is called a transmitter or a talker. The device taking data from a bus is called a receiver or a listener. Sometimes the transmitter is called a source and the receiver a sink. Unless otherwise stated, the term data means information being moved along a bus, rather than its natural rower use where it often refers to the contents of an address location.

The primitive bus of figure 2 presents the receiver with a problem. How does it know when to sample the data on the bus? If both receiver and transmitter had perfect clocks they could arrange for the receiver to sample the data at the right time, but in practice it is difficult to do this reliably over a long time span.

Identical characters

Another solution would be to let the receiver look for changes in the data on the bus. When the receiver detects a change of state on one or more of the m lines of the bus, all it has to do is wait a short time for the data to settle and then it can sample the data. This scheme is analogous to that used by asynchronous serial data buses where a start bit denotes the beginning of a stream of 10 or more bits. A particular difficulty with this arrangement is that two identical characters cannot be transmitted consecutively as none of the lines changes state between the characters.

The open-loop bus protocol encountered most frequently uses a single control line to synchronise the receiver with the transmitter. The line may be called "data available", and when asserted by the transmitter it tells the receiver that data is now available for it to read.

Note the use of the word "asserted". All lines must be in an electrically low or high state, and one of these states must be chosen as the level which causes the action to take place, but for the purposes of description it does not matter what the actual level is. A line is asserted when it is set at the level which causes its named action to be carried out.

A typical microprocessor with a synchronous data bus is the 6809, whose timing diagram is given in figure 3. The 6809 has a 16-bit address bus which it uses to provide memory and peripherals with the location of the memory, into which data is being written, or from which data is being read. The eight-bit data bus is bidirectional and moves data to the CPU
in a read cycle and from the CPU in a write cycle.
The R/W read/write line from the CPU indicates to the memory the nature of the data transfer. When it is in a logical 1 state a read cycle is taking place. The line used to control the bus is the E (enable) line, and is a system clock. The O line is a clock identical to the E clock, but lagging the E clock by one-quarter of a cycle; O stands for quadrature. It is not strictly necessary for data transfer.

The timing diagram in figure 3 corresponds to a read cycle when R/W = 1. At the start of the cycle when E is low the CPU is busy calculating the value of the address of the memory location to be examined. Up to point C the contents of the address bus are invalid and may not be used, hence the shading. After point C which occurs $t_{AD}$ seconds after the start of a cycle the address is valid until point $D_{AC}$, the address hold time, after the end of the cycle.

The memory assumes that the address is valid when E is high and, as R/W = 1, puts its data on the data bus. At the end of the cycle signified by the falling edge of the E clock, the CPU reads the contents of the data bus.

The protocol of the 6809 requires that the data be valid at least $t_{DOR}$ seconds, the data set-up time, before the end of a cycle, and that the data remains stable for at least $t_{OR}$, the data hold time, after the end of a cycle. It is entirely up to the designer of the system to ensure that these criteria are satisfied and that the memory component is capable of working at the speed demanded by the CPU.

The CPU blindly reads the data bus at the end of a read cycle. If the memory has failed or is not there because an erroneous address has been generated, the CPU does nothing about it. Fortunately, such failures are rare and the majority of microprocessors work quite happily with a synchronous bus. However, they are of less use when dealing with memory or peripheral components having widely differing access times, or where the system must have a very high level of reliability or integrity.

Information transfer using a closed-loop protocol requires that the receiver should confirm the receipt of data to the transmitter. This interaction between transmitter and receiver is usually called handshaking, though some people call it an interlocked transfer. In general, there are two types of handshake procedure: the two-wire handshake and the three-wire handshake.

**Two-wire handshake**

In a two-wire handshake two control lines, data available, DAV, and data accepted, DAC, facilitate an orderly flow of information from transmitter to receiver. Figure 4 illustrates the operation of the two-wire handshake.

The transmitter now sees that the receiver has confirmed its receipt of data so the transmitter can de-assert DAV, its job having been done. In turn the receiver de-asserts DAC and the exchange of information is complete.

A potentially fatal problem can arise with handshaking protocols. Suppose the transmitter asserts data available and the receiver is not working. Does the transmitter wait for ever, hoping to see data accepted? If this were to happen the system would just hang up.

In a well-designed system a time-out mechanism is used to avoid hang-ups. When the transmitter first asserts DAV a timer is started. If a certain period, the time out, elapses without DAC being asserted, the data transfer is aborted and some form of error-handling procedure invoked.

Suppose in a large computer system someone runs a program which produces a paper-tape output. As the paper-tape punch is not frequently used it might not be plugged in. When the program tries to send data to the tape punch it receives no acknowledgement, and times out. This results in a call to the operating system which prints a message on the operator's console, suspends this task, and runs another.

The 68000 16-bit microprocessor uses a two-wire handshake to transfer data between itself and peripherals and memory. Figure 5 illustrates the operation of the 68000 in a read cycle. At the end of state $S_7$ the 68000 puts out an address on its address bus, and at the end of state $S_0$ it asserts its address-valid strobe, $AS$, telling the memory that the address is valid and should be acted upon.

When the peripheral sees that the address strobe has been asserted, it acknowledges it by asserting DTACK, data acknowledge, and puts data on the data bus. When the 6800 CPU sees DTACK it latches the data from the memory and terminates the read cycle. Should DTACK not be asserted within a reasonable time external circuitry provided by the designer, as only he can say what constitutes a reasonable time — asserts the active-low bus error BERR input to the CPU. The CPU may then either try to run the bus cycle again or to initiate a bus error sequence, which is really a special form of interrupt.

Handshaking can be taken one step further by the addition of a second control line, in addition to data available, from the receiver to transmitter. Called, ready for data, RDF, it indicates to the transmitter that the receiver or receivers are able to accept data.

The three-wire handshake is largely associated with the IEEE-488-1975 bus which is designed to transfer data between one or more computers and intelligent test and measurement equipment. Such an interlinked network of equipment forms the basis of automatic testing.

Carefully controlled power levels, for punch is not frequently used it might not be plugged in. When the program tries to send data to the tape punch it receives no acknowledgement, and times out. This results in a call to the operating system which prints a message on the operator's console, suspends this task, and runs another.

The 68000 16-bit microprocessor uses a two-wire handshake to transfer data between itself and peripherals and memory. Figure 5 illustrates the operation of the 68000 in a read cycle. At the end of state $S_7$ the 68000 puts out an address on its address bus, and at the end of state $S_0$ it asserts its address-valid strobe, $AS$, telling the memory that the address is valid and should be acted upon.

When the peripheral sees that the address strobe has been asserted, it acknowledges it by asserting DTACK, data acknowledge, and puts data on the data bus. When the 6800 CPU sees DTACK it latches the data from the memory and terminates the read cycle. Should DTACK not be asserted within a reasonable time external circuitry provided by the designer, as only he can say what constitutes a reasonable time — asserts the active-low bus error BERR input to the CPU. The CPU may then either try to run the bus cycle again or to initiate a bus error sequence, which is really a special form of interrupt.

Handshaking can be taken one step further by the addition of a second control line, in addition to data available, from the receiver to transmitter. Called, ready for data, RDF, it indicates to the transmitter that the receiver or receivers are able to accept data.

The three-wire handshake is largely associated with the IEEE-488-1975 bus which is designed to transfer data between one or more computers and intelligent test and measurement equipment. Such an interlinked network of equipment forms the basis of automatic testing.

Carefully controlled power levels, for
Imagine a microcomputer system which offers all the exciting prospects of full 16 Bit technology to come; but isn't too proud to admit that your existing 8 Bit Software has many years of useful life ahead. So it incorporates the new, high performance MC68000 16 Bit, 8 MHz processor, and an integral software selectable Z80A processor.

And that is the only concession that the new Cromemco 16 Bit System needs to make.

Its use of the MC68000 processor adds new found freedoms to microcomputer systems development. To start with it is fast. Benchmark tests showed it four times as fast as the Z80A, and twice as fast as the PDP11. It offers superb software performance without having to resort to expensive memory management techniques. The 1000 plus instruction set offers the widest options for producing compact efficient code. Its 32 Bit Architecture offers full 16MByte direct memory addressing. It all adds up to the promise of larger, more efficient software programs, executed in a highly controlled and managed environment.

But it takes Cromemco to put promise on the path to reality. So to support MC68000 processing power there is a new concept in memory cards, full S100 and IEEE 696 compatibility, and a new software library based on 16 Bit Code to optimise the new found processing power.

The Memory Storage comes in single 256K or 512K cards with built in error detection and correction. That gives a full 4MByte of high speed memory in a Cromemco 16Bit System 3, with internal space to spare. The S100 and IEEE 696 compatibility offers the widest possible options in add-on facilities and interface requirements.

The new software library is comprehensive. There is a 16 Bit version of the proven Cromix Multiuser operating system, (now it will support up to 18 users or tasks). There is a new Fortran 77, designed for creating larger programs in a science/engineering/research environment, and COBOL, PASCAL, and 'C', a Structured BASIC, and a 68000 Assembler.

Overall the Cromemco 16 Bit Systems extend the existing boundaries of microcomputer application. In particular, they offer the Scientist and Engineer the opportunity to dramatically reduce the cost of performing the complex mathematical functions required in multi dimensional design, simulation and analytic processes. What was once mainframe capability and became mini is now decidedly Cromemco Microcomputer capability.

But without professional assistance along the way, the path from promise to reality is fraught with obstacles. Comart are Cromemco's longest standing, most experienced distributor in the UK. A five year partnership in this industry, is a lifetime in others.

So with Cromemco's dual processor and Comart support, you won't have to write off the past to step on forward into the future.

Please send me details of Cromemco's 16 Bit development now and as it evolves.

Name

Position

Company

Address

Tel

Cromemco File
Developing through Evolution

Comart Ltd, Little End Road, Eaton Socon, St Neots, Cambs Tel: (0480) 215005 Telex: 32514 ComartG.
example, can be applied to a PCB under test and a number of signals injected at various points by signal generators controlled from the IEEE bus. Simultaneously a battery of programmable signal monitors could sample the signals on the PCB at a host of predetermined points. The whole process may be controlled by a computer which configures the signal sources and measuring equipment, and then receives reports from the measuring equipment via the bus. Even-

timing diagram called a message-exchange sequence. Each action of the control lines is represented by a message between the transmitter and receiver. Read this diagram downwards from top to bottom, unlike the timing diagram which is read from left to right.

In the two-wire handshake the transmitter assumes that the receiver is always ready. The handshake itself merely confirms the acceptance of data. The three-wire handshake is used in an environment where receivers may take a little time to

![Figure 6a.](image)

Data 1 0
RFD 0
DAV 0
DAC 0

from transmitter
from receiver
from transmitter
from receiver

A B C D E F

Figure 6a.

![Figure 6b.](image)

Transmitter (talker)
I have data for you
As you have accepted the data, I acknowledge it

Receiver (listener)
I am ready for data
I have received the data
I am busy, therefore I am not ready for data
I can now clear data accepted and everything is as it was in the beginning

![Figure 6b.](image)

Table 1.

<table>
<thead>
<tr>
<th>Electrical state</th>
<th>Logical state</th>
</tr>
</thead>
<tbody>
<tr>
<td>high &gt; 2.0V</td>
<td>0 = false</td>
</tr>
<tr>
<td>low &lt; 0.8V</td>
<td>1 = true</td>
</tr>
</tbody>
</table>

The solution to this problem is to let receivers signal when they are not ready for data. The transmitter must wait if any receiver says it is not ready for data. Once the last receiver has said that it is no longer not ready for data, they must all be ready for data. An identical argument may be applied to data accepted which, in the case of the IEEE bus, becomes not data accepted, NDAC.

A second problem is due to the electrical nature of typical bipolar-logic elements. The gates which drive the handshake lines have open-collector outputs: they can pull the line down actively to an electrical low state with the line sitting at less than 0.4V with respect to ground.

When not pulling the line down, the open-collector gate has no effect on the line, apart from a small leakage current. If none of the open-collector gates connected to the line is pulling it down the line is pulled up to a high level of greater than 2.8V by a resistor. The line normally sits at a high state and may be pulled down to a low state by any of the open-collector gates connected to it.

Each bus has the electrical high state is called a logical-zero or false state, and the electrical low state is called a logical-one or true state. In these circumstances the bus is said to operate with negative logic rather than the conventional positive logic where an electrical low state represents a logical-zero — see table 1.

Table 1.

The three lines used to control the flow of data are:

- DAV, Data Valid; when true DAV indicates to the receivers that data is available on the eight data lines.
- NRFD, Not Ready For Data; when true this line indicates that one or more lines are not ready to accept data.
- NDAC, Not Data Accepted; when true this line indicates that one or more lines have not accepted data.

**Listeners active**

The timing diagram of a data transfer as an IEEE bus is given in figure 7. Suppose that the bus is initially quiet with no transmitter activity. Three active receivers are busy and consequently they have asserted NRFD, pulling it down to an electrical low condition, that is NRFD true. Not all receivers may be taking part in a conversation with the transmitter. The receiver must have been programmed as listeners are said to be active.

The diagram shows two dotted lines to the left of the rising edge of NRFD. The first dotted line represents one of the receivers becoming ready for data. This does not affect the state of the NRFD line as two other receivers are holding it down. When the third receiver de-asserts...
(continued from page 111)

NRFD the line rises to an electrically high state signifying that not ready for data is false, or the line is ready for data. If a transmitter wishes to use the bus it samples the state of the NRFD line and, if it finds it false, puts its data on the data bus. After a delay of 2µs to allow the data to settle, the transmitter asserts DAV by pulling it down to an electrical low state. As soon as the listeners see DAV asserted they assert NRFD by pulling it down, signifying that they are once more busy.

<table>
<thead>
<tr>
<th>Data lines</th>
<th>False</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAV</td>
<td>False</td>
<td>True</td>
</tr>
<tr>
<td>NRFD</td>
<td>False</td>
<td>True</td>
</tr>
<tr>
<td>NDAC</td>
<td>False</td>
<td>True</td>
</tr>
</tbody>
</table>

Figure 7.

Meanwhile the listeners are holding NDAC electrically low indicating that not data accepted is true. When a receiver sees DAV it reads the data from the bus and sets NDAC false. That is, if not data accepted is false then data accepted must be true.

Because all receivers must make their NDAC outputs false before the NDAC line may rise to an electrical high or false state, the transmitter does not know that data has been accepted until the slowest reader has acknowledged. The cycle is now completed by the transmitter releasing DAV followed by the receivers asserting NDAC.

Serial links

The three-wire handshake has been adopted for the IEEE bus and this bus has surfaced in at least one of the popular microprocessor systems so it seems that it will be around for some time. Several semiconductor manufacturers have produced chips to interface to this bus, either as part of a microprocessor chip set or as a stand-alone interface. However, the three-wire handshake is not necessarily the best approach to the transmission of data over a bus.

Any production to protocols for buses would be incomplete without a mention of the type of protocols used by serial buses where the transmission path or data link conveys information from transmitter to receiver a single bit at a time. In general an m-bit parallel data bus is at least m times faster than the equivalent data link — nobody uses the term bus when there is a single line. Consequently, designers choose a serial data link when economy is more important than speed.

Data links may also be broadly classified into two types: asynchronous and synchronous. Asynchronous serial data links usually operate with the individual data bits formed into groups representing single characters or words. More often than not, the code chosen to represent the characters is the seven-bit ASCII code used by the majority of printers and VDUs.

The problem facing a serial data link is that data and control information may not be separated by having separate lines. The only alternative is to separate control and data by time. Figure 8 shows how this may be done.

When the line is inactive it sits at -12V representing a logical-zero or "mark" state. The popular RS-232 interface uses this convention: the older 20mA interface represents a logical-zero by a current of 20mA and a logical-one state by no current. When the transmitter wishes to transmit a seven-bit character it first raises the line to a +12V level, representing a logical-one or a space condition. This level is maintained for T seconds, where 1/T is the rate at which bits are transmitted.

When the receiver sees a zero-to-one transition on the line it waits iT seconds and samples the line. If it sees a zero, it assumes that the transition was a false alarm and does nothing. If it still sees a logical-one it assumes that a character is about to be transmitted and triggers its local clock. This clock samples the state of the line every T seconds for the next 9T' seconds. Note that T' is not the same as T since the clock at the receiver is not synchronised with the clock at the transmitter, hence the term asynchronous transmission.

The first period of T seconds is called the start bit and has the control function of telling the receiver that seven data bits are to follow immediately. These are transmitted with the least-significant bit first. In figure 8 the word is 1000101, which is 42hex and represents the ASCII character B. As long as the receiver samples each bit within its own time slot the seven data bits will be correctly assembled into the appropriate character.

The eighth bit is a parity bit chosen to make the total number of Is in the eight bits even. Should an error occur during transmission with a 1 being turned into a 0 or vice versa, the received data will no longer have an even number of Is, indicating an error. It is also possible to transmit words with an odd parity where the total number of Is is odd.

Control characters

The last bit is a stop bit at the idle level which provides a breather between the current word and any following word. It is a hangover from the days when the transmitter and receiver were entirely electromechanical devices. In order to send additional control information down the line, special control characters have now been devised for this purpose. For example Carriage Return, Escape, Device Control 1, etc.

There are many possible arrangements of a synchronised serial-transmission system. Bits are sent down the line continually with no gaps between individual bits or between groups of bits. The receiver must separate the bits and group them into packages. Unlike the asynchronous format, data is not set in groups of seven bits representing a word but in much larger groups called packets or frames.

One method of extracting bit timing is to encode the data in the way illustrated in figure 9. Each of the bit periods is called a bit cell and has a duration T seconds. If a 1 is to be transmitted a low-to-high or positive transition is made at the centre of a bit cell. If a 0 is to be transmitted a high-to-low transition is made, guaranteeing that there is at least one transition per bit and the duration between consecutive transitions is either T or T'. It requires a relatively modest amount of circuitry to extract timing

(continued on page 114)
WP2020 is an advanced word processing system which runs on selected 8080/Z80 and 16 bit 8088/8086 based microcomputer systems. All standard word processing functions are incorporated plus custom keytops which makes the system easy to use for the beginner or experienced typist. Some of the other main features include, multi-printer support plus background printing, spelling checker, merge documents and communications for electronic mail.

CM2020 is a powerful information retrieval system which the user can configure to suit individual needs. It runs on Z80 based CP/M systems and requires 48k memory. The query processor supports relational and logical operators and incorporates its own internal sorting module. All program modules are in Z80 native code and the system uses standard CP/M files allowing easy access by other programs. CM2020 can be used standalone, as a basic filing program for a customized system, or as a records management system which can be used in conjunction with WP2020.
Data transmission

(continued from page 112)

information from this phase-encoded signal.

Once the bits have been separated the receiver's next task is to group them into packages or frames. As the transmitted data is pure binary data it is impossible to use special characters to control the flow of data. A clever solution to this problem relies on a technique called bit insertion or bit stuffing.

Suppose you decide to indicate the start and end of a frame of data by means of a special flag which has the unique value 01111110. Whenever the receiver sees these eight bits it knows it must be the beginning or the end of a frame. Now suppose that the transmitter monitors the data it is sending. If it sends the sequence 011111 it may be in for trouble. If the next bit is a 0 there is no problem, but if the next bit is a 1 followed by a 0 a flag pattern is generated. When the transmitter sends the sequence 011111 it inserts a 0 after the fifth 1 so that 0111110X is transmitted. The X represents the bit that would have been sent after the five 1s. No matter what X is, a flag cannot now be formed. At the receiver flags are removed because they merely split the data stream into frames. If the sequence 011111 is received the next bit, which must be a zero, is stripped or deleted. A typical frame has the format shown in figure 10.

This packet of information begins with an address, allowing the transmitter to communicate with a number of different receivers over a common data link: only the receiver addressed by the transmitter responds. The control field is used to control the flow of information. It can contain a poll bit which when set causes the receiver to get in touch with the transmitter, software handshaking. Included in the control field are sequence counts which number the frames flowing along the link; one number for data flowing in each direction.

If any frames are lost in transit a receiver notices that the next frame is not in sequence and can therefore ask for a retransmission.

Slow but sure

The data itself transmitted in the data field is in pure binary form. After the data comes a 16-bit cyclic redundancy code, CRC, obtained by dividing the preceding binary values by a polynomial and recording the remainder. At the receiver the same process is performed and if the locally generated CRC is different to the received CRC an error is assumed to have occurred. This method of error detection is very powerful.

A serial data link seems crude by comparison with the parallel data link with its special control lines, but the serial link may ultimately prove to be the most popular and enduring arrangement. While a serial link is slower, very high-speed transmission is normally required only within the CPU itself. Moreover, modern serial links such as Ethernet operate at up to 10,000,000 bits per second, and the use of fibre optic links could lead to a 10-fold improvement in performance.
Two years old this August, Pete & Pam Computers send greetings to all their customers.

In August 1980 Pete and Pam Fisher set up a business selling hardware and software for Apple Computers. In two years the business has grown to encompass offices in both London and Lancashire, 22 employees and an annual turnover that is rapidly approaching eight figures.

We have earned distributorships from over 50 hardware and software companies, many of whom are "household" names, including BASF, Broderbund, Epson, Interactive Structures, NEC, Orange Micro, On-Line Systems, Micro Pro., Microsoft, M & R, Saturn Systems, Sirius Software, Videx, Versa Computing and Zenith, to name but a few.

Surprised? If you already deal with us, you won't be.

Our reputation for sound advice, comprehensive stocks and prompt delivery has been a major consideration in the decision of over 500 Apple dealers, numerous multi-national and large companies and many thousands of individuals to buy from Pete and Pam.

You've read about us. We'd like you to talk to us. Our sales and service staff will be pleased to assist. Call us today.

Pete & Pam Computers

Head Office: Waingate Lodge, Waingate Close, Rossendale, BB4 7SQ
London Office: 103-5 Blegborough Road, London, SW16 6DL
Phone: (0706) 227011 Telex: 635740 Petpam G
Phones: 01-769 1022/3/4 & 01-677 2052

PRACTICAL COMPUTING September 1982
If you use a **CASHBOOK** read on:-

**CCS CASH £175 + VAT**

The answer for all cash based businesses.
- Full 18 column analysed cash book
- Running bank balances
- Instant VAT returns

(available on Apple II)

**CROESO COMPUTER SERVICES**
516 MUMBLES ROAD, MUMBLES, SWANSEA.
TEL: (0792) 61555/61556.

Don't forget our other Apple systems:

- **PUBLSTOCK**
- **PACCS**
- **CLASS**

PRACTICAL COMPUTING September 1982
and finds one system which has raised the rate of correct diagnosis to over 90 percent.

Medical diagnosis

ONE OF THE HUMAN tasks which the computer was predicted to take over, back in the days when computers were mysterious and their potential apparently limitless, was that of doctoring. The cybernetic future, as seen from the broad and speculative viewpoint of the mid-1950s, would include automated medicine.

Indeed, as recently as this year, Clive Sinclair has suggested in these pages that one of the most vital roles for the home — as opposed to professional — computer would be as a home medical diagnostic resource, to some extent replacing doctors themselves.

The idea of a machine which will support people, in sickness or in health, has clearly taken a powerful hold on the collective imagination, and is still, despite the demythologising effect of the microcomputer, current among today's enthusiasts. Almost half of the fiction manuscripts which arrive at Practical Computing bear directly or indirectly on the theme of the ultra-intelligent machine though, sad to report, the prognosis of the majority is gloomy. Usually the UIM has learned its human-derived rules too well and is busy defeating its makers at their own game.

It would surprise the futurologists, or optimists, of the 1950s to discover how wide of the mark many of their predictions were, particularly with respect to computers in medicine. The author of the psychological quiz program Eliza must be astonished to the extent that a tongue-in-cheek program has ended up as a standard, a rallying-point for the proponents of automation in medicine. Anyone who has ever used it would realise immediately that such a simulation of intelligence, no matter how extensive, would be unworthy if relied on as the sole means of deducing a patient's mental health.

After all, that falls under human relations, does it not?

Professional paranoia

Much work has been done on diagnostic computing but surprisingly little has been achieved. This is not mere professional paranoia — one can imagine all sorts of frights the patient as well as the doctor might take when confronted with automated medicine.

But what does impede practical progress is the inability of most medical practitioners — clinicians, to use the precise term — to concert their minds in such a way as to make their methodology comprehensible to the computer. And frankly, they jolly well do not see why they should devote a great deal of time and energy translating serviceable human methods of working into computer methods.

Put this way, the case seems unanswerable. But there is no cause for complacency about the soundness of clinicians' existing methods — as Dr Tim de Dombal soon discovered when he started researching diagnostic decision-making.

De Dombal found that many doctors, especially junior doctors, were not very good at collecting information from patients. "They ask a large number of irrelevant questions; they fail to ask questions that are relevant; they fail to record the data in a way that is easy to follow; they ignore obvious clues in the information available; or they obtain masses of relatively useless biochemical data, using less than five percent of it."

Information theory

De Dombal has not been alone in working towards some kind of application of what he describes as "information theory" which would help the clinician to be more rigorous and more effective.

Several groups in the United States, as well as at the Royal College of Physicians in London, were working in the late 1960s and early 1970s to formulate useful applications of information science to medicine.

Given the observable haphazardness of the decision-making process among doctors, it may seem surprising that so many patients admitted to hospital do get well. Strip away the veneer of mystique which overlays any profession and you will find cock-ups comparable to those which you know happen every day in your own.

From the early days of his study at the Department of Surgery in Leeds Hospital, De Dombal cites evidence of doctors' all-too-human fallibility: "To our surprise, no universally accepted definition of an 'acute abdomen' exists, although when interviewed, a group of 19 surgeons all claimed to know what the term meant."

The same depressing picture emerged when individual symptoms were considered: regarding the term dyspepsia, we found 20 different definitions in the literature, all different and some mutually incompatible. Data concerning the spectrum of diseases that present as 'acute abdominal pain' were fragmentary, data on the geographic stability of diseases incompatible. Data concerning the spectrum of diseases that present as 'acute abdominal pain' were fragmentary, data on the geographic stability of diseases incompatible. Data concerning the spectrum of diseases that present as 'acute abdominal pain' were fragmentary, data on the geographic stability of diseases incompatible. Data concerning the spectrum of diseases that present as 'acute abdominal pain' were fragmentary, data on the geographic stability of diseases incompatible.

The computing team. The program, which is brief to the point of terseness, is based on the assignation of prior probability of 0.60 for any event, unadjusted by computing: "Clinicians are unwilling and ineffective users of computer terminals," he says.

Symptom database

What he did was to devise a standard set of terms describing abdominal pain on a preformatted sheet. The clinician examining a patient runs through this list, which is then handed on to a member of the computing team. The program, which is brief to the point of terseness, is based on the assignation of prior probability of any particular symptom, or combination of symptoms, according to a database of 600 cases whose data has already been analysed according to a mathematical model known as Bayes' theorem. Symptoms are compared point by point to arrive at a posterior probability which, in the latest version, is read out as a bar chart.

This brief account elides a great deal of hard work and a number of different implementations. The first system in 1971-72 was run on 1K of a Wang 700C. It is now available for use on a Wang 2200, Apple or Pet, though the simplicity and brevity of the program makes it (continued on page 120)
For the best PET software...

- **COMMAND-O.** For Basic IV CM7/PET, 39 functions £59.95 + VAT, with improved "ToolKit" commands
- **DISK-O-PRO.** For Basic II PET, adds 2 commands £59.95 + VAT, including Basic IV, in one 4K ram
- **KRAM.** For any 32K PET/CM for retrieving £86.95 + VAT, with improved "Tcolkit" commod.s
- **DISK-O-FRO.** For Basic II PEE, aids 25 commands £59.95 + VAT, including Basic IV, in one 4K ram
- **SPACEMAKER TV.** For any PET/CM, mounts 1-4 ems £29.95 + VAT in one ram slot, switch selection
- **PRONTO-PET.** Soft/hard reset for 40-volume BTs £9.99 + VAT
- **SUPERKRAM,** REQUEST & KRAM PLUS will be available shortly

We are sole UK Distributors for these products, which are available from your local CBM dealer, or direct from us by mail or telephone order. To order by cheque write to: Calco Software, FREEPOST, Kingston-upon-Thames, Surrey KT2 7BR (no stamp required). For same-day Access/Barclaycard service, telephone 01-546-7256. Official orders accepted from educational, government & local authority establishments...

... at the best prices!

- **WORDPRO IV PLUS** RRP £395 less £98.75 = £296.25
- **WORDPRO III PLUS** RRP £275 less £68.75 = £206.25
- **WORDPRO II PLUS** RRP £135 less £31.25 = £103.75
- **VISICALC** RRP £125 less £25.00 = £100.00
- **TOOLKIT Basic IV** RRP £54 less £9.50 = £44.50
- **TOOLKIT Basic II** RRP £29 less £7.25 = £21.75

The items above are available by mail or telephone order at our Special Offer Price when purchased with any one of our software products. This offer is for a LIMITED PERIOD only, UK - ADD 15% VAT, OVERSEAS airmail postage - add £1.00 (Europe), £1.00 (outside Europe).

**WE OFFER:** On site Engineering Maintenance contracts for any microsystem in the Grampian Region.

**WE SELL:** APPLES, RA.I.R., COM-ART, CROMEMCO, and now the amazing ACT SIRIUS 16 bit micro-computer designed by Chuck Peddle.

**WE SPECIALISE:** In business, process control, and North Sea Oil engineering database applications.

**Calco Software**
Lakeside House - Kingston Hill - Surrey - KT2 7QT
Tel 01-546-7256

---

**WHATEVER YOU WANT TO PUT IN YOU'LL GET MUCH MORE OUT OF US**

One plain fact you can bank on is our determination to provide the highest quality lowest cost individually applied micro-computer equipment and materials. That adds up to the finest value in London and the South — with over attentive service to match.

- * Lease and leasepurchase business plans from as little as £8.40 per week.
- * Tailor made 'in house by us' programmes for specialised applications.
- * System explanation and training that's down to earth.
- * We'll meet and beat any price on consumable items, discs, paper, ribbons etc.

It's as simple as that. Find out how a micro-computer can help your business.

A telephone call — 01 661 0095 — will bring us to you or visit our showrooms in Sutton.

56a Grove Road, Sutton, Surrey, SM1 1BT.
NETKIT II Universal Communications for the Commodore PET

Why buy an expensive terminal when you can use a Commodore PET and still be able to run normal business software.

NETKIT II is being used in many varied and diverse applications, not only as an intelligent or dumb terminal to MINI or MAINFRAME COMPUTERS, but also to support PET to PET communication with shared processing and transfer of programs and data. Numerous other applications are in use including interfacing to NC MACHINES, PAPER TAPE PUNCHES, TELEX EQUIPMENT, HAND-HELD DATA CAPTURE TERMINALS and other industrial and scientific equipment.

NETKIT II is the completely re-designed and upgraded version of the best selling NETKIT communications interface. Unlike other software communication packages which are available, NETKIT II is a combined HARDWARE and SOFTWARE package which provides the PET with an RS 232 interface and new powerful communication commands. As the software is contained in a 4K EPROM within NETKIT II a disk drive is not a necessity.

NETKIT II is now available for all series of PETS and is supplied with a comprehensive operation and applications manual.

ONLY £150 + VAT.

Kuma Computers Limited

PROFESSIONALS IN SOFTWARE APPLICATIONS: INTERFACING

Sirius - 1.
The best price/performance you've ever seen on a personal computer: £2395 + VAT For 128K, 1.2 Mbyte, 16 bit, available software includes: CP/M86, MSDO, Mbasic, COBOL, PASCAL, FORTRAN, etc.

Osborne - 1: You can take it anywhere. CP/M + 64K RAM, Dual discs interfaces and Wordstar, Super Calc, Mbasic. All for £1250.00 + VAT. Ask us about additional software.

Newbrain:
The only professional micro of this size: Phone us for immediate FREE delivery + SOFTWARE CATALOGUE Newbrain AD with onboard display £232.61 + VAT.

SHARP A + B:
Computers and systems with a Wealth of software applications programs. "WDPRO" Wordprocessing, Database, Accounts, Mail Lists etc. Phone Now for our new Autumn 170 Program Catalogue.

SHARP = KUMA = SOFTWARE

Printers:
Matrix - from £380.00 + VAT. Epson Mx 80F/T3 NEC (C. Itoh) Daisywheel - from £476.50 + VAT. Brother 8300 Tec Star Writer

Applications:
Direct experience of office applications, phone us for advice on ledgers, stock control, payroll and word processing.

Software: the established leader for Sharp Computers.

Training: Financial planning, information storage and word processing. One day introductory seminars.

MAIDENHEAD (0628) 71778
Kuma Computers Ltd.,11 York Road, Maidenhead, Berks. SL6 1SQ.
Tel: (0628) 71778/9 Telex: 849462 TELFAC Kum

PRACTICAL COMPUTING September 1982
easily adaptable for use on almost any small micro, including possibly hand-held.

It would seem, incidentally, to be ideal for use with Sinclair's new Spectrum which has the required 32K for the current implementation and would quickly load the further 154K of overlays for rare conditions from its Microdrives. Additionally the small size, light weight and easy-clean properties of the Sinclair would seem to make it ideal for hospital use — not to mention, of course, the low cost.

---

**COMPUTER-AIDED DIAGNOSIS PROGRAM**

**ACUTE ABDOMINAL PAIN**

This is an experimental programme to help you make accurate diagnoses. **CLINICAL JUDGEMENT MUST ALWAYS TAKE PRECEDENCE**

**COMPUTER user is**: CHAN M (PROJECT/RESEARCH ASSISTANT)

**DATA from**: house surgeon

**Patient's Reg.No**: 123456

**Date**: 29/06/82 at 1510 hrs.

**SYMPTOMS**

- Male
- Age: 20-29
- Pain onset: LT LOIN
- Pain now: LT HF
- Other aggravation: NO REL FACTORS
- Pain now: L LOIN
- Pain <12 hrs
- Severe
- Nausea: NO
- Vomiting: NO
- Appetite: OK
- No indigestion: NO
- Cholecystitis: NO
- Bowel obstruction: NO
- Renal colic: NO
- Pre-existing pain: NO
- No previous surgery: NO
- Not taking drugs: NO

**EXAMINATION**

**CLINICIAN'S PREDICTION**: APPX-DELIE ERROR

**INVESTIGATIONS**: URINE ANALYSIS

**INITIAL PLAN - A&E**: PLAIN X RAY

**COMPUTER PREDICTION**

- Appendicitis: 0%
- Diverticular dis: 0%
- Perforated ulcer: 0%
- Non-specific pain: 0%
- Cholecystitis: 0%
- Bowel obstruction: 0%
- Renal colic: 0%
- Dyspepsia: 0%

In a practical experiment, the system was given the symptoms of an acute abdominal condition which is moderately common and whose symptoms, having suffered from themselves, I was easily able to describe. First I was questioned about the symptoms I was suffering on the basis of the pre-formatted questionnaire. Once completed, the data from the form we key into the Pet — obviously, no examination took place, which is why that entry is blank. The Pet then displays the top four lines of the second printout. This requires input by the clinician.

One of the fundamental principles of the program's construction — as its title makes clear — is that the system is in no way to be used as a substitute for diagnosis. It is merely a diagnostic aid. In order to arrive at the computer's analysis, the clinician is obliged to fill in both his own prediction, the investigations he proposes to make, and his proposed plan of action. Only then will the computer divulge its analysis. This is absolutely vital — not only in order to assure responsible working practice, but also to put on record the fact that the human diagnosis is the final one.

**Error of judgement**

As may be seen, the clinician’s prediction — a deliberate error — was that the symptoms I described amounted to a case of appendicitis. But the computer correctly assigns an almost 100 percent probability to renal colic. The computer — unlike the junior houseman who finally admitted me, having written “suspected pethidine addict” on my notes is not prejudiced by any notions derived from the novels of Mr William Burroughs.

De Dombal is insistent that his system be used only as a diagnostic aid and feels that a great deal of harm was done in the 1950s by computer people who predicted that the doctor was on the way out. Their stated objective, he remembers, was “to get the computer and the patient together and hook the doctor in there somewhere", by creating a rule-based system capable of general diagnosis.

De Dombal feels this is an astonishing misunderstanding both of the role of doctors and the use of computers. Why did he start on this hard road, back in 1969? “I guess like everyone else I had the impression that computers would save me time and effort. And of course they did not.”

In fact, the tendency of the work De Dombal has been doing for the past six years is to do away with the computer altogether. The useful work was that of preparing to use the computer, in the sense of reducing the terminology to a repeatable and reliable system which will be rapidly comprehensible. That work is now being made available to many doctors worldwide who are members of the
Where the Action is...

ACTION FILE is a complete software system — simple to install, simple to use and lets you get on with the business of running your business. ACTION FILE is a very flexible system, easily tailored to meet your specific needs (we have a Bespoke Systems Division) which frees you from the restrictions imposed by other software systems.

The four ACTION FILE modules — payroll, bill of materials, accounts and stock control — are available individually or as an integrated package. The payroll program allows you to make pay adjustments and speeds up weekly, fortnightly or monthly payrolls. The bill of materials module breaks down manufactured products to assemblies of any level and improves efficiency with defined production plans for up to 26 periods. The accounts systems run sales, purchase and nominal ledgers, and have the additional facility of a double entry transaction system with audit trail. The stock control program provides detailed product descriptions, and can be locked into the accounting system to produce invoices, delivery notes and addresses.

