

Personal Computer

ADD MUSCLE TO YOUR MK-14

US \$2.00/FF8.80/LIRE 1700/DM 3.80/FL 4.00/BF 55
S Fr 3.50/Pts 135 DKr 10.75/SKr 7.65/NKr 8.25/A Sch 28

World

APRIL 1980 50p

EUROPE'S LEADING MICRO MAGAZINE



ZX80 DOUBLE FIRST
Sinclair makes it, PCW tests it

The computer with growth potential

The System Three is Cromemco's best selling small business computer. It's easy to see why.

Not only is it ideal for the first time computer user. But perhaps more important, it can be expanded into a comprehensive business facility servicing many varied company requirements.

Single-user system

You can start small. A 64K computer with a megabyte of floppy disc storage costs under £4,000.*

Perhaps your initial reason for choosing Cromemco was its flexible database management system—ideal for client records, order processing, sales analysis, inventory control, and many more business uses; or you might have required the full screen word processing system, capable of printing up to 20 original letters an hour; possibly you needed Cobol, Basic or Fortran, to develop your own customised packages.

Easy to use

Whatever the reason, you were highly impressed with the ease with which your very first computer application got off the ground. So you added another. And another. And pretty soon quite a lot of company business was running on your Cromemco.



Single-user System Three, with 64K memory, 2 discs, terminal and printer. Ideal for small businesses.

Will it expand?

It was then you discovered that the terminal is the limiting factor, because of the time taken to input data. If only you could connect a second terminal you could double your system's workload. . .

Multi-user system

Fortunately, we can readily expand your Cromemco. Unlike other makers' systems, all we need to do is add some memory and a ® TU-ART interface, and the multi-user system is ready to run . . . with a printer and up to 7 terminals, each with up to 48K.

New operating system

Moreover, your terminals can function quite independently of each other. Under Cromemco's new operating system they can be used to update and interrogate the company's database; for correspondence, with the word processing system; for data entry, using the full screen editor; or indeed for running any combination of CP/M software, *simultaneously*.

Up to 72 megabytes

We can increase your floppy disc storage to 2 megabytes if necessary. And if that's not enough, we can also add Cromemco's hard discs to provide you with up to an amazing **72 megabytes** on-line.

Rely on MicroCentre

Remember—at MicroCentre we fully understand Cromemco systems. That's why we're Cromemco's top UK distributors. So trust your initial Cromemco investment to MicroCentre. And call us any time to discuss your hardware enhancements or software needs.

Your company's future growth may depend on it.



Multi-user System Three, with 320K memory, 4 discs, 7 terminals and fast line printer. Each terminal has its own operating system, and can run any software package independently.

*Price excludes VAT and delivery. Terminals and printers to be added according to user requirements. ® TU-ART is a Cromemco trademark.

For  **Cromemco... call the experts**

NOW IN SPACIOUS
NEW SHOWROOMS

Tel. 031-556 7354

Micro Centre

STILL IN
CENTRAL EDINBURGH

Complete Micro Systems Ltd., 30 Dundas Street, Edinburgh EH3 6JN

CONTENTS

Volume 3 No 4. April 1980

32 NEWSPRINT: Guy Kewney rounds up the month's news.

39 COMMONS REPORT: Ian Lloyd MP joins PCW on an occasional basis to report the goings-on at Westminster.

40 COMMUNICATION: Praise, suggestions, criticism and complaint... two pages of reader's letters.

42 BENCHTEST: Mike Dennis reviews the Challenger C2-4P.

47 VIEWDATA: First of a two-part introduction to the Information Age — presented by Dr. Adrian Stokes.

50 OVERCOMING DISABILITIES: A. R. Berry describes the Electraid 5602 communication aid.

55 BENCHTEST: The Sinclair ZX80... David Tebbutt conducts the first-ever in depth appraisal.

60 BOOKFARE: Sci-fi sighs — Malcolm Peltu on "fan-zines"; plus, starting this month, a technical review section with Michael James.

63 BEEFING UP THE MK-14: Tim Hawkins with some expansionist ideas that centre around a bus interface system.

68 INTERRUPT: "Conscientious Cowboy" pulls the trigger on the CRA: David Firnberg debates

microcomputing in schools.

72 IMPHEX: Tyrone Crudis (in his own inimitable way) presents an improved version of Hex.

79 COMPUTER GAMES: Part 4 of the David Levy series... speeding-up the search.

85 SYSTEMS: Mike Knight evaluates eight word processing packages.

90 COMPUTER ANSWERS: Talking shop with Sheridan Williams and his panel of consultants.

93 THE COMPLETE PASCAL: Top-down design; this month, tackling a large scale text formatting program from scratch.

98 CALCULATOR CORNER: Tired of the "is it or isn't it a micro" controversy, Dick Pountain takes a considered look at the HP-41C.

101 PAST FEATURES: Part 2 of our back issue breakdown; this concludes the second volume.

103 DIRECT ACCESS: Featuring Britain's premier machine listing — IN STORE, plus a complete USER GROUP INDEX, DIARY DATA and TRANSACTION FILE.

118 PROGRAMS: PCW's multi-purpose listings section.

122 LEISURE LINES: J. J. Clessa spins a very unlikely problem — but can you solve it?

122 BLUNDERS: Rather a hefty batch this month!

YOUNG COMPUTER WORLD — is returning next month.

Cover photograph: Ian Dobbie

Founder
Angelo Zgorelec

Editor
Bruce Sawford

Technical Editor
David Tebbutt

Consultants
John Coll, Mike Dennis, Michael James, David Hebditch, Sheridan Williams, Dr. Adrian Stokes, Dr. Stephen Castell.

Advertisement Manager
Stephen England (01-631 1786)

Sales Executive
Liz Banks (01-631 1786)

Micromart
Jacquie Hancock (01-631 1682)

Group Advertising Director
Richard Howell (01-631 3187)

Production Manager
Dick Pountain

Art Director
Paul Carpenter

Art Assistants
Jimmy Egerton, Julia Davies

Typesetter
Jane Hamnell

Published by SportsScene Publishers (PCW) Ltd., 14 Rathbone Place, London W1P 1DE, England. Tel: 01-637 7991/2/3. Telex: 8954139 A/B 'Bunch' G. London.

Copyright notice
Personal Computer World is published by SportsScene Publishers (PCW) Ltd. © 1980

Felden Productions. No material may be reproduced in whole or part without written consent from the copyright holders.

Printed by Riverside Press, Whitstable.

Distributed by Seymour Press Ltd., 334 Brixton Road, London SW9 7AG.

PCW welcomes all unsolicited material (written, photographic and illustrative) and although no guarantee can be given as to its safe return, reasonable care and attention will be exercised.

Guidelines for contributors
PCW welcomes articles of interest. Don't be put off if your style of writing is 'under developed'. . . true worth lies in the content, and shaping features comes naturally to us! Manuscripts should not exceed 3,000 words and authors as asked to use triple-spaced lines with a wide left-hand margin; diagrams, listings and/or photographs should be included wherever possible. Please enclose a stamped, self-addressed envelope if you would like your article returned.

Because of the foregoing, it is necessary to add that the views expressed in articles we publish are not necessarily those of Personal Computer World. Overall, however, the magazine will try to represent a balanced viewpoint.

Finally, before submitting an article, please check it through thoroughly for legibility and accuracy.

Subscription rates: Britain £8.00 for 12 issues, USA \$20 for 12 issues (surface mail), Continent and elsewhere £9.80 for 12 issues. All prices include postage and packing. Supplies to specialist shops can be arranged by negotiation direct with the publishers.

TEST SUITE
Personal Computer World thanks Sharp UK Ltd., for their kind donation of a model MZ-80K.

EDITORIAL

The check's in the post!

Blunders lives! Well, none of us can be perfect in an imperfect world. . . perhaps it's all part of the fun. But, that said, the staff of PCW actually does spend a great deal of time checking — even triple checking — contributions, be they letters, programs or features.

As the magazine grows in maturity — and complexity — so, inevitably, it's a system that occasionally fails. In order to minimise these failures, PCW now intends to establish a team of referees

willing to validate contributions; a fee will be paid according to the amount of effort involved in checking each particular work.

If you feel you might be able to help in some way, drop us a line, marking the envelope "referee". And please don't automatically accept that "there must be others better than me". In this particular game, accuracy, consistency and reliability are just as important as depth of knowledge.

Should your interests lie in programs, we'll need details of your machine configuration and relevant software. If it's hardware that turns you on, then we'd welcome word on your areas of interest and experience.

All of us here feel that, once implemented, a referee system will greatly assist the continued evolution of Personal Computer World as Europe's premier journal of microcomputing. Volunteers. . . one step forward please!

New

Produced and widely used in England and U.S.A.

COMPLETE BUSINESS PACKAGE

INCLUDES EVERYTHING FROM INVENTORY TO SALES SUMMARY
PROMPTS USER, VALIDATES EACH ENTRY, MENU DRIVEN

Approximately 60-100 entries/inputs require only 2-4hours weekly and your entire business is under control

PROGRAMS ARE INTEGRATED

- 01 = ENTER NAMES/ADDRESS, ETC
- 02 = *ENTER /PRINT INVOICES
- 03 = *ENTER PURCHASES
- 04 = *ENTER A/C RECEIVABLES
- 05 = *ENTER A/C PAYABLES
- 06 = ENTER/UPDATE INVENTORY
- 07 = ENTER/UPDATE ORDERS
- 08 = ENTER/UPDATE BANKS
- 09 = EXAMINE/MONITOR SALES LEDGER
- 10 = EXAMINE/MONITOR PURCHASE LEDGER
- 11 = EXAMINE/MONITOR (INCOMPLETE RECORDS)
- 12 = EXAMINE PRODUCT SALES

SELECT FUNCTION BY NUMBER

- 13 = PRINT CUSTOMER STATEMENTS
- 14 = PRINT SUPPLIER STATEMENTS
- 15 = PRINT AGENT STATEMENTS
- 16 = PRINT TAX STATEMENTS
- 17 = PRINT WEEK/MONTH SALES
- 18 = PRINT WEEK/MONTH PURCHASES
- 19 = PRINT YEAR AUDIT
- 20 = PRINT PROFIT/LOSS ACCOUNT
- 21 = UPDATE END MONTH FILES MAINTENANCE
- 22 = PRINT CASH FLOW FORECAST
- 23 = ENTER/UPDATE PAYROLL (NOT YET AVAILABLE)
- 24 = RETURN TO BASIC

WHICH ONE? (ENTER 1-24)

01 SUB. MENU EXAMPLE: 01 = EXAMINE: 02 = INSERT: 03 = AMEND: 04 = DELETE
05 = PRINT (1,2,3): 06 = NUMERIC COMBINATIONS: 07 = SORT

ALLOW ONE DISK . VERY FLEXIBLE . ADD YOUR OWN FUNCTIONS . EASY TO INTEGRATE . SINGLE REY PROMPTS

All programs in BASIC for CP/M . PET . 6800

G. W. COMPUTERS LTD the producers of this beautiful package

We export to all countries: Callers by appointment only:

Contact Tony Winter. Tel: 01-636 8210

G. W. COMPUTERS LTD

89 Bedford Court Mansions, Bedford Avenue, London WC1

BARCLAYCARD ACCEPTED
CBM APPROVED

BARCLAYCARD ACCEPTED
CBM APPROVED

PRICES: Programs 1-23 EXC (19,20,22,23) £475: Inclusive £575: Stock Integrated Option - £100; Bank integrated Option + £100

IMPORTANT

We also sell the Hardware to do the above tasks
so you can do the complete purchase at one source.

.PET • PET • PET • PET • PET • PET

PET COMPUTER 32K	£795.00
PET Floppy Disc	£795.00
PET Printer T/Feed	£645.00
PET Cables	£45.00
PAPER	£28.50
10 Diskettes	£28.50
1 year software support	£50.00
	£2387.00

SPECIALS • SPECIALS • SPECIALS

48K Industrial Microsystems and Twin D/Drives 5¼" (Lastone)	£1750
Intertube Video Terminals	£495
Computhink 800K	£895

SUPERBRAIN • SUPERBRAIN • SUPERBRAIN

Twin Floppy D/Density 5¼" TWIN Z80 PROCESSOR
64K RAM: Just add any printer £1950.00

Optional S100 bus adaptor £250
ADD ON 1 MEGABYTE DISC UNITS OR UP TO 10
MEGABYTE HARD DISK £ P.O.A.

● PRINTER OPTIONS ● PRINTER OPTIONS ●

a) Paper Tiger	195 cps	£685
b) Texas 810	150 cps	£1495
c) Teletype 43	30 cps	£895
d) DEC LA34	30 cps	£895
e) OUME Daisywheel	45 cps	£1950
f) NEC Sprinwriter	65 cps	£1650

SOFTWARE • SOFTWARE • SOFTWARE

. CPM MBASIC-80	£156
. CPM FORTRAN-80	£200
. CPM COBOL 80	£320
. CPM WORD STAR	£250
. CPM SUPER SORT	£20
. CPM BSTAM	£75
. CPM DESPOOL	£30
. CPM PASCAL M	£200
. PET COMACCOUNTS	£650
. PET COMPAY	£150
. PET COMBIS/COMSTOCK	£150
. PET WORDPRO	£75
. PET SUPER COMWORD	£150
. PET MASTER LIBRARY	various

SUGGESTIONS • SUGGESTIONS • SUGGESTIONS

PET 32K-Floppy 2040-Printer 3022	£2235
PET 32K- Computhink 800K- PRINTER 3022	£2335
PET 32K- Floppy 2040- DEC LA34 + Interface	£2635
PET 32K- Computhink 800K- DEC LA34 + Interface	£2735
SUPERBRAIN 64K + Texas 810	£3445
SUPERBRAIN 64K + NEC as Word Processor	£3900

Walkie Talkie Telephone (freedom Phone)
Connects to normal telephone make. or take calls
300ft from home. £195 (not P.O. Approved)

Telephone Answering Machine. Recall Message
anywhere in World £195 (not P.O. Approved)

Call for Special All-in Deal Offers

Warranty includes free replacement of equipment
within 90 days if found defective

We export to all countries: Callers by appointment only:

Contact Tony Winter. Tel: 01-636 8210

G. W. COMPUTERS LTD

89 Bedford Court Mansions, Bedford Avenue, London WC1

RAIR

Terminal choice

Choose from the best

Best terminals • Best prices

Best delivery



DECWRITER IV Desk Top Terminal

£795 or £40 per month

New desk-top microprocessor driven terminal, operating at 300 baud, printing at burst speeds up to 45 cps. Major features include firmware selectable character sizes, horizontal and vertical spacing, tabulation and margins. The keyboard feels like a typewriter and the 9x7 matrix print head produces clear printing.



HYTERM Word Processing Terminals

From £1900 or £95 per month

New range of microprocessor controlled 'daisy-wheel' terminals for word processing applications. Features include proportional spacing, justification, centring, bold printing, etc., plus all standard Hyterm features. Available for metal or plastic daisy wheels giving widest range of type fonts.



SILENT 700 Portable Terminals

From £1105 or £56 per month

Range of microprocessor controlled lightweight terminals featuring a field proven thermal printing technique giving silent printing at 30 cps. Options include built-in acoustic couplers and a non-volatile magnetic bubble memory capable of storing 20K to 80K characters. This feature allows full editing of data prior to transmission.

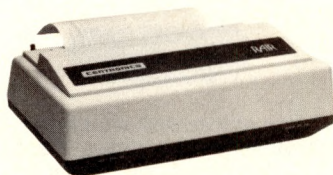


H1410/1420 VDU's Low Cost Video Terminals

From £590 or £30 per month

Two new low cost VDUs featuring full cursor control, 24 x 80 screen, and additional numeric keypad. Enhancements include upper-and lower-case characters, alternate function keypad, low intensity, blink or non-display, field and column tabulation and alarm.

NEW MODELS



MODEL 730 Low Cost Miniprinter

£555 or £29 per month

Lightweight low cost 100 cps printer. Major features include three-in-one paper handling: cut sheet, fan fold or roll paper. In printing of upper- and lower-case characters, and microprocessor logic for high reliability. The 730 communicates via an integral F interface at speeds up to 9600 baud using busy line signalling.

NEW MODEL

To RAIR Limited 30-32 Neal Street, London WC2H 9PS Telephone 01-836 4663 Telex 298452

Please send me full information on

Name _____ Position _____

Company _____

Address _____

Telephone number _____ Extension _____

PCW1

VERBATIM MAGNETIC MEDIA



THE BEST THAT MONEY CAN BUY.

VERBATIM — the world's finest and best known range of magnetic data storage products — includes Floppy Discs, Mini-Floppies, Cassettes, Mini-Cassettes, cartridges and cards. All are 100% tested during manufacture, all are *certified* error free. We stock all types, including all varieties of the popular 5 1/4-inch floppy discs.

If you are a dealer:

Start stocking VERBATIM products — your customers will appreciate a better quality product at better prices. Call BFI Electronics for a comprehensive catalogue, dealer price list, and details of display material and retail packaging.

If you are a user:

Your system is only as good as its data storage — so don't be content with inferior products. Insist on VERBATIM by name, as indeed do some of the biggest names in the computer business!

BFI Electronics Limited
516 Walton Road,
West Molesey,
Surrey KT8 0QF
Tel: 01-941 4066
Telex: 261395

TOMORROW TODAY at Birmingham Computer Centre

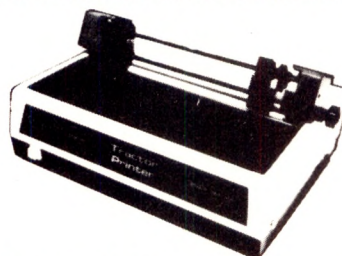
Commodore official distributors



3016, 3032, 3008 PETS
The reliable value for money system with after sales support, instruction and training facilities and a wide range of programmes.



3040 DUAL DRIVE FLOPPY DISC
The latest in disc technology. Low cost with reliable data transfer.



3022 PROFESSIONAL PRINTER
The high specification printer. Prints all PET characters onto paper and accepts labels, printed forms, cheques etc.



Apple authorised distributors
The sophisticated quality system with a reputation for advanced design and innovation.

**Camden Electronics, First Floor,
462 Coventry Road, Small Heath,
Birmingham B10 0UG.
Telephone 021 773 8240**

Open Mon.-Sat. 9.30-6.00 p.m.

A MEMBER OF THE COMPUTER RETAILERS ASSOCIATION

Isaac Newton's

easy solution!



Apple prices are tumbling at Microdigital!

A 48K Disk based computer system
for only

£1044

+ VAT
For March,
April, May and
June only.



	Nett	VAT	Total
16K byte Apple Computer	£695.00	£104.25	£799.25
Disk System	£349.00	£52.35	£401.35
Total with 32K free extra memory	£1044.00	£156.00	£1200.60

OFFICIAL ORDERS

We Welcome official orders from bona-fide commercial and government organisations. We require payment 14 days after invoice date.

Latest Apple II plus model with floating point basic and auto-start ROM.

Buy a 16K Apple with Disk drive and get 32K of memory Free.

Extras			
Second Disk Drive	£299.00	£44.85	£343.85
Pascal Language System	£299.00	£44.85	£343.85
Graphics Tablet	£462.00	£69.30	£531.30
Appletel System	£595.00	£89.25	£684.25
Black & White Modulator	£14.00	£2.10	£16.10
Eurocolour Card	£79.00	£11.85	£90.85
Joystick	£25.00	£3.75	£28.75

All Prices include courier delivery within U.K.



MICRODIGITAL

25 Brunswick Street, Liverpool L2 0BJ
Tel: 051-236 0707 (24 hour Mail Order)
051-227 2535 (All other Depts.)

Mail orders to: MICRODIGITAL LIMITED,
FREEPOST (No Stamp Required)
Liverpool L2 2AB.

Apple Business Systems -ring Graham Jones 051-227 2535

Software Packages	£	Word Processor/Letter	£
Stock Control	£225.00	Writer	£130.00
General Ledger	£295.00	Book keeper Package	£295.00
Purchase Ledger	£295.00	Credit Control	
Sales Ledger	£295.00	Package	£150.00
		Payroll	£385.00
		+ VAT at 15%	



apple computer
Sales and Service

Please send systems as above at £1200.60 in addition please send:

Total Remittance _____

Name _____

Address _____

Access and Barclaycard welcome.





The Parliament of the British Isles, Rovafone and a new telephone breakthrough open the door to new consumer savings.

DIAL FREE ON A CORDLESS EXTENSION TELEPHONE

Britain's phone system is the world's greatest. No country can compare. But what has made our phone system even greater is the recent parliamentary decision to allow consumers to plug in their own phones — phones they can buy themselves.

We will soon be able to choose which phone we want to plug in. And that creates competition, and competition usually results in lower prices, innovative products and better service.

We do now have lower prices and a very exciting new product which we have selected as the best example of the new telephone ownership decision. The big break for you is neither of these things, but something far more reaching, but more of that later.

THE NEW PHONE
It's called the Rovafone Mobile Telephone System. And its manufacturer is a supplier of phones to other large telephone companies.

Rovafone is the Greatest innovative product of its kind in the World and of this century. It's a Breakthrough in communications for both industry and the private person.

Why?

This solid state, microchip telephone has no cumbersome leads to cart about. Is completely portable. Enables to you dial and answer calls at will up to a radius of what is an incredible 3 to 5 miles inside or outside doors. . . up to now impossible. Whether in the garden, farm, warehouse, office, basement, at the pub or whenever you're not near your phone.

What other features?

Takes up to 16 digit telephone numbers, has last number radial, push buttons, pager and intercom, security coded, rechargeable cells, charger, carrying case, belt clip and only weighs 28 ounces.

THE 'DIAL FREE' KEYBOARD

The push buttons save time and money and temper. Simply key in the number as fast as you like. It goes straight into memory and is automatically dialled for you. Number engaged! Simply press Radial button and number will be recalled again automatically. Number remains in memory until updated with new number.

Push-button dialling, works anywhere in the world, you are not charged by the telephone company for this extra service. Assuming that you have rotary dial service at present, you are actually able to Push-Button Dial for FREE!

Base Station only item to connect. Simply attach two wires to your telephone line and you don't have to disconnect present phone (still operational). You're on the Air within seconds ready to go. And since Rovafone operates like a phone it's very easy to use.

Intercom and Pager. Touch one button on the base station (base station also very compact) and Rovafone beeps and you can talk direct to any telephone on the same line as the base station. This saves you time as you are easy to locate and can take necessary action straightaway, instead of having to run backwards and forwards getting in a tizz.

Security Access Coded. No other mobile phone can access your telephone line unless required as Rovafone has a digital code to prevent this happening. Means complete private two way conversations.

Rechargeable Cells. Saves You Money. Holds a single charge for 40 hours due to a unique energy saving circuit. The charger supplied takes a mere 3.5 hours to fully charge cells and be fully operational.

Light Weight. Only 28 ounces and is easily handcarried, clipped to belt or just simply slung over shoulder using the black grained carrying case supplied.

Low Price. The Rovafone is only £345.95 complete. It will pay for itself quickly, not only in conveniences, but with savings up to £20 a month rental charges from telephone company. (Amount charged rental for Rovafone).

When you determine the true cost of telephone ownership, you compare costs over 5 years. Even a £15 charge monthly equals a staggering £900 or over twice the cost of Rovafone.

Also other mobiles with only 300 feet range, and without half the facilities of Rovafone now cost in the shops £320. Rovafone

Mobile Telephone Systems are the very best and longest range units available in the world.

We make it an attractive proposition due to our policy of fair prices and fair play. We want to make it easy for you to own a Rovafone without being cost prohibitive which is usual on launch of new technology oriented products today.

A PERSONAL TEST

All you do now is order Rovafone. They'll be in the shops next year. Or avoid the wait and order one now, directly from us.

We were the first major distributor of Rovafone Mobile systems in the UK and have delivered thousands to homes throughout the country.

Put one in now you'll really appreciate the efficiency, time saved, convenience and other savings.

If service is ever required, we have a prompt service by mail offering free replacement of system up to one year.

In our experience the only item which goes wrong are the rechargeable cells and they are easy to replace, and available.

Rovafone Mobile Telephone Systems are made to very exacting standards of reliability and workmanship. Only the very best components and chips are used in its construction. And every Rovafone goes through very tough operational tests so that it won't let you down. Every system is built to last a long time.

TRY ONE TODAY

We urge you to at least give Rovafone a try. A complete personal test right in your own home, under everyday conditions. Order one today from Goregrange Communicators Ltd under our 30 day trial period.

Plug it in. See how nice it looks, see how easy it is to dial numbers by pressing buttons and how little space it takes up, and how convenient and efficient it is.

NOW FOR THE ALL IMPORTANT BREAK MENTIONED EARLIER. . .

We Now Take A Big Risk!!! That's right! But we're so confident about Rovafone measuring up to what you've been told, and that you'll be 100% pleased with it that we are

prepared to take the risk — so this is what we propose. . .

You send us a cheque for £364.95 and for thirty days from the date you receive the complete Rovafone System, you can check it all out thoroughly in every way at no risk whatever. And remember, the 30 days only start from when you receive the system. Not before.

If you're not totally convinced after this 30-day period (which will give you a chance to put Rovafone completely through its paces) simply return the complete system to us and we'll in return refund your £364.95 in full, plus a cheque of our own to cover your postage costs incurred on returning the system to us.

You have nothing to lose except a few minutes of time and a 10p stamp cost.

To order your Rovafone Mobile Telephone System send your cheque for £364.95.

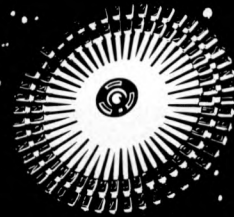
We'll send you the Rovafone, Base Station, Rechargeable cells, Charger, attractive Black grained carrying case, Belt Clip, Full instructions and One full year's guarantee covering the whole system.

Why not act ahead of the crowd and order an exciting space age way to catch those calls immediately. Order your Rovafone System at no obligation today.

Please note normal range of Rovafone is 1 mile. For 3 to 5 mile range special booster and compact external aerial required at £95 extra inclusive. (Ranges quoted are under optimum transmitting conditions). Remember, a lost call means lost business!