ACTION FILE as an integrated system vastly improves the efficiency of your business. For example, when an invoice is printed, the ACTION FILE will automatically adjust the stock figures and update the sales and nominal ledger for you. It's as simple as that!

ACTION FILE applications include the service station package which meets all the requirements for the management of a garage chain, and links a shift card system with standard accounting programs. The estate agents system which provides full administration facilities and the rapid matching of applicants with registered properties.

ACTION FILE is available to run with Superbrain, LS1 M3, North Star Advantage, Comart, Casu, RML 380Z and most CP/M systems. It is also available on the 16 bit SIRIUS.

To find out where the Action is, contact:

Sales Office: Action File Ltd., 19 Alexandra Parade, Weston-Super-Mare, Avon, BS23 1QT. Tel. (0934) 24947

Distribution: The Micro Solution Ltd., Park Farm House, Heythrop, Chipping Norton, Oxfordshire, OX7 5TW. Telephone (0608) 41197

Circle No. 193

PRACTICAL COMPUTING September 1982
Dombal found that with its aid, the rate of correct diagnosis moved from 42 percent to 91 percent — more accurate even than the most senior clinicians, whose accuracy is stated to be 81 percent. A further trial showed that when the diagnostic tool was withdrawn, the diagnostic accuracy of clinicians declined.

Computerised hospitals

The long haul is beginning to pay off for De Dombal. His system is shortly to be installed in 10 hospitals in Britain, supported partly by the National Health Service but mostly by the enthusiasm of other doctors who have heard of it and want to participate. The area of application is still acute abdomen, though work has been done in other medical areas, using the same computer methodology. At Leeds there are programs in gastroenteral bleeding, acute chest pain, gastric dyspepsia and gynaecology.

De Dombal is a full-time clinician running a department himself so there are limits to what he can take on: "We have just about run out of areas to cover — not because we cannot think of anything else but because within the confines of this small group we have four areas to cover and that is a full-time job. But other people are looking at head injury, jaundice, back pain and rheumatology, so it looks as though there are other areas which are amenable to this approach.

"By and large this sort of methodology is useful where there is a well-defined end point. You know you are right if you take out an appendix and it is black and within 12 hours the patient gets better. That is not a matter of semantics; you know objectively you were right." He says there are four criteria in determining whether the methodology he has adopted will be useful. Firstly, the endpoint must arrive quickly — you must be able to tell, soon, whether the decision was right.

"Secondly, you must know whether you are right or wrong on objective grounds — as in the removal of an obviously infected appendix. Thirdly, that there be a relatively small number of common diseases. Bayesian analysis becomes unwieldy when there are more than about a dozen common causes among which the computer must decide.

Fourthly, the diagnosis must be difficult — there is clearly no point in the computer undertaking something which human beings already do superbly well.

"Every mistake which the junior doctor might make which is corrected by the computer is one that I have made myself. I hope that I have learned from my mistakes, but it has taken me 10 years. It is all very well to say that you should learn from your mistakes but it is really a very extravagant way of learning, because each new patient does not regard himself as a new teaching module."
NOTHING BEATS EXPERIENCE

SWTP computer systems distributors all have specialised fields. Chances are there's one specialising in your very line of business. Combine his experience with your business needs and arrive quickly at your optimum system.

What a relief from those who baffle you with computer jargon but can't speak your language.

Meet some of our specialists.....
Task offers a range of application packages for Leasing companies, Life Insurance Intermediaries and companies, Insurance brokers, Solicitors and Professional Accountants. In 1981 a Task system was selected after extensive bench testing against two mini computers for the prestigious contract to instal the first ever computer system on the Floor at Lloyds of London. Task now employ 21 people including a team of in-house trained programmers.

Peter Tarrant
TASK Business Systems,
16 West Street, Dorking,
Surrey RH4 1BL.
Tel: 0306-880818

Abies Informatics is one of the leading suppliers of systems for General Practitioners. The Abies system covers repeat prescriptions, Age/Sex Register and Patient Questionnaires. It is a vital tool for the delivery of medical care in that it aids the identification and recall of 'at risk' groups and keeps tabs on patients with chronic illnesses and disabilities. Service includes a comprehensive programme of training and advice and a telephone 'hot line' to help out with queries.

Tim Benson
Abies Informatics,
10 Barley Mow Passage,
London W4 4PH.
Tel: 01-994 6477

Plant Hire companies are provided with the means to quicker, easier, more accurate documentation with management information on specific line usage and profit contribution. Functions covered are invoicing, sales ledger, purchase ledger, tool identification and location, maintenance scheduling, use and servicing (including costs) and history.

A. Alexander
Harris Baldry Consultants Ltd.,
101A Clapham High Street,
London SW4 7TB.
Tel: 01-622 2445

B.O.M.P. (Bill of Material Processor) is a sophisticated and general purpose tool to form the heart of any production control system. It allows the construction of a parts file and bills of material. The part file record format is flexible and can be amended to the users requirements. Reports available from the system include Multi-level indented explosion with or without prices, Multi-level where-used report, Stock valuation, Gross requirements, Cost change audit list and list parts file.

John McEvoy
Computer House (Turnkey),
172 New Bridge Street,
Newcastle-Upon-Tyne.
Tel: (0632) 617001/321335

Designed and developed specifically to serve the needs of the building and construction industries, the program package, called the Franklin Builders System after its producer, builder Brian Franklin, has already proved itself in use for more than five years. Programs cover integrated payroll, purchase ledger and job costing. Information once input is automatically posted to the relevant ledgers. Purchase invoices, for example, update purchase and cost-ledgers, preventing errors and saving time.

Brian Franklin
AMICRO, 158 Hanworth Road,
Hounslow TW3 3TR.
Tel: 01-570 0864

Roger Sherrin MBE
Systems Selection, 46 Girwood Road,
London SW18.
Tel: 01-789 6939

Software devoted to personnel record processing and personnel recruitment, assessment and development. Studies include job environment, achievement of objectives, use of human, material and financial resources, verbal and written communications, personnel relationships at work and adaptability and reactions to change. A questionnaire has been devised which produces a 7 page report covering 21 different personnel characteristics.

D. Stephens
Douglas Stephens Associates Ltd,
12A Stortford Road, Great Dunmow,
Essex.
Tel: 0371-3639
The computer system for dairies, launched in 1978 by C.M. Computer Systems Ltd., has now established itself as one of the best selling dairy systems in the U.K. The system not only carries out all office accounting procedures, but also creates a detailed roundsman book and a unique receipt printout facility. The system suits dairies with as few as 4,000 customers or as many as 650,000.

Chris Wright
C.M. Computer Systems Ltd.,
57A New Road, Chippenham,
Wilts SN15 1ES.
Tel: (0249) 51341/50262

City-based and linked with a large firm of Auditors, Beyts Logic is supplying Multi-User SWTPc systems with packages for ledgers, stock control, order monitor and invoicing and specialising in the Wholesale Cash and Carry markets. In designing this system, recognition was given to the specific requirements of wholesalers with regard to stock control for both sales and buying departments, for the transport manager, credit control manager and for generating managerial returns.

Mike Anderson
Beyts Logic Ltd., 9th Floor,
Lee House, London Wall,
London EC2Y 5AX.
Tel: 01-588 4100

STRIX is a package which enables anyone to create, update and amend files of all kinds of text and to retrieve any item instantly using simple words or word prefixes. It is designed for the SWTPc/S/09 computer which provides powerful computing facilities at low cost, thus bringing a sophisticated information retrieval system within the reach of thousands of small businesses, libraries and research laboratories.

Art Martin
Delta Design & Graphics Ltd.,
177 Gordon Avenue, Camberley,
Surrey.
Tel: 0276-683515

The Imtec System 016 is a microfilm based retrieval system which combines a single microfilm reader/printer with a sophisticated computer to allow retrieval of microfilmed document within seconds by computer controlled page search. Computer indexing of information from every document microfilmed enables selection of documents carrying relevant information to be selected from hundreds of thousands stored in cartridges within arms reach.

John Brown
Imtec Equipment Ltd.,
170 Honeypot Lane, Stanmore,
Middlesex HA7 1LB.
Tel: 01-204 8355

Configurations from £4,000 to £40,000. Up to 12 Terminals. 760K to 160 MByte Disk Storage. 20MByte Tape Streamer. 64K to 784K Memory. Languages: ‘C; BASIC, Fortran, Pascal, Pilot, Forth, SAGE plus various Database Managers with Report Generators.

Operating Systems: UniFLEX, FLEX, CP/M.


Southwest Technical Products
(Computers) Co. Ltd.,
12 Tresham Road,
Orton Southgate, Peterborough,
Cambridgeshire PE2 0SG.
Tel: (0733) 234433 Telex: 32600
You'll be glad you chose a personal computer with power enough to grow with your needs.

The ICL Personal Computer

Choosing the wrong personal computer can work out very costly, because though they grow to meet your needs, they just don't grow enough.

The new ICL Personal Computer gives you more.

It's a versatile, professional personal computer. It can start with a single Visual Display Unit, naturally, and it has a wide range of functions to meet your increasing requirements.

And it can grow larger than most other personal computer systems, because its capacity for additional hardware is greater.

Starting at £2,895 with one VDU and printer.

The ICL Personal Computer provides a range of options enabling you to have a system tailored to meet your changing needs.

For example, by adding a fixed-disc, you can have eight times the original storage capacity, and support up to 4 VDUs. And there is an extensive range of Personal Computer hardware.

Wide range of application software available, providing limitless possibilities.

So your secretary can do her word processing, you can do your forecasts, and your accountant can do the invoicing, all at the same time.

That's what makes the ICL Personal Computer more than just a personal computer.

And because ICL is Europe's leading computer company, with thousands of satisfied users in over 80 countries worldwide, we can offer ICL Trader Point service back-up that's second to none.

What more could you ask for, apart from a demonstration?

To: ICL Trader Point, ICL House, Putney, London SW15 1SW.
Please send me further information on the new ICL Personal Computer.

Name

Company Name & Address

Telephone

Type of Business

PRACTICAL COMPUTING September 1982
A SIMPLE TECHNIQUE was described in March’s Practical Computing, for generating vast game structures, such as mazes, in computers with limited memory capacity. However, the technique has a drawback when playing games in which objects have to be moved around, because the objects generated as part of the structure are fixed within it. The earlier article suggested that this drawback could be overcome and here is a method of moving the objects around.

The method makes use of hash coding, a technique which provides a means of speedily storing and retrieving entries in a large table of data or in records held in a disc file. A portion of the data to be stored, known as a key, is used to determine the address at which the data will be stored rather than storing it sequentially.

Hashing keys

As an example of a key consider a file whose records each contain a name and address. A suitable key for hashing might be formed from the first four letters of the name together with the first four letters of the town in the postal address.

When a program attempts to recall particular data, having been given a key, it computes from the key the address at which the data should be stored. It then examines that to determine whether data is in fact present instead of having to search the entire table or file. In games programs, whenever an object is removed from any location it is recorded by its co-ordinates x, y and z, and then moved by a code number or letters. Additional information known as the status of the object and data for objects which have been deposited at locations away from where they were originally generated is also recorded. The status of Removed and Deposited is denoted by the values -1 and +1 respectively. Each record is therefore an entry in a table with the headings: Location Co-ordinates x, y and z; Object Code; Object Status.

Time consuming

The simplest way to build up this table would be to put entries into it sequentially from the start, maintaining a count of the number of entries so far. Major disadvantages occur in this scheme whenever the player moves to a new location. The whole table may have to be checked to see whether any objects have been removed from this location or dropped here. As the game proceeds and more and more objects are displaced this checking grows more time-consuming and the game soon becomes tedious.

Instead a method is needed of putting entries into the table so that the time taken to find all entries for a given location is short and also independent of both the location and the total number of (continued on page 129)
Today MicroModeller is used for the planning and control of financial and other operations of over 2,500 organisations in the UK. Our clients include many Times Top 1000 companies, banks and financial institutions as well as smaller businesses.

MicroModeller is available on the following micro computers:
- ADDS Multivision
- Apple II & III
- Altos
- Cifer 2684
- Commodore 8032 & 8096
- Dynabase
- Hewlett Packard HP125 & 87
- Memory 7000
- Xerox 820
- TA Alphatronic
- NEC PC8000
- National Panasonic
- Pericom
- Rair Black Box
- Sirius
- Superbrain
- Wang Writer
- South West S09
- IBM PC
- Digico Prince
- Hytec 4500
- Future Technology 88

Our range of software products now includes the following:
- Decision Modeller
- Strategic Financial Planning Tool.
- Micro Link Line
  Communicates with main frame computers or bureaux.
- Micro Graph Power
  Produces high resolution, colour business graphics on a plotter.

Our clients also have the benefits of Intelligence (UK) Customer Services, providing support and assistance in the use of our software. These services include:
- Telephone Hotline
- Training
- Consultancy
- User Magazine
- User Groups

Further information and enquiries to:
Sales Director
Intelligence (UK) Limited
30 Lingfield Road
London SW19 4PQ
Telephone 01-947 9846
Telex CALLING 444423

Circle No. 198
displaced objects. These ideals are approached by the hash coding method. In order to work efficiently the hash-coded addresses of entries in the table must be distributed randomly across the table but must be repeatable for any given location. This property is reminiscent of the very function used in generating the game structure itself. Indeed the generating function W can, with a simple modification, be used as the hashing function. As W has to be computed for the location when the player arrives there, very little extra computation is needed to get the hash-coded address in the table for that location. W is obtained with the subroutine.

9000 \( U = 100 \times \text{SQRT}(X \times X + Y \times Y \times Z) \)
9010 \( W = U - \text{INT}(U) \)
9020 RETURN

which always returns a floating-point value in the range 0 <= W < 1

An extension of this range to span the table is now required, that is to map on to the range from 0 to L where L is the length of the table less one, or the maximum number of entries it could hold less one. This mapping is achieved simply by multiplying W by L: the hash-coded address in the table for a given location is just

\[ H = W \times L. \]

Avoid collision

The remaining question is whether two different locations can produce the same value for H. In general, unfortunately, they can and do. The phenomenon in which two or more keys produce the same hash code is termed a "collision", and most of the programming involved in hashing is concerned with handling collisions. There are several approaches in use for handling them but only one is described here.

The first entry in the table can be stored without fear of a collision at the hash-coded address, its home address. If another entry has the same code it obviously cannot be put in the same place. However, the entry which is there already must be marked in some way to show that there is at least one other entry for this address. A way of doing that is to put another column in the table, headed "pointer to next entry in chain", and to set up chains of entries from each home address. The new entry which has collided is tabulated in the next free, or empty, row following the collision point and the earlier entry points to this new entry, thus extending a chain.

The end of a chain will have a pointer value which cannot be an address in the table; -1 will do. Figure 1 shows a hash chain of three entries in a table which so far has five entries labelled A to E, inserted in alphabetical order. The chain

![Image](listing continued from page 127)

then
Return (end of chain)
end if
Row no = pointer column (row no)
end loop

Basic:

4100 \( R = W \times L \)
4110 IF \( OC(R) = -1 \) OR \( OX(R) \neq X \) OR \( OY(R) \neq Y \) OR \( OZ(R) \neq Z \)
THEN 4170
4120 ) Statements to act on object found (e.g. report it)
4170 IF \( OP(R) = 0 \) THEN \( R = OP(R) \) \# Go to 4110
4180 RETURN

Listing 4. Subroutine: Add object to table.

Outputs: Entry row no ( = -1 if not possible to add object),
previous row no in chain ( = -1 if none), table.

NB: There are four possibilities:
1) The home location is free, so add there (gives previous row no = -1).
2) There is a free entry later in the chain, so add there.
3) There is a free entry elsewhere in the table, so use that
and extend the chain (staying close to home if possible).
4) There is no room in the table (gives entry row no = -1).

Pseudo-code:

Row no = W \times L
Entry row no = -1
Previous row no in chain = -1
Row no before home = row no - 1
Row no after home = row no + 1
Loop:
If code column (row no) = -1
then
If pointer column (row no) = -2
then (case (1) or (2))
pointer column (row no) = -1
end if
Go to Put object
end if
If pointer column (row no) \neq -1
then
Previous row no in chain = row no
Row no = pointer column (row no)
Go to Loop
end if
End of chain = row no
If row no < L
then
For row no = row no after home to L
If code column (row no) = -1
and pointer column (row no) = -2
(i.e. not in another chain)
then
Go to Extend chain
end if
next row no
end if
If row no before home \neq 0
then
For row no = 0 to row no before home
If code column (row no) = -1
and pointer column (row no) = -2
then
Go to Extend chain
end if
next row no
end if
Print 'Table full'
Return (object not added)

Extend chain:
Previous row no in chain = end of chain
Pointer column (end of chain) = row no
Pointer column (row no) = -1
Put object:
Code column (row no) = object code
Status column (row no) = object status

(listing continued on next page)
(continued from previous page)

links entries A, C and E which all have the same hash code, that is the same home address.

A new entry may collide with any previous entry, not just with those which are at their home addresses. In such a case again simply put the new entry on the end of the chain and make the former end-of-chain entry point to it.

Empty entries

However, this second type of collision makes it necessary to exercise caution if deleting entries from the table, because the chain must always be preserved through a deleted entry unless it is at the end of a chain. It makes it necessary to distinguish between free, or empty, entries which are not on any chain and those which are free and therefore available for reuse but are nevertheless still part of a chain. In order to make such distinctions the following conventional values will be used for certain fields in an entry.

Object code = -1 means the entry is free for reuse.

Pointer = -1 means the entry is the last of a chain.

Pointer = -2 means the entry is not in any chain.

To determine whether there is an entry in the table for a given location x,y,z, it is necessary to check all entries on the chain which starts at the home address in the table for that location. Provided that the hashing function is sufficiently random to produce a good spread of codes across the table, so that collisions are minimized, checking is much faster than scanning the whole table.

Listing 1 is a routine to set up the table of displaced objects in the initialising section of a main program. The other four listings show subroutines to manipulate the table for game purposes.

Pseudo-code

Each listing is presented in two versions. The first version of each is written in a general pseudo-code to show the detailed working of the routine and to permit adaptation to any programming system. The second version is a translation of the pseudo-code into Tandy Level II Basic to show how compact the programming can be. Some structure has been sacrificed from the pseudo-code and some conciseness from the Basic so that the relationship between the two versions of each routine may be seen more clearly.

The Basic versions have been used in an extended version of the Mammoth Maze program published in March's Practical Computing, running on a 16K Level II TRS-80. The method works quite effectively in such a system. The full program includes other extensions such as perspective-graphical views of locations and objects and the generation of names for the locations, all still within 10K of Basic.

<table>
<thead>
<tr>
<th>Address</th>
<th>Location</th>
<th>Object code</th>
<th>Object status</th>
<th>Pointer to next entry in chain</th>
<th>Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>302</td>
<td>3</td>
<td>-1</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>678</td>
<td>7</td>
<td>-1</td>
<td>6</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>679</td>
<td>3</td>
<td>1</td>
<td>-1</td>
<td>B</td>
</tr>
<tr>
<td>5</td>
<td>436</td>
<td>4</td>
<td>-1</td>
<td>-1</td>
<td>E</td>
</tr>
<tr>
<td>6</td>
<td>498</td>
<td>4</td>
<td>1</td>
<td>-1</td>
<td>D</td>
</tr>
</tbody>
</table>

Figure 1. A hash chain in a table of displaced objects.

(Listing continued from previous page)

```
1000 R = W * L : ER = -1 : PR = -1 : BH = R = 1 : AH = R + 1
5100 IF O(R) >= 0 THEN 5040
5200 IF O(R) = -2 THEN OP(R) = -1
5300 O(R) = 0 : ST : OX(R)=X : OY(R)=Y : OZ(R)=Z : ER=ER+1
5400 IF OP(R) = -1 THEN PR=R : R=OP(R) : GO TO 5100
5500 IF EC=R
5600 IF R >= 0 THEN 5100
5700 FOR R = AH TO L
5800 IF O(R) = -1 AND OP(R) = -2 THEN 5150
5900 NEXT R
5100 IF BH < 0 THEN 5140
5110 FOR R = 0 TO BH
5120 IF O(R) = -1 AND OP(R) = -2 THEN 5150
5130 NEXT R
5140 PRINT 'TABLE FULL': RETURN
5150 IF OP(EC) = R : OP(R) = -1 : PR = EC : GO TO 5200

Listing 5. Subroutine: Delete object from

Used if an object is deposited at a location (X, Y, Z) from which an identical object has been removed earlier. Depends on the subroutine 'Find object' (Listings 2) having been called first to set the required input parameters.

Inputs: Entry row no, previous row no in chain, table.
Outputs: Table.

NB! There are four possibilities:

(1) Entry is in home position with no chain (previous row no = -1, pointer column (entry row no) = -1).
(2) Entry is in home position and there is a chain (previous row no = -1, pointer column (entry row no) >= 0).
(3) Entry is not in home position but is at end of chain (previous row no >= 0, pointer column (entry row no) = -1).
(4) Entry is not at home position nor at end of chain (previous row no >= 0, pointer column (entry row no) >= 0).

Pseudo-code:

If previous row no in chain = -1 then
   ( case (1) or (2) )
   If pointer column (entry row no) = -1 then
      ( case (1) only : chain link must remain in case (2) )
      Pointer column (entry row no) = -2
   end if
else
   ( case (3) or (4) )
   If pointer column (entry row no) = -1 then
      ( case (3) only )
      Pointer column (previous row no in chain) = -1
      Pointer column (entry row no) = -2
   end if
end if

Code column (entry row no) = -1 (entry row free)

Return

Basic:

5300 IF PR >= 0 THEN 5330
5310 IF OP(R) = -1 THEN OP(R) = -2
5320 DC(R) = -1 : RETURN
5330 IF OP(R) = -1 THEN OP(PR) = -1 : OP(PR) = -2
5340 DC(R) = -1 : RETURN
```

PRACTICAL COMPUTING September 1982
£995 - one off

Dealer discounts available

British designed and built. The Data Dynamics 1303 120 character-per-second printer with lots of features. Stout attractive metal case with integral paper storage.

Data Dynamics Ltd.

Head Office:
Data House Clayton Road
Hayes Middx. UB3 1BD
Tel: 01-848 9781 Tlx: 938429

Manchester Office:
320 Mosley Road Levenshulme
Manchester M19 2LM
Tel: 061-224 3306/7

• Circle No. 199
THE GALAXY 1 COMPUTER

The cost effective solution to your computer needs for only £1,450*

The Galaxy 1 desk top computer system can be used in education, small business applications, word processing, stock control and a host of other environments. Our choice of CP/M as the operating system means that our customers can select a suitable application package from the widest possible range.

However, unlike our competitors, we supply not only the hardware but all the essential system software needed to start using the Galaxy 1 as soon as it is installed. We have adopted COMAL-80 as our standard language. This structured basic is rapidly gaining widespread acceptance and popularity especially in the education market, offering much greater flexibility and ease of use than existing Basics. We also supply a very powerful Z80 assembler/editor called GEM ZAP with GEM PEN, a compact but very powerful word processing package. The system software suite is completed with GEM DEBUG, a useful machine code program de-bugging utility.

Modular design means reliability and ease of maintenance. Unlike many other manufacturers Gemini offer a full one year warranty (except Disc heads which are guaranteed for 3 months). Our distributors carry a full range of replacement boards thereby facilitating a quick, efficient and cost effective back up customer service.

Features include:
- Twin Z80 Processors
- 64K Dynamic RAM
- 800 K Disc Based Storage
- 80 x 25 Screen Format
- Dual Printer Interfaces
- Modular Design
- CP/M 2.2 Operating system
- COMAL-80 – Structured Basic
- Z80 Editor/Assembler
- Text Editor & Formatter
- Program De-Bugging Utility

Telephone Amersham 28321 for the name and address of your nearest distributor.

* Dealer enquiries invited.

Gemini Microcomputers
Oakfield Corner, Sycamore Road, Amersham, Bucks HP6 5EO.

*Price is exclusive of VAT and is for computer & keyboard only—video monitor & printer extra.

British made

PRACTICAL COMPUTING September 1982
Open File

This regular section of Practical Computing appears in the magazine each month, incorporating Tandy Forum, Apple Pie, ZX-80/81 Line-up and the other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

Each month the best contribution will be awarded £20; others receive £6. Send contributions to: Open File, Practical Computing, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Guidelines for contributors
Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous, and explain characters, in particular, should be explained.

We can accept material for the Pet, Vic and Sharp MZ-80K on cassette, and material for the larger machines can be sent on IBM-format 8in. floppy discs.

I found it awkward to keep counting the number of characters so that words didn’t wrap round the screen, writes M J Parrott of Stockport, Cheshire. It occurred to me that a simple text-editing program which could take in text willy-nilly and then convert it to lines of Basic, correctly formatted for the screen, would be a most useful utility. I envisaged the utility constructing the Basic at an arbitrary starting line number, since Renumber could be used for merging it into the host program at the appropriate point.

The utility written to perform this task resides at $4000 to $4188 inclusive and is in two main parts, the first dealing with the intake of text.

A buffer is created by zeroing all bytes from $5000 to $8000 plus one page, to make sure that there will be zero bytes at the end of the text since this is how the second part of the program detects the end of the text. A character is then got from the keyboard and checked. If it is not a control character and is printable on the screen it is put into the buffer and printed on the screen. A double quote is replaced by a single quote, which is what will appear on the screen.

If the character is not a printable one it is checked to see if it is one of the two allowable control characters. If it is either of these, the program loops back for another character. The two allowable characters are Ctrl-L, which forces a line feed, and Ctrl-E, which allows you to quit the inputting part of the program. Return is not allowed.

To use the text inputting part of the program you type in the text without worrying about line breaks — just let words wrap round the screen. If you have input enough text to fill the buffer a bell (continued on page 135)
THE EUROPEAN

COMPUTER TRADE FORUM

Helping you make money, not mistakes

You could be a distributor, a dealer, a software house, a systems integrator, a sales and service company, a retailer—even a DP man about to go into business on your own. You could know the DP/WP business backwards, or you could be coming into the ring for the first time.

But whatever your status, if you owe your livelihood to buying and reselling computers, software or peripherals, you owe it to yourself to visit ECTF at the NEC this Autumn.

ECTF means business

Because it has been specially created for you, it's the computer industry's own trade show. It has been designed to provide you with a wider range of real business opportunities—together under one roof.

ECTF is there to help you plan the most profitable product line, to get the best hardware and software and to negotiate the most advantageous trade deals. Quite simply, your visit could be crucial to your future business success.

Seeing, hearing...and comparing

Wang, DEC, Sony, Olivetti, ICL, Hewlett-Packard, Toshiba—a host of household names will be there, plus many names you may not know: new companies in the market with new products that could be next year's big money makers.

They all need to meet you. They'll want to talk trade terms, marketing support, dealerships, discounts—and how their products can mean bigger profits for you.

And you need to meet them to see, discuss and compare the whole spectrum of WP and DP products. In fact that's the key to ECTF. By knowing what's available, you'll be in a better position to make money...and avoid mistakes.

For trade and trade alone

The general public are not invited to ECTF. The emphasis is on business. And for you it's free.

It takes place at the National Exhibition Centre Birmingham, easily reached by car or train. It will be open for just four days—28 September to 1 October. Fill in the coupon and send it to ECTF, 232 Acton Lane, London W4 5DL—or telephone 01-747 3131 and we'll mail you FREE tickets for you and your business colleagues.

PLEASE FILL OUT AND USE CAPITAL LETTERS

| I Please send me Free Entrance Tickets for my colleagues and myself. |
| Name: |
| Company: |
| Address: |
| Telephone: | Telex: |

(No one under 18 will be admitted)

I would like to receive information on exhibiting at ECTF. Phone me on...

PRACTICAL COMPUTING September 1982
(continued from page 133)

sounds and the second part of the program will begin. The message Now Coding then appears briefly on the screen.

The input part of the program allows you to correct mistakes by using the Backspace key. Just go back to the error and change it. The Backspace mode will work so that you can move to another part of the screen, but you cannot correct text by going to it with this mode. You must use the Backspace key.

On entering the second part of the program various pointers and flags are initialised before the coding itself begins. A pointer, Buf, is kept to the present position in the buffer, and the first character to it, Bas, which corresponds to the pointer Buf are transferred to lower down in memory where the Basic program is being constructed, at $801 upwards. While being transferred, the most-significant bit of each character is set low since this is how Applesoft stores its lines of text. The text in the Basic area of memory is moved by keeping a pointer to it, Bas, which corresponds to the pointer Buf.

The byte down in the Basic area corresponding to that first found blank or CR character is filled with a line feed value $5D. The buffer and Basic pointers are then updated, and a JMP is made back to look at the first character to see if it is zero.

While bytes are being transferred from the buffer down to the Basic area of memory they are checked to see if any correspond to line-feed characters. If so, the rest of the bytes between there and the pointer are moved down, but the pointers Bas and Buf are then updated to this point rather than to the full number of characters on.

A line of Basic is completed by putting in a quote, ASCII $22, followed by a zero byte and updating the Basic pointer to the start of text searching.

Pointers Buf and Bas are then updated to their lines of text. The text in the Basic area corresponding to that first found blank or CR character is filled with a line feed value $D. The buffer and Basic pointers are then updated, and a JMP is made back to look at the first character to see if it is zero.

Lower down in memory where the Basic program is being constructed, at $801 upwards. While being transferred, the most-significant bit of each character is set low since this is how Applesoft stores its lines of text. The text in the Basic area of memory is moved by keeping a pointer to it, Bas, which corresponds to the pointer Buf are transferred to lower down in memory where the Basic program is being constructed, at $801 upwards. While being transferred, the most-significant bit of each character is set low since this is how Applesoft stores its lines of text. The text in the Basic area of memory is moved by keeping a pointer to it, Bas, which corresponds to the pointer Buf.

The byte down in the Basic area corresponding to that first found blank or CR character is filled with a line feed value $5D. The buffer and Basic pointers are then updated, and a JMP is made back to look at the first character to see if it is zero.

While bytes are being transferred from the buffer down to the Basic area of memory they are checked to see if any correspond to line-feed characters. If so, the rest of the bytes between there and the pointer are moved down, but the pointers Bas and Buf are then updated to this point rather than to the full number of characters on.

A line of Basic is completed by putting in a quote, ASCII $22, followed by a zero byte and updating the Basic pointer to the start of text searching. The text in the Basic area corresponding to that first found blank or CR character is filled with a line feed value $D. The buffer and Basic pointers are then updated, and a JMP is made back to look at the first character to see if it is zero.

If the line of the text is signed, zero bytes are stored in what would have been the position of the next link address, and the end of Basic program pointers $AF and $B0 are set to just past the point. Two bytes from the top of the stack are discarded, since the final route called does not return, the screen is cleared, and the Basic program now in memory is Run. From this point on you can do what you like with the newly constructed program: add lines to it, delete lines from it, or Save it to disc for use by Renumber.

The Basic program so constructed can have more lines of screen text than can fit on the screen. Lines such as

20 PRINT "PRESS SPACE BAR TO CONTINUE":GET $T

are not incorporated by the program since their format, and whether or not they will be in a subroutine, depends on several factors.

(continued on next page)
Effects.

confesses R A Sparkes of Glasgow. The

of the Sin and Cos functions to radians,

(continued from previous page)

X = 140 + R*COS(THETA)

NEXT THETA

FOR T =

NEXT

IF Y>191 THEN 150

HPLOT TO X,Y

150

FOR T =

NEXT THETA

FOR T =
In fact it leads to many others! Joining the amazing success of our PAL Encoder Card, these four new expander cards all featuring the unique 'Digitek Safety Tab' are ready to plug straight into your Apple Computer.

**Pal Colour Encoder Card £105** This amazing card with its on-board modulator, displays exceptional colour graphics to your TV.

**16k Ramcard £91** Insert the card straight into slot 0, and increase the memory capability of your Apple without having to remove any memory chips.

**Z80 Expansion Card £110** Installing the Z80 into your Apple gives you two systems in one, which enables you to run the popular CP/M operating system.

**RS232 High Speed Serial Interface £72** The RS232 Interface Card incorporates 13 selectable baud rates from 75 to 19,200.

**Print-master Interface £79** The ultimate parallel interface for Apple to all popular dot matrix printers. The PRINT-MASTER accepts Apple protocols, 15+ software commands and has on-board graphics dump capability to all popular graphics printers. No need to load clumsy software routines - it's all at your fingertips on the PRINT-MASTER - choice of inverse printing, double size picture, 90° picture rotation, many word processor type text commands, plus many more.

Apple is the trademark of Apple Computers Inc

dicotek and Print-master are the trademarks of Digitek (International) Ltd

The people who are really into Apples.

DIGITEK

- Circle No. 202

**EXPANDER CARD SERIES**

Please send me

- Colour Encoder £105
- Ramcard £91
- Z80 £110
- RS232 £72
- Print-master £79

Further Information

I enclose my cheque for £ payable to Digitek International Ltd.

Add 16% VAT to all prices quoted.

Post and packaging FREE.

Telephone orders 0403 66550

My card

My number is 137

DIGITEK (INTERNATIONAL) LTD. 37C WEST STREET, HORSHAM, WEST SUSSEX RH12 1PP
5 1/4" WINCHESTER SUBSYSTEMS
FROM ICE

APPLE · SUPERBRAIN · IBM PERSONAL
S100 BUS & Z80-BASED MICROS

FROM 3 TO 42 MEGABYTE CONFIGURATIONS WITH TAPE STREAMER BACKUP
RETAIL PRICES FROM £1,350 . . . DEALER ENQUIRIES INVITED

THE State-of-the-Art Microcomputer
- 16 bit processor
- 128K RAM
- 2 x 600K disk store
- 800 x 400 pixel resolution graphics
- CP/M operating system

PLUS Extremely well-documented, user-friendly state-of-the-art application software
- ACT PULSAR accounting system
- Sapphire systems management accounting and reporting system
- Sorcim SUPERCALC
- Intelligence (UK) MICROMODELLER
- Micropro WORDSTAR

PLUS A range of high level languages, including Microsoft BASIC-86, Digital Research C-BASIC 86, Micro Focus Cis-COBOL etc, etc.

For more information on the ACT SIRIUS 1 or the above software packages please contact Dr. Gordon Relf at

DRAGON SYSTEMS LTD.
(0792) 474496
37 Walter Road, Swansea, West Glamorgan

PD4 digital
XY plotter

Standard specification includes:
- IEEE-488 AH1, L1, E1 Interface
- Full A4 format, 700 mm/s max. writing speed
- Suitable for direct connection to PET and many other computers
- Optional software including character generator available

Price including IEEE Interface £596 + VAT

J.J. LLOYD INSTRUMENTS LTD.
Brook Avenue, Warsash, Southampton, SO3 6HP.
England. Tel: Locks Heath 4221 (STD 048 95).
Telex: 477042 - JAY JAY - SOTON.
A picture may be worth a thousand words but it still tells only half the story about graphics on the 380Z.

For a start, our standard graphics functions include point plotting, line drawing, instant block fill, block copying, offsetting, and Exclusive Or Plotting.

Then there is the important fact that our Level 2 High Resolution Graphics is supported by Basic, Algol, and Fortran. And since it is contained in an additional 16K of RAM, every byte of user memory remains available for applications programs.

It is also worth noting that 380Z graphics are equally effective in monochrome — for 'colour' just read 'shades of grey.' Again there are 255 shades available, and there's also a very useful facility for fading up and down throughout the grey scale.

There are also the special effects — such as moving between graphics 'pages' for pseudo-animation, or the ability to produce 'instant' graphics by drawing them with the colour 'switched' off and then 'switching' on.

Next, not only can 380Z graphics pictures be saved on and retrieved from disc, they can also be output to one of a range of popular dot matrix printers.

Remember, too, that HRG is not a third-party add-on but designed, developed, and supported by Research Machines itself as an integral part of the 380Z.

And finally, we've now implemented GINO. So for the first time this well-established, professional suite of flexible, device-independent graphics software from the CAD Centre is available on a micro.

If you are interested in graphics — for scientific, technical, and industrial research; or in secondary or higher education; or for design, engineering, or control, then you will be interested in the 380Z.
S100 SYSTEMS
All systems based on the North Star Horizon.

MULTI-USER
Up to 7 users can be accommodated.

5¼ WINCHESTER DRIVES
21 Mb is now available on high speed drive S100 systems.
Drives also available for the Altos and N.E.C.

NEW MULTIPROCESSOR SYSTEMS
A new price breakthrough at £395.00 per board (Z80 64K R.T.C. 2 serial one parallel port).

APPLICATIONS SOFTWARE
We guarantee all our software and provide full support.

LOW COST S100 BOARDS
For graphics, memory and serial I/O.

WHY NOT TAKE THE ADVANTAGE...
The new exciting microcomputer in the North Star range. We have a good stock of C.P.U.s plus hardware and software.

PERIPHERALS
A comprehensive range of printers and V.D.U.s to cater for most needs including Epson, Televideo and N.E.C.

MAINTENANCE
A cost effective reliable service for the Business Microsystem—we make them work.

Head for the North Star, head for...

69 Loudoun Road • London NW8 0DQ
Telephone 01-328 8737/8
Telex 266828 HMS-G.
Time into words

THIS ROUTINE takes an input in figures, and determines whether it can be interpreted as a time in the 24-hour clock system. If so, it outputs the time in words.

The input can be from the keyboard, as in this version, or line 50040 can be changed so that the routine uses a value obtained from elsewhere, for example, from the real-time clock. The routine can be used in conjunction with a real-time Adventure, issuing warnings which may sound all the more sinister for being expressed in words.

By changing the data lines, 50250 to 50280, and the four syntax lines which define Words$, 50140 to 50170, you can make the routine produce times in French or any other language.

The routine has been written on a Sharp MZ-80B in Sharp Disc Basic, but it should be easily converted to other dialects. A problem may arise if it is used as a subroutine in a longer program which also contains Data statements.

Sharp Basic allows the use of Restore with a line number. Readers without this facility will have to ensure that there are no unused Data lines earlier in the program which will be read instead of the subroutine's data.

Long variable names have been used to minimise the chance of confusion with variables used in the main program:

VOC$ - The vocabulary array
FIGS - User's input
NUM$ - The input stripped of non-numeric characters
PAST$ - The words "past" or "to"
MINS - The words "minute" or "minutes"
WORDS - The sentence finally produced

**Sharp firmware. Listing 1.**

```basic
10 LIMIT 1999
20 GOSUB 10
30 USR(20000)
40 FOR X=20002 TO 24118
50 X%=X:20002:PRINT"X(X):":"A%=X:GOSUB16:PRINT"
60 B=FEEK(X):A%=X:GOSUB16:PRINT
70 B=FEEK(X):A%=X:GOSUB16:PRINT
80 FORH=20001TO20020:PERF:PRINT,H,NEXT:RETURN
90 DATA 197,213,229,33,0,0,17,54,76,1,0,16,237,160,234
100 44,79,225,209,135,201
110 6D:PRINT$A
120 IF I=1 TOA=V%:B%=R%-A%:INT(V%):IFR%THENR%+47
130 B%=B%:INT(V%):NEXT
140 FORI=A TO 1:STEP-1:PRINTB%=I:;NEXT:RETURN
```

**Listing 2.**

<table>
<thead>
<tr>
<th>DECIMAL ADDRESS</th>
<th>CONTENTS(DEC)</th>
<th>ASSEMBLY LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>20000</td>
<td>197</td>
<td>PUSH DC</td>
</tr>
<tr>
<td>20001</td>
<td>213</td>
<td>PUSH DC</td>
</tr>
<tr>
<td>20002</td>
<td>229</td>
<td>PUSH HL</td>
</tr>
<tr>
<td>20003</td>
<td>33</td>
<td>LD HL,0000</td>
</tr>
<tr>
<td>20004</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>20005</td>
<td>17</td>
<td>LDEE,46</td>
</tr>
<tr>
<td>20006</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>20007</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>20008</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>20009</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>20010</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>20011</td>
<td>237</td>
<td></td>
</tr>
<tr>
<td>20012</td>
<td>159</td>
<td></td>
</tr>
<tr>
<td>20013</td>
<td>234</td>
<td></td>
</tr>
<tr>
<td>20014</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>20015</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>20016</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>20017</td>
<td>209</td>
<td></td>
</tr>
<tr>
<td>20018</td>
<td>193</td>
<td></td>
</tr>
<tr>
<td>20019</td>
<td>201</td>
<td></td>
</tr>
</tbody>
</table>

**Open file: Z-80**
Ball-bearing maze.

The MZ-80 has a 40-by-25 line memory-mapped VDU, and the Poke address of the top, left-hand corner is 53248. The main features of the program are:

Lines 40-60 draws a border around the edge of the screen. Any characters may be used for the border, which is 40 characters wide at the top and has 3 lines between the left and right borders.

Lines 100-200 Pole on to the screen at a random position one of three sizes of circular "holes". Any character inside the border the ball do not allow it to appear in a hole. Lines 210-220 choose a random position for the ball. don't allow it to appear in a hole. Line 230 initialises real-time clock and the ball's velocity and acceleration. Lines 240 to 360 is the main program loop. For small angles of tilt from the horizontal, the ball's acceleration is proportional to the original speed, that is, the coefficient of restitution is 0.25.

Lines 1000-1100 print instructions and "Do you want to play?"

The main variables are:

A$ — input string
X — dummy variable
B — horizontal ball position
C — virtual ball position
d — horizontal ball acceleration
E — vertical ball acceleration
F — Poke position; also for the hole's position

The MZ-80 can produce a single user-defined character which could then be used anywhere on the screen. Any character can be created in a matter of seconds; just make a note of the numbers which the computer prints out besides the grid. In the program the rows are numbered from the bottom 1 to 8, so to define your character use CALL "DEFCCHAR", (ASCII value of your choice), ROWS, ROW 7, ROW 6, etc. (eg. line 460)

RML user characters.

The same procedure changing the following lines of the program:

4 FORX=20022 TO 33982
5 X1=X-15414:PRINT etc, as above

12 DATA 197,213,229,33,18,17,54,78,1,139,35,57,162,44,78,262,25,209,193,201

To make copies of the Basic tape turn the system off and then on again, and load Basic tape SP-5025. Replace the Basic tape with a blank tape and rewind to the beginning. Start the cassette recorder and type USR(33) in direct mode.

After Ready is displayed enter USR(36) while the record buttons are still engaged. Three minutes later, Ready is displayed. Press Stop, button and then Rewind. The Basic tape is now duplicated, and can be successfully used instead of the master tape.

The assembly language equivalent for the monitor dumping routine, Data statement 12, is shown in listing 2. Ball-bearing maze

This game for the Sharp MZ80K improves co-ordination, is simple and can be easily converted to other machines, write Richard Cotterill of Bury St Edmunds, Suffolk. It was inspired by the gimballed wooden tables which can be tilted by two controls to roll a ball bearing around a track.

RML user characters.

This program by Roger Moffatt of Belfast for the Research Machines 380-Z or 480-Z makes use of the new level 2 graphics support routines in BasicSG2. When run it displays an eight-by-eight grid on the screen with a small x in the lower, left-hand box. If the F key is pressed, the colour of the square is inverted — from black to white, or vice versa — and the x can be moved about the grid using the following keys:

A moves the x up,
V moves the x down,
D moves the x left,
G moves the x right.

In this way a character can be formed on the grid, and when you press Return the computer produces a single user-defined character which could then be used anywhere on the screen. Any character can be created in a matter of seconds; just make a note of the numbers which the computer prints out besides the grid.

In the program the rows are numbered from the bottom 1 to 8, so to define your character use CALL "DEFCCHAR", (ASCII value of your choice), ROWS, ROW 7, ROW 6, etc. (eg. line 460)

Horizontal velocity H — vertical velocity

Horizontal — vertical acceleration

Horizontal accelerations
The Tuscan S100 can read and write in 18 different disc formats including IBM, RML 380Z, and Superbrain, plus many more CP/M based machines. Now with optional IEEE interface and high definition colour graphics. The versatility of the S100 Bus and CP/M make an investment in Tuscan S100 an investment in the future.

Communication with minis and mainframes? - no problem! With four different communication options, Tuscan S100 looks and feels like an intelligent terminal.

Plotters and colour printers? - no problem! Tuscan S100 is just about the most versatile cost effective micro around. 5 or 8" hard or flexible, disc drives mean power at your fingertips. We go for capacity at low cost plus professional expertise. Send for our prices now - and a list of references. (Just in case you want to check our track record.)

Transam Microsystems Ltd.,
59/61 Theobalds Road,
London W.C.1.
Telephone 01-405 5240/2113
Interex

I HAVE AMASSED a large number of magazines such as Practical Computing, writes George Raven of Walton on Naze, Essex, and ever since I became the proud owner of a Pet I have been buying computer books and monthly magazines regularly. Matters reached a stage when I knew the program or routine I was looking for was in one of them but could not remember which, and had neither the time nor the inclination to go through them all to find it.

Interex can be used to index all the useful or interesting bits as you come to them in a way that would help you to recover them whenever you want to. Yet it can easily be adapted for use in other areas such as cookery or woodwork.

Interex was written on a 32K Pet with Basic 4 and uses 4040 disc drive and a 4022 printer. The routines should not be difficult to adapt to other machines if required. The program is quite simply an index of interesting subjects and works on a simple menu system. There are four selections

1. Enter name of index
2. Main classifications
3. Sub-classifications
4. Close index

Selection 1 uses a little routine which allows you to name the index the very first time you use it, and thereafter it tells you its name, waits and then returns to the menu. Selection 2 allows you to access the main classifications, add more and print a list of them in alphabetical order. Selection 3 gives access to the sub-classifications and enables you to print a list of entries under a particular main heading, and selection 4 closes down the system by use of SYS64790.

The main variables used are:

mm$ Main classifications
nm$ Sub-classifications
sd$ Provision for further detail
mg$ Name of magazine
y Year of publication
vv$ Volume or volume and issue
p Page number
nn Number of main classifications

Each of the 50 main classifications becomes the subject of a file which can (continued on page 149)
Buying your first Genie I microcomputer is just the start of a long and enthralling adventure, for it won’t be long before you will want to expand your system with some of the wide range of peripherals which make up the complete Genie System.

Firstly there is the **Expansion Box**, which immediately expands your Genie’s capacity to 32K RAM, and up to 48K RAM if required. It can be connected to 4 disk drives, a printer, RS232 interface or S100 cards.

Then there is the **Printer**, a compact unit with 80 column, 5 x 7 matrix print-out, which connects to your Genie through the Expander, or via the Parallel Printer Interface.

The **Disk Drive** gives you greater storage capacity and full random access file handling, with the option of double-density through a special adapter. New Dual Disk Drive now available!

Finally, there is Genie’s very own **12" Monitor**, a must if you want to let the rest of the family watch their T.V. in peace!

Available in B & W or green tube.

The supreme advantage of the Genie I system is its compatibility with the TRS 80, which means that literally 1000’s of pre-recorded programs are already available, just waiting to be plugged into your Genie!

The recent improvements in the Genie system, including Extended Basic, sound unit and machine language monitor, make it the ideal system for the committed hobbyist, and an excellent and easy-to-use educational tool.

**SPECIAL TECHNICAL GENIE HOT-LINE ON 0629 4995**

for all your technical advice and service back-up on any aspect of the Genie system direct from the experts!

Please send me FREE, 16 page colour brochure on the Genie Computer System. I enclose 25p postage.

Name

Address

Telephone

PC-82

Lowe electronics

Chesterfield Road,
Matlock,
Derbyshire DE4 5LE.
Telephone: 0629 4995.
Telex: 377482 Lowlec G.
Bringing it all back home...

...to Manchester, birthplace of computing in Britain. To Belle Vue from November 25th to 27th — the obvious place for the Northern Computer Fair.

Following the incredible success of our London show ‘the biggest-ever personal computer exhibition’ where over 38,000 people visited us in 3 days, we’re going to repeat the performance in Manchester.

Whatever your specialised line of business — personal computers; home computing; small business systems; associated software — this is the exhibition designed for you.

It’s the ideal showcase for companies who need to demonstrate to a fast expanding and increasingly well informed audience all aspects of personal computing.

...you cannot afford to ignore it.

For further details about exhibiting at the Northern Computer Fair, contact the Advertisement Manager, Practical Computing, Room L310, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Telephone: 01-661 3500 Ext 3021

Name:
Position in Company:
Company:
Address:
Telephone:
THE RICOH 1600S

If it's high performance you're looking for, the Ricoh 1600S is for you, offering an amazing 60 characters in just 1 second. An updated version of the tried-and-tested 1600, the new S model has been re-designed and fitted with all sorts of extras. Yet one thing hasn't changed — the price, making the 1600S cheaper than any equivalent model on the market. This superb performer incorporates the Z80 microprocessor, auto bidirectional printing and look-ahead logic, increasing speed and efficiency. Other capabilities include proportional spacing, graph plotting and word processing enhancements. The printer includes a standard centronics interface, and RS232 and IEEE options are available.

The Ricoh 1600S is available only from Micropute and their authorised dealers, all backed up with a nationwide service network. If you're interested in the 1600S either as a customer or as a dealer, send the coupon now.

FEATURES

<table>
<thead>
<tr>
<th></th>
<th>DIABLO 630</th>
<th>QUME SPINT 5</th>
<th>SPIN-WRITER</th>
<th>RICOH RP.1600 (10 DATA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINT SPEED (CPS)</td>
<td>40</td>
<td>45/55</td>
<td>55</td>
<td>60</td>
</tr>
<tr>
<td>PRINT ELEMENT</td>
<td>DAISY-WHEEL</td>
<td>DAISY-WHEEL</td>
<td>THIMBLE</td>
<td>DOUBLE DAISY-WHEEL</td>
</tr>
<tr>
<td>AUTO BIDIRECTIONAL</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>AUTO LOGIC SEEKING</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>PROPORTIONAL PRINT CAPABILITY</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>EXTENDED CHARACTER SET</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>LETTER QUALITY PRINT</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>CUSTOM INTERFACE OPTION</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>PRICE</td>
<td>£1675</td>
<td>£1950</td>
<td>£1950</td>
<td>£1450</td>
</tr>
</tbody>
</table>

The above information was gathered from distributors and abstracted from their current literature. Prices shown are those advertised at the present time.

Catherine Street, Macclesfield, Cheshire. SK11 6QY. Tel: Macclesfield 612759

Circle No. 209
THE VERSATILE COMPUTER
with the features you need for TODAY and TOMORROW

* Z-80 (8 bit processor)
* 8088 (16 bit processor)
* 128K ram
* 8035 keyboard processor
* S-100 slots

The Vector 4 is an advanced 8/16 bit desk top computer. It allows you to take advantage of the existing 8 bit CP/M programs while also providing 16 bit processing power.

The future is built into the Vector 4 with its Z-80 and 8088 processors.

Let ALMARC show you tomorrow's computers today.

Almarc Data Systems Ltd,
Great Freeman Street,
Nottingham NG3 1FR.
Tel: (0602) 52657
Telex: 37407 Almarc/G

FOR TOMORROW'S SYSTEMS TODAY

Almarc Data Systems Ltd,
Ward International Building,
Green Street,
High Wycombe,
Bucks. HP11 2RF.
Tel: (0494) 23804.
This short program for the 3000 series Pet by Jonathan Turpin of Stanford-le-Hope, Essex, resides in the second cassette buffer, and is used for converting the Pet's character set to true ASCII.

The routine works through a Sys Call, and operates on the characters in CS. If CS is not present then the routine returns having done nothing, otherwise all the Pet's upper- and lower-case characters contain up to 100 sub-classifications filed sequentially. These numbers are arbitrary and can be varied to suit the user. Each main classification is also filed sequentially in a file named Main Subjects, which is used to sort and print a list of main headings if required.

Entries are made by use of a simple input trap and the whole program made crashproof by the use of Poll 144,88, to disable the stop key, at line 80. Entering an asterisk * will return you to the menu, and there is a facility to correct entries before acceptance.

To start an index first select 1 on the menu and give the file a name, say, Pet Programs, then select 2 and enter all the main headings if required.

If you are not sure whether a particular main heading has been entered you can either refer to the printed list of main subjects or use the Select facility shown at the bottom of the screen after pressing 2 on the main menu. It is all quite simple really. The main features of the Basic coding are shown in the table.

**ASCII codes**

This short program for the 3000 series Pet by Jonathan Turpin of Stanford-le-Hope, Essex, resides in the second cassette buffer, and is used for converting the Pet's character set to true ASCII.

The routine works through a Sys Call, and operates on the characters in CS. If CS is not present then the routine returns having done nothing, otherwise all the Pet's upper- and lower-case characters.

(continued on next page)
are changed to the standard ASCII codes.

The equivalent program in Basic using the string functions is very slow and can
double the printing time of an output, and also creates problems with the gar-
bage collection routines. The code is used in the routine is totally relocatable,
and only needs to be entered at a different start location to be used on any of
the other Pet computers.

To use the routine the string to be
output is put in C$, a SYS 826 command
and only needs to be entered at a different
start location to be used on any of
the other Pet computers.

The hexadecimal locations used are as follows:

$00,01,02 These locations are usually the
USR vector, and are used as temporary
storage.

$2C,2D These locations contain the Basic
interpreter’s pointer to the end of the vari-
able table.

$2A,2B These locations contain the Basic
interpreter’s pointer to the start of the vari-
able table.

$03A3 to $03A3 These locations hold the
routine, and are part of the second cassette
buffer.

$03A4 This is used by the program for tem-
porary storage, if relocating the program the
instructions relating to these locations
should be changed to suit the new location of
the code, locations $036F and $0377.

The important parts of the routine are as follows:

```assembly
0360 88 DEY
0361 84 02 STY $02
0363 B1 00 LDA ($00),Y
0365 C9 41 CMP $E41
0367 85 00 ADC $20
036A 85 02 C8 BI 00 8D A4 03
036B B0 05 BCS $0392
036C 18 CLC
036D B0 05 BCS $0392
036E 90 09 BCC $039D
036F C9 05 CMP $E5B
0370 B0 05 BCS $039D
0371 8D A4 03 STA $03A4
0372 91 00 A4 02 DO $035F
0374 B1 00 STA $0342
0375 B0 05 BNE $03A3
0376 91 00 STA $0342
0378 18 INY
0379 A5 02 STA $03A4
037A 18 CLC
037A C9 05 CMP $E5B
037B 8D A4 03 STA $03A4
037C 91 00 STA $0342
037D 8D A4 03 STA $03A4
037E 91 00 STA $0342
037F 60 RTS

PC IRQ SR AC XR YR SP
. 1055 133A 32 00 10 00 F6
. 033A A5 2A LDA $2A
. 033C B5 00 STA $00
. 033E A5 2B LDA $2B
. 0340 B5 01 STA $01
. 0342 A0 00 LDY $E0
. 0344 B1 00 LDA ($00),Y
. 0346 C9 43 CMP $E43
. 0348 F0 16 BEQ $0360
. 034A 18 CLC
. 034B A5 00 LDA $00
. 034D 69 07 ADC $E07
. 034F B5 00 STA $00
. 0351 90 02 BCC $0355
. 0353 E6 01 INC $01
. 0355 C5 2C CMP $2C
. 0357 D0 E9 BNE $0342
. 0359 A5 01 LDA $01
. 035B C5 2D CMP $2D
. 035D D0 E3 BNE $0342
. 035F 60 RTS
. 0360 C8 INY
. 0361 B1 00 LDA ($00),Y
. 0363 C9 80 CMP $E80
. 0365 D0 E3 BNE $034A
. 0367 C8 INY
. 0368 B1 00 LDA ($00),Y
. 036A 85 02 STA $02
. 036C C8 INY
. 036D B1 00 LDA ($00),Y
. 036F 8D A4 03 STA $03A4
. 0372 C8 INY
. 0373 B1 00 LDA ($00),Y
. 0375 85 01 STA $01
. 0377 AD A4 03 STA $03A4
. 0379 B5 00 STA $00
. 037C A4 02 LDY $02
. 037E F0 DF BEQ $035F
```

PC IRQ SR AC XR YR SP
. 0401 E62E 32 04 5E 00 E6
. 033A A5 2A B5 00 A5 2B 85 01
. 0342 A0 00 B1 00 C9 43 F0 16
. 034A 18 A5 00 69 07 85 00 90
. 0352 02 E6 01 C5 2C D0 E9 A5
. 035A 01 C5 2D D0 E3 50 C8 B1
. 0362 00 C9 80 D0 E3 C8 B1 00
. 036A 85 02 E9 B1 00 8D A4 03
. 0372 C8 B1 00 85 01 AD A4 03
. 0374 85 00 AD 02 FO DF 88 64
. 0376 02 B1 00 C9 41 90 16 C9
. 038A 5B 00 AD 02 D0 DF 88 64
. 0382 02 B1 00 C9 41 90 16 C9
. 038E 69 20 ADC $E20
. 0390 90 0B BCC $039D
. 0392 C9 05 CMP $E5B
. 0394 90 09 BCC $039F
. 0396 C9 DB CMP $E5B
. 0398 D0 DD BNE $0380
. 0399 B0 05 BCS $039F
. 0399 18 CLC
. 039B E9 7F SBC $E7F
. 039D 91 00 STA ($00),Y
. 039F A4 02 LDY $02
. 03A1 D0 DD BNE $0380
. 03A3 60 RTS

ASCII codes.

<table>
<thead>
<tr>
<th>PC</th>
<th>IRQ</th>
<th>SR</th>
<th>AC</th>
<th>XR</th>
<th>YR</th>
<th>SP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1055</td>
<td>133A</td>
<td>32</td>
<td>00</td>
<td>10</td>
<td>00</td>
<td>F6</td>
</tr>
</tbody>
</table>

(continued from previous page)
Factorials

AFTER SEEING F. S. Dewhirst's program for factorials on page 126 of the September 1981 issue of Practical Computing, J. Yale of Corfe Mullen, Dorset, decided to write a similar program in Forth. The program takes 13 seconds to calculate 100! and 11 minutes to compute and display all the factorials up to 100. The 2,568 digits of 1,000! only take 40 minutes or so to compute.

The program is contained in three blocks or screens. The function of each of the new words is:

**BYTE-ARRAY** — This is the definition of a new data type, an array of bytes. This is the only way in the program which is CPU specific as it contains some Z-80 assembly code for speed of array access.

**MAX-DIGITS** — A constant giving the maximum length of number to be used, set to an arbitrarily large value.

**F-BUFF** — The buffer to hold the factorial defined using Byte-Array of length Max-Digits. To access the Nth element of F-Buff the code is:

```
15 AGAIN DROP
16 \... 
17 \... 
18 \... 
19 \... 
```

This program was developed on a Research Machine 380-Z using a cassette-based Forth system available from F. Donovan, 35 St Julians Road, St Albans, Hertfordshire, AL1 2AZ.

```
... - Prints the following string up to a terminating 
/PRINT - Divides the second stack item by the 
0= - Tests the top stack item against zero. 
... - Starts a new Forth definition. The word 
... - Ends a Forth definition. 
CODE - Introduces the assembly-code portion of a new defining word. 
S - Marks the logical end of a block. Any text after this point will not be compiled. 
ALLOT - Given a number on the top of the stack, allocates that amount of dictionary space in this case for an array. This word is sometimes called DP+1! 
FAC - Displays the factorial in F-Buff with a comma in every third position. 
FAC - Given a number on the stack, computes its factorial in F-Buff. 
```

Sample run.

```
\... 
```

```
\... 
```

```
\... 
```

```
\... 
```
Telephone charges

**THIS PROGRAM** by Michael Miller of Sheffield calculates telephone call charges at the new rates from May 1, 1982. It just fits into 1K so avoid adding frills such as extra print explanations or input checks unless you have an expanded memory.

The program prompts you to specify the call distance, using letters A, B, or C, then the charge rate, using digits 1, 2, or 3. Next you input the length of the call in minutes and seconds, pressing Newline after each. The cost of the phone call then appears on the screen.

The main problems to be dealt with by the program are the complex interaction between distance and charge periods and the charge increments in units, rather than direct proportion. The crucial lines are 170, 190, and 210 which respectively calculate call units for local calls, those up to 35 miles and those over 35 miles, also taking account of the charge time band. Note that time is worked in minutes.

Line 220 calculates the cost, the factor 4.945 representing the unit cost of 4.3p plus VAT at 15 percent.

**Machine-code command**

**Users** of machine code on the ZX-81 often wish to switch between Fast and Slow modes while still using machine-code writes Iain Stewart of Alva, Clackmannan. After studying the Syntax table at 0C29 to 0C29 of the 8K ROM, which tells the interpreter where to go to execute each keyword of a Basic program, he has found what he thinks is a foolproof method for switching between modes in machine code.

The instruction

```
CALL FAST (CD200F)
```

will put the ZX-81 in Fast mode; and similarly,

```
CALL SLOW (CD280F)
```

will put the ZX-81 in Slow mode.

**Cricket**

**CRICKET** by Keith Driscoll of Bootle, Merseyside, runs on the 1K ZX-81. The wickets are set up on the left-hand side of the screen. Your man is controlled by keys I and O.

The ball is bowled at you and you must hit it. If you hit it you score one run. You start with 11 men. You lose them by being bowled out or by landing on the black lines to be found on either side of the wickets.

```
4.945 representing the unit cost of 4.3p
plus VAT at 15 percent.
```

<table>
<thead>
<tr>
<th>Cricket.</th>
<th>Cricket.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. let s=0</td>
<td>110 if z=b and x=1 then goto 500</td>
</tr>
<tr>
<td>2. let k=0</td>
<td>120 if x=0 and z&gt;8 and z&lt;12 then goto 500</td>
</tr>
<tr>
<td>4. let b=10</td>
<td>130 if b=5 or b=15 then goto 400</td>
</tr>
<tr>
<td>5. cld</td>
<td>140 if k=11 then goto 600</td>
</tr>
<tr>
<td>10 for a=9 to 11</td>
<td>200 goto 50</td>
</tr>
</tbody>
</table>
| 20 print at a,0 ;"GRAPHIC
SHIFT H" | 400 print "L.B.W."
| 30 next a | 410 let k=k+1 |
| 45 let z=int(rnd*15+3) | 420 pause 20 |
| 46 let x=10 | 430 goto 9 |
| 50 print at b,1;"0 GRAPHIC
SHIFT 5", at b-1,1;":at
b+1,1": " | 500 let s=s+1 |
| 60 let b=b+(inkeys="@")-( | 510 goto 9 |
| inkeys="1") | 600 print s;" runs all out " |
| 70 print at 3,1;":":at
13,1:" " | 610 stop |
| 80 print at z,x;"o" | 500 let k=k+1 |
| 90 let x=x-1 | 310 print"man out" |
| 100 if x=-1 then goto 9 | 320 pause 40 |
| | 330 goto 9 |
Colour me Prism

Hard copy in colour? It’s here today, with a range of 400 shades at a price you can afford. Teleprinter Equipment’s Prism printer brings colour within reach of every business, engineering and scientific work station.

Think what this means in speed of recognition, range of variables and graphic presentation.

As well as colour, the Prism printer comes with a host of other advanced features, including:

- Single sheet feed
- Graphics with additional 2K buffer
- High speed print mode (in excess of 200 cps)
- Correspondence quality print

Opt for Prism colour now, and bring a whole new dimension to your work.

Trade enquiries welcome.

Teleprinter Equipment Ltd
Akeman Street, Tring, Herts HP23 6AJ
Tel. Tring (0442 82) 4011/5551
International Tel. + 44 44282 4011/5551
Telex: 82362

Associated Companies
GADC/CAE/ME
THE 16-BIT PERSONAL COMPUTER

The ACT Sirius 1 is more than the UK's best-selling 16-bit personal computer. It is the only one with such a large choice of 16-bit software — business and scientific programs specially developed to take advantage of the high speed 16-bit Intel 8088 microprocessor at the heart of every Sirius.

Combine this faster and more powerful software with the advanced specifications of the Sirius 1 and you can see why more and more business users are choosing Sirius.

Because Sirius users have both the latest microcomputer technology and the powerful 16-bit software that takes full advantage of it. Ergonomics plays a vital part in the design of ACT's Sirius 1. The screen tilts and swivels to suit the user and glare is eliminated. The display is razor sharp, and the brilliance and contrast can be adjusted using keys on the low profile detachable keyboard.

UP TO 896 KBYTES RAM

128 Kbytes of RAM memory as standard easily upgraded to a massive 896 Kbytes ensures plenty of capacity for fully fledged business software and associated record files.

Within the basic system is 1.2 Mbytes of floppy disk storage, with 2.4 Mbytes double sided disks available as an option. More than any other comparable personal computer.

As a result, the Sirius is suitable from the start for large record processing applications. And with 5 and 10 Mbyte Winchester disk drives scheduled for early introduction, the Sirius can easily match your own organisation's growth.

SOFTWARE THAT TALKS BACK

And built into every Sirius is a revolutionary new concept: An audio decoder that can play back verbal messages and prompts under program instruction to assist the non-computer people to get acquainted with the software more quickly.

NEW 16-BIT SOFTWARE

All the big names in applications software are on the Sirius: ACT's Pulsar for accounting, WordStar for word processing, MicroModeller for financial modelling and SuperCalc the "spread sheet" program. Plus the exciting SELECT, the only word processor that teaches you how to use it in less than 90 minutes.

And more than 100 top software companies are currently developing specialist software for every business and profession from the motor trade to solicitors.

The ACT octagon encapsulates our philosophy of providing users with a single source for their computing solutions. ACT products include personal computers — network micro-computer systems — turnkey mini computers and a total range of services, including software development, computer field engineering, computer supplies, and a complete range of Bureau services.

The eight specialist ACT companies are each leaders in their field and are wholly owned by Applied Computer Techniques (Holdings) p.l.c., one of Britain's largest and most successful computer companies.
The Sirius has more available programming languages than any newly-introduced personal computer. MicroSoft's BASIC 86, interpretative or compiled, CBASIC, a choice of several versions of COBOL, three different PASCAL's and a full scale FORTRAN.

The benefits? Programmers and software houses are making the Sirius their first choice computer for business software development.

Unlike other personal computers, the ACT Sirius 1 is delivered with the two industry standard operating systems at 16-bit level — MS-DOS and CP/M-86. Once again a guarantee now of the widest choice of off-the-shelf 16-bit software.

And further operating systems are under development. The much vaunted UNIX and a new system to support a low cost local area network.

**COMMUNICATIONS**

The Sirius is the ideal communications system, with two independent RS232 communications ports in addition to parallel and IEEE 488 ports. Available NOW are all the facilities required to communicate directly with large, mainframe computers.

Further backing is available by way of a dedicated Sirius Training Centre, run by ACT and open to all.

To support the product ACT has a truly professional network of systems dealers, hand picked for its knowledge of the business environment, enabling top quality support to always be close at hand.

ACT SIRIUS 1 — THE COMPLETE 16-bit personal computer.

To know more about the 16-bit ACT Sirius 1 and its exciting range of 16-bit software, clip the coupon and return it to:

**ACT (Sirius) Ltd.,**

FREEPPOST,

Halesowen, West Midlands,

B63 1BR.

Or call for details now on

021-501 2284

Price excludes VAT.

Circle No. 212
3.7 million reasons why the Atari Home Computer is something to see. The display screen used with our computers is composed of 192 horizontal lines, each containing 320 dots. Delivering colour and luminosity instructions to each dot for a second requires 3.7 million cycles...a lot of work for the normal 6502 processor.

That's why the Atari computer has equipped its 6502 with its own electronic assistant. It's called ANTIC and it handles all the display work, leaving the 6502 free to handle the rest. What this means to you is uncompromisingly spectacular display capabilities without loss of computer power needed to carry out the demands of your program.

That's a quality you just don't find in ordinary home computers. And it's one of the reasons some computer experts say that Atari computers are so far ahead of their time.

There's more...which is what you'd expect from Atari Language. The Atari Home Computer uses several programming languages to give the user maximum control of its extraordinary capabilities. PILOT, Microsoft BASIC and Atari BASIC are understood and spoken by the Atari computer. You'll also find our Assembler Editor cartridge indispensable for machine language programming.

Sound. An Atari computer has four sound generators, or voices, activated by a separate microchip. This leaves the principal microprocessor chips free to perform other tasks. And you can take full advantage of this capability which is designed for easy programming.

Change. Atari Home Computers have been designed to make change and expansion easy. The Atari computer has a modular operating system that can be easily replaced as new technology develops. If you need it, memory expansion requires no more than inserting additional RAM modules. And the Atari ROM cartridge system also makes it easy to change languages. In short, your Atari computer won't become obsolete by future developments...because it already incorporates the future.

Sharing. To learn more about the amazing capabilities of Atari Home Computers, either visit your local dealer or fill in the coupon below.

**THE GRAPHIC DIFFERENCE BETWEEN ATARI® COMPUTERS AND ALL THE OTHERS.**

*Atari 800** Computer only

---

3.7 million reasons why the Atari Home Computer is something to see. The display screen used with our computers is composed of 192 horizontal lines, each containing 320 dots. Delivering colour and luminosity instructions to each dot for a second requires 3.7 million cycles...a lot of work for the normal 6502 processor.

That's why the Atari computer has equipped its 6502 with its own electronic assistant. It's called ANTIC and it handles all the display work, leaving the 6502 free to handle the rest. What this means to you is uncompromisingly spectacular display capabilities without loss of computer power needed to carry out the demands of your program.

That's a quality you just don't find in ordinary home computers. And it's one of the reasons some computer experts say that Atari computers are so far ahead of their time.

There's more...which is what you'd expect from Atari Language. The Atari Home Computer uses several programming languages to give the user maximum control of its extraordinary capabilities. PILOT, Microsoft BASIC and Atari BASIC are understood and spoken by the Atari computer. You'll also find our Assembler Editor cartridge indispensable for machine language programming.

Sound. An Atari computer has four sound generators, or voices, activated by a separate microchip. This leaves the principal microprocessor chips free to perform other tasks. And you can take full advantage of this capability which is designed for easy programming.

Change. Atari Home Computers have been designed to make change and expansion easy. The Atari computer has a modular operating system that can be easily replaced as new technology develops. If you need it, memory expansion requires no more than inserting additional RAM modules. And the Atari ROM cartridge system also makes it easy to change languages. In short, your Atari computer won't become obsolete by future developments...because it already incorporates the future.

Sharing. To learn more about the amazing capabilities of Atari Home Computers, either visit your local dealer or fill in the coupon below.

**THE GRAPHIC DIFFERENCE BETWEEN ATARI® COMPUTERS AND ALL THE OTHERS.**

*Atari 800** Computer only

---

Please send me FREE a brochure, price list and the address of my nearest stockist.

Name ________
Address ________

Atari International (UK) Inc.
Windsor Hse., 185-195 Ealing Road, Alperton, Wembley, Middlesex.
Random numbers

BASIC CAN GENERATE random numbers with ease, using the RND function, but anything written entirely in assembler for speed or size benefits requires special arrangements, writes A Phillips, of Lancaster.

The listings show three assembler routines which access the random-number generator in the Basic ROM, and which can be incorporated into an assembler program. The routines are extremely simple: the random-number generator is entered at &AF41; the other calls all move data in and out of Basic's 32-bit register located at &2A to &2D. The comments on the instruction lines indicate their functions.

The routines are not intended to be used directly from Basic; there would be no point in so doing, the listing shows them being compiled with two demonstration routines which are entered from Basic in order to produce some example values. The three routines are as follows:

Initrand initialises the random-number generator using the elapsed-time clock as seed. This is exactly equivalent to IRND(-TIME)

Open file: BBC

Random integer values

This is exactly equivalent to IRND(-TIME)

The listings show three assembler routines which access the random-number generator in the Basic ROM, and which can be incorporated into an assembler program. The routines are extremely simple: the random-number generator is entered at &AF41; the other calls all move data in and out of Basic's 32-bit register located at &2A to &2D. The comments on the instruction lines indicate their functions.

The routines are not intended to be used directly from Basic; there would be no point in so doing, the listing shows them being compiled with two demonstration routines which are entered from Basic in order to produce some example values. The three routines are as follows:

Initrand initialises the random-number generator using the elapsed-time clock as seed. This is exactly equivalent to IRND(-TIME)

Open file: BBC

Random integer values

This is exactly equivalent to IRND(-TIME)

The listings show three assembler routines which access the random-number generator in the Basic ROM, and which can be incorporated into an assembler program. The routines are extremely simple: the random-number generator is entered at &AF41; the other calls all move data in and out of Basic's 32-bit register located at &2A to &2D. The comments on the instruction lines indicate their functions.

The routines are not intended to be used directly from Basic; there would be no point in so doing, the listing shows them being compiled with two demonstration routines which are entered from Basic in order to produce some example values. The three routines are as follows:

Initrand initialises the random-number generator using the elapsed-time clock as seed. This is exactly equivalent to IRND(-TIME)
Adda is the number one choice for business systems using Commodore's powerful 32K or 96K microcomputer with 1 megabyte disk storage (even more with new hard disks)! Our top four software packages will meet most business needs, at prices you can afford. In every case we will help you select the most cost effective software systems backed with Adda's training and servicing skills.

We have a continuous programme of Open Days at all four sales offices where you can look at our packages without feeling harassed.

Adda is the number one choice for business systems using Commodore's powerful 32K or 96K microcomputer with 1 megabyte disk storage (even more with new hard disks)! Our top four software packages will meet most business needs, at prices you can afford. In every case we will help you select the most cost effective software systems backed with Adda's training and servicing skills.

We have a continuous programme of Open Days at all four sales offices where you can look at our packages without feeling harassed.

PEGASUS
SYSTEMS FROM £4000
accounting for sales, purchase and nominal ledger, invoicing and stock control

WORDCRAFT
SYSTEMS FROM £3640
full wordprocessing facilities with high-quality printer

SILICON OFFICE
SYSTEMS FROM £3640
for powerful data management reporting

VISICALC
SYSTEMS FROM £2900
financial planning with the world's top selling program

DIAL A DEMO
01-997 6666

You can also see our top four systems demonstrated in your own office! Just call 'Dial a Demo' on 01-997 6666 and we'll fix a time.

Give us a call. We know the Adda deal adds up to a great deal more.
Cassette word processor

WORD PROCESSING normally demands the use of discs to give the required fast direct access to lines of text for adding or deleting lines or words within the body of the text, writes Peter Hodson of High Wycombe, Buckinghamshire. This program provides simple word-processing facilities for a personal computer with a printer but limited to cassette storage.