Order within 7 days and receive a "Free Gift" worth an incredible £30 and it's yours to keep whether you keep Rovafone or not. (Add 15% VAT)

To GOREGRANGE COMMUNICATORS LTD (ASD)
5 Station Parade,
Woodthorpe Road,
ASHfrod, Middlesex
Phone No: 09326 60453
100% Leasing available for Limited companies. Please phone Hamilton Leasing on FREEPHONE 3123 (Dial 100 and ask operator — call is free).



**small systems
presents**

**PET COMPATIBLE
DAISY WHEEL
PRINTER**

S.S.E. RICOH RP40

- Printing Speed - 40 C.P.S.
- Character-set - 96 characters, metal faced printwheel
- Choice of typefaces
- Line width - 136 characters (10 characters per inch)
- Line width - 163 characters (12 characters per inch)
- Form width - 16"
- Integral PET IEEE-488 Addressable Interface (Disc compatible)
- 240v 50Hz
- Micro-Processor controlled
- Reputation for high reliability
- Options:-
- Pin Feed Platen
- Acoustic cover
- Form Tractor
- RS232 C Interface, Centronics Interface

**Complete word processing systems - Commodore PET,
Software and RP40 Printer also available.**

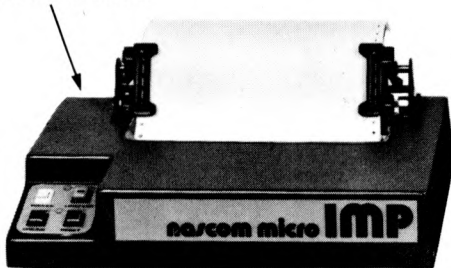
HIGH QUALITY PRINTING AT LOW COST £1590.00 inc. PET INTERFACE



We've put together a total system... so you can take it apart

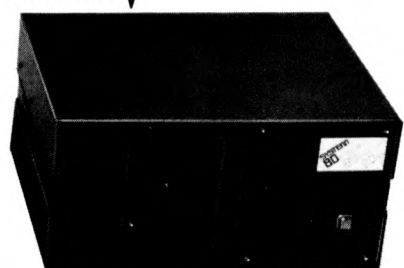
IMP Printer

80 cps (max) bidirectional;
punched or unpunched paper;
tractor or pressure feed; 7x7 dot
matrix; 110-9600 baud rates. £325
built and tested.



Floppy disc system

Double sided, double density 5¼in disc giving
280K bytes formatted, including controller
board/PSU/Housing and interconnects £480.
Controller board £127.50 • Second Disc £240.
CP/M £80



System 80 housing

High strength GRP moulding in variety of colours.
Accepts 12x8 Nascom 2 CPU board, four 8x8
expansion boards. £85 incl. frame racking,
interconnects and motherboard.

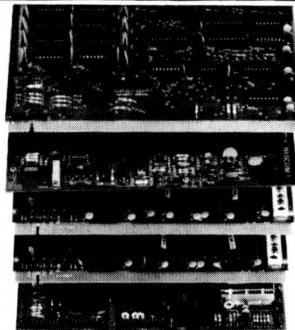
Expansion boards*

16K RAM £127.50 • 32K RAM £185.00
48K RAM £245.00

High Resolution Programmable Graphics £90 (kit).
High Resolution Colour board £140 (kit).

*Available in kit form.

All prices subject to VAT.



Microprocessor board* (Nascom 2)

4MHz Z80 CPU; TV or Video + 1200 baud
Kansas City + Serial RS 232 printer
Interfaces; Keyboard; 128 character ASCII
plus 128 Graphics in 2 x 2K ROM; free
16-way parallel port; 8K BASIC; NAS SYS
operating monitor. £280 built and tested.

Firmware & MOS ICs

Zeap Assembler (4, 1Kx8 EPROMs) £50
Nas Pen text editor (2, 1Kx8 EPROMs) £30
NAS-DA disassembler (3, 1Kx8 EPROMs)
£37.50 • 2708 £9.50 • 2716 £26
MK 4118N4 £12.75 • MK 4116N4 £55 for 8

System 80 is Nascom's total microcomputer system. It incorporates many of the existing and widely acknowledged products. And many totally new products.

But, above all, System 80 is the culmination of 3 years of microcomputer board design. Our concept was to take microcomputers to their obvious conclusion – total option concept. We have resisted offering an inflexible, boxed system. The housing is irrelevant – it's what's inside that counts. However, we still think our new housing is quite attractive.

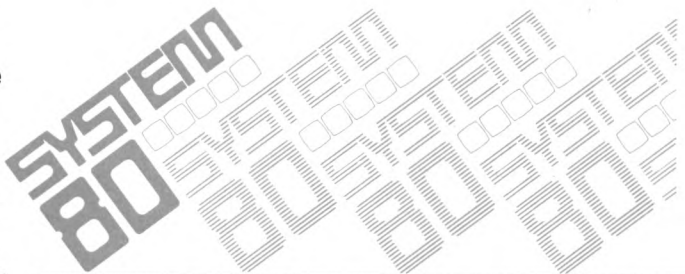
It can accept up to five boards, including the CPU board, plugging into an integral frame and NASBUS motherboard. It can be supplied with either 3A or 5A PSU depending on your choice of boards. Provision is made for external connection direct to the boards concerned. The housing is designed to have a further expansion box, plus 5 more boards, stacked on top and plugged into the main motherboard.

Not only do we give you the opportunity to take our system apart so you can choose only the cards you want. We've gone still further. You can also choose your own firmware for the Nascom 2 CPU board.

It has 24-pin sockets – all with link option – to give you a choice between 2708, 2716, TMS 2716, 2508,

2516, 2532, 2758 and 2732 EPROMs. Using 2716 EPROMs alone gives you over 16K of firmware. Firmware in EPROM is available from Nascom now and soon we shall have ROM packages as well.

System 80 – Total Option Concept



For further details and stockists please contact:
Nascom Microcomputers Limited, 92 Broad Street,
Chesham, Bucks. Telephone: (02405) 75155

nm
Nascom Microcomputers

TAKE CONTROL



Advanced interfacing for micro-mainframe connection, control instrumentation and communications for the microcomputer user.

We have interfacing experience with

Mainframes

IBM, ICL, Univac, Honeywell, DEC, Harris, Etc.

Instrumentation

Strain Gauges, Gas Chromatographs, Chart Recorders, Auto Analysers, Digital Oscilloscopes, Thermocouples, Accelerometers, Etc.

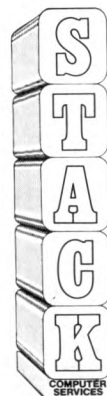
Peripherals

Punches, Readers, Discs, Tapes, Plotters, Bar Codes, Etc.

For further information please contact **Graham Knott** or **Jeff Orr** on **051-933 5511**

Stack Computer Services

290/298 Derby Road, Bootle, Liverpool 20.



Packaged Information Processing Systems

We offer a variety of turnkey systems based on APPLE II and MICRO STAR. It is our endeavour to give a complete service from problem determination through to the supply of computer based solutions. We will solve the problem either with a tailor made suit of programs, or a ready written package from another famous software house.

We can also supply three excellent DEVELOPMENT SYSTEMS, namely NASCOM, ACORN and NORTH STAR HORIZON



Phone for further details or...

Come along and see all of the above equipment, plus a wide range of peripherals, which are now on display in our new offices and showroom.

AT
15 Sandhill, Quayside, Newcastle Upon Tyne
Tel: 0632 614939

'ever heard of COMAL ?

(extended and structured BASIC with built in file system)

'EVER HEARD OF A MULTI-USER SYSTEM RUNNING TWO DIFFERENT HIGH-LEVEL LANGUAGES (COMAL & PASCAL) AT THE SAME TIME?

phone **digital data electronics** Ltd.

[01] 727 6668

for more information on the **spc/1** micro-computer system.

Starting at £1995 (single user ready-to-run system including the micro with one mini disc drive, VDU, 32 Kbyte RAM and COMAL software), expandable to an eight - user system with up to 80 Megabytes of hard disc storage and capable of running COMAL, Pascal and Assembler at the same time!

Please add 15% VAT to above price

TANDY

TRS-80 MICROCOMPUTERS

FOR BUSINESS,
LEARNING AND
ENTERTAINMENT

TRS-80 MODEL I TRS-80 MODEL I
4K LEVEL I 16K LEVEL II

£385.25 £546.25

TRS-80 4K Level I System. Place a cassette in the player . . . type CLOAD and press the ENTER key . . . watch the screen for the READY indication . . . type RUN, press ENTER . . . what then? Depending on the cassette you could run Maths, English, Chess, Draughts & Video game programs for educational fun! And if you want to write your own programmes, the Level 1 "plain language" manual (included) makes it easy to learn. 26-1001.

TRS-80 16K Level II System. Business people and professionals by the thousands have discovered the capabilities of Level II. And TRS-80 ready-to-use software means you (or your staff) can put it to work immediately, with a minimum of training. Calculator-type keypad now included—yet the price is at an all time low. 26-1006.



NOW AVAILABLE

TRS-80/
MODEL I C.P.U.'s

- * Complete and ready to run from your own TV monitor
- * Includes C.P.U., Power Supply, UHF Modulator/connector, Instruction Manual, Game Cassette and connection lead for cassette player.

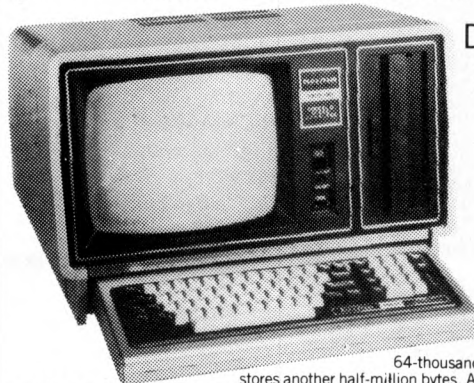
4K Level I C.P.U.
£289
Cat. No. 26-9051

16K Level II C.P.U.
With numeric
key pad
£439
Cat. No. 26-9056

CTR-80 Cassette Player — Specially adapted for use with TRS-80 Model I computer systems. 26-1205 **£41.95**

NEW

TRS-80 MODEL II MEANS BUSINESS



Designed to Meet the Needs of
Business and Administration
5 Figure Computing Power
at a 4 Figure Price

Orders being
taken for
Systems from **£1,999**
(PLUS V.A.T.)

DELIVERY 30-60 DAYS

Model II operates at twice the speed of our famous best selling Model I. In addition to its 32 or 64-thousand bytes of Random Access Memory, a built-in 8" floppy disc stores another half-million bytes. And modular design accepts additional disk drives for up to 2 million bytes of memory! Model II's 12" high-resolution video monitor displays 24 lines of 80 upper and lower case letters. The professional 76-key keyboard has special function keys and a calculator keypad. Model II systems include our enhanced Level III BASIC language, one of the most powerful computer languages today.

Visit your TANDY Computer Centre or any TANDY store for details on the TRS-80 Model II — the really low-cost microcomputer that's "strictly business"

All Prices inclusive of V.A.T.
except where stated.

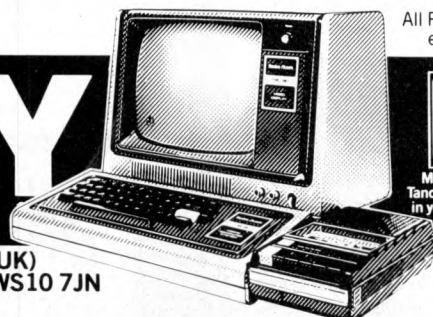
Access, Barclaycard and
Trustcard welcome. Check your
telephone directory for your
nearest store.
Offers subject to availability.
**OVER 180 STORES &
DEALERSHIPS NATIONWIDE.**

TANDY

The Biggest Name in Little Computers

For Further Information
on TRS-80 Systems
contact

TRS-80 DIV. TANDY CORPORATION (Branch UK)
BILSTON ROAD, WEDNESBURY, WEST MIDLANDS WS10 7JN
Telephone 021-556 6101



TANDY
DEALER

Most items also available at
Tandy Dealers. Look for this sign
in your area. Prices may vary at
individual stores.



MICROCOM

For Hardware, Software, Peripheral

PET 2001



from **£475**

commodore
authorised dealers

PET 3016 (16K RAM and large keyboard)*
£675.00
PET 3032 (32K RAM and large keyboard)*
£795.00

BASIC SYSTEMS

PET 2001-8 (PET with 8K memory + integral cassette) £475.00
PET 3008 (8K) with large keyboard £475.00
PET C2N External Cassette Deck £53.00

ACCESSORIES

IEEE/RS232 Serial Interface 'A' Output only £106.00
IEEE/RS232 Serial Interface 'B' Input/Output £186.00
Programmers Toolkit - 10 powerful new commands for your Pet - plug in ROM chip 8K and 16/32K resp £75/£55

IEEE-448/Centronics type parallel Interface £45.00
IEEE to Pet Cable £19.00
IEEE to IEEE cable £24.00
PETSET 1 16 Channel AD Converter c.w. all interfacing requirements £166.00

TRS 80



from **£365**

From Radio Shack Corp.