The program does not attempt to provide all the features of a full word-processing system, but does provide the basic text-editing capability which can make the production of letters and short reports so much easier. The full text is transferred from cassette to RAM and is held in RAM during processing; the amount of text which can be handled in a 16K machine is about 8,000 characters.

The program has been written for a 16K Video Genie with the full set of cursor keys, and with lower-case characters available on the screen by Poke but not Print. A machine-code routine is used to print lower-case characters; it can be omitted if your machine has a proper lower-case printer but limited to cassette storage.

The program should work on the TRS-80 Model 1 and should be adaptable to many other systems without too much trouble.

About 80 bytes of high memory should be reserved for the machine-code routine before loading the program. When you Run, the first prompt is for the address at which the routine should be loaded. It is completely relocatable, and should be placed at a convenient address in high memory.

The File Create or Update message should be answered.

C to create a new text file, in which case variables will be re-initialised.

U to update an existing text file, when the program will ask whether cassette 1 or 2 is being used, and then load the text file. It will pause after loading the file if it does not hold the title of the file, to allow you to restart if you have loaded the wrong cassette.

The program gives the opportunity to change the title of the file, and then

(continued on next page)
Space keys, and if reset to zero the key will be detected by INKEY$ again if it is still being held.

Line 480 reverses the effect of the shift key, so that text can be typed in the usual typewriter manner with the shift key giving upper case.

Lines 600 to 630 take the text on the bottom line of the screen and assign it to the relevant element of the array of text. This is done by changing the contents of the Basic variable table for AS to point to the bottom line of the screen, 16320; the length of AS is held at VarPTR its address at VarPTR+1 and VarPTR+2. AS is then moved, without trailing blanks, to the current element of the array DS.

Lines 1000 to 1120 display the list of options and direct the processing to the relevant control routine:

display 1500-1540
change 2000-2040
add 2500-2550
end 3000-3100
user

Lines 8000 to 8040 load the machine-code routine to handle lower-case characters, and should be omitted if you do not need it.

The print routine, lines 4000 to 4430, exposes one of the few significant differences between the Genie and the TRS-80. The Genie addresses its Printer via Port 253, whereas the TRS-80 uses memory-mapped I/O via address 14312.

Line 4000 in this program includes Lnp(253) which reads the status of the printer; for the TRS-80 this should be Peek (14312). This check is included to prevent the program "hanging up" if the printer is not ready or not connected.

The printer used when developing this program was a Tandy Line Printer VII, which has no £ sign. The program can produce a £ sign by use of the printer's graphics, and this is the function of lines 4070 to 4073 and 4212 to 4235.

The program runs on a 16K Video Genie. It could be improved by faster Loading and Saving of the text, perhaps using the machine-code routine given in Practical Computing February 1982, page 171.
in a word: MicroValue.

The Galaxy 1 computer utilises the widely acclaimed Gemini multiboard modules which make it one of the most reliable 2.2 CP/M computer systems on the market.

Do not be misled by the low price. Galaxy 1 has many standard features which are extra on computers costing twice the price.

Examples of this are: full on-screen editing, keyboard type ahead, serial printer driver, parallel printer driver, graphics both block and programmable, and 64K of user RAM.

Standard software with the Galaxy 1 includes COMAL 80, a high level language; a text editing package; a 280 assembler; a 280 disassembler and, of course, industry standard operating system: CPIM 2.2.

QUIBS, the business package offered for the Galaxy 1, has been especially written for the Gemini modules. The extremely low cost of £500 is available because of Gemini's high volume potential. This price is substantially lower than comparable software.

Please call your nearest MicroValue dealer for full information on the system.

Galaxy 1 is an all British product with a 12 month warranty (except Disc heads which are guaranteed for 3 months).
If you could program a computer by simply telling it the result you wanted, without using complex codes or languages, then anyone could become a programming professional. Sounds fantastic?

But now it's possible with Personal PEARL, and all for less than £200. It generates quality Business Programmes, Data Management, Costing, Mailing—indeed you create your own library of programmes that matches your operation today, and tomorrow.

After all, no-one understands your business better than you. So let Personal PEARL take the technology out of computer programming, and you'll find yourself writing professional business software—at the touch of a button.

Please send more details of Personal PEARL.

Name:

Company:

Address:

Tel:

Computer Make: VDU Make:

Disk Size:

Pearl Software International (UK) Limited, PO Box 34, Poole, Dorset, BH14 8AR.
Tel: Parkstone (0202) 741275

Circle No. 216
Terminal emulation

AS BOTH the number and range of available computer systems increase, observes Philip Robertson, it is important that one computer system can communicate with another. The computer industry is investing sizeable resources in this area. The program described here allows a CP/M machine, in this case a Superbrain, to behave as a terminal on a remote computer, in this case a Superbrain, to the notes of explanation:

Philip Robertson, it is important that one computer can communicate with another. The computer industry is investing sizeable resources in this area. The program described here allows a CP/M machine, in this case a Superbrain, to behave as a terminal on a remote computer, in this case a Superbrain, to the notes of explanation:

Wordno

WORDNO is a simple MBasic program to estimate the number of words in a text file, writes David Green of Nairobi, Kenya. It was written to count words in WordStar files, so it is capable of dealing with control characters and non-zero high bits.

The file is read in one byte at a time, then Aended with 127 to mask the high bit; Control characters are ignored. If a printable character is found a flag is set. If a space or carriage return is found when the flag is set then a word is counted and the flag reset. When the file ends the total is printed.

It is a little slow — it takes about 80 seconds to count 1,000 words on an Osbornel, but it is not the sort of program you need to run all the time. It certainly beats counting by hand.

The program counts hyphenated words as one, unless at the end of a line when it counts two. Things like an isolated asterisk or a row of stars count as single words. The last word will not count unless you finish with a return.

Wordno

100 ' WORDNO - A PROGRAM TO ESTIMATE WORDS
110 ' IN A "WORDSTAR" FILE.
120 ' C 1982 by D. R. Green
130 ' P.O. Box 50973, Nairobi, Kenya
140 DEFINT A - Z
150 N = 0 'SET COUNT TO ZERO
160 LINE INPUT " What is the filename? ";FILENAME$
170 OPEN "I",1,FILENAME$
180 FLAG = 0 'MARKS A "NON-SPACE" CHARACTER
190 WHILE NOT EOF(1)
200 ' REMOVE HIGH BIT FROM CHARACTER ON INPUT
210 CHAR = ASC(INPUTS(1,1)) AND 127
220 IF CHAR > 32 THEN FLAG = 1 ELSE IF (CHAR = 32 OR CHAR = 13) AND FLAG THEN N = N + 1 : FLAG = 0
230 WEND
240 ' ************ FINISH HERE ON EOF ************
250 PRINT:PRINT:PRINT " There are";N;" words"
260 CLOSE
270 END
Brainless prices!

Now

SUPERBRAIN™ at unbelievably low prices from the Micro Computer Club

JUNIOR 320K DISK CAPACITY £1250
QD 720K DISK CAPACITY £1550
SD 1.5MB DISK CAPACITY £1800
MICROLINE 83A PRINTER WITH M/C £ 450

And price includes CP/M and Microsoft M Basic

Only by selling direct mail order that we can offer SUPERBRAIN™ at these prices

- On site maintenance available from day one.
- Nationwide contracts through Software Sciences — a member of THORN EMI group.
- Software Sciences will inspect, deliver and maintain your SUPERBRAIN.
- The 24 hour call-out basis.
  JUNIOR .......... £375pa
  QD ............... £415pa
  SD ............... £440pa
  MICROLINE 83A PRINTER .... £150pa

- Membership of the Micro Computer Club entitles members to other special offers on Hardware and Software.

To: The Micro Computer Club
PO Box 66 Croydon CR9 4QB Tel: 088 32 4388
Please accept my order and enrol me as a member of the Micro Computer Club.

All prices are based on exchange rate at time of going to press and may be subject to change. All orders must be accompanied by a cheque for the sum due. This will not be banked until four days before despatch.
Carriage within UK extra at £25 Greater London £35 Outside London

To: 

<table>
<thead>
<tr>
<th>M/C TYPE</th>
<th>QNTY</th>
<th>UNIT PRICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINTER</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MAINT QNTY UNIT PRICE TOTAL

Name .................. TOTAL
Address ................ CARRIAGE
VAT at current rate
Post Code ............... CHEQUE TOTAL

All machines sold to UK specification with full manufacturers warranty.
Conversion techniques are explained in a section detailing the difference between the two machines.

**Conclusions**
- The quality of the book is generally high, but is let down in some areas by the clarity of reproduction.
- The descriptions of the programs could have been improved by including an explanation of how they actually worked.
- There should be something in the book to suit all members of the Sinclair community.

**Basic Programming on the BBC Microcomputer**


This book aims to teach the user how to program in BBC Basic. It is written using non-technical language which allows the beginner to understand the concepts fully, though it assumes that you have a BBC model A or B in front of you.

The programming starts off at a very simple level which accustoms the beginner with the machine. Once the basic skills have been established, more complex commands are covered, for some of the advanced commands only the main points are discussed. The colour and animation facilities are covered well, although advantage is not taken of the full potential of the model B. This means that all the programs will run on both models.

A section on peripherals listing add-ons for the BBC Micro is already out of date and was obviously written before the price rises in February. The glossary includes a short explanation of all the command words.

**Conclusions**
- This book provides an excellent introduction to the BBC Microcomputer. It is especially useful as an alternative to the BBC's manual.
- It teaches BBC Basic in a non-technical easy-to-understand way, ideal for the beginner.
- The book should appeal to anyone who has or intends to use a BBC Micro, and explains how to use the extended facilities offered on this powerful computer. It is approved by Acorn.

**Apple Pascal Games**

*By Douglas Hergert and Joseph T. Kalash. Published by Sybex. 371 pages.*

This book has two potential audiences: those interested in games and those interested in Pascal. The games are mostly familiar examples published many times before in Basic. A comparison of Basic and Pascal versions shows nicely the power and effectiveness of Pascal. The text should persuade the programmer who works in Basic that Apple Pascal offers a better medium for writing games.

Most of the features of Apple Pascal are illustrated, including records, sets, pointers, files and recursion. Turtlegraphics are used in the third part of the book. Particularly good is the presentation of a more substantial program at the end of the book. For it is in bigger programs that the advantages of Pascal are most apparent. Programmers who study the examples should learn a great deal about how to use Pascal.

**Conclusions**
- Since most textbooks on Pascal are short on worked examples, collections such as this one are valuable.
- The book provides particularly welcome examples on features specific to the Apple implementation.

**My Micro Speaks Basex (and loves it)**

*By Paul Warme. Published by Hayden, distributed by John Wiley, £7.75.*

**Basex**...
SYSTEM 4000
EPROM EMULATOR/PROGRAMMERS

P4000 PRODUCTION EPROM PROGRAMMER
This unit provides 'simple, reliable' programming of up to 8 EPROMs. It has been designed for ease of operator use — a single 'program' key starts the blank check — program — verify sequence. Independent blank check and verify controls are provided along with mode, pass/fail indicators for each copy socket and a sounder to signal a correct key command and the end of a programming run. Any of the 2704/2708/2716 (3 rail) and 2508/2758/2516/2716/2732 EPROMs may be selected without hardware or personality card changes. 2 year warranty. Price £545 + VAT: + £12 DELIVERY

VM10 VIDEO MONITOR
This compact, lightweight Video Monitor gives a clean crisp picture on its 10" screen. Suitable for use with the EP4000, SOFTY and other systems. 12 month warranty. Price £88 + VAT, carriage paid.

MODEL 14 EPROM ERASERS

MODEL UV140 EPROM ERASER
Similar to model UV141 but with out timer. Low price at £61.50 + VAT, carriage paid.

EP4000 EPROM EMULATOR/PROGRAMMER
The microprocessor based EP4000 has been designed as a flexible, low cost, high quality unit for emulating and programming all the popular NMOS EPROMs without the need for personality cards, modules or hardware changes. Its software intensive design permits selection of the 2704 / 2708 / 2716 triple rail EPROMs and the 2508 / 2758 / 2516 / 2716 / 2732 single rail EPROMs for both the programming and emulating modes. The video output (T.V. or monitor) for memory map display in addition to the built-in Hex LED display, for stand alone use, is unique in this type of system. This, with the double function 28 key keypad, powerful editing features, powered down programming socket, buffered tri-state simulator cable and 4x8 data RAM gives you the most comprehensive, flexible and compact systems available today. 2 year warranty. Price £545 + VAT: + £12 DELIVERY

MODEL UV141 EPROM ERASER
• 14 EPROM capacity
• Fast erase time
• Built-in 5-50 minute timer
• Safety interlocked to prevent eye and skin damage
• Convenient slide-tray loading of devices
• Available Ex-Stock at £78 + VAT Postage Paid

DISTRIBUTORS REQUIRED — EXPORT ENQUIRIES WELCOME

GP INDUSTRIAL ELECTRONICS LTD,
UNIT E, HUXLEY CLOSE, NEWHAM INDUSTRIAL ESTATE,
PLYMOUTH, DEVON PL7 4JN
TELEPHONE: PLYMOUTH (0752) 332961 (Sales) / 332962 (Technical Service).

SOFTWARE SYSTEMS

SOFTY 2
LOW COST 2716 EMULATOR/PROGRAMMER
• Direct output to T.V. • High speed cassette interface • On card EPROM Programmer • Multifunction 'such keypad • 2K Monitor in 2716 • 2K RAM • 128 byte scratchpad RAM • 2K EPROM Emulation • Can program 2732 / 2532 in two halves • Editing facilities including — Data entry / deletion, Block shift, Block store, Match byte, Displacement calculation • Supplied with ZIF socket, Simulator cable, comprehensive manual, Anti-static printed EPROM tray and PSU. SOFTY 2 £169 + VAT (includes p&p)

SOFTY 1
LOW COST 2704/2708 EMULATOR/PROGRAMMER
• Direct output to T.V. • High speed cassette interface • On card EPROM Programmer • Multifunction keypad • 1K Monitor in 2708 • 1K RAM • 128 byte scratchpad RAM • 1K EPROM Emulation • Comprehensive editing facilities • Supplied with ZIF socket, Simulator cable and comprehensive manual

SOFTY 1 (Built and tested) £120 + VAT
SOFTY 1 Power Supply £20 + VAT

EX-STOCK EPROMS

SOFTY 1 CONVERSION CARD
Enables SOFTY to program the single rail EPROMS, 2508 / 2758 / 2516 / 2532. Selection of device type and 1K block are by pcb slide switches. ZIF Programming socket. Supplied built and tested. £40 + VAT.

EX-STOCK EPROMS

1-24 £6.50
25-99 £6.00
100 up £5.75
ADD VAT AT 15% - POSTAGE PAID

WRITE OR TELEPHONE FOR DETAILS ON ANY OF OUR PRODUCTS

© Circle No. 218

PRACTICAL COMPUTING September 1982
TODAY is my birthday, and my age is now a perfect square. Strangely, it is also the sum of the ages of my children. The children's ages are all in the grid — in binary, of course:

1 across x 5 up, or 4 across
1 down + 6 up, or 8 up
6 across x 2 down - 7 across, or 3 down
9 down x 6 down - 12 up, or 11 up
10 up x 10 across + 4 down, or 8 across

How old am I?

---

**Age Square**

by

Tony Roberts

---

---

**Solution to August puzzle**

"Sir. This is as twisted as my stick, not straight and nasty like your English ones. Our ancestors never wasted a thing but, like a haggis, you can only eat each bit the once."

Well, did you manage, with the help of that clue, to unravel the mystery shrouding the solution to the code on the stone? As you can see nothing is wasted, and the words twist and turn around each other.

---

**MICRO-80**

UK Subscription Dept.

24 Woodhill Park Pemby Tunbridge Wells Kent TN2 4NW

LOOK what you get when you subscribe to MICRO-80 the monthly magazine for TRS-80 and Video Genie. Now in the 3rd year of publication!

All new subscribers (and existing ones when they renew) receive free of charge a Software Cassette complete with 62 page user manual featuring:

- **Level I in Level II** - Convert your Level II TRS-80 to operate as a Level I machine.
- **Copier** - Copies Level II System tapes, irrespective of where they load in memory.
- **Z80 MON** - A low memory, machine language monitor.
- **Improved Household Accounts** - Powerful enough to be used by a small business.
- **80 Composer** - A music generating program.
- **Plus Two Games** - Poker and Cube (a version of the Rubiks cube for Disk users).

Order just the magazine or take it each month complete with the published programs ready-to-load on cassette or disk.

Please enrol me for an annual subscription and send me my FREE cassette program. I enclose £16.00 (magazine only) or £43.60 (magazine and cassette edition) or £75.00 (magazine and disk edition).

(Enclose your cheque/P.O. made payable to MICRO-80 and send to the above address.)

Software offer, and prices apply to U.K. residents only. Overseas subscription rates on application.

Name

ADDRESS

PC 9/82

Circle No. 219

PRACTICAL COMPUTING September 1982
ARE YOU PROGRAMMING IN A POLICE STATE?

Every time you run a BASIC program millions of innocent machine cycles get executed unnecessarily!
- RED TAPE. Every GOTO and GOSUB involves a meticulous search through the whole program for the target line.
- BUREAUCRACY. Every variable reference results in a thorough investigation of the system's dictionary.
- PROTOCOL. Who decides on the precedence of operators? The BASIC interpreter, of course.
- DOGMA. Each inoffensive constant has to undergo an indoctrination from decimal to binary each time it is used.

AND WHO SUFFERS? WHY YOU, THE CONSUMER, OF COURSE!

But you can stop this needless waste. A compiler sorts all this red tape out ONCE, before you run the program. The result? Speed-ups of 10, 20, even 30 times.

DO YOUR PROGRAMS A FAVOUR.
GET A COMPILER.

ACCEL Level2 BASIC
ACCEL3 Full DISK BASIC
(tape) £19.95
(tape= gluttefem Circle No. 220

DISKS STATIONERY PRINTERS

Special offers on disks, stationery and printers
Floppy diskettes in boxes of 10 5½" s/density s/secorted only £15.00
8" s/s density s/secorted only £15.00
(Add £1.00/box P & P + Vat.)

Continúous stationery-1000 sheets
9½"x11" Plain single part only £4.95
9½"x11" Plain (with ½" margins) only £5.96
14½"x11" Lined or plain single part only £7.00

Printers from Newbury Labs
Special Introductory Offer
A free box of 9½"x11" Stationery with every Newbury Printer purchased

For the printer that has everything standard, buy The Newbury 8510 or 1550.
Price includes 6' cable

Circle No. 220

TRS80 Models I+II and VIDEO GENIE

PRACTICAL COMPUTING September 1982
Earth at war is the dramatic setting for this futuristic game. Steven and Sean Wallis replace normal chess pieces with spaceships equipped with laser bolts.

THE YEAR IS 2082. The date is July 10. From deep in the gigantic caverns of the moon, Fires blazed. An enormous slender gleaming white spacecraft burst free of the weak lunar gravity and disappeared into space. With Earth Command flagship, Toronto, reached escape velocity, equipped with back-up and recharging facilities for the two monstrous fleets, both sides were equally equipped. Earth was at war.

This is the setting for Galactic Chess, a futuristic version of chess with firing and warping facilities. Normal chess pieces are replaced by spaceships, which start with allotted numbers of laser bolts and shields. Two players alternately control opposing fleets. Their aim is to destroy the opposing king, winning the battle.

All ships except the pawn move as in chess but casting does not exist. Pawns can move one square vertically or horizontally but cannot queen. Firing takes place in the same directions and distances as moving. The king and queen’s squares on each side are space bases and may not be entered by an opposing ship under any circumstances. Ships inside are automatically replenished with laser bolts at a rate of one per turn, but may not hold more than the allotted capacity. Ships are manipulated by moving an arrow-shaped cursor, which indicates the square in front and below. It is moved with the cursor keys. An illegal response sends the cursor to its starting position.

To move, move the cursor to the ship’s (continued on next page)
Main variables.

$P(5,1)$ Array of ships. $P(x, 0)$ face right, $P(x, 1)$ face left.

S(7,7) Ship type 0-5, 9 empty square.
C(7,7) Colour of ship, Or 1
W(7,7) Number of laser bolts for ship.
D(7,7) Number of shields.
X(5) Maximum number of laser bolts and shields per ship type.
W(1) Ship type in warp.
WM(1) Number of laser bolts for ship in warp.
WD(1) Number of shields.
X Cursor address on screen, ship plotting control variable.
Y Ship plotting control variable.
CC Player, 0, 1.
CX & CY Cursor position.
ZV & ZY Old cursor position.
X(5) Maximum number of laser bolts and shields.
D(7,7) Number of shields.
C(7,7) Colour of ship, 0 or 1.
P$(5,1)$ Array of ships. $P$(x, 0) face right, $P$(x, 1) face left.

Program lines.

100-210 Initialization. 120 and 130 contain the spaceship character strings.
230-330 Instructions.
350-440 Set up board.
460-490 Optional visual and sound effects.
510-540 Accept and process option.
1250-1350 Replenish stocks in space bases, return from warp and next player.
1370-1690 Game ends. Optional picture.
1710-1720 Plot ship on board.
1740-1870 Move cursor.
1890-2030 Optional music.

on the ship on the cursor square. The ship’s laser bolts and shields are then displayed. An empty square has no laser bolts and eight shields.

To warp a ship, press W with the cursor on its square. At any time each player can have one ship in warp. It may return later in the game in a random position on the board and will destroy any ship on that square. If another of the player’s ships is already in warp it will never return, and if this is the king, the game is lost.

Quite interesting and complex games can be played, and there are a number of strategic points which should be taken into account. The king should normally remain in its space base so that it is fairly safe, but sometimes must be moved to avoid being fired at. It may also be wise to move it to recharge other ships. Always keep it in a safe position. Try to break through the opposing defence to get in a position to attack the king from as near as possible to be most effective.

"WINCHER HOUSE, CANNING ROAD, WESKIELDEN, HASTINGS, HA3 7SJ, ENGLAND. Telephone: 01861 1166."
Take opposing ships where possible, but keep your ships safe at the same time. Ships have greater attacking powers, laser bolts from queens and bishops may serve and hit another ship, possibly your own. Those from knights are most effective but have a limited range. Bishops and knights often need recharging.

It is quite often worth warping, but you should usually warp pawns, avoid it when one of your ships is already in warp. Use warping as a last resort for major ships, and only warp your king under very severe conditions. Reporting is not a very good use of a turn but is used to survey the situation or to use up a turn if you do not wish to or cannot move. When you move a ship be careful not to leave it where it may be taken. Beware of the way pawns move; try to destroy as many of the opposing ships as possible to lessen the chances of mistakes.

The board occupies all lines of the 40-by-25 screen and is 33 characters wide by 40 -by-25 screen and is 33 characters wide of the opposing ships as possible to lessen the way pawns move; try to destroy as many of the opposing ships as possible to lessen the chances of mistakes.

The board occupies all lines of the 40-by-25 screen and is 33 characters wide starting from the fourth column. The corners of most squares are marked by

<table>
<thead>
<tr>
<th>Type</th>
<th>White</th>
<th>Grey</th>
<th>Shields maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pawn</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Bishop</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Knight</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Rook</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Queen</td>
<td>6</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>King</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

Table of ships.

In line 1740, l00 is the line length multiplied by 3, and 53252 is the top left of the screen + 4.

POKE 4465,X:POKE 4466,Y is equivalent to PRINT @ X, Y.

POKE (HOMET)+LEFT$(A$)X,LEFT$(A$)Y

where AC$ is a string of right cursors and DNS$ is a string of down cursors. Alternately, the ships, laser bolts, etc. could be plotted in high resolution. Note that all ships are plotted in line 1720.

Poking of X should be retained. All the other Pokes and the USRs produce sound and visual effects and may be removed, although they add an extra dimension to the game. In Print statements a reverse-C clears the screen and moves the cursor to 0, 0, reverse-H moves the cursor to 0, 0 and reverse arrows move the cursor one character in the direction indicated. In line 1420, Music 'R3 causes a short wait.

Games

Table of ships.

Take opposing ships where possible, but keep your ships safe at the same time. Ships have greater attacking powers, laser bolts from queens and bishops may serve and hit another ship, possibly your own. Those from knights are most effective but have a limited range. Bishops and knights often need recharging.

It is quite often worth warping, but you should usually warp pawns, avoid it when one of your ships is already in warp. Use warping as a last resort for major ships, and only warp your king under very severe conditions. Reporting is not a very good use of a turn but is used to survey the situation or to use up a turn if you do not wish to or cannot move. When you move a ship be careful not to leave it where it may be taken. Beware of the way pawns move; try to destroy as many of the opposing ships as possible to lessen the chances of mistakes.

The board occupies all lines of the 40-by-25 screen and is 33 characters wide starting from the fourth column. The corners of most squares are marked by

<table>
<thead>
<tr>
<th>Type</th>
<th>White</th>
<th>Grey</th>
<th>Shields maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pawn</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Bishop</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Knight</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Rook</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Queen</td>
<td>6</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>King</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

Table of ships.

In line 1740, l00 is the line length multiplied by 3, and 53252 is the top left of the screen + 4.

POKE 4465,X:POKE 4466,Y is equivalent to PRINT @ X, Y.

POKE (HOMET)+LEFT$(A$)X,LEFT$(A$)Y

where AC$ is a string of right cursors and DNS$ is a string of down cursors. Alternately, the ships, laser bolts, etc. could be plotted in high resolution. Note that all ships are plotted in line 1720.

Poking of X should be retained. All the other Pokes and the USRs produce sound and visual effects and may be removed, although they add an extra dimension to the game. In Print statements a reverse-C clears the screen and moves the cursor to 0, 0, reverse-H moves the cursor to 0, 0 and reverse arrows move the cursor one character in the direction indicated. In line 1420, Music 'R3 causes a short wait.

64K SUPER PAGER

Turn two ROM sockets into SIXTEEN with the latest expansion board from SUPERSOFT. Suitable for all PET/CBM models, the SUPER PAGER enables you to select any one or both of eight separate areas of the screen + 4, from eight sharing the U01 or for USB eight and one from eight sharing the U10 (or USB) socket. Because the SUPER PAGER is software selectable (with a simple POKE command) you can switch functions in a program. May be used with the SUPERSOFT range of graphics boards. At just £75 plus VAT the SUPER PAGER is a long-term solution to a perpetual problem!

PET EPROM PROGRAMMER

With the EP.1 you could program your own 2k and 4k machine code software which includes the SUPERMON extended monitor. Price £75 plus VAT

*** SPECIAL OFFER *** BUY A SUPER PAGER AND AN EP.1 AND WE'LL SUPPLY A 4K EPROM CONTAINING THE EP.1 SOFTWARE AT NO EXTRA CHARGE.

FUN & GAMES!

There is a lighter side to our range. At £8 we've got COSMIC ALIENS, ASTEROIDS, METEORITES, SPACE RESCUE, SUPER GLOOPER and TANKS — all in fast machine code with sound. Adventure games for 32k machines include HITCH-HIKERS GUIDE and CHECKS OF DOOM at £10, other top selling games are PET CHESS (£25), HALLS OF DEATH (£14) and OTHELLO (£8). Add VAT to all prices — and ask for our free catalogue when you order.

SUPERSOFT

Winchester House, Canning Road, Walthamstow, London, E17 7SJ, England. Telephone: 01-861 1166

PRACTICAL COMPUTING September 1982
**BUYERS' GUIDE**

Printers

The Peripherals Buyers' Guide is a survey of printers suitable for small computers. We have excluded any system which costs significantly more than £2,000. The printers are listed in alphabetical order. The addresses of the main suppliers are listed at the end of the guide.

Printers may be divided into several categories. The highest-quality printing is produced by the daisywheel-type which creates text in various type-faces, according to the wheel used. The quality ranges from excellent typing to rather poor book printing and generally there is a proportional-spacing facility. Those machines tend to be expensive and slow. Daisywheels can be either plastic — inexpensive, but must be replaced often — or metal — expensive but durable.

For faster printing, you must turn to dot-matrix machines. The print quality tends to be poor and the machines noisy. Older machines use a 7-by-5 matrix which puts the descenders of letters such as 'y' above the line. That makes bulk text difficult to read. Better printers use a matrix nine dots deep to give true descenders. Recently, several firms have produced dot-matrix printers which give an approximation to typewriter printing and proportional spacing. They are less expensive than daisywheel machines, work faster and could well be used for correspondence-quality work.

Some dot-matrix printers employ sensitised paper to produce printing by more direct electrical effects. They are often quiet and fast, but the paper can be expensive, unpleasant to handle and hard to obtain.

The trend is to build more processing power into printers. That means they offer increasingly varied features, so it is hard to categorise them precisely.

A printer has to be connected to the computer by a cable and a more or less standard interface. The normal interfaces are the Centronics parallel, RS232 serial port — also known as the V-24 — and 20mA current loop. The IEEE is a parallel interface used by Pet; 'cpi' means characters per line, 'cps' means printing speed in characters per second. Allow five characters to the word.

The more intelligent printer prints as its head moves in both directions across the paper — bi-directional printing. Still more
Buyers' Guide

intelligent ones end the head movement at the ends of short lines. These two features can more then treble the working speed.

Printers use two types of paper: plain paper fed — like a typewriter — pinch- and pin- or sprocket- or tractor-fed with holes along the margins. That paper can be supplied fan-folded or in rolls.

Pinch feeding is more expensive but is convenient for letters. Only a few machines will accept both pinch- and pin-fed paper. It is possible to obtain headed letter paper bonded lightly on to pin-fed, fan-folded computer paper for word processors.

Some printers allow direct control of the print-head to give graphics. KSR means keyboard, send and receive, ASR means automatic send and receive, RO means receive only. KSR machines can be used as electric typewriters in local mode.

Comb or line printers have a whole line’s worth of dot hammers so they can print a line of text at a time. They tend to be very expensive and very noisy but produce an enormous quantity of work.

ACCESS DATA COMMUNICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADC 1251</td>
<td>Matrix printer, continuous paper, £13 per box, 80 or 132 cpi, 125 cps, 99 matrix, RS232, Centronics and IEEE interfaces.</td>
<td>£550</td>
</tr>
<tr>
<td>ADC 2401</td>
<td>9x9 dot-matrix printer, continuous paper, 136 cpi, 240 cps, RS232, Centronics and IEEE interfaces. Available from Access Data Communications.</td>
<td>£1,350</td>
</tr>
</tbody>
</table>

ADDMASTER

400 receive only
Uses 2.5in. Tally roll paper, 16 cpi, 48 cps. Main U.K. agent Clary Ltd. £243

420-426 receive only
Dot matrix grade-one Tally roll paper at £5 for 20 rolls. BCD serial or 10-line serial interfaces, 12 cpi, 36 cps. £246

AMBER

Amber 2400
Low-cost inked-ribbon dot-matrix printer using plain paper rolls. Unusual mechanism involves only four print needles, which oscillate horizontally across paper to build up line of dots. 24 normal-size five-by-seven dot characters per line on 58mm. wide paper at speed of 0.7 lines per second. Upper- and lower-case ASCII set, expanded characters and dot graphics. Acorn, BBC, Pet, TRS-80, UK 101 and ZX interfaces available. Main U.K. distributor Amber Controls Ltd. £70

ANADEX

Main U.K. agent Anadex Ltd

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP-500</td>
<td>Dot matrix, tractor feed, parallel interfaces, 18 cpi, 48 cps.</td>
<td>from £367</td>
</tr>
<tr>
<td>DP-660</td>
<td>Dot matrix, pinch feed for printing labels, uses sprocket feed. Parallel interface. 19 cpi, 57 cps.</td>
<td>from £700</td>
</tr>
<tr>
<td>DP-750A</td>
<td>Dot matrix, RS232 20mA current loop, 21 cpi, 25 cps.</td>
<td>from £1800</td>
</tr>
</tbody>
</table>

WANTED

for the ZX Spectrum

We require the following programmes to be written for the Sinclair Spectrum:

- ASSEMBLER/DEBUGGER
- CHESS
- SPACE INVADERS
- GALAXIANS
- ASTEROIDS
- PUCKMAN

We will consider supplying a ZX Spectrum to the right applicants for the duration of the work and will pay a generous royalty for exceptional programmes.

Send details of experience etc. to BOX No. 1000

PRACTICAL COMPUTING September 1982

MINI DISKS — BIG SAVINGS

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD 525 S/SIDED 40 TRACK</td>
<td>£16.45</td>
<td></td>
</tr>
<tr>
<td>MD 550 D/SIDED 40 TRACK</td>
<td>£22.45</td>
<td></td>
</tr>
<tr>
<td>MD 677 S/SIDED 77 TRACK</td>
<td>£24.45</td>
<td></td>
</tr>
<tr>
<td>MD 557 D/SIDED 77 TRACK</td>
<td>£32.45</td>
<td></td>
</tr>
</tbody>
</table>

Prices are per ten pack, excluding VAT.

All disks are factory fresh, soft-secured, hub reinforced and certified 100% error-free.

Please include UK p&p at 95p per pack, then add 15% VAT to total.

Send Cheque/PO now to:
DATATECH LTD, DEPT PC, FREEPOST, ALTRINCHAM, CHESHIRE, WA15 0BR.

MINI DISKS — BIG SAVINGS

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD 525 S/SIDED 40 TRACK</td>
<td>£16.45</td>
<td></td>
</tr>
<tr>
<td>MD 550 D/SIDED 40 TRACK</td>
<td>£22.45</td>
<td></td>
</tr>
<tr>
<td>MD 677 S/SIDED 77 TRACK</td>
<td>£24.45</td>
<td></td>
</tr>
<tr>
<td>MD 557 D/SIDED 77 TRACK</td>
<td>£32.45</td>
<td></td>
</tr>
</tbody>
</table>

Prices are per ten pack, excluding VAT.

All disks are factory fresh, soft-secured, hub reinforced and certified 100% error-free.

Please include UK p&p at 95p per pack, then add 15% VAT to total.

Send Cheque/PO now to:
DATATECH LTD, DEPT PC, FREEPOST, ALTRINCHAM, CHESHIRE, WA15 0BR.

WANTED

for the ZX Spectrum

We require the following programmes to be written for the Sinclair Spectrum:

- ASSEMBLER/DEBUGGER
- CHESS
- SPACE INVADERS
- GALAXIANS
- ASTEROIDS
- PUCKMAN

We will consider supplying a ZX Spectrum to the right applicants for the duration of the work and will pay a generous royalty for exceptional programmes.

Send details of experience etc. to BOX No. 1000

PRACTICAL COMPUTING September 1982

MINI DISKS — BIG SAVINGS

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD 525 S/SIDED 40 TRACK</td>
<td>£16.45</td>
<td></td>
</tr>
<tr>
<td>MD 550 D/SIDED 40 TRACK</td>
<td>£22.45</td>
<td></td>
</tr>
<tr>
<td>MD 677 S/SIDED 77 TRACK</td>
<td>£24.45</td>
<td></td>
</tr>
<tr>
<td>MD 557 D/SIDED 77 TRACK</td>
<td>£32.45</td>
<td></td>
</tr>
</tbody>
</table>

Prices are per ten pack, excluding VAT.

All disks are factory fresh, soft-secured, hub reinforced and certified 100% error-free.

Please include UK p&p at 95p per pack, then add 15% VAT to total.

Send Cheque/PO now to:
DATATECH LTD, DEPT PC, FREEPOST, ALTRINCHAM, CHESHIRE, WA15 0BR.
supercharge your
SUPERBRAIN

* Speed up disk operations by 400%  
* Cut copying time by up to 75%  
* Copy screens to memory or printer  
* Chain COM files from BASIC  
* Get BDOS errors under your control  
* Write unbreakable security routines  
* Autoboot any program  
* Customise your favourite Word-processor

SeeDee Software tune-up kits start at £130.00

Full details from:
COMPUTER FACILITY
0734 867855
32 Redlands Road,
READING,
Berks.

BBC MICRO
VITAL BITS & PIECES
RGB COLOUR
SYSTEM FOR MODEL 'B'
14" Monitor + Interface Cable £275.00
PC COMPOSITE SIGNAL COLOUR SYSTEM
14" PAL Monitor + Interface Cable £275.00
12" GREEN TRACE MONITOR Monitor + Interface Cable £95.00
EPSON AX80 FT/3 PRINTER Friction/Tractor/Graphics £345.00
Interface Cable £20.00
USER PORT INTERFACE FOR MODEL 'B'
Connector + ribbon Cable to Terminal strip with Data Sheet included £25.00
Please add VAT + p&p £10.00 (User Port p&p £1.00)
Terms: Cash with Order
PEDAGOG COMPUTER SERVICES
11 Fairbridge Road London N19 3EW Tel: (0485) 40664

AXION CORPORATION
Main U.K. agent Memec Systems Ltd
EX-820 receive only £500
Electro-sensitive dot matrix includes plotting capability for full graphics, paper at £3 for a 240ft. roll, RS232C or 20mA serial and ASCII parallel, 20/40/80 cpi and up to 180 cps, 5x7 matrix.

EX-850 Video Printer £500
Electro-sensitive dot matrix, aluminised paper at £3 for a 240ft. roll. Needs only the video signal from user’s. Normal resolution 13.5 seconds per screen, high resolution 27 seconds per screen.