TRS 80, 4K Level I consisting of Keyboard with 4K memory, Video Unit, Cassette Drive and 240v power supply unit £365.00
TRS 80, 4K Level II (as above with Level II Basic) £425.00

BASIC SYSTEMS

TRS 80, 16K Level II (as above with 16K memory) £499.00
TRS 80, Expansion Interface with 16K RAM £275.00
TRS 80, Expansion Interface with 32K RAM £360.00

ACCESSORIES

TVJ 232C serial Interface £35.00
Centronics Parallel Printer Interface (direct to keyboard) £40.00
TRS 80, Voice Synthesizer £345.00
TRS Voxbox - speech recognition system £135.00
TRS 80, Numeric Key Pad supplied and fitted £49.00

Radio Shack Phone Modem £160.00
UHF Modulators (encased with leads for 625 lines) £20.00
RAM upgrade (4-16K, 16-32K, 32-48K) supplied and fitted at our premises (Kit £80.00) £85.00
S100 interface for TRS 80 (6 slots) £375.00
TRS80 CPU 3 speed mod. £26.00

APPLE II

from **£750**



apple & ITT 2020
authorised dealers

Apple II Plus computer - APPLESOFT extended basic in ROM - (16K RAM) - video output £695

BASIC SYSTEM

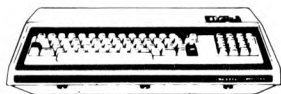
ACCESSORIES

Apple black and white modulator for domestic TV £20.00
Eurocolor card - provides colour on domestic TV £79.00
Parallel Printer Interface Card £110.00
High Speed Serial (RS232C) Interface Card £113.00
Communications Card £130.00
Centronics Card £130.00
Integer Basic Firmware Card £116.00
PASCAL language system - includes language card to provide user with PASCAL, PALSOFT & INTEGER BASIC £299.00

Real time clock/calendar card - 1/1000 sec to 388 days with interrupt, software controllable £128.00
Speechlab - provides voice control for the Apple £127.00
Supertalker - adds human speech output! £205.00
ALF Music Synthesizer Card £180.00
A1-02 Data Acquisition Card £180.00
Graphics Tablet £462.00
AC Line Controller £270.00
RAM Upgrade (16-32K, 32-48K) £69.00
Hobby Prototype Card £20.00
Romplus - u, l/c, mixed text/graphics £105.00

SORCEROR

from **£740**



Exidy
authorised dealers

Sorcerer 16K RAM (inc. UHF Modulator) £740.00

BASIC SYSTEMS

Sorcerer 32K RAM (inc. UHF Modulator) £840.00

ACCESSORIES

Exidy Video Monitor (High Resolution) £240.00
Exidy Video Disk Unit £1,800.00

Exidy S100 Bus with Interface + motherboard PSU £200.00
CP/M for Sorcerer on Disk £145.00

COMPUCOLOR

from **only £999**



for computer with colour monitor, keyboard and integral disk drive. Second disk drive £316.00

ADVANCED SYSTEMS
Altair, Equinox, Billings, Heath, Rair, Horizon. Installations include hard disk and multi tasking. Prices on Application.

CORVUS 11mb Hard Disk for TRS 80 & Apple. Complete with interface & D.O.S. £3500.00

TANDY Model II now available for demonstration at our Camberley Office. (by appointment only) P.O.A.

SPECIAL OFFERS

(limited period)

PET BUSINESS SYSTEM. For only £1999.00
Comprising CBM 3032 Microcomputer, CBM 3040 Dual Disk Drive, CBM 3022 Tractor Feed Printer and all cables - Total cost if items purchased separately £2158.00
(Comprehensive business software available including: Sales, Purchase, Nominal Accounts; Stock Control; Word Processing etc.)
ITT 2020 - 48K RAM Colour Output to UK Colour TV only £595.00

PUTERS ETC

Consultancy and Competitive Prices.

Registered business name



DISKS

PET	
CBM 3040 (dual drive) 343K User storage*	£795.00
Computhink (dual drive) 400K storage	£895.00
Computhink (dual drive) 800K storage	£1145.00
TRS80	
Shugart drive	£315.00
Micropolis drive	£315.00
Percom FD200 drive 110v	£299.00
Micropolis Dual Drive (394K storage)	£995.00
Corvus Hard Disk (11mB)	£3500.00
APPLE	
Apple Drive - 116K storage 1st drive	£349.00
Apple Drive - 116K storage 2nd drive	£299.00
Corvus Hard Disk (11mB)	£3500.00
SORCEROR	
Exidy - 143K storage	£495.00
Exidy Dual drive (630K storage)	£1195.00
Corvus Hard Disk (11mB)	£3500.00

PRINTERS

PET	
CBM 3022 (80 col with PET graphics - tractor feed)*	£525.00
TRS80	
TRS 80 Screen Printer (text + graphics) (110v)	£445.00
New Radio Shack Micro Printer	£245.00
GENERAL	
Teletype 43 KSR Serial (pin or pinch feed, 132 cols)	£825.00
Teletype 33 KSR Serial (110 Baud) Reconditioned	£450.00
OKI - parallel/serial (pin or pinch feed, 40, 80, 132 cols selectable)	£499.00
Centronics 779 parallel (tractor feed, 132 cols)	£825.00
Anadex DP 8000 serial/parallel (112 cps bi-directional tractor feed, 40, 80 cols selectable)	£560.00
Centronics Micro Printer (20, 40, 80 cols selectable)	£395.00
Heath WH 14 serial (80, 96, 132 cols selectable)	£475.00
QUME daisy wheel printers	P.O.A.
TCM100/MICROHUSH Thermal Printer (40 cols) inc. interface for PET/APPLE/TRS80	£266.00

ETC.

Diskettes 5 1/4" (blank) boxed (min order 10) each	from £3
C12 Cassettes (min order 10) each	£0.35p
Ansaback 'phonemate' telephone answering machine, voice operated twin cassette	£190.00
Pace EZ-PHONE - Cordless Telephone	£225.00
Computalker Speech Synthesis for S100	£350.00
BOOKS - Large range of microcomputer related books and magazines	
TERMINALS	
Pentland V1, 80 char./24 lines 2 page memory	£580.00
PROGRAMMABLE CALCULATORS. TEXAS INSTRUMENTS. Business Programmable Calculators - complete range. Send for list + prices. (We are authorised TI dealers).	

IF YOU DON'T SEE IT - ASK IF WE HAVE IT

SOFTWARE

PET	
PETSOFT authorised dealers - over 160 programmes on cassette and disk. Send for catalogue.	
STAGE ONE COMPUTERS S/W dealers - PETAID, Stock Control, etc. Send for list.	
74 Common BASIC Programs on one tape	£15.00
PETACT Business Software - Sales and Purchase Ledger	P.O.A.
CBM DISK-BASED BUSINESS SOFTWARE -	
Commodore Word Processor powerful word processor package	£75.00
CSTOCK - STOCK CONTROL - gives complete stock report	£150.00
CBIS - BUSINESS INFORMATION SYSTEM - Storage & Retrieval of all types of company records	£150.00
COM ACCOUNTS - Full Financial Business Accounting System incl: Sales, Purchase, Nominal Ledgers (integrates with C Stock and C INV)	£610.00
PAYROLL - Handles hourly, weekly or monthly paid employees (Tape) (We are authorised CBM Business Software Dealers) Send for List.	£50.00
GD 1001 - Assembler Development System	£75.00
GD 010 - Lisp. Interpretive Language (Artificial intelligence)	£25.00
JOYSTICK PACKAGE - complete with connector software	£25.00
CAR INSURANCE QUOTATIONS - computerised car insurance quotation suitable for insurance brokers (TVJ S/W)	£25.00
MORTGAGE QUOTATIONS - suitable for agents/mortgage brokers (TVJ S/W)	£25.00
TRS 80	
COMAC III SUITE - computerised accounting for TRS 80 (TVJ SOFTWARE)	£75.00
STOCK CONTROL - complete inventory control - recorder level - P/O's etc.	£115.00
CP/M	£95.00
CBASIC	£75.00
FORTTRAN includes compiler, relocatable assembler text editor and linking loader	£95.00
PASCAL - tomorrow's programming language today	£195.00
ELECTRIC PENCIL - powerful word processor allows full cursor movement, insert/delete, string search block movement, adjustable line length, justification on cassette	£65.00
ELECTRIC PENCIL as above - disk version	£115.00
LOWER CASE MOD KIT for Electric Pencil	£28.00
DATA MANAGEMENT/REPORT GENERATOR - easily formats disk files, allows entry, edit, delete and list of records and retrieves data for display or calculation on screen or printer	£200.00
RSM-2D DISK MONITOR - powerful system manipulates disk data, has Z-80 break routine	£25.00
ISAM - INDEX SEQUENTIAL ACCESS METHOD - sub routines to facilitate control of random data files	£45.00
ST80D communications software	£60.00
NEWDOS - TRSDOS with corrections and enhancements	£25.00
NEWDOS+ - as above but with further facilities:-	£45.00
KBFIX, Renum, Screen to printer in one step, DOS commands from BASIC, Level I in II, Superzap, Disassemble, load and save faster, list variables	£49.00
LIBRARY 100 - an assortment of 100 programs	£39.00
SARGON CHESS - 16K Level II - the 1979 Champ Version I	£14.00
SARGON CHESS - 16K Level II - the 1979 Champ Version II	£24.00
APPLE	
A2FP FUNCTION PLOTTER - Comprehensive graph plotting	£18.00
U-DRAW II - High Resolution graphics editor. Create a figure then intake, expand, contract etc and store on disk	£27.00
LISP - programming language suitable for research in artificial intelligence	£30.00
3-MILE ISLAND - Complex disk based game simulating nuclear reactor	£27.50
VISICALC - Instant Visual Calculation - provides a powerful planning and forecasting tool	£95.00
APPLE WORD PROCESSOR - Complete text editing, storage and retrieval of text (disk based)	£42.00
LITTLE GENIUS - Comprehensive disk based Apple Soft Tutorial	£35.00
MUSE authorised dealers. Many programs on cassette and disk. Send for list.	
SORCEROR many programs available - send for list.	

* 5% DISCOUNT ALLOWED FOR EDUCATIONAL ESTABLISHMENTS



T&V JOHNSON (MICROCOMPUTERS ETC) LTD

Member of the TV Johnson Group of Companies

Camberley (Head Office)
165 London Road, Camberley
Surrey, GU15 3JS.
Telephone (0276) 62506

Oxford
148 Cowley Road, Oxford
OX4 1JJ.
Telephone (0865) 721461

Bristol
48 Gloucester Road, Bristol
BS7 8BH
Telephone (0272) 422061

Hours of business
Mon-Fri. 9.30 - 5.30
Sat. 9.30 - 1.00

+ Ansaback eves
and w/ends.
Telex 858893

PRICES EXCLUDE VAT, FREIGHT & HANDLING SEND OR PHONE FOR PRICE LIST & BROCHURES (All prices correct at time of compilation)

Directors: Dr. R.V. King BA, MIEE
S.G. Johnson, BSc. (Hons.)
T.S. Johnson, ABIBA, ACMB, FBSC, MBIM
A.S. Barton ACII, ABIBA, CdirAF.

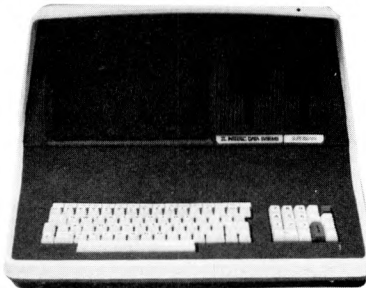
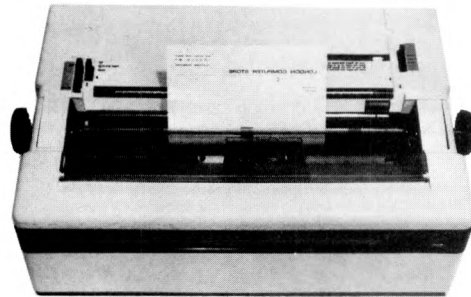
Branches at:
Birmingham, Bristol, Edinburgh, Leeds, London, Louth,
Newmarket, Nottingham, Oxford, Byfleet, Wokingham.

... FASTEST DAISY IN TOWN ...
NEW RICOH RP-1600 PRINTS AT 60 CHARACTERS PER SECOND!!!!
FAST ENOUGH FOR YOUR LISTINGS AND WORD
PROCESSING NEEDS. £1250

Richo high-speed daisy wheel, heavy duty commercial printer gives a high-quality printout, coupled with low noise level necessary for office environment. Nationwide service by UDS. Service under 90 day warranty is provided at your premises.

124 char: upper/lower case. — 60 chars:/sec print speed — 10/12 chars: per inch giving 136 or 163 columns. — 15 inch wide friction platen. — forward/reverse paper feed for graphics. — Top of the form and host of other features. — Centronics type parallel interface as standard.

Options: serial interface £60 — PET interface £50 — APPLE interface £65 — TRS-80 interface £45.



TRS-80 MODEL I

NEW VERSION 16K LEVEL II WITH IMPROVED KEYBOARD, REDESIGNED VDU, STEADY SCREEN, & EASY LOADING CASSETTE RECORDER . . . £475
 NEW REDESIGNED EXPANSION INTERFACE FOR TROUBLE FREE DISC OPERATION. £199
 * TEAC 40 TRACK DUAL DISC DRIVES (204K)

. £440

* FREE ANTIGLARE SCREEN — WORTH £15 WITH EVERY 16K LEVEL II

SUPERBRAIN £1875

COMPLETE COMPUTER
 TWIN Z 80-A 4MHZ. — 2 DOUBLE DENSITY DISC DRIVES. — 64K RAM. — HIGH RESOLUTION 12 INCH CRT. 80 x 24 LINES. — UPPER/LOWER CASE. — 2 RS232 PRINTER PORTS. — CPM OPERATING SYSTEM. — WORD PROCESSING & ACCOUNTS PACKAGES AVAILABLE.