EX801/802 receive only £279
Electro-sensitive, dot matrix, aluminised paper at £3 for a 240ft. roll, RS232C, Centronics, Apple, Pet, and Tandy interfaces, 20/40/80 cpi, 180 cps, 5x7 matrix.

CENTRONICS
Main U.K. agents Bytech, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 150 £499
Table-top demand document dot-matrix printer, 150 cpi, bidirectional logic-seeking, using fan fold, roll and cut sheet paper up to 9.5in. wide 80 columns, RS-232 and parallel models available.

Model 152 £695
As model 150, but 132 columns 15in. wide.

Model 352 £1,400
Print station; advanced dot-matrix printer, 132 column 200 cpi bidirectional logic seeking printer. Three-way paper-handling with built-in single-sheet feeder. Has second printing mode which at 60 cps gives very high-definition letter-quality printing, and high-quality pin addressable.

Model 353 £1,740
Print Station; similar to model 352 but with liquid-crystal display for status indication and user-selectable parameter set-up.
Model 739
Table-top correspondence-quality mini-printer with three-way paper handling and proportional character set. £504

Model 6300
Industrial 300 line per minute band printer. P.O.A.

Model 6600
Same as 6300 but with 600 lines per minute. P.O.A.

Model 6080
Very quiet 600 line per minute band printer for office use. Has a variety of interfaces to suit most micro, mini or mainframe computers. £5,583

COMPUTER DEVICES INC

Miniterm 1201, 1202, 1203
Thermal mechanism, uses Thermal Type B paper at £2.40 per roll, RS232 or parallel — 1201 only — interfaces, 90 or 132 cpi, 10/30 cps, 7x5 matrix. Main U.K. agent Teleprinter Equipment Ltd. £396

DATAC

Main U.K. agent Datac Ltd

414 free-standing assembly receive only
Electro-sensitive, matrix printer type 245L, electro-sensitive roll paper, 59mm. wide x 30m. long at 90p per roll for 20 cpi, six-bit parallel ASCII, character serial interfaces, 16, 20, 32 or 40 cpi, 32 to 80 character per serial, 7x5 matrix. £130

DMI-40P free-standing terminal, receive only
Impact, matrix, uses pressure-sensitive roll paper, 10mm.-wide ordinary paper version, using ink ribbon. Cost of paper £1 per roll, seven-bit parallel ASCII, character serial, RS232C or graphics, 40 or 20 cpi, up to 80 cps, 7x5 matrix. £350

411C compact panel mounting, receive only
Electro-sensitive matrix type 245L or R, uses electro-sensitive roll paper, 59mm. wide x 30m. long at 90p per roll, six-bit parallel, serial interfaces, 16, 20, 32 or 40 cpi, 32 to 80 cps, 7x5 matrix. £209

411 panel mounting, receive only
Electro-sensitive matrix printer type 245L or R, uses electro-sensitive roll paper, 59mm. wide x 30m. long at 90p per roll. Interfaces include six-bit parallel ASCII, character serial, four-bit parallel BCD, character parallel EIA/RS232C, character serial, RS232C or graphics, 20mA current loop, under development 40 cpi, 32 to 80 cps, 7x5 matrix. £189

313 panel-mounting, receive only and
312 free-standing, receive only
Impact matrix type PU-1100, Tally roll paper, 59mm. wide x 36m. long at 60p per roll, CTTTV24 or EIA RS232C or 20mA current loop interfaces, up to 20 cpi and up to 36 cs, 7x5 matrix. £289

412/1 and 412/5 receive only
Electro-sensitive dot matrix type 245L, uses electro-sensitive aluminum-coated paper, 59mm. x 30m. at 90p per roll, six-bit parallel, ASCII, character serial and four-bit parallel BCD, character parallel, RS232C/V24 interfaces, 20mA current loop under development, 16, 20, 32 or 40 cpi, 32-80 cps, 7x5 matrix. £255

522/1 and 522/4 receive only
Impact matrix type, roll paper, 114mm. x 75m. up to three copies plus original, cost of paper £1.10 per roll. Parallel interface and RS232C, 20mA current loop and parallel buttered, asynchronous interfaces — (522/4). 40 cpi, 100 cps instantaneous rate, 33 cps average rate — including CR and LF, 7x5, 7x10. £499 (522/1) £535 (522/4)

EPSON TYPE 3 PRINTERS

Epson’s superb Type 3 series replaces the Type 2 and offers:

* IMPROVED PERFORMANCE
* MANY NEW FEATURES
* LOWER PRICES

For free brochure and special Epson offer write, stating your computer, to:
DATATECH LTD,
DEPT PC, FREEPOST,
CHESHIRE, WA15 0BR.

MICROCASE
”turns a board into a real computer”
For NASCOM 2
COMPUIKIT
SUPERBOARD
ALSO UNCUT FOR NASCOM 1 ETC.

Direct from us or from your dealer — but make sure you see a GENUINE MICROCASE

COMPUTERCAT
SOFTWARE
BBC MICRO
DATABASE 1 £12.95
Set up your own database with search, sort facilities. About 300 records for 64K.

TREASURE ADVENTURE £6.95
Specially adapted for the BBC Micro — an old favourite.

VIDEO GENIE & TRS 80 £5.95

FORTY NINER £5.95
Find the gold in sunny California.

BRIDGE BUILDER £5.95
A game of skill to bridge the gap.

TANK BATTLE £5.95
A game for two. Test your skills in battle.

* prices include VAT & Postage.

224 Chapel Street, Leigh, Lancs
Tel: (0942) 685730

PRACTICAL COMPUTING September 1982
MICROWARE (London Ltd)

COMPLETE DISC DRIVE SUB SYSTEMS
For Tandy; Video Genie; Nascom
AND ALL POPULAR MICROS

SINGLE UNITS
£175

DUAL UNITS
£295

BBC MICRO
SINGLE UNIT FROM £135

Includes PSU and attractive desk top cabinet
Fully guaranteed CDC disc drives
Cast aluminium chassis
5 mill sec track to track
250k; 500k or 1MB
Industry compatible

Microware
(London Ltd)
637 Holloway Road,
London N19
Tel: 01-272 6237
01-272 6398

Circle No. 242

*BIG EARS*

SPEECH INPUT FOR ANY COMPUTER

Hugely successful Speech Recognition System, complete with microphone, software and full instructions.

HUGELY POPULAR AT TEST DAYS PLEASE STATE COMPUTER. UNIX, SUPERTERMINAL, NASCOM, 8080, PDP 11, DEC 20, VAX, APPLE, 6502, 128K, 6128K, 6512, AMSTRAD

ZX80 ZX81

MUSIC SYNTHESER + 16 LINE CONTROL PORT

Pot 3.5dB music, sound effects, drums etc. Full period of attack, decay and frequency. Input/Output lines provide control and monitor facilities for Music Sounds Facility, Control Facility, Model Railway, etc. etc. Works with or without music software.

Add keyboard to make a live performance polyphonic synthesiser!

MARGIN VALUE AT ONLY £19.50 KIT
Extra Connector at £2.50
25.50 (BUILT)

* Circle No. 243

OSBORNE 1
IN OXFORDSHIRE
WE DEMO AND DELIVER TODAY
0295.66555

Circle No. 244

DATA DYNAMICS

Main U.K. agent Data Dynamics Ltd
303 Printer
Dot matrix, up to six-part stationery width from 3m to 15.375in., V24/RS232C, 20mA current loop, 132 cpl, 30 or 60 cps, 7x7 matrix.

ZIP ASR/K7 twin cassette
Dot matrix format, uses standard Teletype roll paper, V24, RS232C, or 20mA current loop operating at half or full duplex, 80 cpl, 10 or 30 cps switch selected, 5x7 matrix.

ZIP 30 keyboard printer, RO, ASR, or KSR
Dot matrix, standard roll paper, 20mA half or full duplex current loop or V24 RS232C, 80 cpl, 10 or 30 cps — switch selected, 5x7 matrix.

390 eight-level and 392 five-level
ASR, KSR and read-only versions. Impact printers, friction or sprocket feed, 6.5In. paper with roll diameter 9in. 74 or 88 cpl, 6.6 or 10 cps.

Models 32 and 33 page printers
Available in ASR, KSR and receive-only versions. Friction or sprocket feed, 20mA or 60mA parallel, up to 86 cpl, 6.6 or 10 cps.

DATA GENERAL CORPORATION

Dasher TP1 Printer models 6040 and 6041
6040 standard keyboard and can be used as a typewriter. 6041 is a receive-only terminal printer without keyboard, 30 or 60 cps, switch selectable, EIA-RS232C interfaces, 5x7 dot matrix. Main U.K. agent Data General.

DATAPLUS

400 series receive-only Model 480
Impact dot matrix, uses standard Tally roll, up to 3.75In. side, from 80c per roll, RS232C, V24, 20mA current loop, but parallel IEEE, Pet and Apple interfaces, 30/40 cpl, 110 cps, 7x5 and 7x10 matrices. Main U.K. agent Dataplus Ltd.

DATASOUTH CORPORATION

DS-180

DIABLO

HY type II receive only
Impact daisywheel plastic or metal print wheel, parallel, interface, 132 10-pitch cpl or 199 12-pitch cpl, 40/45/55 cps. Main U.K. agent Diablo Systems Ltd.

630 receive only

PRACTICAL COMPUTING September 1982
**DIGITAL EQUIPMENT**

**DecWriter LA34 KSR**  
Dot matrix, uses roll or fan-fold paper, friction-feed, up to five copies, RS-232 or 20mA interfaces, adjustable up to 256 cpi, 5x7 matrix. Main U.K. agent Bytech.  
**A120**  
7x7 dot matrix, EIA or 20mA option, up to 217 cpi, 180 cps. Main U.K. agent Bytech.

**DIGITRONIX**

**Mini-Printer**  
32 column electro-sensitive, 110-4,800 baud, ASCII Serial inputs at RS232C, 20mA, 64 font at 64 cps. Main U.K. agent Digitronix.

**DRG**

**Starwriter FP1500-25**  

**ELECTROGRAPHIC AV**

**EC-800 receive only**  
Impact, matrix printer, uses any type of paper, parallel, RS232C, TRS-80, Apple interfaces, 80 cpi, 150 cps, 7x5 or 7x6 matrices. Main U.K. agent Electrographic AV Ltd.

**500 series receive only**  
Impact, matrix printer, uses 3.5in. Tally roll paper and flat documents, serial or parallel interfaces, 40 cpi, 120 cps, 7x5 or 7x6 matrices. Main U.K. agent Electrographic AV Ltd.

**EPSON**

**TX-80**  
Impact, dot matrix, friction pin-feed RS232C, V24, 20mA current loop, bit parallel, Centronics, IEE, Pet, Apple and TRS-80 interfaces, 80 cpi, 150 cpi, 7x5 or 7x10 matrices and graphics. Optional PROM chips for high-resolution graphics. Main U.K. agent Dataplus Ltd.

**MX-80**  
Impact, dot matrix, accepts any type of paper, Centronics parallel interface, optional serial and IEE 488 interfaces, 44, 66, 80, 132 cpi, 80 cps, 9x9 matrix — 2.1 x 3.1mm. High resolution graphics.

**EXTEL CORPORATION**

**M30 receive only keyboard send/receive and automatic send/receive**  
Impact, dot matrix printer, uses roll or fan-fold paper, V24 or 20mA interfaces, 80 cpi, 30cps (with buffer) 5x7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

**M30 B208L keyboard send/receive**  
Dot matrix, uses roll paper, V24 or 20mA interfaces, 80 cpi, 30 cps, 5x7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

---

**EX-DEMONSTRATION UNITS**

- **CBM 3032 PET 32k computer**  
  £500
- **CBM 3022 Printer**  
  £225
- **Computhink 800k disc drive (dual)**  
  £250

**ADVANCED MANAGEMENT SYSTEMS**

- **8 Moorfields, London EC2Y 9AA**
- **Tel: 01-638 9319**
  (Approved Commodore Dealers)

**THE POWER BANK**

- **Plug your micro computer video unit and Printer into the POWER BANK and forget about a disabling break in the electricity supply. This unit will continue to run your system in the event of a mains failure... WITH NO INTERRUPTION TO YOUR WORK!**
- **Vital when running business systems. This unit will of course suppress MAINS SPIKES and SURGES.**
- **SINEWAVE OUTPUT**
- **120VA £320**
- **250VA £450**
- **plus carriage, packing and VAT**

**FLOPPY DISC DRIVE REPAIRS**

- **Repair and alignment of floppy disc drives.**
  - **Shuggart, Tandon and CDC a speciality**
  - **Competitive Prices**
  - **Quantity Discount**
  - **Fast Service**
- **Tel: 0626 62389/0364 52188**

---

**PRACTICAL COMPUTING September 1982**
RAM BARGAINS

4116 — 200ns. 85p each. 100 + £6.60 each.
4116 — 250ns. 75p each. 100 + £5.65 each.
100 + £5.15 each.
2114 — 300ns. 75p each. 100 + £5.15 each.
2114 — L — 200ns. 85p each. 100 + £6.60 each.
4816 — 100ns. BBC RAM 85p each. 68p each. 70p each. 55p each. 85p each. £3.50 each. £4.50 each. £3.50 each. £4.40 each. £2.20 each. £1.80 each. £3.95 each. £3.95 each. £9.00 each.
Add 50p P & P and VAT at 15%.

ATHANA FLOPPIES

Minis with free plastic library case and hub rings.
S/S D/D. £26.50 for 10. £27.50 for 10.£9.00 each.
D/S D/D. £15.50 for 10. £24.50 for 10. £25.50 for 10.
All other discs available add 85p P & P and VAT at 15%.

ORCHARD COMPUTER SERVICES

SEARCHING FOR BEST PRICE
FIND LOWEST PRICE...GO TO ORCHARD

PET
3211 CASSIETTE £13 Our own transport deliver. 4116 £350
4116 19K £65 4122 £85
4164 32K £115
4164 64K £130
2114 96K £175

DESK DRIVES
2031 102K £395
6410 243K £395
our best offer £395
8230 110K £395 Price
932 210 £1295
discontinued.
9283 320 £1995
930 75M £2195
For super service.

PRINTERS
4022M BLACK/BIDYR £395
4223 BLACK/CO £395
2430 — DASH £1795

If you know what you want why wait?

ORCHARD COMPUTER SERVICES
ORCHARD HOUSE, 21 ST. MARTIN'S ST., WALLINGFORD, OXON.
TEL: WALLINGFORD (0491) 35259

Search.

FACIT

4520 and 4521
Seven-wire print head, uses roll paper Telex type (Facit 4520), friction feed, fan-fold (Facit 4521) pin feed, serial, V24/RS232C, Centronics parallel interfaces, both fitted as standard, 80 cpl, 100 cps at 12 characters per inch, 9x9 matrix. Main U.K. agent Facit Ltd.

GENERAL ELECTRIC, U.S.A.

ITT 3330

HEATH ELECTRONICS

WH14

INTEGRAL DATA SYSTEMS

Paper Tiger Model 460

LEAR SIEGLER INC

300 series
Dot matrix, uses standard paper, RS232C, 20mA parallel interfaces, Centronics 701/703 type 132 cpl, 180 cps, 9x7 or 9x9 matrices. Main U.K. agent Penny & Giles Data Recorders Ltd.

LOGABAX

LX-213
Dot matrix printer, plain paper, fan-fold or cut to six-ply, RS232C or V24 interfaces, 132 cpl, 218 cpl, 180 cps, 8x7 matrix, optimised bi-directional printing. Main U.K. agent Brospa Data Ltd.

LRC EATON

7000+
Dot matrix printer, uses roll paper, RS233, IEEE, current loop and parallel interfaces, 20, 32, 40 and 64 cpl software selectable by option, 40 cps, 7x9 matrix. Main U.K. agent Russet Instruments.

MALIBU ELECTRONICS CORPORATION

Masterprint 165
Dot matrix, fan-fold paper, RS232C, current loop and parallel interfaces, 132 cpl, 165 cpl, 10x9 matrix with 18x9 matrix character set which approaches word-processing quality, graphics. Main U.K. agent MBS Terminals Ltd.

MANNESMAN TALLY

Main U.K. agent Peritronic Ltd
M-80 MC
Dot matrix, 9.5in. pin feed paper, all interfaces, 80/132 cpl, 200 cps, 9x9 or 9x9 matrices.
Buyers' Guide

**T1612 keyboard send/receive**
- Dot matrix, single or multi-part paper, pin feed, RS232C or 20mA interfaces, 132/218 cpl, 160 cps, 7x9 or 9x9 matrices.

**T1612 receive only**

**T1602**
- Dot matrix, single- or multi-part paper, pin feed, Data Products, Centronics and serial interfaces, 132 cpl, 160 cps, 7x9 matrix.

**MICRO PERIPHERALS INC**

**MPI-88T**
- Dot matrix printer, uses fan-fold, roll and cut-sheet paper, RS232C, current loop and parallel interfaces, 80/96/120/132 cpl, all software-selectable, 120 cps, 7x7 matrix. Main U.K. agent Russet Instruments.

**NEWBURY LABORATORIES**

**Model 8300**
- Dot matrix, pin-feed paper up to 9.5 in., eight-bit parallel interface or CCITT V24, RS232C interfaces, 10 characters per inch, 125 cps, 7x9 matrix. Main U.K. agent Newbear Computing Store.

**NIPPON ELECTRIC COMPANY**

**Spinwriter**
- Combines golf-ball daisywheel and thimble mechanism, uses continuous or single-sheet computer paper, RS232C serial (RO and KSR), Centronics-compatible and Diablo-compatible interfaces, 9080 input bus line, current loop, 55 cps, solid-font matrix. Main U.K. agents Northamber the Printer People, and Memec Systems.

**OKI**

**Microline 80A**
- Dot matrix, 9x7, 80 cps, 80 or 132 cpl, pin, traction or friction feed, RS232, 20mA Centronics. Main U.K. agent X-Data.

**Microline 82A**
- Dot matrix, impact printer, 80 cps, bi-directional logic-seeking, 40, 66, 80 or 132 cpl, pin, friction or tractor feed, serial and parallel interface, 160 characters. Main U.K. agent X-Data.

**QUME**

**Sprint 5/45 receive only**
- Daisywheel mechanism, uses plain paper, fan-fold or cut appear A4 up to six-ply, RS232C or V24 interfaces, 196 cpl at 12 pitch, 45 cps.

**Sprint 9-35 KSR**
- 35 cps daisywheel printer, exceptionally quiet operation, integral keyboard.

**Sprint 9-45 RO and Sprint 9-55 RO**
- Similar to the 9-35 KSR but with no keyboard, 45 or 55 cps. Main U.K. agent Qume (U.K.) Ltd.

**PINEWOOD COMPUTERS**

**THE LAUNCH OF THE 64K EXPANSION BOARD FOR 8032 PETs**
- Yes. We couldn't wait for the others so we have launched our own 64K Memory Expansion board to upgrade the 8032 PET to a full 96K. Silicon Office and other 96K programmes are now possible on a 32K PET with our board. It is of U.K. Design and manufacture and comes complete with full fitting instructions.

**Our Price £350**

**EPSON/PET INTERFACE CARD**
- RRP £90
- For all MX printers. Our board gives 40 column PET's uppercase and graphic and 80 column PET's both upper and lowercase without the need of switches or any software routine.

**RICOH RP1600 INTERFACE CARD**
- RRP £115
- Our board gives 40 column PET's uppercase and 80 column PET's both upper and lowercase without any restrictions.

Add £10 delivery plus VAT to above prices.

**PINEWOOD COMPUTERS Mail Order Dept., 17 Adelphi Crescent, Hayes Park, Hayes, Middx. or telephone 01-841 1507**

**DEALER ENQUIRIES WELCOME**

**CHIPS GALORE**

**H116 200n.s.**
- 80p ea

**80p EA**
- 6502 4.50 ea

**4116 200n.s.**
- 50p ea

**6520 2.80 ea**

**4164 200n.s.**
- 40p ea

**6522 4.10 ea**

**2560 200n.s.**
- 60p ea

**6523 6.10 ea**

**6116P 3.25 ea**

**6545 C.R.T. 8.50 ea**

**2716 2.25 ea**

**6504 6.00 ea**

**2732 4.00 ea**

**6529 8.25 ea**

**2732 4.00 ea**

**1486/9 53p ea**

**For larger qty's phone 01-668 7522**

**Please add 50p p&p & VAT**

**KESTREL ELECTRONIC COMPONENTS**

112 GODSTONE ROAD, PURLEY, SURREY

**PRACTICAL COMPUTING September 1982**
MICRO SERVICING
AND REPAIRS
-APPLE PET-VIC BSC ITT
and other makes
Micro Malfunction? Send or drop your micro
in to us. We’ll repair it in our workshops
and return it. Our staff are fully qualified
and we are Main Dealers and Software
Specialists for most making machines.
ALSO FULL MICRO SERVICE CONTRACTS
IN LONDON AND EAST ANGLIA
MICROSTORE MICRO MANAGEMENT
327 King’s Rd. LONDON 32 Princes St. IPSWICH
SW3. Tel: 01 352 9291
Suffolk. Tel: 0473 57871

EX-DEMO APPLE III
COMPUTER SYSTEM
AS NEW
Includes: 128K Computer, 12” Video Monitor,
Spare Disk Drive, Silentype Printer, Visicalc III,
Apple Writer III and all System Software.
Normal Retail Price
£3321.00
Above System Price
£1995.00
Prices do not include VAT.
Call:
DaVinci Computers Ltd.
65 High Street
Edgware
Middx. HA8 7DD.
01-952 0526

Complete Business System
TRS 80
48K Model I Level II, Double Density upgrade,
Lower Case upgrade, Numeric Key pad, complete
with Interface, System Desk, Green Screen, etc.
£795.00
To suit above: 2 Shugart SA 400 disk drives, 35
track Double Density $48.00
Alternative: Teac 80 Track Double Density twin
drives.
£136.00
Two of these twin drives will give total disk storage
of approx. 1.5 MB.
Also Centronics Dot Matrix Printer Model 779.
£136.00
We also have Business Software, specifically written
for this model and orientated towards distribution
and accounting.
Please phone Wolverhampton
(0902) 710 700 for further details.

MICROCOMPUTER INSURANCE
Comprehensive cover at a reasonable premium:
• All Risks Cover (incl. Transit) — up to
£10,000 for £20
• Increased Cost of Working — to
reinstate lost data
• Breakdown & Derangement —
alternative to maintenance agreement
Write with details of equipment to:
Geoffrey Hoodless & Associates
Freepost (no stamp required)
Woking
Surrey GU21 3BR
Tel: Woking (04862) 61082 (24 hrs)

RAIR
Main U.K. agent Rair Ltd
820/825 Desk-top printer
Dot matrix, RS232C interface, 132 cpl, 75 or 150 cps, 7x7 matrix.
£1,090
DecWriter IV keyboard printer, KSR and read only
Dot matrix, uses standard listing paper, RS232C current loop
interface, 215 cpl, 30 or 180 cps, 9x9 matrix.
£795
M200
Dot matrix, uses continuous paper, parallel or serial interface, 132
cpl, 340 cps, double 7x9 matrix.
£1,995
DecWriter III
Dot matrix, uses continuous listing paper, RS232C or 20mA, current
loop interfaces, 132-215 cpl, 180 cps, 7x7 matrix.
£1,550

RICOH
RP-1600
Daisywheel, uses single-sheet or continuous paper, Centronics
and compatible interfaces, 132 cpl, 60 cps. Main U.K. agent Nexos
(U.K.) Ltd.
£1,285

ROXBURGH PRINTERS
X60 SP printer/plotter
Dot matrix, impact printer/plotter, pin-feed, fan-fold paper,
RS232C, IEE488, CBM, Centronics, HP85, 20mA, Tektronix, 80/96
cpl, 100 cps bi-directional, 8x8 matrix, three character generators,
various other generators. U.K. dealer Roxburgh Printers Ltd.
RP 8021
Dot matrix, impact printer, Tally roll, parallel, RS232C, 20mA, 21
cpl, 150 lpm, 9x7 matrix, sprocket-feed option for labels. U.K.
dealer Roxburgh Printers Ltd.
RP 8040
Dot matrix, impact printer, Tally roll, parallel, RS232C, 20mA, 40
cpl, 72 lpm, 9x7 matrix, sprocket-feed option for labels. U.K. dealer
Roxburgh Printers Ltd.
RX8000
Dot-matrix impact printer, friction or tractor/friction feed ver-
sions. Centronics, RS-232/20mA loop, 80, 96 or 132 cpl, 80 lpm
bidirectional logical seeking, 9x7 matrix, double-width characters.
RX40 — Apple
Dot-matrix thermal printer, tally roll, direct Apple II connection,
40 cpl, 120 lpm, high-resolution graphics printing, 10
seconds for 1 page. U.K. dealer Roxburgh Printers.
£152

SEIKOSHA
GP-100
Impact dot-matrix printer forming five-by-seven dot characters
using an unusual system involving a single hammer hitting a rotating
star-shaped bar. Centronics, RS-232, 20mA current loop or IEEE
interfaces. Prints 80 characters a line at 30 cps on standard 10in.
paper; dot graphics capability. Optional 8K buffer. Main dealer
Watford Electronics.
£185

S FARID (SPECTRONICS) MANUFACTURING
TP-40 and TP-65 receive only
Thermal, matrix, uses thermal paper, cost of paper £1.80 each roll,
seven-bit parallel interface, push-button control and self-test, 40 or
54 cpl, 13 or 18 cps, 9x9 dot matrix. Main U.K. agent S Farid
(Spectronics) Manufacturing Ltd.
from £660
**SMITH-CORONA**

TP-1
Daisywheel printer with Centronics or RS-232 interface. Prints at 17 cps on fanfold or cut-sheet paper up to 15.5in. wide. 10 pitch or 12 pitch versions giving 105- or 126-character lines. Main distributor Smith-Corona.

£500

**TELETYPe CORPORATION**

Model 43 keyboard send/receive
Impact matrix printer, uses pin-feed or friction-feed, dual RS232C and 20mA current loop interfaces, 132 cp1, 30 cps, 4x7 matrix on nine-wire printhead. Main U.K. agent Geveke Electronics Ltd.

£800

**TEXAS INSTRUMENTS**

Main U.K. agents Taxas Instruments and Rair Ltd

OMNI 800 series

Models 810, 820 and 825
Dot matrix printers, uses paper, EIA, current loop, parallel interfaces, 132-216 cpl compressed print (models 820 and 825), 132 cpl (model 810), 75 cps (model 825), 160 cps (models 810 and 820), 9x7 matrix.

Silent 700, model and 745 portable
Thermal mechanism, uses thermal paper at £1.50 per 100ft. roll, integral acoustic coupler, EIA interfaces, 80 cp1, 30 cps, 5x7 matrix.

Silent 700, 743 Keyboard send/receive version
Thermal mechanism, uses thermal paper at £1.50 per 100ft. roll, EIA, 20mA current loop interfaces, 80 cpl, 30 cps, 5x7 matrix.

from £1,090 to £1,660

£1,250

£1,105

**TRANSDATA**

313 Receive only
Dot matrix mechanism, uses thermal paper at £60 per box of 24 rolls x 150ft. RS232C and parallel interfaces, designed for use as VDU hard copy, 80/132 cpl, 30 to 45 cps, 7x5 matrix. Main U.K. agent Transdata Ltd.

£790

**TRANSTEL COMMUNICATIONS**

AR receive only
Dot matrix, uses standard teleprinter paper, V24, current loop interface, 80 cp1, 30 cps, 7x5 matrix. Main U.K. agent Transtel Communications Ltd.

P.O.A.

**UNITED SYSTEMS CORPORATION**

Main U.K. agent Aviquipo Ltd.

DigiTec 6320
Electro-sensitive dot matrix, electro-sensitive line roll paper at £1.80 per roll, RS232C or isolated 20mA current loop, 21 or 32 cpl, prints two lines per second, 1,200 Baud receive, 5x7 matrix.

£483

DigiTec 6330
Dot matrix, electro-sensitive paper at £1.80 per roll, 8-bit parallel/character serial, 21 or 32 cpl, 5x7 matrix.

£431

DigiTec 6410
Dot matrix, electro-sensitive paper at £1.80 per roll, RS232C or 20mA current loop, 21 or 32 cpl, two lines per second, 5x7 matrix.

£237

DigiTec 6420
Dot matrix, electro-sensitive paper at £1.80 per roll, 8-bit parallel serial, 21 or 32 cpl, prints two lines per second, 1,200 Baud receive, 5x7 matrix.

£237

DigiTec 6450
Dot matrix, thermal paper at £1.80 per roll, RS232C 20mA current loop, 21 cpl, prints two lines per second, 110 or 300 Baud receive, 5x7 matrix.

£266

£483

£431

£237

£237

£266

PRACTICAL COMPUTING September 1982
**Tape and RS232 I/O and sound output soc-**

TorONI SCIENTIFIC SUPERBOARD II, metal

**and send to Room L310, Quadrant House, The Quadrant,**

writing, 20p per word, minimum charge £2.

1200. Modulated uhf output. Assembler/Edi-

**kets. Switchable I/O and baud rates, 110/300/

sound generator. Updated to CEGMON moni-

ter, 32x68 char display, 25MHz clock, 8K RAM.

Tape and RS232 I/O and sound output soc-

kets. Switchable I/O and baud rates, 110/300/ 1200. Modulated uhf output. Assembler/Edi-

tor, word processor and computer terminal programs. £225. 0248-680034.

**VECTOR GRAPHIC**

**MP printer**

Uni-directional seven-wire x five-column dot matrix, original and one copy, maximum paper thickness 0.2mm., uses pin-wheel paper feed, 70 lines per minute, 150 cps. TTL level interface, two parallel output ports and one-parallel input port. Main U.K. agent Almarc Data Systems Ltd.

**DigiTec 5640**

Dot matrix, thermal paper at £1.80 per roll, eight-bit parallel serial 21 cpl, two lines per second, up to 1,000 Baud receive, 8x7 matrix.

**DigiTec 6550**

Dot matrix, thermal paper at £1.80 per roll, RS232C or 20mA current loop, 21 or 32 cpl, prints two lines per second, 110 or 300 Baud receive, 8x7 matrix.

**WALTERS MICROSYSTEMS**

**Dolphin BD-80P**

Impact, dot matrix, adjustable sprocket feed, any-one of three interface choices. 10 characters per inch, 80 cpl, full ASCII character set, self-testing, 64 graphics characters, 8x7 and 11x7 matrices, double-width characters, bi-directional printing. Main U.K. dealers Texas Instruments or Walters Microsystems.

**Dolphin BD-136**

Impact, dot matrix, forms tractor, fully interfaceable, 136-226 column width, full graphics capability, 8x9, 8x9 matrices, 32 user-definable characters plus full ASCII set, data-formatting functions, fully logic seeking, self-testing. U.K. dealers Nexos.

**WINERG DATEN TECHNIK**

**Sole U.K. distributor Access Data Communications Ltd**

**Print Swiss Matrix Printer**

Dot matrix RS232C, 20mA, 60mA and parallel interfaces, Centronics-compatible, 80 cpl, constant throughout 80 cps, 95-1000 lines per minute, 7x7 matrix. KSR version also available.

**Penny & Giles hard copies**

Electro-static RMP paper 127mm x 70m. at £3.90 per roll, RS232C, current loop option, 80/40/20 cpl, 80 columns, 110 lines per minute, 8x5 line printer, 8x7 message printer matrix.

**WHYMARK INSTRUMENTS**

**Main U.K. agent Whymark Instruments Ltd**

**Model 281**

Dot matrix, Tally-roll paper printer, IEEE, RS232C, serial, and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes.

**Model 204 label printer**

Dot matrix, impact printer for self-adhesive labels, IEEE, RS232C, serial and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes.

**Model 3011 ticket/forxprinter**

Dot matrix, plain paper, options automatic date and time, IEEE, RS232C, 40 cpl, 40 cps, 52 character set with four character sizes.

**Model 501 rack-mounting printer**

Dot matrix plain paper, options automatic date and time, IEEE, RS232C, 40 cpl, 40 cps, 52 character set with four character sizes.

**Model 801 80/120 column printer**

Dot matrix, plain or fan-fold paper, proportional spacing up to 120 cpl, 120 cps, bi-directional printing, user-definable character set, up to 4K selectable character fonts, graphics, and user-definable characters, also available; very large characters seven lines high.
Alphabetical list of suppliers

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Data Communications Ltd</td>
<td>Unit 17, Eskdale Road, Uxbridge Industrial</td>
</tr>
<tr>
<td></td>
<td>Estate, Uxbridge, Middlesex UB8 2RT.</td>
</tr>
<tr>
<td>Almarc Data Systems Ltd</td>
<td>Great Freeman Street, Nottingham NG3 1FR</td>
</tr>
<tr>
<td>Anadex Ltd</td>
<td>Central Way, Walworth Industrial Estate,</td>
</tr>
<tr>
<td></td>
<td>Andover, Hampshire</td>
</tr>
<tr>
<td>Aviquipo of Britain Ltd</td>
<td>Weaver House, Station Road, Hook, Hampshire</td>
</tr>
<tr>
<td>Bytech Ltd</td>
<td>RG27 9HU</td>
</tr>
<tr>
<td>Cable and Wireless</td>
<td>St. Peter's Road, Maidenhead, Berkshire</td>
</tr>
<tr>
<td>Cifer Systems Ltd</td>
<td>SL6 7QU</td>
</tr>
<tr>
<td>Clary Ltd</td>
<td>Suttons Industrial Park, London Road,</td>
</tr>
<tr>
<td>Comma Computers</td>
<td>Earley, Reading, Berkshire RG6 1AZ</td>
</tr>
<tr>
<td>Data General Ltd</td>
<td>83 Blackfriars Road, London SE1 6HQ</td>
</tr>
<tr>
<td>Dataplus Ltd</td>
<td>Avro Way, Bowerhill, Melksham, Wiltshire</td>
</tr>
<tr>
<td>Datapix Ltd</td>
<td>SN12 6TP</td>
</tr>
<tr>
<td>Dacoll Engineering Services Ltd</td>
<td>12-14 Lower Addiscombe Road, Croydon, Surrey</td>
</tr>
<tr>
<td>Datataxl Ltd</td>
<td>CR9 8AG</td>
</tr>
<tr>
<td>Davinci Computers Ltd</td>
<td>West Horndon Ind Park, West Horndon, Essex</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>CM13 3MJ</td>
</tr>
<tr>
<td>Digital Systems</td>
<td>Gardners Lane, Bathgate, West Lothian</td>
</tr>
<tr>
<td>Digiion Ltd</td>
<td>Tudor Road, Broadheath, Altrincham WA14 5TN</td>
</tr>
<tr>
<td>DRG Business Machines</td>
<td>12 Leeming Road, Borehamwood, Hertfordshire</td>
</tr>
<tr>
<td>Electrographic AV Ltd</td>
<td>Data House, Springfield Road, Hayes, Middlesex</td>
</tr>
<tr>
<td>Ezeel Ltd</td>
<td>3rd and 4th Floors, Hounslow House, 724-734</td>
</tr>
<tr>
<td>Exel Ltd</td>
<td>London Road, Hounslow, Middlesex TW3 1PD</td>
</tr>
<tr>
<td>Facit Ltd</td>
<td>39-49 Roman Road, Cheltenham GL51 8QQ</td>
</tr>
<tr>
<td>Diablo Systems Ltd</td>
<td>17 Billing Road, Northampton NN1 5AW</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>65 High Street, Edgware</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Regent House, 20 The Broadway, Woking, Surrey</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>OU21 5AP</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>10 Burners Lane, Kln Farm Industrial Estate,</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Milton Keynes</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>13-14 Lyns Crescent, Winterstoke Road,</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Weston-super-Mare, Avon.</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Printinghouse Road, Hayes, Middlesex UB3 1AP</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Engineering Division, The Exchange Telegraph</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Company Ltd, 73-75 Scrutton Street, London</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>EC2 4TA</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Maidstone Road, Rochester, Kent</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Dombnistle Industrial Estate, Dunfermline</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>RMC House, Vale Farm Road, Woking, Surrey</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Bristol Road, Gloucester GL2 6EE</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Unit 9, Fairacre Industrial Estate,</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Dedworth Road, Berkshire</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Edinburgh Way, Harlow, Essex</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>Crowhurst Road, Hollingbury, Brighton</td>
</tr>
<tr>
<td>Digitronix Ltd</td>
<td>BN1 8AN</td>
</tr>
</tbody>
</table>

PRINTERS — use this ASR33 teletype terminal. Full 80 column width plus RS232 interface. Also gives keyboard and paper tape punch reader for offline storage. Gaoget at £99. Tel: High Wycombe (0494) 25938.

MUST SELL — North Star Horizon 48K/Quad Drives £1420; IMS or Godbout 8K ram boards £42; Tandon 80 track 5in/800K drives £21.50; Apple/IBM serial card £75; other items? Phone Crawley 515201.

TELETYPE KSR33, printer plus keyboard, RS232 interface, plus stand, excellent condition, £120. Tel: 01-950 0416.

ZX81/16K with typewriter keyboard, over £40 software, tons info etc. £99.50. Twofold 0962-713771.

SUPERBOARD II £110. psu, programmable sound generator, new metal case, all manuals, excellent condition. Ring 04946-5311 after 6.