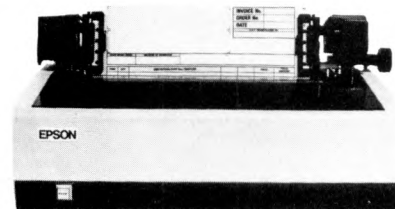


EPSON TX-80 £395

DOT-MATRIX PRINTER WITH PET GRAPHICS. PRINTS 80 COLUMNS ON PLAIN PAPER AT 90 CHARACTERS/SECOND. ADJUSTABLE TRACTOR. — UPPER/LOWER CASE. — DOUBLE WIDTH PRINTING. — MICRO CONTROLLED. — SELF TEST. — HEAVY DUTY PRINT HEAD USING JEWELL BEARINGS FOR LONG LIFE. — CENTRONICS PARALLEL INTERFACE. — MADE BY SHINSHU SEIKI AN AFFILIATE OF SEIKO WATCH CO OF JAPAN. OPTIONS: PER INTERFACE WITH CABLE £50. APPLE INTERFACE WITH CABLE £60.

TRS-80 MODEL II £1999

STATE OF THE ART SECOND GENERATION COMPUTER. 32K, DOUBLE DENSITY DISC DRIVE (600K) over 10,000 already sold in USA. 8 slot motherboard ensures future expansion for hard discs and other peripherals. 76 key professional keyboard, SELF TEST on power up. TR-DOS & LEVEL III BASIC STANDARD. CP/M AVAILABLE as option, making a wide range of accounting, educational, scientific and word processing packages instantly useable. NATIONWIDE SERVICE THROUGH OVER 180 TANDY STORES & COMPUTER CENTRES.



LOW COST WORD PROCESSOR I

BASED ON TRS-80 LEVEL 2 16K, CASSETTE RECORDER, ELECTRIC PENCIL SOFTWARE, UPPER/LOWER CASE MOD, PRINTER INTERFACE AND RICOH DAISY WHEEL PRINTER. COMPLETE READY TO GO £1850. FREE MAILING LIST PROGRAM.

WORD PROCESSOR II

BASED ON "SUPERBRAIN" COMPUTER SHOWN ABOVE. WITH RICOH PRINTER & "MAGIC WAND" THE ULTIMATE IN WORD PROCESSING. LETTERS AUTOMATICALLY FORMATTED WITH ADDRESSES FETCHED FROM SEPARATE FILE. COMPLETE SYSTEM £3400.

INVOICING, STOCKCONTROL, SALES LEDGER, PURCHASE LEDGER, PAYROLL AVAILABLE FOR ABOVE COMPUTERS. FROM £250 PER PACKAGE.

Prices quoted above do not include VAT. Phone or call for further details or demonstrations.

LONDON COMPUTER STORE
43 GRAFTON WAY, OFF TOTTENHAM COURT ROAD, LONDON W.1.
TEL: 01-388 5721 OPENING HRS: 11-7 MON-FRI, 12-4 SATS.

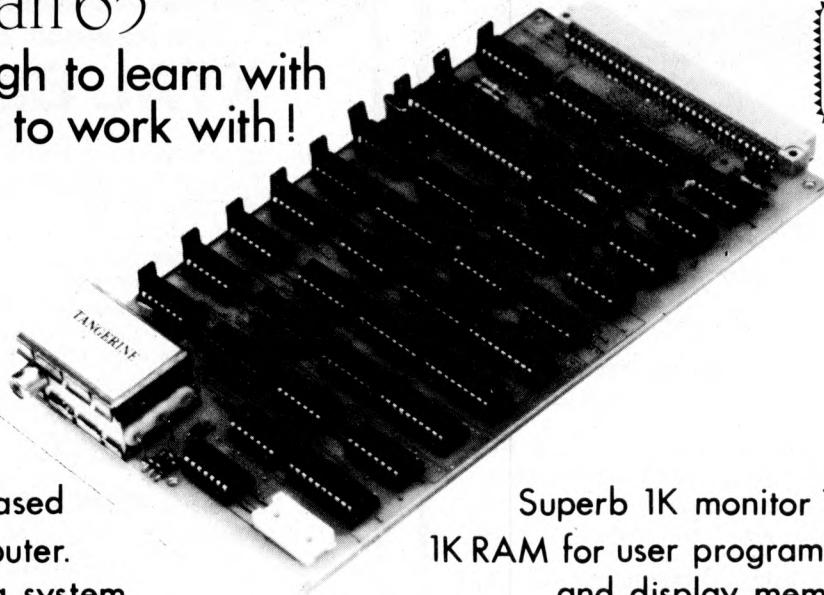
TANGERINE

COMPUTER SYSTEMS LIMITED

microtan 65

Small enough to learn with
Big enough to work with!

£69
plus VAT



A 6502 based
microcomputer.

Expands into a system.

VDU alphanumeric display on un-modified domestic TV of 16 by 32 characters.

Optional lower case pack making a total of 128 displayable characters.

Optional chunky graphics pack (64x64 pixels) • Excellent documentation.

Superb 1K monitor TANBUG

1K RAM for user programme, stack
and display memory.

MICROTAN 65 outperforms all other small microcomputers in terms of value for money and performance. It is much easier to use as a result of the video display, intelligent keyboard socket, and very powerful monitor. The system grows to become a very useful, complete microcomputer in sensibly priced and very well designed modules. Each module is superbly packaged and with comprehensive hardware and software documentation. The Microtan users manual is A4 size, 136 pages thick, and comes beautifully bound.

TANBUG is probably the most powerful 1K monitor available. Apart from bringing the hardware alive it really does serve the purpose of programme debugging. TANBUG offers memory and register examine, modify and list, block moves, single instruction, multiple non-destructive breakpoints with ability for multiple passes, address offset calculation and many other useful features. MICROTAN 65- More power for your money!

The TANEX expansion board opens the door to a full system as well as including an abundance of features. In its minimum configuration TANEX is supplied with 1K RAM, 16 parallel I/O lines, TTL serial I/O port, cassette interface, 2x16 bit counter timers, memory mapping, data bus buffering, and is fully socketed. When fully expanded TANEX offers all of the above plus a further 6K RAM, 6K ROM, 8K MICROSOFT BASIC, a further 16 parallel I/O lines, 2 counter timers and TTL serial I/O port, and a third serial I/O port with RS232/20mA, full modem control and 16 different baud rates. Check the price list below to see how cheap it is to fully expand the system.

20 Way keypad- plugs into the intelligent keyboard socket and gets you going without the expense of a full ASCII keyboard. Keyboard socket will accept any ASCII keyboard.

Mini-mother board, comes complete with connectors and reset switch.

ORDER FORM:

Qty. Microtan 65 Kit	£79.35
Qty. Microtan 65 Assembled	£90.85
Qty. Tanex (min.con) Kit	£49.45
Qty. Tanex Assembled	£60.95
Qty. Lower case pack	£10.90
Qty. Chunky Graphics pack	£ 7.50
Qty. 20 Way Keypad	£ 8.95
Qty. Mini-mother board	£ 9.95

ALL PRICES INCLUDE VAT. Add £ 1.50 P&P Please.

EXPANSION COMPONENTS:

Qty. Serial I/O Kit	£14.80	6552	£ 9.20
Qty. 2716(5V type)	£28.75	2114	£ 4.80

NAME: _____

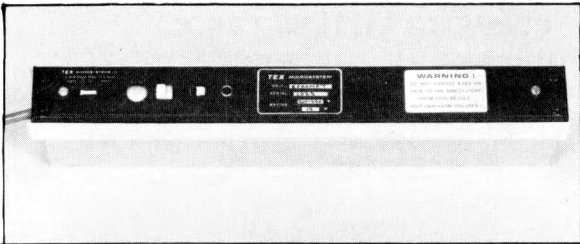
ADDRESS: _____

BROCHURE AVAILABLE ON REQUEST PLEASE SEND 10p.
TANGERINE COMPUTER SYSTEMS LTD.
FOREHILL, ELY, CAMBS. Tel: (0353) 3633.

TANGERINE

COMPUTER SYSTEMS LIMITED

'EPROMPT' ERASER



- * SCRUBS UP TO 32 CHIPS IN 15 MINS ON 200-250v A.C. *
- * CONTINUOUS 253.7nm BEAM. SAFE & SIMPLE. GUARANTEED *
- * **£39** C.W.O. **£40** NETT 30 DAYS: ALL INCLUSIVE! *

+ NEW PRODUCTS +

TEX 90 8K 16-BIT MICROCOMPUTER **£99**

TMS9980. 'TEXBUG' MONITOR. RAM. TIMER. V24 I/O. MANUALS

TEX100 IEEE S100 BUS & POWER UNITS: PAIR **£95**

RUNS Z80A+64K DRAM+V24 I/O+DISC I/O+2 MINIFLOPPIES:

'EXPANDOBUS' 4-SLOT EXPANDABLE MOTHER/EXTENDER **£39**

COMPACT POWER: +9v8a. +16v6a. -16v1a. FROM 240v A.C. **£59**

TELE-TEX SMART V24 T.V. TYPEWRITER FROM **£99**

16x64. 256 CHAR. PROGRAMMABLE SOUND & DEVICE CONTROLS

TRADE ENQUIRIES INVITED FOR SUBSTANTIAL DISCOUNTS.

WE ALSO NEED PARTNERS FOR PRODUCTION INVESTMENT.

ALL ORDERS AND ENQUIRIES POST-FREE TO:

TEX MICROSYSTEMS LTD.

FREEPOST. ST. ALBANS. HERTS. AL1 1BR

OR PHONE ST. ALBANS 64077 OUTSIDE WORKING HOURS



**CRYSTAL ELECTRONICS
CC ELECTRONICS**

The newest Z80 Basic! **XTAL Basic 2-2**

HAS to be the best yet for your Nascom 1or 2
All the usual features of other 8K floating-point BASICs
**Plus: Extra commands/functions—INCH, KBD, CMD\$
ON ERR GOTO, ERR, PI, CLOAD? (tape verify)**

**And Add up to 64 reserved words of your
choosing—Now put your own disc, tape, control,
graphics commands, etc for the ULTIMATE in BASIC
flexibility! Fully upward compatible with version 2.1
(see earlier Ads). Can be easily adapted to most Z80
systems. Works with T2, B-BUG, T4 and NAS-SYS
monitors. Existing version 2.1 users—Return your
original tape (less manual) with 50p P & P and we will
update it FREE of charge!**

Price: still only £35 + VAT!

WE ARE NOW A SHARP AGENT

We stock the MZ-80K fully supported.

Prices from £520.00 plus VAT.

Coming shortly—**CRYSTAL BASIC (SHARP)**
—releases another 6k of memory + extra
commands.

Members of Computer Retailers Association & Apple Dealers Association

Shop open 0930-1730 except Wed. & Sun.

40 Magdalene Road, Torquay, Devon, England. Tel: 0803 22699

Access and Barclaycard welcome.



COMPUTERS
AND
COMPONENTS




Wego Computers Ltd

**WEGO MARK SENSE
CARD READER**

for PET; Apple; RS232C; S100 & TRS-80
from £620 (Apple) to £900 (S100)
+ V.A.T. Software available.

**WEGO SEQUENCE
SWITCH BOX**

 CBM approved.

to power up your microcomputer &
peripherals in the correct sequence,
with one switch. £59.55 + V.A.T.

C.C.S. CARDS

Apple interface cards and Petunia and
Video Buffer for the PET.
Details available on request.

Servicing & Software
capabilities. Consult us
for your requirements.

Available from your local dealer, or
direct from: Wego Computers Limited
22A, High Street
CATERHAM, Surrey CR3 5UA
Tel: (0883) 49235 Telex: 8813791

**SOLE U.K. DISTRIBUTORS FOR CALIFORNIA COMPUTER SYSTEMS
AUTHORISED COMMODORE & APPLE DEALERS.**

interface components



NASCOM IMP
PLAIN PAPER PRINTER
FOR ONLY
£325
PLUS VAT
AVAILABLE EX-STOCK
IDEAL FOR WORD
PROCESSING

NASCOM IMP AVAILABLE EX-STOCK

The incredibly low-price Nascom IMP is now available off the shelf at Interface Components. It plugs into any microcomputer system with a serial RS 232 interface, including the popular Nascom 1 & 2.

Although an impact matrix printer, its versatile feed mechanism allows it to accept A4, foolscap and quarto letterheads making it suitable for word processing applications. And it's quiet too. Line printers and many typewriters are deafening by comparison.

Finished in a smart blue plastic enclosure, the IMP is only £325 plus VAT (post and packing extra) completely assembled.

FEATURES

- 80 characters wide
- 60 lines per minute
- Bi-directional printing
- 10-line print buffer
- 96 character ASCII set (includes \$, #, £)
- Automatic CR/LF
- 8½" paper (pressure feed)
- 9½" paper (tractor feed)
- Baud rate 110 to 9600
- External signal for optional synchronisation of baud rate

ORDER FORM

Send your orders to:
Interface Components Ltd, Oakfield Corner,
Sycamore Road, Amersham, Bucks HP6 6SU.
Telephone: 02403 22307 Telex: 837788.