CASIO FX702 NEWSLETTER £5.50 per year, issue 1 free. R. Cooper, 11 Braintree Road, Dunmow, Essex.


APPLE II+ 64K, disc, DOS 3.3,3.2,1, dual ATY-3-6910 sound board, Pascal system, 12 inch Hitachi monitor, software £1400. Complete sets PCW, Practical Computing — offers. Gary Fuller 01-898 5789.

TRS-80 Level II 16K monitor and CTR-81, numeric keypad, boxes, manuals and £92 software. Offers around £200. Phone (0742) 301310, 6-8 pm.

FOR SALE: Pet 4016 and cassettes and deck, cover, manual, nearly new. Ring G. T. Baker (0562) 885182 weekdays or evenings, £150 o/n/o. — buyer collects.


COMPLETE HOBBIISTS SYSTEM (inc. word processing), based on Superboard. TV,cassette recorder, heavy duty line printer. CEGROM, new BASIC 1 & 3, enhanced video, 2MHz word processing program in EPRON. Manuals, programs, many extras, £500. Bradford 699463.

FOR SALE, Sharp MZ20K, 48K and software £320 o/n/o. Perfecl 51 disc drive based with p.s.u. £35. L. J. Stubbs, 96 Colderidge Way, Crewe. Tel: 0270 581657.

VIC 10, 16K EDUCATIONAL PROGRAM, primary school age. Maths in a castle maze situation, and 5K rocket launch maths and spelling test. £7.50 — S.A.E. for more details. D. Darroch, 12 Herbert Road, Bath, Avon.

TRS-80 32K Level II, fitted Tandy's high-res graphics, ROM for flashing cursor, system load/save, single key entries and lower case, interface, VDU, cassette, £50. Tandy line printer U.C. £150. All with books/boxes etc. Plenty of software, serip, IRIV, XREP, EDTASM, TBUG and games. Phone Chandler's Ford 2002.
COLOUR GRAPHICS OUTPUT from most computers connects via RS232 or Kansas City interface with domestic television, £189.95 inclusive. (0272) 502008.

M280K 48K with £1,000 software. Year old. Business software, languages, CP/M, games, £695. Tel. 0344 844336.

PET 3032 (Basic 4), toolkit, chomputer, mikro, cassette, sound, 3040 disc drive, £ offers. 952-0815

FOR SALE. Quality software for BBC micro. Write for details: P. Swah, 13 Woodberry Gardens, North Finchley, London N12 0HD.

16K MICRO TAN 65, basic, Watford expan- sion motherboard, graphics, toolkit, cas- keyboard, latest mod’s, much more, worth over £500, accept £280 o.n.o. Tel. 073082 (Lisa) 3910 after six.

COMMODORE 40 col. 32K Basic 4. With dual disk drive DOS 2.1 and Commodore 80 col. tractor, matrix printer, lot of software. Tel. 0492 67288.

BBC SOFTWARE (A/B): Adventure £6.50, pontoon £4.95, cassette, S.A.E. to Michael Durcy, 2 Foulds Road, Trawden, Colne, Lancs.

S-100 cards various 8K RAM £70. 32K £140. F.D.C. £60. 6809 CPU £60. Newbury 7000 VDU £150. ICL 7181 £70. Oscilloscope 10-18U £20. Tel. Portsmouth 699539 (evenings for details).

ACULAB floppy tape for sale, plus over £100 worth of software on wafer: utilities, games. All just £150. Tel. (0403) 55674.

VIDEO GENIE: EG3003 16K v.g.c., 7 months old, extra manuals and some software. £199 o.n.o. Tel. Parbold 2696.

SPECTRUM BUSINESS SOFTWARE. Matrix Planer, the popular on-screen business planning and modelling system (similar to VisiCalc) is now available for the 48K Spectr. Includes powerful replicate and print commands. Ideal for homes and small busi- ness financial planning, forecasting and 'what-if' analysis. £8 from Graham Asher, 60 Maryland Road, Wood Green, London N22 5AN. Price includes cassette and full instructions.

APPLE USERS! Try "Fraction Action" the latest program from Kingfisher Computer Services. Writers of quality educational software. Catalogue available. Tel. 02-756 6099.

Kode Services, 0249-813771

MBS Terminitals Ltd, 0932-33151

Memec Systems Ltd, 084421-3149

MBF 0734-415191

Microsense Computers Ltd, 0442-40151/4119

Northernbury the Printer People Ltd, 0372 62071

Newbair Computing Store, 0635-30509

Nexos U.K. Ltd, 084421-3191

Penny & Giles Data Recorders Ltd, 042-5271 511

Peritronic Ltd, 0506 41001

Peripheral Hardware Ltd, 01-941 4806

Qume (U.K.) Ltd, 0734 384646

Rain Ltd., 01-836 4663

Robox (Office Equipment) Ltd, 041-221 5401

Roxburth Printers Ltd, 07973-3777

Russel Instruments Ltd, 0734-988147

S. Farid (Spectronics) Manufacturing Ltd, 02013-77337

SEN Electronics 09328-66744

Smith-Corona 01-958 7766

Stack Computer Services Ltd, 051-933 8511

Teleprinter Equipment Ltd, 044282-4011/9

Terminal Display Systems Ltd, 0254-662244

Texas Instruments Ltd, 0254-67446

Transdata Ltd, 01-403 5115

Watford Electronics 0922-40598

Wilkes Computing Ltd, 0272-259581

Whyam Instrument Ltd, 07372-41753

X-Data 0753 49117

Station Road, Calne, Wiltshire SN11 0JR

Aldwyth House, Madeira Road, West Byfleet, Surrey KT14 6BA

Park Industrial Estate, Thame, Oxon

Barclays Bank Chambers, Pegg Lane, Kirkgate, Tadcaster, North Yorkshire

Finway Road, Hemel Hempstead, Hertfordshire HP2 7PS

3-5 Dawes Court, Esher, Surrey KT10 9QA

49 Bartholomew Street, Newbury, Berkshire

3 Jefferson Way, Thame, Oxfordshire OX9 3FU

Mudeford, Christchurch, Dorset BH23 4AT

Lomond House, Almond Vale, Livingston, Scotland

Armfield Close, West Molesley, Surrey

Bridgewater Close, Reading, Berkshire

30-32 Neal Street, London WC2H 9PS

Unit 14, Anderson Shopping Centre, Glasgow G2 7PH

22 Winchelsea Road, Rye, E. Sussex TN31 7BR

Unit 1, Nimrod Way, Nimrod Industrial Estate, Reading, Berkshire RG2 0EB

Dawkins Road, Industrial Estate, Poole, Dorset BH15 4JY

5 London Street, Chertsey, Surrey

SCM House, North Circular Road, Stonebridge Park. London NW10 7SS

230-236 Derby Road, Bootle, Liverpool L20 8LN

70 Akeman Street, Tring, Hertfordshire HP23 6AJ

Hillside, Whithbirk Estate, Blackburn, Lancashire BB1 3SN

Manton Lane, Bedford MK41 7PA

Battlebridge House, 87-95 Tooley Street, London SE1 2RA

33-35 Cardiff Road, Watford, Hertfordshire WD1 6ED

Bush House, 72 Prince Street, Bristol BS1 4HU

6 Holmdele Road, Reigate, Surrey RH2 0BQ

Marish Wharf, St Mary's Road, Langley, Slough, Berkshire SL4 1HE
As wise men do; more and more users are choosing microcomputer hardware by North Star. The North Star reputation is based on the quality, performance, reliability and cost-effectiveness of their products.

**HORIZON**

The Horizon is a 64K RAM, dual 5.25" floppy disk drive, 4MHz Z80A based microcomputer. Designed to fit a wide range of business, educational, scientific and industrial applications. There are now over 100,000 Horizons in operation throughout the world in offices, schools, universities, laboratories and industrial plants.

For those who need to handle, store and retrieve large amounts of data, the Horizon is available with a variety of integral Rodime mini-winchester hard disk drives. Available as 3, 6, 9, 10, 12, or 21Mb versions (formatted capacities), the Rodime series of 5.25" hard disk drives represent the best in Winchester drive technology.

The Horizon's versatility enables it to adapt to an almost unlimited number of uses, and with the addition of a hard disk the Horizon's capabilities can be expanded to meet your growing system requirements.

**ADVANTAGE**

The Advantage is a compact 64K RAM 4MHz Z80A based integrated graphics computer. Suitable for business and educational use the Advantage can instantly convert data into precise graphs, line charts, bar charts, pie charts or 3-Dimensional images.

The Advantage uses a second 8035 processor to service keyboard and disk I/O, and the 12" display screen operating in both Character and/or Bit-Mapped graphics modes uses a further 80K of memory. By adding a printer, hard copy may be obtained, ideal for illustrating statistical data at board meetings and lectures. For extra computing power the Advantage is available with an integral hard disk drive.

Complete with all business graphics, self-diagnostic and graphics demo software the Advantage is backed up by North Star's G-BASIC/G-DOS and Graphics CP/M, each of which support both graphics and character mode.

Two new developments for the Advantage are an 8/16 Upgrade, which adds the 8088 16 bit CPU's processing power with an additional 64K RAM, and NorthNet, a low-cost local network. By adding the appropriate cards up to sixty-four 8 or 16 bit Advantages may be utilized as interconnecting workstations or servers allowing transfer of both 8 and 16 bit files.

**STARLINK**

Starlink is a multi-user CP/M timesharing executive that logically integrates the North Star Horizon with a range of hard disks. Designed and developed at Interam, Starlink can cater for small business and educational applications and in addition provide a powerful and yet reasonably economical solution to office automation.

Under Starlink large amounts of data that are stored on hard disk can be accessed by one or more users in a time sharing or multi-processing environment.

Advantages can be used under Starlink as interactive workstations whilst retaining the functions of an independent computer.

As a major distributor of North Star products Interam are able to offer superb price incentives to both trade and retail customers. Be wise and ring now. Be wise and follow the star, the North Star.

Complete the coupon for further details.

**INTERAM**

Microcomputer Specialists
46 Balham High Road London SW12 9AQ Tel: 01 675 52567

**PRACTICAL COMPUTING** September 1982

---

Circle No. 271

---
YOUR GUIDE TO DIGICO
BRITAIN'S LEADING
BUSINESS INFORMATION TECHNOLOGISTS?

DIGICO. A totally modern computer system designed to bring the cost of up-to-date information technology within the reach of the smallest business. And to grow with them.

DIGICO-MONEY SAVING ADD-ON-GROWTH COMPUTER SYSTEM
MICRO'S
MINI'S
MAINFRAME

FIRST
ADD ON OTHERS
AS REQUIRED

SOFTWARE PACKAGES FOR EVERY KIND OF OPERATION

RENTAL SCHEMES TO SAVE YOUR CAPITAL

e.g. A complete word processor for £41 per week. Rental on even the smallest business system includes maintenance.

Superb back-up, THIRTY
SERVICE CENTRES
NATIONWIDE...

... for expert advice and help. And you're never far from a DIGICO engineer.

Legal, Accounting
Word Processing
Transport, Medical,
Production Control
Stock Control, Payroll
Telecommunications
Dentistry, Printing

BUILDERS MERCHANTS
Incomplete records
Publishing, Holidays
Bookshops, Betting
Warehousing, Mailings
Maintenance, Teaching
Research

GUARANTEE
Your computer has a SEVEN year guarantee of maintenance provided there is a maintenance contract continuously from new.

7-YEAR
PLUS

MINIMUM INTERRUPTION PLAN
If your micro breaks down, we'll swop it over to keep you going.

DIGICO have been designing, manufacturing and installing computer systems since 1966.

DIGICO COMPUTERS
46 BROADWAY LETCHWORTH, HERTS. Tel: LETCHWORTH 78172
32 YORK RD, LEEDS. Tel: LEEDS 486688

FULL INFORMATION (NO OBLIGATION) FROM

DIGICO COMPUTERS
46 BROADWAY LETCHWORTH, HERTS. Tel: LETCHWORTH 78172
32 YORK RD, LEEDS. Tel: LEEDS 486688

Circle No. 272
Our users’ group list is organised on a region-by-region basis. If you wish to make contact with one of these groups, feel free to phone them using the number given. Club meetings are, on the whole, monthly. Most clubs are of a “general” variety, and are pleased to hear from all prospective members, whether or not they have a computer.

In order to keep our records up to date, it is important for club secretaries to contact us, with at least the amount of detail given in the list below. This is even more important if there is a change in the club telephone number. Send all details to: Practical Computing, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

---

**AVON**

B.A.U.D., Bristol Apple Users and Dabblers
Geoff Smythe
Datalink Microcomputer Systems Ltd
10 Waring House
Redcliffe Hill
Bristol BS1 6TB.
Tel: 0272 219427.

Bristol Computing Club
Leo Wallis
6 Kilbernie Road
Bridge Farm Estate
Bristol BS14 0HY.
Tel: 0272 832453.

Brunel Computer Club
S W Rabone
18 Castle Road
Worle
Weston-Super-Mare
Avon BS22 4GJ.
Tel: 0934 513060.

**BEDFORDSHIRE**

Tandy Bristol Users Group
Roger J Bamkin
19 Wood Street
Bedford
Tel: 0254 523943.

**Berkshire**

Commodore Pet Users Club
M Guilford
818 Leigh Road
Slough Industrial Estate
Slough, Berkshire.
Tel: 0753 74111.

**Buckinghamshire**

Apple Users’ Group
S F Proffitt

---

**Berkshire**

Slough Industrial Estate
818 Leigh Road
M Gulliford
Commodore Pet User Club
BERKSHIRE
Tel: 0462 18522.

Hertfordshire.

Pirton, near Hitchin
Joe Manifold
6502 Users’ Club
Tel: 0234 41685.

Bedford
29 Chaucer Road
Tel: 0272 512283.

Tandy Bristol Users Group
Roger J Bamkin
19 Wood Street
Bedford
Tel: 0254 523943.

**Cambridgeshire**

Peterborough Computer Club
Trevor Marchant.
Tel: 0733 76681.

**Cheshire**

North-west Computer Club
John Lightfoot
135 Ashton Drive
Frodsham, Warrington
Cheshire WA6 7PZ.
Tel: 0928 31519.

**Cleveland**

Cleveland Microcomputer Club
J H Telford
13 West Crescent
Norton, Cleveland.
Tel: 0642 550061.

**Cornwall**

Cornish Radio Amateur Club
— Computer Section
Bob Reason

---

24 Mitchell Road
Camborne
Cornwall TR14 7JH.
Tel: 0209 713637.

**Devon**

Acorn Atom User Group
T G Merdeith
Sheerwater
Yealm View Road
Newton Ferrers
South Devon.

Exeter and District Amateur Computer Club
Doug Bates
2 Station Road
Pinhoe
Exeter.
Tel: 0392 69844.

Plymouth and District Amateur Computer Club
Keith E Gould
Willygoat House
Meavy Lane
Yelverton
Devon PL20 6AL.
Tel: 082285 2575.

**Dorset**

TOPIC — Tandy Owners’ Programme and Information Co-operative
Secretary
Fred Thorp
75 Bridport Road
Parkstone
Poole
Dorset.
Tel: 0202 730483.

Cosmacs Users’ Group
Peter Hibbs
54 Runnymede Avenue
Bournemouth
Dorset BH11 9SE.

**East Anglia**

Anglia Computer User Group
Jan Rejzl
128 Templemore
Sprotstion Road
Norwich NR3 4EQ.

Norwich and District BBC Microcomputer User Group
Paul Beverley
Room B12A
Norwich City College of Further and Higher Education
Ipswich Road
Norwich.

Norfolk NR2 2LJ.
Tel: 0603 60011, ext. 233.

**Essex**

London and South-east Sharp MZ-80K User Group
Joe Seet
16 Elmhurst Drive
Hornchurch
Essex RM11 1PE.
Tel: 04024 42905.

TRS-80 User Group
Michael Dean
22 Roughtons
Galleywood
Chelmsford
Tel: 0245 76127.

UK101 User Group
Adrian Waters, 117 Haynes Rd
Hornchurch
Essex.
Tel: 494 0490.

Springfield Computer Club
Steve Cousins
1 Aldeburgh Way
Springfield, Chelmsford
Essex CM1 5PB.
Tel: 0245 50155.

**European**

Dainamic — European Users’ Club of DAI personal computer
Heide 98
3171 Westmeerbeek
Belgium.

Nascom Brugergruppe
Asbjorn Lind
Sidevolden 23
DK 2730 Herlev
Denmark.
Tel: 02 91 7182.

**GLOUCESTERSHIRE**

Cheltenham Amateur Computer Club
M Pullin
45 Merestones Drive
The Park
Cheltenham GL50 2SU.
Tel: 0242 25617.

990 User Group
Chris Gadagan
21 Thistle Downs
Northway Farm, Tewkesbury.
Tel: 0684 239821, Ext. 310.

**Hampshire**

Independent Pet Users Group
G A Parkin
Robert May’s School
West Street, Odiham.
Tel: 0257 871200.

(continued on next page)
Independent Pet Users' Group
South-east Region
164 Chesterfield Drive
Sevenoaks
Kent TN13 2EH.
Tel: Sevenoaks (0732) 53530.
Gillingham User Group
A Aylward
194 Balmoral Road
Gillingham.
Tel: 0634 56830.
Medway Amateur Computer and Robotics Organisation
Mrs C Webster
13 Ladywood Road
Cuxton, Rochester
Kent.
Tel: 0634 78517.
Mid Kent TRS-80 Users' Club
Roger Marriott
Kent Micro Services
55 High Street
Maidstone
Kent.
Medway Atom Users' Group
Clement M Rutter
St John Fishers School
Ordnance Street
Chatham
Kent.
Tel: 0634 42811 during school term.
North Kent Amateur Computer Club
B J Biddles
3 Acar Road
Biggin Hill
Kent TN16 3SP.
Tel: 29 71742.
Lancashire
Amateur Computer Club 2650 Library
Roger A Munt
51 Beechwood Drive
Feniscowles, Blackburn
Lancashire.
Tel: 0254 22341.
Arnold School ZX-81 Users' Club
Martin Wren-Hilton
4 Little Polton Lane
Poltone-Ifley
Blackpool SY6 7ET.
Tel: 0253 884 225.
Chorley Computer Club
Chris Hicks
131 Market Street
Chorley
Lancashire.
Tel: Chorley 78376 or 71875.
North Lancashire User Group
Mike Fordham
14 Arundel Drive
Carleton
Blackpool.
Tel: 0253 891769.
North-west Group Amateur Computer Club
Ken Horton
50 Lymfield Drive
Worsley.
Tel: 061 228 6333, Ext. 372.
TRS-80 Users' Group
Melvyn D F Franklin
40 Cowlees
Westhoughton, Bolton
Lancashire.
Tel: 0942 812843.
West Lancashire Pet Users' Club
D W Howett
197 Victoria Road East
Thorton
Blackpool FY5 3ST.
Tel: 0253 869 108.
Leicestershire
Leicestershire Personal Computer Club
Jill Olorenshaw
19, Arden Road
Mount Buildings
Charles Street
Leicester.
Tel: 0533 22255.
Lincolnshire
Lincolnshire Microprocessor Society
Eric Booth
Bishop Grosseteste College
Newport, Lincoln.
Tel: 0522 27347.
London
Comp80 — Scientific Computer Users' Group
P L Roberts
50 Cromwell Road
WimbledonLondon SW19 8LZ.
Tel: 01-540 3713.
Computerclub
Roger R Frampton
42 Great Windmill Street
London W1V 7PA.
C/P/M Users' Group U.K.
D Powys-Lybbe
11 Sun Street
London EC2M 2PS.
Tel: 01-247 0691.
East London Amateur Computer Club
c/o Fred Lingar
Harlow Green Library
Cathall Road
London E11.
Tel: 01-554 3288.
Croydon Micro Computer Club
C/o Vernon Giftford
Croydon Reference Library
Katharine Street
Croydon.
Tel: 01-653 3207.
Croydon Apple Users Group
W S Macmillan
38 Box Ridge Avenue
Purley
Surrey.
Medical Micro Users' Group
Patrick Dixon
C/o Medicom
14 Broadway Drive
London W13.
Tel: 01-579 5845.
National TRS-80 Users' Group
J S Wallsman
292 Caledonian Road
London N1.
Tel: 01-607 0157.
National ZX-80 Users' Group
Tim Hartnell
44-46 Earl's Court Road
London W8 6EJ.
North London Hobby Computer Club
Robin Bradbeer
Dept. of Electronic and Communications Engineering Polytechnic of North London
Holloway Road
London N7.
Tel: 01-607 2789.
Southgate Computer Club
Panos Koumi
30 Chandos Avenue
London N14 or Alan Toothill on 01-360 7014 (home) or 01-882 6111 Ext 2281 (work).
South-east London
Microcomputer Club
Thames Polytechnic Greens End
London SE18.
Tel: 01-852 4922 — Roger Kreitman
01-853 5829 — Peter Phillips.
MK-14 User Club
Geoff Phillips
8 Poolsford Road
NW9 6EP.
Tel: 01-200 6209 or 01-207 2000, Ext. 233.
OSI U.K. User Group
Richard Elen
12 Bennerley Road
London SW1 6DS.
Pet Users' Education Group
Dr Chris Smith
Dept. Physiology
Queen Elizabeth College
Campion Hill Road
W8 7AH.
Tel: 01-937 5411, Ext. 429.
The Bobat Computer Club
Tabassam Kayani
12 Calderon Road
London E11 4EU.
Tel: 01-556 5423.
Manchester
Manchester Atom Users' Group
Tel: 061-370 5121 ext 27 — John Ashurst
Abraham Moss Centre
Crescent Road
Manchester 8.
Manchester Computer Club
David Wade
28 Hazel Road
Altrincham
Cheshire.
Tel: 01-556 5423.
Merseyside
Level 1 User Group
N Rushton
123 Roughwood Drive
Northwood, Kirkby
Merseyside L33 9UG.
U.K. Pilot User Group
Alec Wood
Wirral Grammar School
Wirral GR14 15L.
Tel: 01-882 6111 Ext 2281 (work).
St Albans West Herts 80 Users' Group —
Tel: 05827 5366, evenings.
Hertfordshire.
Harpenden
5 Ox Lane
Harpenden
Hertfordshire.
Tel: 05827 5366, evenings.
West Herts 80 Users' Group —
TRS-80 Video Genie
Terry Bradbury
20 Spurne Way
St Albans
Hertfordshire.
Tel: 0727 73633.
International
International Association of Cromeco Users
PO Box 17658
Irvine, California 92713 U.S.A.
Ireland
CP/M/IRL — the Irish CP/M Users' Group
Doug Nolley
Gardner House
Ballsbridge
Dublin 4.
Tel: 01 686411.
Isle of Wight
TRS-80 Users' Club
Mike Collins
3 Aolits Gardens
Ventnor
Isle of Wight.
Kent
Computer Users' Club
Tony Latham
72 Sidmouth Road
Welling
Kent DA16 1DS.
We don't need to tell you what the micro chip has done for computer hardware.
Without it we'd still be in the world of Flash Gordon and mad professors.
Luckily, we have got the micro chip and the computer is now an everyday part of business life.
So, it seems odd that we should have to wait until now for a similar breakthrough in the world of computer software.
Still, it's been worth the wait.
PlannerCalc, the new "CP/M spreadsheet business planner from Comshare, is the first in a series of powerful packages that are going to put all others in the shade.
And, what's more, at £39.00 (plus VAT and p. & p.) it makes other people's price tags look a little extravagant.
PlannerCalc can handle the kind of business planning applications that fit into the spreadsheet format.
And unlike all other "calc" products it allows you to enter calculation rules in English.
It uses the popular 'spreadsheet' approach, with a window that can be rolled in all directions.
Which means you can enter new figures or rules and immediately see their effects on everything else in the model.
PlannerCalc also incorporates some very mainframe-like features - for example, you don't need to number the models rows in the correct logical sequence as it can sort the rows itself as it calculates.
It comes with the best manual on the market and it's suitable for most micros with CP/M operating systems, at least 64K of memory and a minimum width screen of 80 characters and 2 floppy disc drives. (It'll even run on the new IBM personal computer.)
But if PlannerCalc is this good, how can we afford to sell it at such a low price?
Simple.
Because we know just how good it is.
And because we know it's going to sell in thousands.
(In the U.S.A. we sold 5000 copies in the first month alone.)
As your needs and demands grow you can move on to other more powerful packages like MasterPlanner, the next step up in the Comshare range.
Which is good news for both of us.
Because when you do make that move you won't have to reprogram.
Masterplanner is totally integrated with PlannerCalc and you simply carry on where you left off.
But first you'll need to get hold of PlannerCalc.
To order, clip the coupon and enclose your cheque or credit details (but, please, no small change) or ring Teledata on 01-200 0200 and we'll send you PlannerCalc, the manual and list of Comshare's other business software.

COMSHARE
Making the computer make sense.
*CP/M is the registered trade mark of Digital Research Inc.
Comshare Ltd., 32/34 Great Peter Street, London SW I P 2DB. Telephone 01-222 5665.
To: Dept. PC/9, Comshare Limited, 32/34 Great Peter Street, London SW I P 2DB.
Please send me copies of PlannerCalc at £16.65 inc. VAT and p. & p. per copy, I enclose a cheque/postal order for £________ made payable to Comshare Limited.

>Please debit my Access Card No: for £

Barclaycard No: for £

Signature:

Name:

Address:

Tel No: 189

IMPORTANT: Please fill in the following particulars:

Type of micro: Memory size: K
Floppy Disc size: Single Sided Double Sided
8' Single Density Double Density
12'

Please allow 28 days for delivery. VAT No: 238418649 Registered No: 980406

Comshare reserves the right not to accept any order; any acceptance will be subject to Comshare's Terms and Conditions of Use.
Duplex are pleased to announce a new high speed tape cassette interface for the OCTET 121 which provides infinite mass storage; viz a C15 tape can hold 100,000 characters at 1200 baud.

The tape interface may also be used with any microcomputer which supports an RS232 serial line.

- RS232 connection
- Switch selectable baud rates 150/300/600/1200.
- Connects to OCTET PI, NPI, CI and NCI typewriter interfaces and other RS232 devices
- Tape counter to identify beginning and end of data blocks
- Extremely easy to use

For further details, contact sole regional distributors for all OCTET Series products.
(continued from page 188)

**MIDDLESEX**

Independent Pet Users' Group
Geoff Squibb
108 Teddington Park Road
Teddington
Middlesex.
Tel: 01-977 2346.

Richmond Computer Club
Bob Forster
18a The Barons
St Margaret's
Twickenham
Middlesex.
Tel: 01-832 1873.

West London Personal Computer Club
G J Brain
81 Rydal Crescent
Harrow
Middlesex.
Tel: 01-977 2346.

**SCOTLAND**

Central Scotland Computer Club
James G Lyon
78 Slamannan Road
Falkirk FK1 4NF.
Tel: Falkirk (0324) 22430.

Edinburgh ZX-80/81 Users' Group
Keith Mitchell
19 Meadowplace Road
Edinburgh EH12 7UJ.
Tel: 031-334 8483
031-661 3183 — John Palmer.

The Grampian Amateur Computer Society
M Basil
Orton Cottage
Burnside
Lumphan
Kincardineshire
Grampian Region.
Tel: 033 983 284.

Scottish Amateur Computer Society
Alistair Macpherson
6 Curriehill
Castle Drive
Edinburgh 14.
Tel: 031 449 6658.

Ithaca Audio S-100 User Group
Strathclyde Computer Club
Dive Weaver 16 Elvie Place
Condorrat
Glasgow.
Tel: 041 322 3927.

**NORFOLK**

East Anglia Computer User Group
Under East Anglia
York.

**NORTHAMPTON**

Personal Computer Users' Club
J R Jackson
Mereway Upper School
Mereway
Northampton NN4 9BU.
Tel: 0604 63616.

**NOTTINGHAMSHIRE**

Independent TRS-80 User Group
Mike Costello
17 Langbank Avenue
Rise Park
Nottingham NG5 5BU.

Nottingham Microcomputer Club
P McQuoney
28 Seaforth Avenue
Wollaton
Nottingham.
Tel: 0602 751742.

TRS-80 and Video Genie Users' Group of Nottingham
Marc Leduc
30 Waterlooe Road
Beeston
Nottingham.
Tel: 0602 225165.

**NOTTINGHAM**

UK Apple Users' Group
5b The Poultry
Nottingham NG1 2HW.
Tel: 0602 532354.

**OXFORDSHIRE**

Oxford University Microcomputer Society
Phillip Taylor
St John's College
Oxford.
Tel: 0865 47671.

Oxfordshire Microcomputer Club
S C Bird
139 The Moors
Kidlington
Oxford OX5 2AF.
Tel: 08675 6703.

Research Machines Users' Group
Tony Crowle
134 Howard Street
Oxford.

**SUSSEX**

The Arun Microcomputer Club
P Cherriman
228 St Leonard's Road
Hove
Sussex BN4 4ND.

**HAMPSHIRE**

Midhants Computer Society
Peter Smith BECC
42 Compton Road
Southwick
Brighton BN4 4ND.

The Grampian Amateur Computer Society
M Basil
Orton Cottage
Burnside
Lumphan
Kincardineshire
Grampian Region.
Tel: 033 983 284.

Scottish Amateur Computer Society
Alistair Macpherson
6 Curriehill
Castle Drive
Edinburgh 14.
Tel: 031 449 6658.

Ithaca Audio S-100 User Group
Strathclyde Computer Club
Dive Weaver 16 Elvie Place
Condorrat
Glasgow.
Tel: 041 322 3927.

**WORCESTERSHIRE**

Minicomputer Users in Secondary Education — MUSE
R Trigger, 48 Chadacre Way
Catshill, Bromsgrove
Worcestershire.

Worcester and District Minicomputer Users in Secondary Education — MUSE
Mrs J Brown
The Amateur Computer Club
281 Lidgett Lane
Pinhills
Wolverhampton WV1 1LY.
Tel: 0902 27371 Ext. 56.

**WORTHING**

The Arun Microcomputer Club
P Cherriman
228 St Leonard's Road
Hove
Sussex BN4 4ND.

**STAFFORDSHIRE**

Independent Pet Users' Group IPUG
57 Clough Hall Road
Kidsgrove
Stoke-on-Trent
Staffordshire.

The Amateur Computer Club of North Staffordshire
Michael Turner
542 Lightwood Road
Lightwood
Staffordshire WV5 OJZ.

**SURREY**

Forth Interest Group U.K.
H Dobson
38 Worsley Road
Frimley, Camberley
Surrey GU16 5AU.
Tel: Deepcut (02516) 6254.

ZX-80 Users' Club
David Blagden
PO Box 159
Kingston-Upon-Thames
Surrey KT2 5YQ.

**SUSSEX**

The Arun Microcomputer Club
P Cherriman
7 Talbot Road
Littlehampton
West Sussex BN17 7BL.
Tel: 090 64 7607.

Brighton Hove and District Computer Club
Rod Phillippe
3 The Broadway
Southwick
Brighton BN4 4ND.

Crawley Computer Club
FJ Fieldhouse
18 Seaford Road
Crawley
West Sussex.
Tel: 0293 543509.

Mid-Sussex Microcomputing Club
Bernard Langton
228 St Leonard's Road
Hove
Sussex BN1 6AU.
Tel: 0403 61156.

Southern Users' of Pet Association SUPA
Howard W Pilgrim
42 Compton Road
Brighton
Sussex BN1 6AN.
Tel: 0273 561962.

**TYNE AND WEAR**

Newcastle Personal Computer Society
Tom Graves
19a West End Street
Somerfield BA16 0LQ.
Tel: 0458 45359.

**SOMERSET**

Ohio Scientific U.K. User Group
Tom Graves
19a West End Street
Somerfield BA16 0LQ.
Tel: 0458 45359.

**STAFFS**

Independent Pet Users' Group IPUG
57 Clough Hall Road
Kidsgrove
Stoke-on-Trent
Staffordshire.

The Amateur Computer Club of North Staffordshire
Michael Turner
542 Lightwood Road
Lightwood
Staffordshire WV5 OJZ.

**SURREY**

Forth Interest Group U.K.
H Dobson
38 Worsley Road
Frimley, Camberley
Surrey GU16 5AU.
Tel: Deepcut (02516) 6254.

ZX-80 Users' Club
David Blagden
PO Box 159
Kingston-Upon-Thames
Surrey KT2 5YQ.

**SUSSEX**

The Arun Microcomputer Club
P Cherriman
7 Talbot Road
Littlehampton
West Sussex BN17 7BL.
Tel: 090 64 7607.

Brighton Hove and District Computer Club
Rod Phillippe
3 The Broadway
Southwick
Brighton BN4 4ND.

Crawley Computer Club
FJ Fieldhouse
18 Seaford Road
Crawley
West Sussex.
Tel: 0293 543509.

Mid-Sussex Microcomputing Club
Bernard Langton
228 St Leonard's Road
Hove
Sussex BN1 6AU.
Tel: 0403 61156.

Southern Users' of Pet Association SUPA
Howard W Pilgrim
42 Compton Road
Brighton
Sussex BN1 6AN.
Tel: 0273 561962.

**TYNE AND WEAR**

Newcastle Personal Computer Society
John Bone 2 Claremont Place
Gateshead, Tyne and Wear
PO Box 159
Sunderland SR6 9PU.
Tel: 0902 27371 Ext. 56.

**YORKSHIRE**

West Yorkshire Microcomputer Group
P R Clark
Tel: 0532 450667.

Leeds and District Branch of the British Computer Society
Dave J Shepard
Tel: 0924 270419.

Darlington Computing Club
Tel: 0325 67766.

Penine and District Computer Club
Chairman
Douglas R Bryant
Tel: 0535 43007.

South Yorkshire Personal Computing Group
S P Gray
Tel: 0742 351440.

Sharp PC-1211 Users' Club
Jonathan Dakwayne
281 Lidgett Lane
Leeds LS17 6PD.

York Computer Club
S Wilson
Tel: York 470464 after 6pm.

National TI-59/59 Club
R M Murphy
Dept. of Electrical Engineering
University College Swansea
Swansea, South Wales.

WILTSHIRE

North Wiltshire Computer Club
Mathew Jones
Pinphill
Boxwood
Calme, Wiltshire.

**WEST MIDLANDS**

Central Program Exchange
Mrs J Brown
Dept. of Computing and Mathematical Sciences
The Polytechnic
Wolverhampton
WV1 1LY.
Tel: 0902 27371 Ext. 56.

Amateur Computer Club
John Tracey 100 Booth Close
Brierley Hill
West Midlands DY6 8SP.
Tel: 0384 70097.

Birmingham 7/66 User Group
Sue Dunn
Tel: 021 707 7170.

Midland Amateur Computer Club
Roy Diamond
Tel: 0203 454061.

West Midlands RML User Group
Pete Smith BECC
Camphill Centre, Stafford Road
Birmingham B11 1AR.

**WORCESTERSHIRE**

Minicomputer Users in Secondary Education — MUSE
R Trigger, 48 Chadacre Way
Catshill, Bromsgrove
Worcestershire.

Worcester and District Computer Club
D J Stanton
Tel: 0905 22704.

**YORKSHIRE**

West Yorkshire Microcomputer Group
P R Clark
Tel: 0532 450667.

Leeds and District Branch of the British Computer Society
Dave J Shepard
Tel: 0924 270419.

Darlington Computing Club
Tel: 0325 67766.

Penine and District Computer Club
Chairman
Douglas R Bryant
Tel: 0535 43007.

South Yorkshire Personal Computing Group
S P Gray
Tel: 0742 351440.

Sharp PC-1211 Users' Club
Jonathan Dakwayne
281 Lidgett Lane
Leeds LS17 6PD.

York Computer Club
S Wilson
Tel: York 470464 after 6pm.
COST CONSCIOUS!
Heralding the beginning of a new age of low cost Word Processing Computer Systems

SMITH CORONA TP-1
- Dedicated Computer Printer
- Microprocessor Controller
- Serial, Parallel or IEEE Interface
- Lowest cost purpose-built Daisywheel

£485 + VAT

BYTEWRITER
- Keyboard Printer
- Lift off facility
- Built-in self test
- Rigid carrying case

£485 + VAT

DISCOM TRADING COMPANY
Dresden House, 51 High Street
Evesham, Worcs. WR11 4DA
Telephone (0386) 3591

Further Information Please
Name
Address

Telephone

YOUR QUICK-LEARN WAY TO BASIC OR COBOL

Learn computer programming quickly and easily through the renowned ICS "Open College" system, taking the course at your own pace and in your own time.

Use the famous ICS study texts, backed up by your own expert tutor, and learn computer programming, the proven way, with ICS home study.

Courses:
Introduction to Computer Programming
Programming in BASIC
Programming in COBOL

Approved by CACC
Member of ABCC

ALL DETAILS FREE—SIMPLY RETURN THE COUPON BELOW

Please send me your prospectus on Computer Programming

Name
Address

Post to: Dept 346Y
ICS School of Computer Programming
160 Stewarts Road,
London SWW 4UJ

This book is excellent.'
- Jim Strasnia

Unquestionably the most accurate and comprehensive reference I have seen to date.'
- Jim Butterfield


Cut out or copy coupon, or write to:
LEVEL LTD (PC), PO Box 438, Hampstead, London NW3 1BH.
Send ...... copies of Programming the PET/CBM at £14.90 (post free)
I enclose cheque/P.O. for £......or official order.
NAME
ADDRESS

Fast Service — same day despatch

PC 982
Boris Allan appeals for more attention to programming principles and less on the merits or otherwise of individual languages or machines.