Please send me.....Nascom Imps at £325 each
plus VAT at 15% plus £2.50 p&p.

Name _____

Address _____

Access or
Barclaycard No. _____

Personal callers welcome

PCW/4/80

PCW 17

SUPPORT MEMBERS OF THE COMPUTER
RETAILERS ASSOCIATION...



THEY WILL SUPPORT YOU.

For further details on the associations aims,
membership, code of conduct etc.

Please contact: Mrs H. Gibbons, C.R.A., Owles
Hall, Buntingford, Hertfordshire. (0763) 71209.

LITTLE GENIUS

If you find self-instruction manuals difficult to
follow then meet our Little Genius.

Little Genius floppy diskettes
are the fastest, easiest way to
master your micro.

Little Genius will save you
time and effort, teaching you
to exploit all your micro's facilities.

Courses now available:

Applesoft basic
Pet basic
Palsoft basic
Advanced Applesoft
Advanced Petsoft
Advanced Palsoft
Using your Apple
Using your 2020

For further information ask your
local dealer or contact Peter
Brown at Suite 504, Albany House,
324 Regent Street, London W1R
5AA. Telephone 01-580 6361.



The Rohan Computing Collection.....

Qume

CIPER

digital

OKI

Sprint 5/45 Daisywheel printer/terminal. Ideal for word processing and general use. RS 232 standard, successfully installed on PET's, Apples, Tandy TRS 80, Sorcerer etc...

Wordstar The best word processor for cpm systems. Special version with addressing facility.

Wordcraft Converts a 32k PET & discs into a superb word-processor.

VDU's The most legible VDU's on the market, superbly made and British. All black or seafoam finish. Detachable 62 or 102 key keyboards. Lear Seigler and VT52 emulation.

2684 Microcomputer as VDU's but 2nd Z80, integral disc and CPM, graphics facility.

LA 34 The best desk top, full width, 30cps terminal, 10, 12, 16 characters per inch, optional tractor.

LS 120 180 cps terminal.

11/03 & 11/23 computer systems available with CAP MicroCOBOL, accounts, Autoclerk.

Microline 80 The smallest and quietest desk top printer available (61db) 5, 10 or 16 characters per inch, 40, 30, 132 wide. Standard machine will take 9.5 inch sprocket feed paper, roll and single sheet. With centronics interface, PET IEEE or user port interface, Tandy TRS 80 directly to keyboard unit without expansion box.

TNW 2000 The only bi-directional PET to RS 232 interface we know that runs Qumes etc. at full speed i.e. 1200 baud £165.00. Also available Teletype 43, North Star, Rair Black Box.

TRADE & EDUCATIONAL ENQUIRIES WELCOME,

Rohan Computing 52 Coventry St., Southam, Warwickshire CV33 0EP. Tel: Southam (092681) 4045

Research Resources Ltd

Micro-computers for Education, Science and Technology.

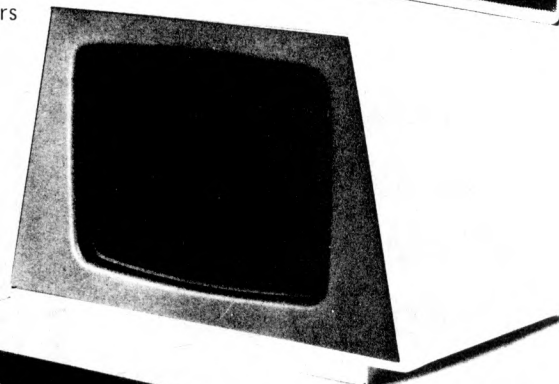
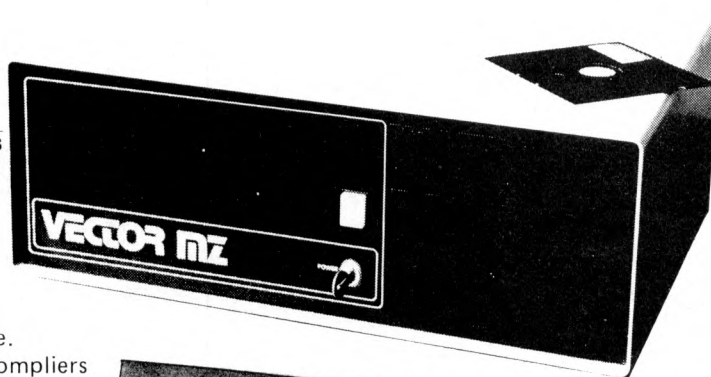
SWTP and GIMIX 6809/6800 Computers

- * GIMIX — 56K RAM with integral 340K disc drives
- * SWTP CS/09 — up to 384K RAM, MULTI-USER
- * Upgrade your existing 6800 with 16/8 bit 6809 CPU board
- * Install your MF-68 and RAM in a new GIMIX chassis
- * New DMAF-2 8" Dual Floppy disks — 2.5 Megabyte
- * 64 Megabyte Hard Disks
- * Memory available in 4,8,16,32,128k Boards
- * New Graphics VDU — CT82B — Improved 50Hz UK Standard
- * New TSC BASIC — very fast + Multi-user/Multi-tasking
- * Plus LAB-BASIC, SAM, PASCAL, PILOT, FLEX. etc.
- * A-D, D-A converters



SINTROM PERIFLEX and VECTOR Z-80 Computers

- * Z80A CPU, S100 Bus, CP/M
- * 48k or 64k enhanced version
- * 5 1/4" QUAD density Micropolis disk drives
- * 8" Twin discs, built-in or separate units
- * MDOS or CP/M operating system
- * Hardware floating point board and software.
- * Fast Fourier transform and digital filtering package.
- * Plus LAB-BASIC, PASCAL, FORTRAN, BASIC Compilers and SAM (Statistical Analysis for Micros)



PET — New Models, Disc drives, Printers

- * Up to 32k of user RAM
- * 360k intelligent disk drives (CBM)
- * 40 Column printer — only £245
- * 80 Column Graphics printer
- * Exclusive to RRL: LAB-BASIC for Control, special interfaces for laboratory/teaching work and statistics packages.



THE MATRIX IS HERE * 16 Bit Machine with integral disk drives.

RRL specialises in designing micro-computer systems for educational and scientific use. We will supply the complete system — processor, VDU, printer, special interfaces, software etc. — to solve your problem. For further information:

Tel: Welwyn Garden (07073) 26633

RESEARCH RESOURCES LTD, 40 Stonehills,
Welwyn Garden City, HERTS. AL8 6PD.

To: RRL, 40 Stonehills, Welwyn Garden City, Herts
Please supply full information on your services.
We are particularly interested in
Name
Address
Tel

DISCOUNT PETS

NEW 8K PET £445 with large keyboard, 16K £540, 32K £640, Dual Floppy £640, Programmer's Toolkit £45, Cassette £50. BASE 2 PRINTER £475 compatible with PET 3 Interfaces: IEEE, RS232, Centronics parallel, 3 Character fonts —one downloadable, programmable horizontal & vertical densities, stepping motor, tractor feed, contiguous plotting. TEXAS TI 99/4 £800 with 13" colour monitor. The most advanced home computer. AIM 65K SYSTEM £400, cased, powered and with optional assembler and BASIC. Also memories & motherboards for AIM 65/KIM by Seawell. Disk system (2 x 5" drives) with DOS £800. S-100 SYSTEM £1000 based on North Star with single disk drive, Z-80, 2 ports, 32K memory, completely assembled and tested. Runs all North Star software. Dual Disk version £1200. NORTH STAR HORIZON II £1400 SOROC IQ 120 VDU £550 S-100 BOARDS assembled and tested only. 16K fully static 2MHz memory with bank select, optional wait states, write protect etc. £150. 4MHz £200. Jade 4MHz A-80 CPU £140. SD PROM-100 EPROM programmer £140. 2 serial & 1 parallel I/O card £120. SOFTWARE COMPLETE ACCOUNTS PACKAGE FOR NORTH STAR £520 e.g. BOUGHT & SALES LEDGERS, VAT, AUDIT TRAIL, PAYROLL for NORTH STAR on two disks £56. (also for PET, Listing only £50. SUPER BLAKE 7 game for PET on disk £23, for Challenger 8" disk £15, PET cassette £20, listing only £10, self-learning noughts and crosses (NS, PET, OSI) £13 disks, £11 cassette. Send for list or call:

INTELLIGENT ARTEFACTS LTD
CAMBRIDGE ROAD, ORWELL,
ROYSTON, HERTS.
Telephone: Arrington 689

Erase Eproms in 8 minutes for under £100

£97 delivered in U.K.
+ V.A.T.



The high speed, high capacity model UV8 sets new performance and price standards.

- Cuts typical erasure times by a factor of 5
- 8 MINUTE SOLID STATE TIMER
- Capacity up to 14 EPROMS
- 2708 type erased in 4 to 7 minutes
- High intensity 254 NM UV source
- Safety interlock automatically starts timing sequence
- Audio tone signals erasure cycle complete
- Internal switch to extend erase time.

MICRODATA Computers Ltd, Belvedere Works, Bilton Way,
Pump Lane Industrial Estate, Hayes Middlesex.

Telephone (01) 848 9871 (6 lines) Telex 934110

You've heard about it
Read about it — HERE IT IS

AVAILABLE EX-STOCK
COMPLETE KIT AS PER
MANUFACTURER'S SPECIFICATION

With provision for 8K on board expansion. Excludes 4118 x8+

INCLUDES FREE 16K EXPANSION
VALIIE £140 includes ALL parts with every kit

NASCOM-2
ON DEMONSTRATION NOW

£295 + 15% WITH
VAT FREE
16K EXPANSION WORTH £140

AVAILABLE ONLY FROM US ON THE COUPON BELOW

OPTIONAL EXTRAS
3 AMP POWER
SUPPLY VAT 15%
£29.50 Post £1.50
For NASCOM-2

8 OFF 4118*
For NASCOM-2
Purchasers
£80 Early
Delivery

RS232 COMPATIBLE
80 COLUMN PRINTER brand new
List price £550 If sent by carrier £5 extra
OUR PRICE
£325 + VAT 15%

FULL MANUFACTURER'S WARRANTY — DON'T DELAY. ORDER TODAY

Please send me my NASCOM-2 KIT with the FREE 16K EXPANSION
for £295 + VAT.

I enclose remittance

to cover

Name & Address

Also in stock NASCOM-1 • ELF • TRS80 as previously advertised



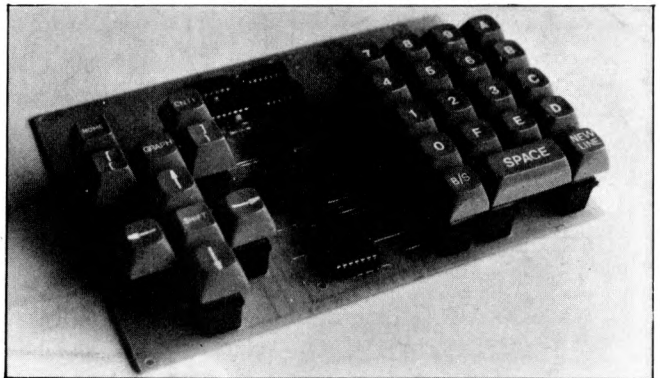
HENRY'S

Computer Kit Division
404 Edgware Road, London, W2, England
01-402 6822



We specialise in NASCOM

(FULL RANGE AVAILABLE)



CONTROL AND HEXADECIMAL KEYPAD SPECIALLY DESIGNED TO ENHANCE NASCOM 1 or 2
Gives Nascom 1 all the additional control keys and facilities of Nascom 2 when used with NAS-SYS complete kit £37.25. NAS-SYS £25.30
Also available as control pad only £23.10
Hex pad only £30.10
No modification is required to your Nascom to use our key pads

DUAL MONITOR BOARD
This kit allows switching between two monitors on

NAS-CHESS
On cassette £15.30
Runs on any monitor

NASCOM 1 GRAPHICS SYSTEM
SYSTEM £33.00

Please state if chess graphics required

NASCOM 2 GRAPHICS SYSTEM

This kit allows our Eproms to be used as the graphic generator in Nascom 2 £25.30 (with chess pieces in Eprom). All the

BITS & P.Cs COMPUTER PRODUCTS
18 RYE GARTH
WETHERBY
WEST YORKSHIRE
LS22 4UL.

TEL: 0937 63744
10 A.M. - 6 P.M.
S.A.E. FOR DETAILS

Nascom 1 £5.70

PORT PROBE
Monitors port input and output on L.E.D.s variable clock for real time interrupts £11.20

This picture shows our graphics system in operation, the game in play is our own

NAS-CHESS

A powerful chess game requiring a minimum of 8K expansion



All the above prices include postage. Please add V.A.T. @ 15%

Mail order only but demonstrations by appointment

MEET THE FAMILY



... THERE MUST BE ONE HERE FOR YOU

The Exidy family is a sophisticated range of products designed to meet the ever increasing variety of computing needs, including home and business uses, educational and laboratory applications, industrial process control etc.

The Exidy range has been designed with built-in growth capacity to take the risk factor out of computer investment. The Sorcerer Computer now has a memory expansion capability from 8K up to 48K within its own cabinet, enabling the system to grow with your needs plus the ability to add many additional plug-in facilities such as disk drives and pre-programmed ROM PAC's.

The standard configuration includes a 63 key typewriter-style keyboard and a 16 key numeric pad. Remote control for dual cassettes. Serial RS232 and parallel interfaces, Z80 processor, 4K resident operating system, 8K Microsoft BASIC in separate plug-in ROM PAC cartridge, 64 character x 30 line display, 128 upper/lower case ASCII character set and 128 user defined graphic symbols, operators manual, introduction to basic programming, connecting leads. All Exidy equipment is backed up by a 12 month warranty covering both parts and labour.

The Word Processing ROM PAC features auto wraparound, dynamic cursor control, variable line length, global search and replace, holding buffer for re-arrangement of text, right justification, line width and line to line spacing, underlining or boldfacing, text merging and a macro-facility permitting tasks such as formletter typing, multiple column printing of automatic forms entry.

Now contact your nearest dealer:

The NORTH

T.W. COMPUTERS, 293 London Road, Hazelgrove, Stockport. 061 4568187
BASIC COMPUTING, Oakville, Oakworth Road, Keighley, W. Yorkshire. 0535 65094
E. S. MICROCOMPUTERS, 7 Berkeley Precinct, Eccleshall Road, Sheffield S11 8PN. 0742 668767
GLYSTHYDON LTD., Nook Farm, Rake Lane, Warton, Preston, Lancs. 0772 633138
MICRODIGITAL, 25 Brunswick Street, Liverpool L2 0BJ. 051 227 2535
MICROPUTE, 7 Westbourne Grove, Manchester M20 8JA. 061 445 8588
MAGNUM CONSULTANTS, 57 Fairburn Drive, Garforth, Leeds. 0532 867897

MIDLANDS

M & R SYSTEMS, 20 Norwich Road, Wisbech, Cambs. 0945 5900
MIDLAND MICROCOMPUTERS, 1 Cherry Wood Drive, Aspley, Nottingham. 0602 298 281
GRIFFIN & GEORGE Birmingham, Manchester, London, Eastkilbride 01-997 3344

LONDON and the SOUTH EAST

C.C.S. MICROSALES, 7 The Arcade, Letchworth, Herts. 046 26 73301
MICROBITS, 34b London Road, Blackwater, Camberley, Surrey. 0276 34044
SLOUGH MICROSHOP, 120 High Street, Slough, Berks. 0753 22855
HOME & BUSINESS COMPUTERS, 445 High Street, Manor Park, London E12. 01-472 5107
E. M. G., 30 Heathfield Road, Croydon, Surrey CR0 1E4. 01 688 0088
G. P. W. ELECTRONICS, 146a London Road, North End, Portsmouth. Hants. PO2 9DJ. 0705 693341
INFORMEX LTD., 8-12 Lee High Road, London SE13. 01-318 4213
N.I.C., 61 Broad Lane, Tottenham N15. 01-808 0377
TVJ MICROCOMPUTERS, 165 London Road, Camberley, Surrey CU15 3JS. 0276 62506

WALES and the WEST

ELECTROPRINT, 5 Kingsdown Parade, Bristol BS6 5UD 0272 292375
TRYFAN COMPUTERS, 3 Swifts Buildings, High Street, Bangor, Gwynedd LL57 1UW. 0248 52042
TVJ MICROCOMPUTERS, 48 Gloucester Road, Bristol 0272 422061

Or send coupon
for further information to:

SOLE DISTRIBUTORS

Geoff Wilkinson
LIVEPORT DATA PRODUCTS
The Ivory Works, St. Ives, Cornwall.
0736-798157

PLEASE SEND DETAILS OF THE EXIDY RANGE

NAME _____

ADDRESS _____

Apple or PET? West London's specialists are also in the West End.*

apple®

APPLE II EUROPLUS 16K	£695.00
DISC DRIVE WITH CONTROLLER	£349.00
DISC DRIVE WITHOUT CONTROLLER	£299.00
16K ADD ON MEMORY	£ 69.00
HITACHI 9" BLACK & WHITE MONITOR	£127.00
EUROCOLOUR CARD	£ 69.00
PASCAL LANGUAGE CARD	£296.00
ALF MUSIC SYNTHESISER CARD	£215.00
TCM 100 SILENT 40 COLUMN PRINTER	£243.00
PAPER TIGER PRINTER	£585.00
TCM INTERFACE FOR PET OR APPLE	£ 49.00

PET®

PET 8K WITH INTEGRAL CASSETTE	£475.00
NEW PET 8K WITH LARGE KEYBOARD	£495.00
PET 3016 16K COMPUTER	£675.00
PET 3032 32K COMPUTER	£795.00
PET 3040 DUAL DRIVE FLOPPY DISK	£795.00
PET 3022 TRACTOR PRINTER	£525.00
PET 2023 FRICTION PRINTER	£475.00
PET C2N TAPE DECK	£55.00
24K EXPANSION MEMORY	£320.00
COMPUTHINK 800K DISK DRIVE	£1145.00
TELETYPE 43 PRINTER	FROM £860.00
QUME SPRINT DAISYWHEEL	FROM £1800.00

FROM

adda

FROM

adda

Adda Computers, 17-19 The Broadway (between W. H. Smith and Burtons), Ealing, London W.5. Tel: 01-579 5845
 *New West End address: Abbott House, 1-2 Hanover Street, London W1R 9WB. Tel: 01-408 1611

Possibly the most cost effective Laboratory Computers in the world.



The Vector Graphic MZ

- *4MHZ Z80A CPU
- *48K ram
- *630K Bytes disk storage
- *Serial port and two parallel ports
- *Prom/ram Board with monitor
- *MDOS Operating system
- *Z80 Assembler
- *Basic Interpreter

Plus a large range of CP/M compatible software including Fortran, Cobol, Macro assemblers etc.

The Vector Graphic System B

- Complete Vector MZ system plus: *
- *Vector Mindless terminal*
- Flashwriter 2 video board (24 x 80) *
- *Software driver on prom*
- MZOS North Star compatible DOS *
- *CP/M configured by Almarc*

DATA SYSTEMS LTD

906 Woodborough Road, Nottingham. Telephone: (0602) 625035

WHAT DOES £425 (INCL. VAT) BUY IN 1980?

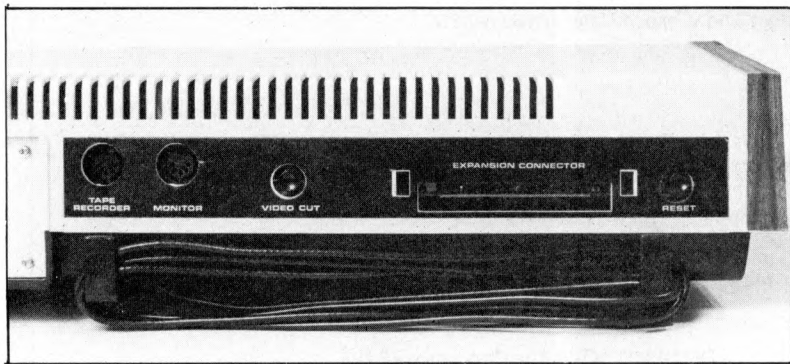


A bounce free typewriter keyboard. A stylish case containing a cassette, PSU, and UHF modulator.



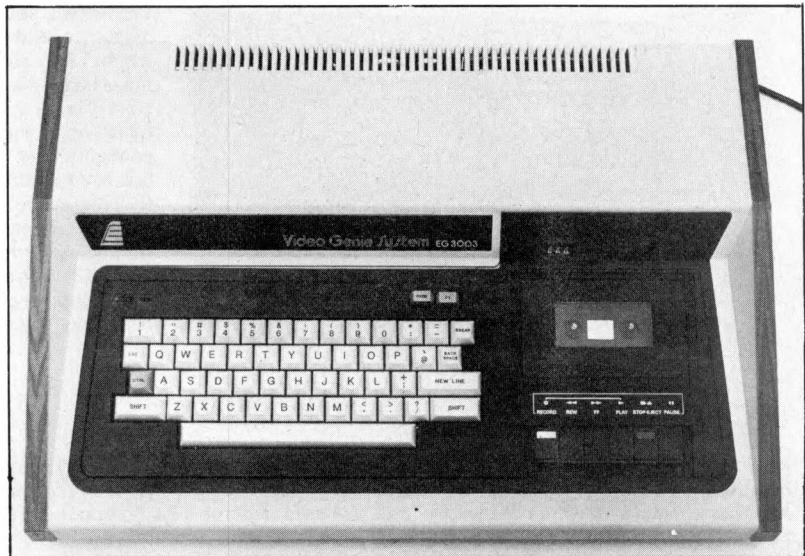
A high quality cassette, with tape counter 16k user RAM. A full 12k Microsoft compatible BASIC, and system monitor, which is able to run TRS-80 level II programs straight from cassette tapes.

With full expansion capability, also outputs for video, TV, and second cassette.



In short a:

video genie system



Contact:

LOWE ELECTRONICS

Low Electronics Limited, Bentley Bridge, Chesterfield Road, Matlock, Derbyshire.
DE4 5LE. Telephone 0629 2817 or 2430. Telex 377482 LOWLEC G

TRADE ENQUIRIES WELCOME



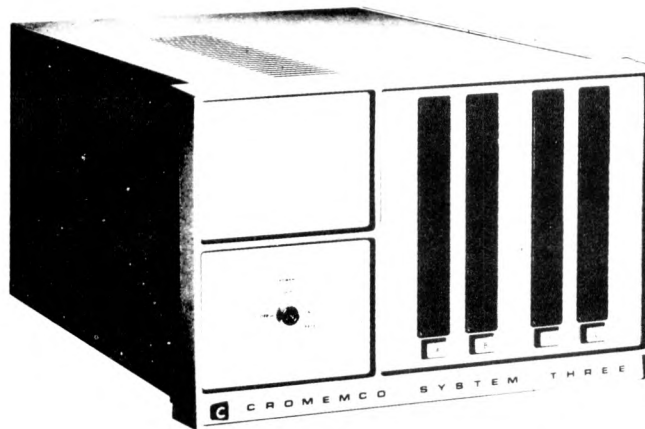
XITAN SYSTEMS

*LOOK AT THESE
NEW PRICES*

CROMEMCO SYSTEM 3

£4,412.00 for this system with vdu.

The ideal business system. System includes a full 64K fast RAM, dual full-size floppies (Persci 277), RS232 interface/20mamp loop for console device, parallel printer port (Centronics/Anadex compatible), 21 slots for expansion, Lear Siesler 24 lines or 80 chars vdu, and ... CROMEMCO's CDOS operating system with their 14 digit BCD extended disk Basic — ideal for those accurate large numbers required by successful businesses. CDOS is CP/M functionally equivalent, with many extra facilities. Optional extras from Xitan include Fortran, Cobol, Text Formatting, Z-80 macro-relocating assembler and DBMS at £59.00 each. CIS interactive screen handling Cobol at £425.00 (recommended to serious business users), Cromemco S100 boards, CP/M (we are an authorised oem distributor of Digital Research's CP/M) for the System 3, Wordmaster, Wordstar, Supersort, and CPM374X utilities.



COMING SOON! ... Full 7-terminal multi-user operating system from Cromemco for System 3 users. Up to 48K per user, all running independently. This operating system has to be seen to be believed. It will run any of the Cromemco provided and supported software packages, in any combination. Features include partition rescue facilities, allocating more memory to users, real-time clock for time/date stamping of jobs and disk queuing techniques. Buy your System 3 now, expand later as you need it.

S100 BRITISH COLOUR BOARD

We are proud to offer the first BRITISH S100 Colour board. Manufactured by a local Southampton company — Hi-tech, we can thoroughly recommend this product. Features include true PAL colour generation for high-definition on your television or colour monitor, 15+ colours and black/white with 6 additional grey scales, 24 lines with 40 characters per line, with standard character set plus 44 numbers and symbols, and 64 computer selected graphics symbols. Symbols include fractions and the £ symbol. Plotting is available at 80 x 72 resolution. Single or double-height characters, with flashing on an on/off duty cycle of 3-1. The board is memory mapped on any 2K boundary, with its I/O port set at any of the 256 available on the S100 bus. Just plug into your S100 system and colour television and go! Driver software and documentation provided. Price £295.00ex vat cash with order. Please specify if for television or 75 ohm monitor.



ON DEMO NOW! The Cromemco Z2-H.

For only £5,380.00 set the reliability and quality of Cromemco, coupled with the capacity of the new IMI 11 megabyte hard disk drive. This is incredible value for money. Specification includes transfer rates of up to 10 times faster than the fastest standard floppy disk, DMA controller for up to 7 hard disk units, and the new extended CDOS operating system. Systems available in three configurations: — A) The Z2-H complete integral system, 64K RAM, Z80A cpu, two double-sided mini-floppies, RS232 console port, parallel printer port, power supplies, cables, case and 12-slot S100 motherboard (7 slots free). B) Additional hard disk subsystem for existing system 2 or system 3 users consisting of one hard disk, DMA controller, power supply, case and cable. C) As unit B but with two hard disks. Prices: Unit A) £5,380.00
B) £4,330.00
C) £7,420.00

Xitan Systems also supplies and stocks vdu's, printers, NORTH STAR HORIZON computers, Commodore Business Machines PETs, S100 boards, and books. We are here to demonstrate the range of quality microcomputer systems available for use today. Ring up for an appointment now! You'll not be disappointed. We have Osborne's Sales Ledger and Payable Ledger in source form for use on Cromemco System 3 with CBASIC2, and we can offer a customising service on these programs. Additional software includes Microsoft Basic Interpreter and Compilers, Cbasic, Macro80, and CP/M for the North Star Horizon.