It’s the pattern not the product

IN COMPUTING, never has so much rubbish been written about so much rubbish. The “this is the best, and only, programming language” or “this is the best, and only, computer” debate can only lead to suspicion of any grouping which claims allegiance to one machine or language. Magazines which cater for only one machine, or family of machines, are even more suspicious.

In the Tower of Hanoi problem — Practical Computing, December 1980 — three pegs are fastened to a stand. On one peg there are discs, with a hole in the centre of each. All are different sizes, with the largest disc at the bottom and the smallest disc at the top. The task is to move all the discs to another peg, one at a time, but in such a way that a larger disc is never placed on a smaller disc.

The machines with which the problem is solved are small and cheap, so that complex languages will be a waste of time. A large super-computer may be a billion times faster than a ZX-81 but no one could afford one. Look first at how the smallest disc moves, and then the next smallest, and so on to the largest.

Figure 1 shows what happens for three discs, and table 1 shows what happens in a rather more mathematical way. Disc 1, the smallest, always moves to the right; right of the right peg is the left peg, wrap round. Disc 2 always moves to the left, disc 3 always moves to the right, and logically disc 4 moves left, disc 5 moves right, and so forth.

Table 1 shows the discs’ movement is very regular. Disc 1 moves every other time, disc 2 moves in a more complex but distinct pattern, and thus it continues. If the move number is expressed as a binary number, the form of the patternings emerges. The disc to move is the one for which the corresponding bit is set to one, with zeros to the right. To decide which disc to move all that is needed is to change the move number into a binary number and find the right-most unit or non-zero bit.

The programming problem can be saved by simulating binary arithmetic. It is the essence of computers that they use binary arithmetic, and the programs can use this characteristic. A whole number is stored on most computers in an exact form, and the exact form is as a series of bits, often 16 bits or two bytes. If the whole number is the move number then the move number is automatically stored by the computer in the form shown in column B of table 1.

In order to use this insight to the problem of working out which is the right-most non-zero bit, try the following statement out on as many computers as possible:

PRINT 2 AND 1, 3 AND 1

the answer will either be 0 1 when using Vic, Pet, and BBC computer among others or 1 1 for Apple, ZX-81, and Atom among others. By contrast

PRINT 2 & 1, 3 & 1

on the Atom provides the same answer as that for the Vic, etc.

Decimal differences

The difference between And and & on the Atom, is the difference between the two types of answer to the simple Print statement. The decimal number 2 is 10 in binary, and the decimal number 1 is 01 in binary, and so if you take each bit in turn

10 AND 01

is 00. Since 3 in binary is 11, then

1111 AND 1000 0000

is 1000 0000.

It is easy to find whether the And, if it exists on your machine, performs a bit-wise And. If you execute

Print (1=1)

and if the answer is -1, then the compu-

(continued on next page)
ter does a bitwise And. If the answer to Print (1=1) is 1, then the And is a relational And, that is, the And can only be used to relate logical expressions.

And is used in this way on the Apple II, ZX-81, and Atom, though the Atom also has &. That the And is of this form is why the Apple and ZX-81 programs are of a different nature to the others. Sometimes it is useful for I to represent True, in cases like this the lack of a bitwise And is a drawback.

The bit-wise machines, apart from the Atom, consider -1 to be true, since -1 as a 16-bit binary number is 1111 1111 1111 1111.

Vic listing.

10 REM TOWERS OF HANOI
20 REM LOGIC VERSION
30 REM
40 REM G J BORIS ALLAN. 1982
50 REM
60 INPUT "DISCS ": D
70 V=0
80 M=1
90 IF (M AND V)=M THEN 100
100 I=1+1
110 IF I>D THEN GO TO 130
120 M=M+M: PRINT "CHR$(ASC"L")"+(I AND 1)*6)
130 GOTO 180
140 END

Atom listing.

10 REM TOWERS OF HANOI
20 REM LOGIC VERSION
30 REM
40 REM G J BORIS ALLAN. 1982
50 REM
60 INPUT "DISCS ": D
70 V=0
80 M=1
90 IF (M AND V)=M THEN 100
100 I=1+1
110 IF I>D THEN GO TO 130
120 M=M+M: PRINT "CHR$(ASC"L")"+(I AND 1)*6)
130 GOTO 180
140 END

BBC listing logical version.

10 REM TOWERS OF HANOI
20 REM LOGIC VERSION
30 REM
40 REM G J BORIS ALLAN. 1982
50 REM
60 INPUT "DISCS ": D
70 V=0
80 M=1
90 IF (M AND V)=M THEN 100
100 I=1+1
110 IF I>D THEN GO TO 130
120 M=M+M: PRINT "CHR$(ASC"L")"+(I AND 1)*6)
130 GOTO 180
140 END

ZX-81 listing.

10 REM TOWERS OF HANOI
20 REM DIVISION VERSION
30 REM
40 REM G J BORIS ALLAN. 1982
50 REM
60 PRINT "DISCS ": D
70 V=0
80 M=1
90 LET V=V+1
100 LET M=M+M: PRINT "CHR$(ASC"L")"+(I AND 1)*6)
110 GOTO 180
120 END

Apple listing.

10 REM TOWERS OF HANOI
20 REM DIVISION VERSION
30 REM
40 REM G J BORIS ALLAN. 1982
50 REM
60 INPUT "DISCS ": D
70 V=0
80 M=1
90 LET V=V+1
100 LET M=M+M: PRINT "CHR$(ASC"L")"+(I AND 1)*6)
110 GOTO 180
120 END

or each bit is true. The difference in the types of Basic is mirrored in Pascal which cannot easily manipulate bits, compared to the superior language Algol 68 in which bit manipulation is simplicity itself.

The first listing for the Tower of Hanoi is for a Vic, though it would be equally true for a Pet. If input and output statements are ignored, there are about eight essential statements, lines 90 and 200 are not really needed. The line numbers are of variable interval to correspond with the ZX-81 program given later.

Valuable lines

Line 60 merely asks for the number of discs to be used, and the program proper starts at line 90. The variable V contains the move number, and at line 90 it is set to zero, since this line is not needed and is only executed once in the program.

At line 100, V is incremented by 1, and I, the disc marker, is set initially to 1, as is M, the mask, that is, the variable used to find the right-most non-zero digit.

At line 130 is a conditional statement (M AND V)=M which is in two parts. The value of M, line 160, is doubled at each occasion the program comes to line 130, that is to say M takes the values 1, 2, 4, 8, 16, 32, which in binary is 0001, 0010, 0100, 1000. If V = 12, in binary this is 1100; and when M = 0001, M And V is 0000; when M = 0010, M And V is 0000; but when M = 0100, M And V is 0100, and so when the rightmost 1 is reached M and V = M. As I is incremented in line 140, then when the conditional in 130 is true and a jump must be made to line 180, disc number I must be moved.

If the disc has an odd number it is moved right, and to the left if even. Line 180 uses this information to provide one Print statement for both cases: the result of I and I is equal to I if I is odd, and if I is even the result is 0. When I is even, CHR$(ASC"L") which is L, is printed; and when I is odd, CHR$(ASC"L") + 6) which is R, is printed.

At line 130, if the conditional is untrue, control passes to line 140, at which I is incremented, and if I is now greater than the number of discs then it exits, this line could be

IF I>D THEN END

Otherwise M is doubled, line 160, and control returns to line 130.

The listings for the Atom and the BBC machine follow the pattern for the Vic, with slight differences but the listing for the ZX-81 and Apple is dramatically different. Both the ZX-81 and the Apple do not use bitwise comparisons, and so there have to be changes The programs for the Apple and the ZX-81 are very similar to each other. The line numbers for the ZX-81 program, in 1K, correspond to the line numbers in the other listings, with the proviso that there is only one statement per line allowable on the ZX-81.

Divided solution

The program is called the Division Version because of the way it tries to emulate the bit-wise comparisons of the other programs. The main differences are that M is made equal to the move number V in line 120, and it is discovered in line 130 if M is odd. If M is even, it is halved in line 160, control is the same as other programs. In line 190, ((M AND V)/M)*40 + 180 is a check to see if I is odd or even. Those who prefer the method of bit-wise comparison to the division method will find the ZX-81 and Apple programs very neat, and very short.

The perpetrators of rubbish frequently avoid Goto; and use If-Then-Else or Repeat-Until instead. In this program Until does not appear, If is avoided, and only Goto is used. The final program, the result of this attempt, will solve the Towers of Hanoi problem using Goto as the only means of control. The program is called the Illogical Version though it is, in fact, quite logical.

<table>
<thead>
<tr>
<th>Rem</th>
<th>Print &quot;disc &quot;, &quot;chr$(asc&quot;l&quot;)&quot;+(i and 1)*6) End</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 REM TOWERS OF HANOI</td>
<td></td>
</tr>
<tr>
<td>20 REM ILLOGICAL VERSION</td>
<td></td>
</tr>
<tr>
<td>30 REM</td>
<td></td>
</tr>
<tr>
<td>40 REM G J BORIS ALLAN. 1982</td>
<td></td>
</tr>
<tr>
<td>50 REM</td>
<td></td>
</tr>
<tr>
<td>60 INPUT &quot;DISCS &quot;: D</td>
<td></td>
</tr>
<tr>
<td>70 V=0</td>
<td></td>
</tr>
<tr>
<td>80 M=1</td>
<td></td>
</tr>
<tr>
<td>90 LET V=V+1</td>
<td></td>
</tr>
<tr>
<td>100 LET M=M+M: PRINT &quot;CHR$(ASC&quot;L&quot;)&quot;+(I AND 1)*6)</td>
<td></td>
</tr>
<tr>
<td>110 GOTO 180</td>
<td></td>
</tr>
<tr>
<td>120 END</td>
<td></td>
</tr>
<tr>
<td>130 GOTO (M AND V)/M*40 + 180</td>
<td></td>
</tr>
<tr>
<td>140 I=I+1: GOTO (I&lt;=D)*40 + 200</td>
<td></td>
</tr>
<tr>
<td>150 M=M/2: GOTO 130</td>
<td></td>
</tr>
<tr>
<td>160 PRINT &quot;DISC &quot;: &quot;CHR$($ASC&quot;L&quot;)&quot;+(I AND 1)*6)</td>
<td></td>
</tr>
<tr>
<td>170 COTO 100</td>
<td></td>
</tr>
<tr>
<td>200 END</td>
<td></td>
</tr>
</tbody>
</table>
Big name hardware at cash-and-carry prices - and with service you'll find hard to match

Telephone for Latest Prices

To Computer Supermarket Ltd, Unit B, Oakley Hay Ind. Estate, Corby, Northamptonshire

Please send me

Model

Item

Price

Shipping

Total

Info only

COMMODORE EQUIPMENT

4018

12" 40 Col. 32K Mem
456.00
644.00
244.00

4032

12" 80 Col. 32K Mem
560.00
644.00
244.00

8256

12" 80 Col. 32K Mem
1040.00
1196.00

SUPERPET

12K Single Disk
350.00
402.50

2037

20K Single Disk
350.00
402.50

2040

20K Double Disk
350.00
402.50

2050

1 Megabyte Disk
756.00
866.25

2125

2 Megabyte Dual Disk
1720.00
1868.00

2055

1 Megabyte Dual Disk
1720.00
1868.00

2056

5 Megabyte Hard Disk
1995.00
2204.25

2059

10 Megabyte Hard Disk
2485.00
2835.25

4022

Matrix Printer
350.00
402.50

4023

High Speed Printer
785.00
902.75

4030

Letter Quality Printer
1220.00
1403.00

PET/HEHE

Cable
28.00
32.20

IEEE/HEHE

Cable
30.00
34.20

VIC 10

Price & Delivery on Application

VIC 20

Personal Computer
153.17
175.00

VIC 30

Price & Delivery on Application

VIC 40

Price & Delivery on Application

VICZ/CZ

Cassette
36.00
41.40

VIC 101A

RS/232 Int
28.50
32.78

VIC 1110

8K RAM Cartridge
36.00
41.40

VIC 1111

16K RAM Cartridge
60.00
69.00

VIC 1112

IEEE Int
44.00
50.60

Prices quoted are for collection. 24 hour Insured shipment arranged anywhere in UK for an additional £1.25 (inc. VAT). VIC, Atari and Texas shipped by insured post P.O.C. Datapost Available.

EXPORT ARRANGED ANYWHERE IN WORLD. Write for details. Approved Distributor for Commodore, Sharp, Atari and Texas. All goods sold with full manufacturer's warranty and subject to conditions of sale (available on request). ALL MACHINES ARE FULL UK STANDARD.

Prices are valid only for the cover date month of this magazine.

Credit Facilities Available. Ring or write for full details.

Shop price list available for bonafide Government and educational establishments. All orders will be acknowledged by return of post.
Cossors fast test and repair service is available to all users of

- Quine
- Ampex
- Sorensen
- Nashua

These are just some of the companies who have now appointed us as UK service agents and whose customers can take advantage of our unrivalled test and repair service.

Our world-wide reputation for high quality products means that all our repair work is done to the highest standard (MOD Defence Standard 0521 in fact).

Additionally, we have insurance cover for the time your equipment is in our hands. So, this is a service that you can trust.

Just as important, our service is fast - in emergencies we can repair single boards within 48 hours.

If you own any of these products, or indeed have any electronics service problems to discuss, just telephone Henry Lassman on Harlow (0279) 26862. We know we can help.

Cossor Electronics Limited
The Pinnacles Elizabeth Way
Harlow /Essex CM19 5BB.

We can assist your company

If you are a supplier of electronics products, you may well find that your marketing will benefit with the backing of our nationally recognised service organisation. Why not call us to discuss it?

---

CITY MICROSYSTEMS LIMITED

65 LONDON WALL, LONDON EC2M 5TU
01-588 7272

- ACT
- Sineus 1
- TELEVIDEO
- BRITISH MICRO

The NEW generation Microcomputer 1MB disc capacity 128K RAM
CP/M 80 compatibility available.

Stand alone and Multi-User, Multi Task, Multi Processor systems.
Television reliability with complete expandability one to sixteen users.

MIMI 802 now available 700K disc drives. CP/M operating system.
Computer & monitor £1,440 + VAT

Complete business accounting systems from £2,400. Word processors from £2,400.
Programme Packages for most applications.

ADVICE, TRAINING AND MAINTENANCE
ALL YOUR COMPUTER REQUIREMENTS READILY AVAILABLE IN THE CENTRE OF THE CITY — LONDON EC2
VISITORS TO OUR OFFICES MOST WELCOME.

---

Circle No. 279
Circle No. 280
VISICALC 80 COLUMN DISPLAY on an APPLE II!

Yes, now its possible for all VISICALC users to obtain Screen Display in 80 COLUMNS, and to have additional memory available for VISICALC applications!!

Install one Saturn 128K Board and get 145K for Visicalc
Install one Saturn 32K Board and get 49K for Visicalc
Install one Saturn 128K Board plus one 32K Board = 177K for Visicalc

VC EXPAND 80 TO GIVE ADDITIONAL MEMORY AND 80 COLUMN DISPLAY – £69.00
VC EXPAND WITHOUT 80 COLUMN DISPLAY – £55.00
VIDEX VISICALC 80 COLUMN SOFTWARE (No Memory Expansion) – £29.95
SATURN 128K BOARD – £359 SATURN 32K BOARD – £149

TRIPLE YOUR DISK ACCESS SPEED

No hardware modification required.
FastDOS
Fast Disk operating system for APPLE II computers
Completely compatible with DOS disks
Completely compatible with all DOS/APPLESORT programs that access DOS through standard hooks, including FID and MUFFIN
Executes all standard DOS commands

Comparative timings:

<table>
<thead>
<tr>
<th>Command</th>
<th>FastDOS</th>
<th>FDOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baking integer basic</td>
<td>13 sec</td>
<td>3 sec</td>
</tr>
<tr>
<td>Calling a 12 file disk</td>
<td>2 sec</td>
<td>1 sec</td>
</tr>
<tr>
<td>Saving a 10 sector program</td>
<td>6 sec</td>
<td>2 sec</td>
</tr>
<tr>
<td>Saving a 100 sector program</td>
<td>34 sec</td>
<td>7 sec</td>
</tr>
<tr>
<td>Loading a 100 sector program</td>
<td>24 sec</td>
<td>7 sec</td>
</tr>
</tbody>
</table>

Recommended Retail Price £19.95

SYNERGIZER with FREE SUPERICALC

Z-Card Z-80 Processor Card
C/PM OP System and Licence
Rodney Zaks C/PM manual from Sybex
16K ADD RAM Ramcard
Smartem 80 col card with enhanced CHR
set and integral soft switch together with free Supercalc
SPECIAL OFFER! £399.00
*Without 16K CARD £335.00

Z-CARD WITH SUPERCALC and CP/M
SPECIAL PRICE £199.00

MACHINE COVERS - only the best material used

Apple only £5.95
Single Disk £2.95
2 Stacked Disks £4.45
Apple, 2 Disks + 9" Monitor or Apple + 12" Monitor £8.95
Apple + 2 Disks £7.95
Epson MX 70/80 £5.45
Paper Tiger 445 - 460 £5.45
9" Monitor £4.95
Apple, 2 Disks + 12" Monitor £9.50
Hitachi 12" Cover £7.50
Qume Sprite 5 Cover £10.95
Apple III Cover inc. Monitor III £12.95
Sirius Machine and Monitor Cover £12.95
Sirius Keyboard Cover £4.45
Epson MX 100 £7.45
NEC 12" Monitor £7.50

THIS MONTH'S SPECIALS

CALCSTAR For APPLE £59.00
WORDSTAR SYSTEMS £59.00
OSBORNE C/PM USER GUIDE £9.95
(Book – No VAT)
BATTLE OF SHILOH £24.95
MATHEMAGIC £49.95
EXPEDITER II £39.95
UZ80 Processor Card £69.00
DIGITEK Colour Card £89.00
16K RAM CARD £65.00

UTILITIES

BACK IT UP BIT COPIER £39.95
SUPER DISK COPY III £7.95
DISK RECOVERY £17.95
DISK ORGANISER II £17.95
MULTI DISK CATALOG III £15.95
DOS PLUS £15.95
QUICKLOADER £15.95
APPLESORT PROGRAM OPTIMISER £13.95
MACRO SCREEN EDITOR £29.95
MON & DISK £21.95
ACE (Applesoft Command Editor) £21.95
LIST MASTER £22.95
DAKIN 5 PROGRAMMING AIDS 3.3 £49.95
HIGHER TEXT II £21.95
HIGHER GRAPHICS II £18.95
HIGHER FONTS I £8.95
PROGRAM LINE EDITOR £21.95
MICROSOFT A.L.D.S. £79.00
MICROSOFT TASCII £109.00
MICROSOFT APPLE 280 £209.95

THE APPLE Compiler

BAG OF TRICKS

From the authors of Beneath Apple DOS
Includes many "hand holding" tutorials that assist you in repairing damaged diskettes and allow you to change sector ordering, reconstruct blown catalogs, etc.

BOOKS (No VAT)

APPLE BASIC : Data File Programming £8.95
What's Where in the APPLE? £8.95
Science & Engineering Programs APPLEII £15.95
A Guide to Programming in APPLE SOFT £11.00
APPLE Pascal Games £11.45
PASCAL PROGRAMMING for APPLE £10.45
APPLE Pascal - a hands-on approach £10.50
Osborne CP/M User Guide £9.95

The amazingly compact MICROWATCH real time clockcard and ELECTRONIC DIARY software for your APPLE II computer £59.00

Prices do not include VAT please add 15% to your remittance Postage and Packing FREE
Buy your £475* Daisy Wheel Printer for your computer and you have an Electronic Typewriter absolutely FREE

The T/Printer 35 is the lightest weight and lowest cost daisy wheel printer you can buy for your computer. So it will fit within your budget and you can carry it wherever you take your micro. Yet it is tough enough to give years of reliable service. Interchangeable typefaces (standard Olivetti 100 character daisy wheels), variable pitch, multiple copies—all the features you would expect of more expensive word processing printers.

Yet the T/Printer 35 costs only £475 with parallel interface. Operating speed under computer control is approximately 120 words per minute of letter perfect output. What typist can equal that?

Then when you're finished using it as a computer printer, the T/Printer 35 is ready to go right on working as an electronic typewriter.

That's the dual-purpose T/Printer 35—the versatile computer printer that fits your budget.

Orders are shipped within the UK carriage-free.

To order or for more information about the T/Printer 35:
*The T/Printer 35 costs £475 with Centronics compatible parallel interface. With RS-232C interface it costs £535. Prices listed are exclusive of VAT.
If you find some of the advertisements in this magazine confusing, just imagine what the products are like!

Don’t you wish you could find someone who will explain in plain English how their software and hardware systems can help your business? Someone who’s not interested in persuading you to work within the limitations of their products, but in making those products help business people overcome their own human limitations. That after all, is what computers are for, to help ordinary people cope more efficiently and quickly with a whole range of everyday problems.

It’s a simple enough principle, but one people tend to lose sight of in a welter of technical data, jargon, and sales talk. It is this principle which is central to the design of all our systems.

That is why our software is designed to respond when you address it in plain English. You don’t have to waste time learning a new language, or in continually translating into one or more other languages to get the different modules of the system to work.

All our software modules speak that same language, English, so they not only understand you, but each other. They integrate, not just on paper, but in your office.

Our software is designed so you can move from one field of information more rapidly and easily than with most other systems.

Because our systems are designed in Britain, for British business people, they can handle British red tape, such as VAT - and if you want further advice or help the chap with the right answers is on your side of the Atlantic.

We also sell the very best hardware, and have designed our software to match, so you can buy a complete computer package from us and be sure that the software and hardware really will work together as one effective entity.

Our software is flexible enough, however, to work with most computers running CP/M.

If this begins to make sense to you and your business, perhaps you should give us a ring. We should be able to come to a closer understanding, which will be good for both of us.

Hardheaded software from Derwent Data Systems

18 Norfolk Street, Sunderland, Tyne & Wear, SR1 1EA, England. Tel. (0783) 652026

Circle No. 285

PRACTICAL COMPUTING September 1982
This new quarterly journal began publication in March 1982. It deals with the interaction of human behaviour and information technology, focusing on research and development in the human sciences relevant to the design, use and impact of information technology in the short and long terms. It draws on a wide range of disciplines including psychology, sociology, ergonomics, computer science, management science and economics.

Published quarterly, £34.00, $85.00, DM160.00.

For further information and/or free specimen copy please write to the Marketing Manager, Taylor & Francis Ltd, Rankine Road, Basingstoke, Hampshire, RG24 OPR, England.

Taylor & Francis Ltd
4 JOHN STREET, LONDON WCIN 2ET
Tel: 01-405 2237/9 Telex: 858540

Cambridge Computer Store
Two Great Micros in stock now!

BBC Computer

Sinclair ZX81
Price Includes VAT.

Cambridge Computer Store
1 Emmanuel Street, Cambridge CB1 1NE
Phone (0223) 358284/85334
Also in our 'Budget Micros' Dept. Commodore VIC-20

'REXAGAN
INTERFACE UNIT
links microcomputers to instruments

'REXAGAN' units allow the interfacing of microcomputers to laboratory and process instruments for data acquisition and process control.

'REXAGAN' was designed to meet the widely varying needs ofICI scientists and engineers and is used throughout ICI.

'REXAGAN' has been used and tested until it has emerged as a powerful, versatile and integrated unit which can be used by junior laboratory assistants or senior engineers alike.

'REXAGAN' will link to most popular microcomputers, including PET, Apple, VIC, Acorn Atom.

'REXAGAN' can do several jobs at once, collect data, send control signals, monitor power supply, sound alarm signals, etc.

'REXAGAN' is the result of intensive development by ICI and can be used for instrument and system control by any individual in environments ranging from school laboratories to industrial plants.

'REXAGAN' comes complete with assembly and programming instructions, in a well-written, well-illustrated manual.

'REXAGAN' is made up of the MASTER UNIT, which connects to the microcomputer and various SIGNAL BOARDS which slot into the master unit. Connector cables run from the signal boards to the control instruments which send data or receive commands.

How many signal boards?
Up to eight signal boards can be slotted into the master unit for simultaneous use. Each board can go in any slot - there is no 'wrong slot'.

What do the signal boards do?
There are 9 different signal boards but only 6 different functions.

Analogue Input
Digital Input
Pulse Counter

Analogue Output
Digital Output
Alarm

Applications Include ...

Manufactured by Imperial Chemical Industries PLC, owners of the trade mark 'REXAGAN'

WORLDWIDE DISTRIBUTORS
DYSON INSTRUMENTS LTD
Sunderland House, Station Road, Hetton, Houghton-le-Spring, Tyne & Wear DH5 OAT, England.
Tel:0783-260433 Telex: 53889

PRACTICAL COMPUTING September 1982
**BABY PLUTO**
320 (H) x 288 (V) x 8 COLOUR DISPLAY

The power and performance of Pluto but with 96Kbytes of memory and half the resolution. An ideal match for low cost colour monitors. Incredible value at only £299 + VAT

**A/D BOARD FOR NASCOM**
- 8 input channels
- 30 microsec conversion
- Over voltage protection
- Prototyping area

Price £120 + 15% VAT (post free)

**EPROM PROGRAMMER**
- Programs 3 rail:
  - 2508/2708
  - 2516/2716
- Single rail:
  - 2508/2708
  - 2516/2716
- Software supplied for Read/Program/Verify
- Can be used with other machines with 2 parallel ports

Price £63 + 15% VAT (post free)

6 Laleham Avenue, Mill Hill,
London NW7 3HL
Tel: 01-959 0106

**“PLUTO” COLOUR GRAPHICS PROCESSOR**
Pluto is a self-contained colour display processor on an 8" x 8" NASBUS and 80-BUS compatible card featuring:
- Own 16 bit microprocessor
- 1192 Kbytes of dual-ported display memory for fast flicker-free screen updates. (Outside of the host address space)
- 640(H) x 288(V) x 3 planes (8 colours) – 2 screenfulls OR
  - 640(H) x 576(V) x 3 planes (optional extra)
- Fast parallel I/O interface usable with ALMOST ANY MICRO. Only single +5v supply required.
- Pluto executes on-board firmware providing high level functions such as:
  - Fast vector draw – over 100,000 pixels/sec. Lines can be drawn using REPLACE, XOR, AND, OR functions
  - User-definable characters or symbols
  - Spare display memory with memory management facilities for allocating symbol storage space or workspace
  - Rectangle Fill and copy using REPLACE,XOR, AND, OR plus 5 other functions
  - Fast access to single pixels
  - Write protect memory planes during copy
  - Double-buffered screen memory for animated displays
  - Complex polygon colour fill

Pluto is expandable. An expansion board will be available later this year to give Pluto up to 8 memory planes with no loss of resolution. $100 Interface now available.

AVAILABLE NOW. ONLY £399 + VAT (p&p free)
Dealer and OEM enquiries invited.

6 Laleham Avenue, Mill Hill,
London NW7 3HL
Tel: 01-959 0106

---

MiRcOPAPPORT
The Relational Database System for Micro Computers

For more information or to order your copies of MiRcOPAPPORT, just contact Peter Barnes, Database Products Group, Logica Limited, 64 Newman Street, London W1A 4SE, Telephone 01-627 9111

MiRcOPAPPORT is a proven Relational DBMS for CP/M-based microcomputers. It has an easy to use Interactive Query Language for retrieving data and formatting simple reports, a utility program for loading data and a powerful command interface for use within Fortran programs. It is a derivative of RAPPORT, the popular DBMS for mini and mainframe computers.

MiRcOPAPPORT can handle 16 data-base files holding up to 30 Megabytes of data. It is powerful, very efficient and proven on a wide range of machines.

---

PRACTICAL COMPUTING September 1982

©PRACTICAL COMPUTING 1982. All rights reserved.
Clearway
The best low cost
local area networking device
Clearway brings the benefits of Local Area Networking to you at very low cost. So if you’re thinking about a networking system be sure to find out more about Clearway, the low cost solution that anybody can install.

Available from Johnson Microcomputers,
Camberley (0276) 20446, Oxford (0865) 721461, Bristol (0272) 422061

Mail the coupon now for full information
Real Time Developments Limited, Lynchford House, Lynchford Lane, Farnborough,
Hampshire GU14 6JA. Telephone: Farnborough (0252) 546213 Telex: 858893 Pletel G

I am interested in Clearway - the low cost Networking System, please send me details.

Name:

Position:

Address:

Telephone:

Send to: Real Time Developments Limited,
Lynchford House, Lynchford Lane,
Farnborough, Hampshire GU14 6JA
Telephone: Farnborough (0252) 546213
Telex: 858893 Pletel G

MICRO WORK STATIONS
A new concept in work stations designed to solve space and mobility problems.

A compact storage unit able to house a full system yet only occupying a space just larger than a 60cm square. Even packed away the equipment can still be used effectively.

Opening the hinged leaf doubles the work surface area creating an operating position with ample knee and leg room.

Write or phone for full details to:-
Crowther-Cosine,
6, Middleton Road, Whittington,
Lichfield, Staffs. WS14 9NB.
Tel. (0543) 432376

PSION
MICROCOMPUTER
PROGRAMMERS & ANALYSTS
Psion is a rapidly growing microcomputer software house.

We require creative, skilled and able programmers and analysts. Applicants should have experience of assembly languages and machine-code on one or more microprocessors. This is an exciting opportunity to work with a dedicated team in Central London in the fastest-growing area of computers.

Salary range £8,000 to £13,000 per annum depending on skill, experience and creative potential.

PSION LTD, 2 Huntsworth Mews,
Gloucester Place, London NW1
Telephone: 01-723 6919 or 723 9408.
Bringing it all back home...

...to Manchester, birthplace of computing in Britain. To Belle Vue from November 25th to 27th—the obvious place for the Northern Computer Fair.

Following the incredible success of our London show 'the biggest-ever personal computer exhibition' where over 38,000 people visited us in 3 days, we're going to repeat the performance in Manchester.

Whatever your specialised line of business—personal computers; home computing; small business systems; associated software—this is the exhibition designed for you.

It's the ideal showcase for companies who need to demonstrate to a fast expanding and increasingly well informed audience all aspects of personal computing.

...you cannot afford to ignore it.

For further details about exhibiting at the Northern Computer Fair, contact the Advertisement Manager, Practical Computing, Room L310, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Telephone: 01-661 3500 Ext 3021

Name: ____________________________
Position in Company: ____________________________
Company: ____________________________
Address: ____________________________
Telephone: ____________________________
SHARP MZ-80K/MZ-80A/MZ-80B, TEXAS INSTRUMENTS, TRS 80, VIDEO GENIE, BBC, VIC 20 (16K), ATARI, CASSETTE BUSINESS SOFTWARE by Dale Hubbard

All programs cassette based. All are menu operated and completely 'user friendly'. Each complete with demonstration file where appropriate and luxury bound explanatory manual outlining the facilities and how the program works.

DATABASE
A complete electronic filing cabinet/card index system. Use as you would a catalogue or Kardex. Operations include sort, search, list, delete, total, line print, add record, change record etc. So many applications in business use, i.e. employee data, suppliers file, customer file, telephone directory, price lists etc. etc. Complete with demo file and bound manual.

INVENTORY CONTROL SYSTEM
All the necessary for keeping a rigidly accurate stock control. Extensive facilities include automatic stock number allocation with user-allocated reference number if required, quick stock summary, full stock summary, stock cost price, stock sell price, minimum stock level, re-order quantity, supplier, supplier telephone no., financial reporting, including overall gross profit margin, cost of new purchases, total of stock at cost and sell etc. etc. Complete with demo file and bound manual.

MAILING LIST
The ultimate mailing list program with facilities to store details on file and print or screen information selectively by user defined codes, in user defined format for suit printer and paper/labels. All the usual routines and more, including sort, search, delete, add, change etc. etc. Complete with demo file and bound manual.

INVOICES/STATEMENTS
Now you can produce crisp, clean and accurate company invoices and statements with your computer and printer. This one is very adaptable in terms of formatting and allows you to design your own form set-up to suit you. Naturally all calculations are automatic and all aspects of VAT are catered for as well as credit and settlement terms messages and other user defined messages. May also be used for credit notes, has inbuilt file for customers name and address details on cassette to save laborious type each time. A must for your business.

SPECIAL OFFER all 5 for £79.95 inc. VAT & p&p.
SPECIAL OFFER MZ-80A computer with all programs £500+VAT.

ACCOUNTS
A gem of a program, all cassette based, with the following features:
- Daily journal
- Sales ledger
- Credit sales
- Purchaser ledger
- Cash sales
- Bank account
- Credit purchases
- Year to date summary
- Purchases other

A fully interactive program suitable for all businesses. Files can be saved and loaded and totals from one file carried forward to another on cassette. Particularly useful from a cash flow point of view, with an immediate accessibility to totals for debtors and creditors. Bank totally supported with entries for cheque numbers, credits and, of course, running balance. Complete with demo file and bound manual.

£19.95

SPECIAL OFFER all 5 for £79.95 inc. VAT & p&p.
SPECIAL OFFER MZ-80A computer with all programs £500+VAT.

ACCESS 111
Welcome
Please state machine type when ordering.
Send cheque, registered cash, PO or Access number to:

GEMINI MARKETING LTD
9 Salterton Road,
Exmouth,
Devon EX8 2BR
Tel: (03952) 5832

Phone us with your Access order for immediate despatch!

£19.95

Are you uncertain what computer system you need? Are you sure you need a computer? Why not come along to one of our seminars or demonstrations and see what we have to show you. We can supply computers from £200 to £20,000 plus. Full installation and service support.

ALL PRICES EXCEPT VIC ITEMS EXCLUDE VAT.

A member of the Cornet Group

329 Euston Road, London NW1 3BG.
01-387-0505

We can supply with a Daisy-wheel printer for only £1,749.00
This must be the cheapest word-star based word pro system.

If you buy a VIC + cassette deck we give you
FREE Intro to basic
Intro to basic 14.95
Games tapes 19.95
10 C1Z tapes 5.00

Low prices
Wabash
5' SSSD 17.00
5' DSDD 24.95
Boxes (10) 2 YEAR G/TEE

Full Range
Apple IC
Apple 111
with the new access data base from Spider

PRAC TICAL COMPUTING September 1982
LONDON COMPUTER CENTRE

TOMORROW'S COMPUTING TODAY

ACT Sirius 1

£2395

8088 Processor
128K RAM
1.2 Mb Disk Storage

8068 100K EXTRA DISK STORAGE
£2170

Superbrain compatibility
Faster disk access
Green Screen: True descenders
22 Function Keys
802E 2 Mb Disk Storage
802HDE 14 Mb Hard Disk 1
Mb Floppy
806 6 User 10 Mb Hard Disk
816 16 User 23 Mb Hard Disk
800 64K User Station

Prices above based on exchange rate $2 = £

Save £300 on this LCC Software Starter Pack

Wordstar
£250

Wordstar Trainer Manual
£25

Dbase II
£350

Supercalc
£175

Special Package Deal
Saving £300

New Superbrain 2
from £1595

Epson Type 3
MX 80/F T
MX 100

AUTHORISED TANDY DEALERS

Model I
48K System
2 Disk Drives
Green Screen
Complete £995

Model II
with TRS DOS and CPM at no extra charge from £1995

Model III
16K £599
48K £649
48K with 2 disk drives £1395

HARD DISKS

Model 6 6 Mb Formatted £1595
Model 12 11.5 Mb Formatted £1895

* Specially designed Hybrid heavy duty power supply

* Data Error Recovery

All prices are Exclusive of VAT and Delivery. Dealer Enquiries invited on all Products.
Large range of CPM Software available. Please phone for Prices.

Demonstrations on all models.

43 GRAFTON WAY, LONDON W1P 5LA (Opposite Maples)
OPENING HOURS: 11-7 MON-FRI 12-4 SAT Tel: 388 6991/2
24 hour answer phone: 01-388 5721

PRACTICAL COMPUTING September 1982

Circle No. 297 205
ZX Spectrum
20 Programs £6.95

The ZX Spectrum has brought advanced computing power into your home, The Cambridge Colour Collection, a book of 20 programs, is all you need to make it come alive.

No experience required. Simply enter the programs from the book or load them from tape (£2.95 extra) and run.

Amazing effects. All programs are fully animated using hi-res graphics, colour and sound wherever possible.

 Entirely original. None of these programs has ever been published before.

Proven Quality. The author already has 30,000 satisfied purchasers of his book of ZX81 programs.

**Hours of entertainment**

- **Lunar Landing.** Control the angle of descent and jet thrust to steer the lunar module to a safe landing on the moon's surface.
- **Maze.** Find your way out from the centre of a random maze.
- **Android Nim.** Play the Spectrum at the ancient game of Nim using creatures from outer space.
- **Biorhythms.** Plot the cycles of your Emotional, Intellectual and Physical activity. Some would say this is not a game at all.

**Improve your mind**

- **Morse.** A complete morse-code training kit. This program will take a complete beginner to R.A.E. proficiency.
- **Maths.** Adjustable to various levels, this program is an invaluable aid to anyone trying to improve their arithmetic.

**Run your life more efficiently**

- **Home Accounts.** Keeping track of your finances with this easy-to-use program will enable you to see at a glance where the money goes and plan your spending more effectively.
- **Telephone Address Pad.** Instant access to many pages of information.
- **Calendar.** Displays a 3 month calendar past or future, ideal for planning or tracing past events.

**ORDER FORM:**

Send Cheque or P.O. with order to:-

Please send me:
- Copies Cambridge Colour Collection Book only £6.95 each.
- Copies Cambridge Colour Collection Book & Cassette £9.90 each.

Name:
Address:

© Circle No. 298
**ACORN ATOM**

Basic built 8k + 2k £135
Expanded 12k + 12k £175

5k + 8k + Colour Card £169
(p&p £12)

Atom pse £7 + £1.25 p&p. 3.5v regulated supply £22 + £2 p&p.
F.P. ROM £20, 1s RAM (£2 + 2141L) £2. Tool box ROM £25.
SK6 £4 ea. PL5 SK5 £2 ea.

Atom disc drive £399 + £9 p&p.

Colour card £32

New monitor ROM 2k allows direct entry of machine code £16.00
FULL RANGE OF SOFTWARE AVAILABLE

ASK FOR ATOM LIST

**FLOPPY DISC DRIVES**

TEAC FD50A Single sided drive mechanism £140.

Olivetti P50 Single sided drive mechanism £140

Single TEAC FD50A in cabinet with PSU £190.

Two TEAC FD50A in cabinet with PSU £300.

APPLE II Disc Drive. Siemens FDO 100.5 chasis, head, motors, track assembly, etc. & in out control PCB with read, write & control electronics plus case & cable £75.00.


DISKETTES 10 S.S.D. case £18 + £1.50 p&p.


**EPROM PROGRAMMER**

An ideal software development tool. A program can be developed, debugged, verified and then can either be committed to an EPROM or the program can be used in any hardware computer by linking the PROM outputs to the EPROM sockets.

Most +5v PROMS can be programmed on SOFTY. See the review in Sept. 81 PE for the various facilities provided on the SOFTY II complete with PSU ROMULATOR and TV LEADS £189 + £2 p&p.

MENTA

280 DEVELOPMENT TOOL for engineers and hobbyists. Full details on request £115.

**COMPUTER COMPONENTS**

- **MOS SERIES**
  - 74LS00 30p
  - 74LS04 35p
  - 74LS08 30p
  - 74LS09 25p
  - 74LS12 25p
  - 74LS20 30p
  - 74LS24 30p
  - 74LS32 25p
  - 74LS37 25p
  - 74LS40 35p
  - 74LS42 35p

- **ALS SERIES**
  - 74ALS00 40p
  - 74ALS04 45p
  - 74ALS08 40p
  - 74ALS09 35p
  - 74ALS12 35p
  - 74ALS20 40p
  - 74ALS24 40p
  - 74ALS32 35p
  - 74ALS37 35p
  - 74ALS40 45p
  - 74ALS42 45p

- **TTLs**
  - 74LS04 30p
  - 74LS08 25p
  - 74LS10 35p
  - 74LS11 20p
  - 74LS12 20p
  - 74LS13 35p
  - 74LS14 25p
  - 74LS15 30p
  - 74LS16 35p
  - 74LS17 20p
  - 74LS19 25p

- **SILICON SERIES**
  - 74S00 30p
  - 74S04 40p
  - 74S08 35p
  - 74S09 25p
  - 74S12 25p
  - 74S20 30p
  - 74S24 30p
  - 74S32 25p
  - 74S37 25p
  - 74S40 35p
  - 74S42 35p

- **TILS**
  - 74LS04 30p
  - 74LS08 25p
  - 74LS10 35p
  - 74LS11 20p
  - 74LS12 20p
  - 74LS13 35p
  - 74LS14 25p
  - 74LS15 30p
  - 74LS16 35p
  - 74LS17 20p
  - 74LS19 25p

- **Z80 DEVELOPMENT TOOL** for engineers and hobbyists.


**VOLTAGE REGULATORS**

- 74LS111 3p
  - 74LS123 5p
  - 74LS124 5p
  - 74LS164 10p
  - 74LS299 25p
  - 74LS295 30p

- **ICS**
  - 74LS124 3p
  - 74LS245 5p
  - 74LS74 10p

**EDGAR 2**

- 74LS124 3p
  - 74LS245 5p
  - 74LS74 10p

**EQUATIONS**

- 74LS124 3p
  - 74LS245 5p
  - 74LS74 10p

**5k + 8k + Colour Card £169**

(p&p £3/unit)

**500p**

**DIP HEADERS**

- 20pin £2.70
  - 24pin £4.30

- 28PIN £4.00

**CONNECTOR SYSTEMS**

- **50 CONNECTORS**

  - Solder type 40p + £1
  - IDC type 120p + £2.25

- **500p**

- **DIP SWITCHES**

  - 4 way 150p
  - 6 way 150p
  - 10 way 160p

- **OIL SWITCHES**

  - 4 way 150p
  - 6 way 150p

**UV ERASERS**

- UV8 £42.50 + £1.50 p&p
  - UV1 with Timer £46.50 + £2.50 p&p
  - (Erasers up to 6 EPROMS at a time)

- UV10 £35.00 + £2.00 p&p
  - UV141 with Timer £78 + £2 p&p
  - (Erasers up to 15 EPROMS at a time)

- UV140 and with built in electronic timer

Direct Mains operated tube £130 + £1.50 p&p

**MONITORS**

BMC 12" Green Screen monitor £99 + £6 card

BMC 15" Colour monitor £240 + £6 card

**SPECIAL OFFER**

- 12" 25-99
  - 2114L-200NS 100p 95p
  - 2716 25p 225p

**BARCLAY & ACCESS CARDS ACCEPTED**

STOCK ITEMS ARE NORMALLY BY RETURN OF POST

**TECHNOMATIC LTD.**

MAIL ORDERS TO: 17 BURNLEY ROAD, LONDON NW10 1ED

SHOPS AT: BURNLEY ROAD, LONDON NW10 1ED

(Tel. 01-452 1500, 01-450 6597. Telex: 922800)

305, EDGWARE ROAD, LONDON W2 Tel: 01-723 0333

PRACTICAL COMPUTING September 1982

207
APPLE II Payroll
£30.43 until 20 September, then £60
*All tax codes, all N.I., all rates of pay
*Monthly, weekly, hourly
*Up to 50 employees at a time
*Meets inland revenue specification
*Very easy to use — no specialists needed!
*Fast
*Usual features, and will also compute gross pay backwards from net!

APPLE II Bookkeeper
£30.43 until 20 September
*Keeps cash book, petty cash book, etc.
*Prints date, details, total, VAT: then prints amount under correct heading
*Details printed and carried forward
*Sorts entries in date order

APPLE II DEMONSTRATION DISC (PAYROLL AND BOOKKEEPER) £12

SPECTRUM PAYROLL £21.74. STOCK CONTROL £21.74
COMPREHENSIVE PROJECT PLANNING PACKAGE (PPP) — AT 1 OF THE PRICE OF COMPARABLE SOFTWARE!
For Z80-based computer with 48K RAM. Portable — all hardware will fit in a briefcase! At present available on 48K Spectrum (also ZK81 with 48K RAM). £120 (manual only: £20, refundable on purchase).
5½" floppy disc, guaranteed for life: £23 for ten discs and permanent library box.
Details on request. Add VAT to prices. Everything post free.

Hilderbay Ltd
Professional Software
8/10 Parkway, Regents Park, London NW1 7AA
Tel: 01-485 1059  Telex 22870

PACK SYSTEMS
38A ALLERTON ROAD
LIVERPOOL 18

SHARP DEALERS OFFER
The new MZ80A 48K micro computer with built in monitor and tape deck — just plug in for high power computing.

TRY ONE OF OUR SUPER VALUE DEALS
Deal 1 MZ80A plus £50 worth of games plus one dozen blank tapes. £477
Deal 2 £100 off word processing WDPRO tape word processor plus MZ80A plus printer I/F cable plus Epson MX80T III printer £952. OUR PRICE £852 COMPLETE.

Run any Centronics parallel printer off your MZ80A without the expense of an expansion box etc. — use the new I/F cable — plugs straight into the back of the computer — only £65.

ALL PRICES EXCLUSIVE OF VAT AND DELIVERY
Phone for details of other offers 051 531 8369

GHOST GOBBLERS! YUGDAB FIGHTERS!
2 GREAT NEW ARCADE GAMES FOR YOU
NEW! From Cornsoft

BOTH GAMES CAN BE PLAYED WITH OR WITHOUT THE MICRODEAL JOYSTICK
SEND FOR DETAILS

Both Games Tandy Model 1 or 3 Level 2 and Video Genie Cassette 16K
SPECIAL OFFER Both Games for Just £22
Both Games £40

Prices include VAT & Postage

We have over 1,000 programs for the Tandy Models 1 & 3, Video Genie & Tandy Color Computers
Send for lists

Will you save the Andromeda Galaxy by destroying the space castle or will the evil warlord Yugdab continue to rule unmolested? Locked in battle with Yugdab your main defence is your ability to skillfully handle your ship.

£11.95

DEAL HOUSE, BRIDGES, BODMIN
CORNWALL PL30 5EF TEL: 0726 850821
DEALER ENQUIRIES WELCOME

GHOST GOBBLERS! YUGDAB FIGHTERS!
2 GREAT NEW ARCADE GAMES FOR YOU
NEW! From Cornsoft

BOTH GAMES CAN BE PLAYED WITH OR WITHOUT THE MICRODEAL JOYSTICK
SEND FOR DETAILS

Both Games Tandy Model 1 or 3 Level 2 and Video Genie Cassette 16K
SPECIAL OFFER Both Games for Just £22
Both Games £40

Prices include VAT & Postage

We have over 1,000 programs for the Tandy Models 1 & 3, Video Genie & Tandy Color Computers
Send for lists

Will you save the Andromeda Galaxy by destroying the space castle or will the evil warlord Yugdab continue to rule unmolested? Locked in battle with Yugdab your main defence is your ability to skillfully handle your ship.

£11.95

DEAL HOUSE, BRIDGES, BODMIN
CORNWALL PL30 5EF TEL: 0726 850821
DEALER ENQUIRIES WELCOME

GHOST GOBBLERS! YUGDAB FIGHTERS!
2 GREAT NEW ARCADE GAMES FOR YOU
NEW! From Cornsoft

BOTH GAMES CAN BE PLAYED WITH OR WITHOUT THE MICRODEAL JOYSTICK
SEND FOR DETAILS

Both Games Tandy Model 1 or 3 Level 2 and Video Genie Cassette 16K
SPECIAL OFFER Both Games for Just £22
Both Games £40

Prices include VAT & Postage

We have over 1,000 programs for the Tandy Models 1 & 3, Video Genie & Tandy Color Computers
Send for lists

Will you save the Andromeda Galaxy by destroying the space castle or will the evil warlord Yugdab continue to rule unmolested? Locked in battle with Yugdab your main defence is your ability to skillfully handle your ship.

£11.95

DEAL HOUSE, BRIDGES, BODMIN
CORNWALL PL30 5EF TEL: 0726 850821
DEALER ENQUIRIES WELCOME

GHOST GOBBLERS! YUGDAB FIGHTERS!
2 GREAT NEW ARCADE GAMES FOR YOU
NEW! From Cornsoft

BOTH GAMES CAN BE PLAYED WITH OR WITHOUT THE MICRODEAL JOYSTICK
SEND FOR DETAILS

Both Games Tandy Model 1 or 3 Level 2 and Video Genie Cassette 16K
SPECIAL OFFER Both Games for Just £22
Both Games £40

Prices include VAT & Postage

We have over 1,000 programs for the Tandy Models 1 & 3, Video Genie & Tandy Color Computers
Send for lists

Will you save the Andromeda Galaxy by destroying the space castle or will the evil warlord Yugdab continue to rule unmolested? Locked in battle with Yugdab your main defence is your ability to skillfully handle your ship.

£11.95

DEAL HOUSE, BRIDGES, BODMIN
CORNWALL PL30 5EF TEL: 0726 850821
DEALER ENQUIRIES WELCOME
WOULD YOU LIKE TO HAVE A PROGRAM TO DEVELOP ALL OF THE APPLICATIONS SOFTWARE YOU WILL EVER NEED?...... THEN YOU NEED —

THE PROGRAM WRITER/REPORTER®

A PROGRAM THAT WRITES PROGRAMS

THE PROGRAM WRITER/REPORTER® Enables ANYONE to write complete, running, debugged BASIC LANGUAGE Programs in 35 to 40 minutes with NO PRIOR PROGRAMMING KNOWLEDGE OR ABILITY.

If you are one of the many who bought a microcomputer in the belief that with just a little studying you could write your own programs, you know that you can't.

If you, as a businessman, thought you could have stock software modified at a reasonable cost with reasonable results, you know that's not possible either.

If you are a hobbyist getting tired of the untold hours it takes to write a program, only to find it takes more hours to debug than to write.

If you are a skilled programmer you don't have to be reminded of the repetitious time spent on each new application.

If you have left your microcomputer sitting somewhere gathering dust...meet THE PROGRAM WRITER/REPORTER®.

THE PROGRAM WRITER/REPORTER® is not just another data base generator.

THE PROGRAM WRITER/REPORTER®, at your direction, makes complete running programs that are thoroughly documented, easy to modify at any time by YOU!

THE PROGRAM WRITER/REPORTER® cuts programming time up to 90% for a skilled programmer.

THE PROGRAM WRITER/REPORTER® will make anyone a skilled programmer in 30 to 35 minutes!

THE PROGRAM WRITER/REPORTER® does the work! You can answer the simple direct questions and THE PROGRAM WRITER/REPORTER® creates...AND ALL IN BASIC LANGUAGE.

Q. After THE PROGRAM WRITER/REPORTER® has produced a program, can it be modified ?
   A. Yes, the resulting program is modular, fully documented and readily accessible for alterations or deletions.

Q. Does the program created use so much disc space that there is very little space left for the record storage ?
   A. No, the code produced is extremely compact despite complete documentation. If requested THE PROGRAM WRITER/REPORTER® will even 'pack' or compress information. You may even delete the remarks making it even more space efficient.

Q. Must I be expert or even conversant with Basic Language ?
   A. No, all questions to and answers from the operator require no computer language knowledge, simple,every day English will do.

Q. What about maths ability ?
   A. If you can count your fingers and toes, you'll have no problems.

Q. Will the programs which I produce with THE PROGRAM WRITER/REPORTER® be bulky, slow or amateurish?
   A. No, the resulting programs will be sophisticated and extremely fast operating. For example, should you create a mailing list or inventory program, the time for any record to be retrieved and displayed from a full disc would take a maximum of 1 second.

Q. Must the programs produced conform to a pre-determined format and file length ?
   A. No, you determine format and file size to fit your requirements. You may have as many as 508 fields or as few as 1.

Q. Can I develop my own business programs ?
   A. For the most part, yes.

Q. What are the limitations ? What programs can I produce with THE PROGRAM WRITER/REPORTER® ?
   A. Your own ingenuity and hardware limitations. 100's of different programs.

TECHNICAL ASPECTS

Write stand alone data base storage/retrieval/update programs to the user's specifications and generates source code in basic (you do not need to use PWR to run generated programs).

Generated programs are easily modified. User-defined prompts, edits, error messages and video attributes are standard, fully supported and easily modified.

You may have 500 fields per record with CP/M; 47 fields with APPLE II+; or 200 fields with APPLE III.

You may have up to 32,000 characters per record with CP/M; 3,000 characters per record with APPLE II+ and APPLE III.

Any field may be a key field. New keys may be added at any time.

Duplicate keys permitted.

Unlimited records per file (disk limited).

Unlimited disks per file.

Record deletion automatically supported.

Record access and file maintenance is user transparent.

Record access by a hashing algorithm guaranteeing fast record retrieval.

Minimal disc overhead since there is no special assembly language routine called. No 'basic' overhead.

Programs produced can be transported between 6800, 6502, 8080, Z80, 8085, 8086 and 8000 based systems.

All packed fields (5 types) may be updated computationally, 12 types - APPLE II . You may add (or subtract) an amount to a field, or multiply or divide a field by a constant.

Multiple file access and update allowed.

Can be used with Microsoft basic on CP/M systems.

Programs are compilable, using Microsoft's BASCOM (CP/M only).

Complex selection/exclusion criteria are possible and easily understood when using the reporter.

With the reporter columns may be the result of computations on fields or other columns or intermediate results limited only by the complexity permitted by Microsoft basic. All basic computational functions are permitted, as are all logical and string functions.

AVAILABLE FOR —

CP/M 8", CP/M 5.2", NEC, OSBORNE, NORTH STAR, VECTOR GRAPHIC, APPLE III & APPLE CP/M AT —

—£25 + V.A.T. (£37.75)

APPLE II AT — £275 + V.A.T. (£331.25)

PLEASE SUPPLY COPIES OF THE VERSION FOR MY COMPUTER MODEL

NAME _______________________________  ADDRESS _______________________________  TELEPHONE No. _______________________________  DEALER ENQUIRIES INVITED

PRACTICAL COMPUTING September 1982
PETS

CBM 4016 — 16K 12" Screen 40 Col. Computer.
CBM 4032 — 32K 12" Screen 40 Col. Computer.
CBM 2031 — 170K Single Drive Floppy Disk.
CBM 4040 — 340K Twin Floppy Disk Drive.
CBM 4022 — 80 Col. 65cps Tractor Printer.
CBM 8032 — 32K 80 Col. 12" Screen Computer.
CBM 8096 — 96K 80 Col. 12" Screen Computer.
CBM 8050 — 1 Meg. Twin Floppy Disk Drive.
CBM 8422 — 22 Meg. Winchester Disk Drive.

Please phone for latest prices.
We offer some of the best deals around!

APPLES

Apple II — 48K Computer.
Apple III — 128K Computer.
Video Monitors — Colour and Black & White.
Disk Drives.

Software

Sales Ledger
Purse Ledger
Incomplete Records
Record Keeping
Bookkeeping
Financial Packages
Invoking
Time Recording
Block Control

NEW DRAGON COMPUTER

Nine colours, 32K, full size keyboard, full expansion capabilities £199.50 inc VAT.

ACCESSORIES

Fluorescent Disks
Storage Boxes
Printer Ribbons
Tractor Feeds
Cassettes
Maintenance

SOFTWARE

Word-processing
Reporting
Incomplete Records
Bookkeeping
Invoking
Block Control

SOFTDRIVE

IBM Compatibles

VICE — Computer. Works with your color TV.
VICE20 — Cassette Unit.
VICE510 — Single Floppy Disk Drive.
VICE910 — Printer.
Expansion Memory, Games Cartridges, Programmers’ Aids & Tutorials.

Low price computer. New accessories coming in all the time. Call for latest news and prices.

BOOKS

Full range of computer books available from Beginners Guides to Advanced Machine Code Programming.

2ND HAND

We have a constant changing range of 2nd hand and ex-demo equipment at considerable savings.

PROFESSIONAL SOFTWARE

CP/M — CDOS — CROMIX
INTEGRATED COBOL PACKAGES

* Accounts
* Invoicing
* Wages
* Stock
* Word Processing
* Data Base Systems

Complete Business Systems for Retail & Wholesale trades, Manufacturing and Service industries + many more.

Services include implementation, support, programming and free helpful advice on equipment. Source code available if required.

Tel. Fakenham (0328) 710810.

PRACTICAL COMPUTING September 1982.
(1) ACT Sirius 1. Available from stock with either 1.2 or 2.4 Mb diskette storage, hard disks available to order. We also supply a complete range of printers for the Sirius including those capable of reproducing the advanced graphics facilities.

(2) FMS 80. The world's best selling database and application generator, available exclusively from Raven Computers. Utilises standard CP/M data files and links to Wordstar and our range of accounting packages. Imposes virtually no limit on the number of data fields, indexes or data files.

(3) Sirius 80. Dual-mode processor card allows software written for any 8 bit CP/M Micro to run unchanged on the Sirius. Does not interfere with any of the advanced features of the Sirius such as hi-resolution graphics and 132 column mode. Data files are totally interchangeable between 8 and 16 bit mode.

(4) Multi-User Hard Disk Network. Utilises Sirius 80 to link up to 64 Sirius computers to a 5, 10, or 20 Mb Hard Disc, sharing files between users. Or use as a powerful stand alone system.


(6) Mainframe Communications. Allows the Sirius to talk to IBM, DEC, BUR-ROUGHS, ICL, etc. Allowing full utilisation of your Sirius.


IBM's PERSONAL COMPUTER
READ ALL ABOUT IT!
THIS PUBLICATION IS THE ONLY
IN-DEPTH EVALUATION
OF THE MOST
SIGNIFICANT MICRO-
COMPUTER EVER
DEVELOPED. TOPICS
COVERED IN ITS
300 PAGES INCLUDE:

- System Unit: 8088 CPU, Co-Processor, System Board, PSU, Keyboard.
- System Peripherals: disk drives, display units, printer, expansion options.
- System Software: BIOS, PC-DOS, CP/M-86, UCSD p-System.
- Languages: IBM Basic, Fortran & Pascal, UCSD Pascal & Fortran, assemblers.
- Applications software: IBM VisiCalc, Easywriter, IBM/Peachtree Business software, IBM Educ. software.
- Communication using the IBM Personal Computer.

PROTOCOL COMPUTER PRODUCTS
49, Beckenham Lane, Shortlands, Bromley, Kent. 01-460 2580/01-466 6982
Price: £12.95 inc. postage.

PRACTICAL COMPUTING September 1982 • Circle No. 308

A+G COMPUTERWARE
This month's special offers
TEC F10-40 PRINTER
Features include:
- WORD PROCESSOR QUALITY DAISY WHEEL PRINTING
- SERIAL RS232C or 8 BIT PARALLEL
- AUTOMATIC PROPORCISIONAL SPACING
- 40 CHARACTERS PER SECOND
- DOUBLE PRINT, BOLD PRINT, AUTOMATIC UNDERLINING, GRAPHICS, HORIZONTAL TABULATION AND REVERSE PLATEN FEED
- 2K BUFFER
- DIABLO CARTRIDGE AND PRINT WHEELS
- LOGIC SEEKING AND SPACE SKIPPING
- PRICE £1050 (a)
- COMPLETE APPLE BASED WORDPROCESSING PACKAGE AVAILABLE WITH F10-40. P.O.A. **

MONITORS
PRINCE 12" 24Mhz 80 COLUMN GREEN SCREEN £99 (b) suitable for APPLE, BBC, ATOM, ZX81, TANDY Etc. BMC 1401 14" RGB COLOUR 40 COLUMN 18Mhz £254 (a) suitable RGB cards available for APPLE AND SHARP

EPSON PRINTERS
THE WORLD'S MOST POPULAR PRINTER WITH NEW IMPROVED FEATURES!
EPSON MX80F/T - 3 £373 (b) EPSON MX100 - 3 £475 (a)
VARIOUS INTERFACES AVAILABLE

OKI MICROLINE PRINTERS
MICROLINE 80 £272 (b) MICROLINE 83A £499 (a)
FULL RANGE OF APPLE HARDWARE AND SOFTWARE
CARRIAGE (a) £15 (b) £8
PAYMENT BY ACCESS OR CHEQUE
MAIL ORDER ONLY
OPEN SIX DAYS PER WEEK (PHONE ANY TIME)
PLEASE ADD V.A.T. TO TOTAL
P.O. Box 34, Cheadle, Cheshire, SK8 4PT Tel: 061 428 2014

PRACTICAL COMPUTING September 1982 • Circle No. 310
There are four models in the ICL Personal
equipment. peripherals and data communication
interfaced to the widest range of terminals,
the ICL Personal Computers to be
at £5,250. mini floppy disk storage and eight I/O ports
bytes of hard disk storage, 500K bytes of
which has 64K bytes of RAM, twin 500K
Computer range starting with the model 10

Our cash prices include carriage and V.A.T. and represent at least
10% discount on normal recommended retail prices.
A surcharge of 10% will be levied on approved institutions requesting credit
terms, to offset the high cost of borrowed money.
When your computer goes down will it be an inconvenience or a disaster?

Microcomputer systems form an indispensable part of our modern working life. Their power and convenience make it easy to forget just how complex they are - until they go wrong!

We hope you will have talked to us long before that happens. In a 'crisis', a fast reliable response is the only type of service you are going to accept.

microserve offers you a complete range of servicing, maintenance and repair plans. With our microserve maintenance contract, for example, we'll have a fully trained service engineer on your doorstep within hours. Other servicing plans include installation, workshop repair and system upgrades.

microserve are specialists in the maintenance and service of Cromemco, North Star and Comit Microcomputer systems.

We operate from service centres throughout the UK, with the technical support of one of the largest microcomputer groups in the country.

For more information, call us today on 0480 215005, or fill in and return the coupon below. It won't inconvenience us, but it might save you from a disaster!

To: microserve, Firepool, Little End Road, Eaton Socon, St Neots, Huntingdon, Cambridgeshire PE19 3BR.
Name
Company
Position
Address
Tel.

Circle No. 314

PORTABLE COMPUTERS

With 16k bytes of ROM and up to 11.5k bytes of RAM memory, with battery protection. Up to 36 program storage capacity. BASIC program language with two dimensions; arrays and variable strings. QWERTY keyboard with upper and lower case. Full range of scientific and math functions (statistical with MICROIL software). Alarm clock and calendar; multi-tone generator; mini-graph 7 x 15 dot matrix display; all under BASIC program control. Line width 36 characters.

CE-150 Four colour Graphic Printer/Two Cassette Interface (for saving/loading) has 8k bytes of Graphics BASIC. Print virtually any drawing, with complete control of up, down, left and right printing. Variable line length from 4 to 36 characters. With rechargeable battery and mains adapter. Dimensions: PC-7000, 195 x 25.5 x 60mm (7 x 1 x 3-1/2); WC-7900, CE-150, 300 x 50 x 115mm (12 x 2 x 4-3/4). Weight 9kg (19 lbs).

Optional add-ons include: CE-151 4k memory module, CE-155 8k memory module CE-153 16-key custom keyboard (summer 82), RS232C communications interface (Autumn 82), CE-152 custom cassette recorder (Autumn 82), custom system briefcase (Autumn 82).

Circle No. 315

PRACTICAL COMPUTING September 1982
EPSON’S NEW TYPE III
simply out of this world

Epson’s new Type III series brings quality graphic printing within the price range of alphanumeric users for the first time.

The MX-80, MX80F/T and the MX-100 offer high reliability, improved performance and greater flexibility.

Performance of the MX-100 has been boosted to 100 cps, and the MX-80 and MX-80F/T each give 80 cps. New features include super and subscript, underlining, deletion and italics. Users can select a unidirectional print mode and system reset.

High resolution printing quality is from a 5x5 dot matrix head, and wide range of type sizes is available. Other user benefits include an easy-change cartridge ribbon, and quiet operation.

All three are equipped with a full 96-character ASCII set, with descenders. The standard interface is Centronics-style 8-bit parallel, with optional RS 232 or IEEE 488 ports, and most popular micro computer systems.

Interfaces to all microcomputers V/A HP 18 or RS23 interfaces. “Commodore Compatible” (special manual and disk at £35).

CASH FLOW FORECASTING
WITH “C-FLOW” TM

C-Flow is a minicomputer based programme which takes the chore out of cash flow forecasts. Financial modellers are very useful but can be complicated to set up and do not store the “build-up” of the figures entered into them. C-Flow could not be easier to use. It comes with the standard headings used by Banks and provides for:

1. Altering HEADINGS for particular needs
2. BUDGET & ACTUAL figures can be entered against each item
3. Simple inputs of Payments and Receipts
4. Simple alteration of any of the figures already entered
5. AUTOMATIC CALCULATION of VAT Content
6. Storage on file of every item making up the totals on your Cash Flow Printout
7. All entries can be allocated to chosen months or automatically to all 12 months and resultant multiple entries are made automatically by “C-Flow”
8. “Across the Board” increase of Budget figures to allow for inflation
9. Detailed printout of all entries making up your forecast figures showing:
   (i) Description of transaction; (ii) Budgeted figure; (iii) Actual figure; (iv) VAT percentage applicable;
   (v) Month to which it is allocated
10. Printout of FULL CASHFLOW FORECAST for 12 months showing all BUDGET & ACTUAL figures and with all TOTALS & VAT entries automatically calculated
11. Currently available on all CP/M based micros – soon available on Apples & Pets

PRICE: £210 (excluding VAT)
Cheque with order (please add 15% VAT) to

COMPUTERS FOR ALL LIMITED
STRATFORD-UPON-AVON. Tel. (0789) 840064
WELLESBOURNE HOUSE, WELLESBOURNE, WARWICKS. CV35 9RH.
64K Superbrain Microcomputer/132 Column Printer/"C-Flow"/"Wordstar/Wordprocessor
"ALL FOR £2,950 (exc. VAT)"

We are also the authors of “CFACC” the nationally used integrated accounts programme — ask for details

CIRCLE NO. 316

CIRCLE NO. 317
Meet some of the best brains in Britain

at THE Northern Computer Fair

The brains we're talking about are the printed circuit, silicon-chip variety and you'll find them (thinking hard) in the vast range of exhibits at The Northern Computer Fair. The show covers the fields of personal computing, home computing, small business systems and associated software, through computer books to video games, with a special attraction being the ZX 81 Sinclair Village. So whether you're a businessman (or woman) who needs to keep up to date with the latest developments in this fascinating field, a die-hard computer enthusiast, or simply interested in the subject, you'll find what you're looking for at the Northern Computer Fair.

Ticket prices at the door are £2.00 for adults and £1.00 for children under 16, but special party rates are available for 20 people or more with the organiser admitted free. For more information contact IPC Exhibitions, Surrey House, 1 Throwley Way, Sutton, Surrey SM1 4QQ. Tel: 01-643 8040.

BELLE VUE, MANCHESTER
NOVEMBER 25-27, 1982
Opening Times 10am-6pm each day

HALF PRICE ADMISSION VOUCHERS
for readers of Practical Computing

Cut this coupon and exchange for half-price ticket at the door.
As a professional computer user, or first time user, you need to see and compare the whole range of equipment and services available for today’s specifiers and purchasers — and what better way is there than spending a day at the first Compec exhibition in Scotland — COMPEC SCOTLAND — the most effective way of bringing yourself up to date with everything the computer industry can offer.

COMPEC SCOTLAND offers a truly comprehensive range: mini- and micro-computers, small business systems, printers, software, terminals and other peripherals, telecom equipment, word processors — as well as the many ancillary services and equipment available.

For computer users, suppliers, systems and software houses, the OEM industry, consultants — and particularly those considering the use of a computer system for the first time — this must be the exhibition for you.

Apply now for as many FREE advance registration tickets that you will need. Clip the coupon now!

Please send FREE advance registration tickets for COMPEC SCOTLAND to:

Name
Job title
Company
Address

Return to: COMPEC SCOTLAND '82 Tickets, IPC Exhibitions, Surrey House, Throwley Way, Sutton, Surrey SM1 4QQ.
The new Dot Matrix printer which proves there has never been a better time to buy British.
- 120 cps. 80/132 columns. □ 9 x 9 dot matrix. True descenders. □ Bi-directional/logic seeking.
- Choice of plug-in interfaces.
- High resolution/ block graphics. (with centronics interface).

**£395.00 ex VAT**

**SINCLAIR ZX81**
£429.95 + VAT

**SHARP PC1500**
£139.15 + VAT

**SHARP MZ80A**
PC1211
£54.95 + VAT

**MAIL ORDER**
SUNDAY OPENING 2pm-6pm
OPENING HOURS MON TO SAT
9.30-6.30pm

**Deans of Kensington**
191, Kensington High St.
London W8
Tel.: 01-937 7896

**APPAREL II - APPLE III**

**DON'T buy any item until you know our discount price**
WITH OUR EXTENSIVE RANGE Minichip Limited
OFFER YOU THE BEST HARDWARE AND SOFTWARE FROM STOCK AT THE RIGHT PRICE.....

**SIRIUS**

VICTOR 9000

- 128K - 1024K RAM
- 1.2 mb DISK DRIVES
- 16bit 8088 GPO...cp/m86
- HIGH RESOLUTION GRAPHICS.....
- SOUND.....LANGUAGE OPTIONS

£2395 +

**COMMODORE**

- 4016....4032....8032....
- 4040....8060....4022....
- 8024....8026....C2N.....
- VIC20.....
- VIC CARTRIDGES.....
- FULL CBM RANGE
- PRICES START FROM VIC AT £173 +

**ORSBORNE**

COMPLETE WITH £800 OF SOFTWARE INCLUDING
- WORDSTAR.....SUPERCALC.....CP/M.....MAILMERGE.....
- C BASIC.....M BASIC

Z 80A CPU ..... 64K RAM
- TWIN DISK DRIVES.....VDU
- RS232 + IEEE Interface

£1250 +

**APPLE**

II/III

- DISK DRIVES.....MONITORS....
- PRINTERS.....ACCESSORIES....
- INTERFACE CARDS.....
- SOFTWARE

**FUJITSU**

TWIN 6809 + Z80A CPU'S
- 64K RAM .....48K VIDEO RAM
- HIGH RESOLUTION COLOUR.....
- BUBBLE MEMORY OPTION.....
- SERIAL + PARALLEL
- INTERFACE – FLEX.....
- UCSD PASCAL.....F BASIC

£995 +

**XEROX 820**

820/5 and 820/8 SUPER
- DENSITY 64K CP/M
- UP TO 1.6mb
- TWIN DISK DRIVES
- LANGUAGE OPTIONS
- BUSINESS SOFTWARE
- WORD PROCESSING

£1750 +

**DRAGON**

9 COLOURS .....5 RESOLUTIONS
- 32K - 64K RAM .....6809E CPU.....EXTENDED
- MICROSOFT COLOUR BASIC
- PROFESSIONAL KEYBOARD
- PARALLEL OUTPUT.....AUDIO
- INTERFACE.....UHF OUTPUT

£173 +

**PRINTERS.....**

- EPSON
- MX80T/3.....£349
- MX80F/3.....£389
- MX80/3.....£499
- MX82.....£369
- MX82FT.....£409
- TEC
- F10/40P/R.....£1285
- F10/55P/R.....£1675
- DIABLO
- 630.....£1680
- 63KSR.....£1950

**SOFTWARE.....**

- MICRO PRO (ANY FORMAT)
- WORDSTAR, MAILMERGE
- DATASTAR, SUPERSORT
- CALCSTAR
- PADMEDE (ALL FORMATS)
- SALES, PURCHASE, GENERAL
- LEDGERS, STOCK, INVOICING

**MINICHIP LIMITED**

THE COMPUTER CENTRE – ENTERPRISE HOUSE
TERRACE ROAD – WALTON ON THAMES SURREY

Tel (09322) 42777 3 LINES

MON TO SAT 9. to 6pm –FREE PARKING OUTSIDE THE DOOR
ALL PRICES EXCLUDE VAT BUT INCLUDE FREE UK DEL IF YOU
PREFER TO ORDER BY MAIL OR TELEPHONE

Circle No. 321
NEW!

Fast CP/M

Business Application Software
from Padmede

Circle No. 322

at £249 per module

The Padmede Business Control System is available now on the following machines:
- Sharp PC-3201, MZ-80B
- Apple II
- NEC PC-8000
- DEC VT180
- Osborne I
- ICL Personal Computer
- Rair Black Box
- Wangwriter
- Hewlett-Packard 125
- OKI if-800
- Toshiba T200
- IBM Displaywriter
- Xerox 820
- IBEX 7102/7103
- Cromemco
- Sirius I (MS-DOS Version)

Send for details of the Dealer Demonstration Pack

Padmede
COMPUTER SERVICES
351 Fleet Road, Fleet, Hampshire
Telephone: Fleet (02514) 21892/3
Telex: FLETEL 858893
A full range of terminals and printers available.

For further details on how this quadruple can help solve your problem call today for a SuperFAST response.

01-341 2447

TM SuperFAST, EuroMicro and EuroMicroNet are the trademarks of EuroMicro Inc.

CP/M and MP/M are trademarks of Digital Research Corp.

available without hardware front panel

A large range of terminals and printers available

Gateway to greater things

The transfer

File transfer

Shared Resources

Hardware

IEEE 5100

bus

Magnetic bus

SOFTWARE

CP/M* MP/M*2.1

PASCAL/Z

FORTRAN

BASIC

COBOL

database

financial

wordprocessing

engineering

number-crunch

EPROM/burn

EPROM/emulate

prototype

emulate/prototype

 werenumber-crunch

Instrumentation

Analogue I/O

Graphics

Front panel

S100

bus

Hardware

Systems bus

Shared Resources

Magnetic bus

tape

9 track cartridge

HDD

floppy rigid/fix/ed rigid/fix/burn

5½"

floppy rigid/fix/ed rigid/fix/ed

8"

bus

SOFTWARE

CP/M* MP/M*2.1

PASCAL/Z

FORTRAN

BASIC

COBOL

database

financial

wordprocessing

engineering

number-crunch

EPROM/burn

EPROM/emulate

prototype

emulate/prototype

 werenumber-crunch

Instrumentation

Analogue I/O

Graphics

Front panel

S100

bus

Hardware

Systems bus

Shared Resources

Magnetic bus

tape

9 track cartridge

HDD

floppy rigid/fix/ed rigid/fix/burn

5½"

floppy rigid/fix/ed rigid/fix/ed

8"