Xitan Systems Ltd., 23 Cumberland Place, Southampton SO1 2BB.

Tel: (0703) 38740

Hours Tue-Sat 9.30 am to 5.30 pm

INNOVATIVE

TRS-80 SOFTWARE

FROM THE PROFESSIONALS

EDITOR/ASSEMBLER PLUS

Now get every feature of Tandy's Editor Assembler and T-Bug all in one package. PLUS - many "big computer" features to simplify your programming, editing and debugging. Its no longer necessary to waste time creating both source and object tapes - Assembler Plus assembles directly into memory. Macros are supported, simply define a Macro and any frequently used sequences are automatically assembled. Assembler Plus also supports Conditional Assembly with 2 new pseudo ops, which enable assembly if a condition is true. There are 7 new expressions available, together with an automatic ORG, improved symbol print out and a Quash command to give you more storage space for general text editing. And that is all just on the Assembly side! The Editor is improved with extra commands like Substitute, Move, Copy and Extend for moving entire blocks and repeating them anywhere in the file, and for searching and substituting occurrences in old text for new text. A Range command is available for both Edit and Find enabling you to operate on a single line or a range of lines. Included in the package is a debugger called Z-Bug which includes all of the features of Tandy's T-Bug and features single step execution, direct execution in command mode and symbolic references, plus up to 8 breakpoints, rather than the single one in T-Bug. Editor/Assembler Plus is written by the original author and comes with an 80 page Manual - best of all it costs the same as Tandy's Editor/Assembler alone!

Editor/Assembler Plus for 16K Level II. Cassette based.....£21.70 + VAT = £24.95 50p P & P

ADVENTURE

The original Adventure was written for a main frame computer and was called Adventureland. Since then there have been many derivatives. The best are written in machine code like the Scott Adams series (for which label we happen to be the sole importers!) but good as they are, they have had to be shortened to fit into 16K. This Microsoft Adventure is the original uncut main frame version, for the first time available for a microcomputer. Once you enter the Colossal Cave, your journey takes you through a labyrinth of caves containing active volcanoes, green snakes, sulfur lakes, killer dwarves, trolls, five foot oysters and many many more surprises before you can collect the 25 Treasures and be a Grand Master! All the while directing your journey with commands and questions to the computer in English. Over 400 messages and descriptions are combined in an endless number of ways in the program vocabulary. Almost literally mind blowing!

Adventure. 32K single drive minimum. Disk based£19.50 + VAT = £22.43 50p P & P

ASSEMBLY LANGUAGE PACKAGE

A Complete Assembly Language package for the user who requires the ultimate in programming aids. This package consists of a Macro Assembler, a Linking Loader, a Text Editor and a Cross Reference Facility. The Macro Assembler accepts Z-80 opcodes and supports a complete Intel standard macro facility including IRP, IRPC, Repeat, local variables and ExitM. The code is assembled in relocatable modules which offer the advantages of easier coding, faster testing, debugging and modifying. An expanded set of conditional pseudo ops allows testing of assembly pass, symbol definition and parameters to macros. Other assembler features include comment blocks, octal or hex listings, titles and subtitles, variable input radix (base 2 to 16) and a complete set of listing controls. The Linking Loader provides a number of loader capabilities executed by means of easy command lines and switches. Any number of programs may be loaded in user specified locations. Internal and external references between modules are resolved automatically. The Loader also performs library searches for system subroutines and generates a load map of memory showing the locations. The Text Editor is a random access line orientated text editor similar to those used on the IBM 360 and PDP-10 computers. The Editor's speed and simplicity make it easy to insert, replace, print or delete lines; edit individual lines; renumber lines in a file and to find or substitute specified text. The Cross Reference Facility provides a convenient alphabetical list of all program variable names, together with the line numbers where they are referenced and defined.

Assembly Language Package. 32K single drive minimum.....£65.00 + VAT = £74.75 50p P & P

FORTRAN

The best Fortran Language Compiler available for the TRS-80 - a standard ANSI Fortran from Microsoft. The package includes the Compiler, a Linking Loader, a Text Editor and a Fortran Runtime Library. The Compiler has a number of enhancements to the ANSI standard: LOGICAL variables which can be used as integer quantities, +127 to -128; LOGICAL DO loops for tighter, faster execution of small valued integer loops; mixed mode arithmetic; hexadecimal constants; Literals and Holleriths allowed in expressions; logical operations on integer data AND..OR..NOT..XOR can be used for 8 or 16 bit Boolean operations; READ/WRITE End of File or Error Condition transfer, that is, control may be transferred to a specified statement on end of file or error encounter; Encode/Decode for Format operations to memory. The standard library supplied includes 49 subroutines, together with routines for 32 bit and 64 bit floating point functions. Users may write non-standard I/O drivers for each Logical Unit Number - making the task of interfacing non standard devices to Fortran, a straightforward one.

Fortran Package. 32K single drive minimum£65.00 + VAT = £74.75 50p P & P

Send large SAE (27p) for our current Catalogue of TRS-80 Software. Add £1.45 for a binder.

A.J.HARDING (MOLIMERX)

28 COLLINGTON AVENUE, BEXHILL-ON-SEA, E.SUSSEX. TEL: (0424) 220391

TELEX 86736 SOTEX G FOR A. J. HARDING





STOP PRESS!!! HB Computers now a major distributor of the remarkable **TEXAS TI99/4** home computer

Buy with confidence from the specialists
HB COMPUTERS LTD

Stock a full range Under One Roof

BUSINESS AND GAMES SOFTWARE FOR THE CBM PET

DISC BASED BUSINESS SOFTWARE
CBM 3040 AND COMPU/THINK

SALES LEDGER

Process up to 1,000 accounts. Full input audit mail, enquiries, statements, debtors list and sales analysis.£350

PURCHASE LEDGER

Specifications as per Sales Ledger.£350

ESTATE AGENT

Property file maintained and houses selected.£25.00

WORD PROCESSOR

All the usual word processor features plus global changes and right justify.£50.00

MAIL LIST

Names, addresses and selection codes on disc. Will interface with our word processors.£50.00

CASSETTE BASED SOFTWARE

STOCK WATCHER

Up to 250 stock items processed. Stock Reports, re-order, etc.£25.00

R H SHAPEMATCH

Memory game. Children love this one.£5.00

R H MASTERMIND

Our version of this popular brain teaser.£8.00

SNAKES & LADDERS

You choose the number of snakes and ladders. Good graphics. Works with our **SOUNDBOX** . . .

R H MICROPOLY

Monopoly board controlled by your PET. Nobody is lumbered with the bank.£12.00

HB COMPUTERS LTD

22 NEWLAND STREET, KETTERING NORTHANTS.

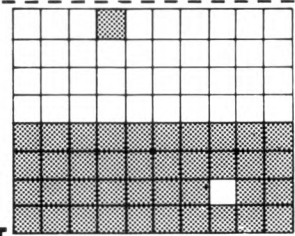
Tel. (0536) 83922 & 520910 Telex 341297

All prices exclude VAT.

Your key To MICROCOMPUTERS

This coupon will bring you details of our new complete home computer course.

You will learn all the basic principles of computer technology and receive full instruction on computer functions and programming. Tuition is carried out at your own pace on your own home computer and is supervised by our qualified computer staff.



FREE BROCHURES

TUTORCOURSE HOME COMPUTER

Please rush me details of your HOME COMPUTER COURSE

Send today for a brochure on this exciting new course.

Name _____

Address _____



Block Caps. Please

Post now, without obligation to:

British National Radio & Electronics School.

P.O.Box 156, Jersey, Channel Isles

Q-COM ELECTRONICS

PET PERIPHERAL SPECIALISTS

PLESSEY MEMORIES 32K WORDS

PETITE (add on) £280
 INPET (mounted inside) £249

IEEE-488 SERIAL OUTPUT INTERFACE

SELF POWERED £110
 P.C. BOARD ONLY £ 85

TERMINALS:-

DECWRITER LA34 £850
 TELETYPE 43 £795

TERMS:- ALL EQUIPMENT EX-STOCK CASH WITH ORDER PLEASE - VAT EXTRA. 3 MONTHS' WARRANTY. TERMINAL DELIVERY £15 EXTRA. FULL BACK UP SERVICE AVAILABLE

TELEPHONE 021-643-1945
 OR 021-643-3540
 OR 021-643-3540

Q-COM ELECTRONICS LTD.,
 5TH FLOOR, ST. MARTINS HOUSE
 10 BULL RING, BIRMINGHAM B5 5DT

STACK COMPUTERS ANNOUNCE . . .



THE AFFORDABLE APPLE

Stack Computer Services can now offer the full range of computers and accessories for the discerning Apple owner. Our aim is to provide a "one stop" source of Apple equipment and Apple compatible peripherals. To this end we are currently expanding our existing premises to accommodate a new department dedicated to the sale and support of Apple products.

Our particular expertise is centred around industrial research and educational applications, with each system being individually tailored to meet the customers specific needs.

**Telephone (Paul Fulwood) on
051-933 5511 (ext. 10) for further details.**

Apple II ++ 16K RAM	£695.00	Apple logo ties	£5.50
Disk drive(no controller)	£299.00	A.C. line controller	£270.00
Disk drive(+ controller)	£349.00	Slave for above	£130.00
16K memory upgrade	£69.00	Rom plus board	£105.00
Prototype/hobby board	£15.00	10 Apple diskettes	£30.00
Parallel printer card	£104.00	Vinyl carrying case	£16.00
Communications card	£130.00	Speechlab	£127.00
High speed serial card	£113.00	Programmers aid1	£27.00
Pascal language system	£299.00	Autostart ROM pack	£38.00
Centronics card	£130.00	Graphics tablet	£462.00
Applesoft BASIC card	£116.00	Appletel system	£595.00
Integer BASIC card	£116.00	B&W UHF Modulator	£14.00
Clock/calender card	£128.00	Supertalker	£136.00
Eurocolour card	£79.00	Microhush printer	£266.00
ALF music synthesizer	£180.00	Thermal paper for above	£2.00
Heuristics controller	£53.00	10" B&W monitor	£100.00
Heuristics speechlink	£173.00	Lower case adaptor	£40.00
IEEE interface	£212.00	Synertec light pen	£165.00



COLOUR

Supercolour system for the Apple gives superb colour on a modified (But still usable) Sony 14" T.V.

Supercolour card **£90.00**
Supercolour T.V. **£300.00**

Stack Computer Services Ltd
290-298 Derby Road, Bootle
Liverpool 20

051-933 5511



Small
Systems
Engineering
Limited

IEEE-488/PET INTERFACES

Type B £186
Bidirectional serial interface is fully addressable and can have split BAUD rates

Type C £120
Serial interface - output only
PET disk, compatible, RS232 C Handshake (Printer Busy), switch selectable Baud rates, Listen Address link selectable.

Type CS £132
Serial interface output only with switchable character sets to match the new PET's lower case Screen mode, otherwise as Type C.

All interfaces are crystal controlled

Type G.P.I. A.P. £249
Micro-based, bidirectional with buffering. The General Purpose Interface allows free use of PET's INPUT # statement without hangup problems. Software changeable BAUD rates optional features include: Second Serial I.O. Port, 20 mA Loop I.O.

Addressable parallel (disc compatible) for Centronics, Anadex etc. £106

Non addressable parallel £45

TV/Video monitor interface £35

Real Time Audio Spectrum Analyser for Commodore PET Microcomputer
32 Channels 1/3 Octave Filters, 1K ROM ROUTINES on board for analysis and graphical display. USR Functions for linkage to PET basic operating system £450

PET MEMORY EXPANSION BOARDS INTERNALLY MOUNTED

24K £328
32K £432

S100 BOARDS

Dynamic Memory Boards
IEEE-S100 Specification Timing
Transparent on Board Refresh
4Mhz Z80 Operation with no wait states.
Fully tested and Burned In
Bank Select versions available -
North Star, Cromemco and Alpha Micro
I.O. Port Bank select
Bank Size to 64K in 16K increments

Size	Standard	Bank Select
64K	£449	£595
48K	£398	£539
32K	£346	£483

P&T IEEE-488 Interface
Provides S100 computers with IEEE-488 £350
Controller, Listener, Talker, Capability

All prices exclude VAT
P&P £5.00 (includes Securicor Express Delivery)

62 New Cavendish Street · London W1M 7LD
Telephone: 01-637 0777 Telex: 8813085 (Abacus)

£39.50*

Professional
ASCII Keyboards



MODEL KB 756

FULLY ASSEMBLED & TESTED
CASE AVAILABLE

Accessories Available include:-

Edge Connector	KB15P	£1.95*
Numeric Key Pad	KB710	£7.50*
Plastic Case (Black)	KB701	£12.75*
DC to DC Converter	DC512	£5.00*

* U.K. Orders add 15% VAT on Order total.

FULL DATA SHEET ON REQUEST

Citadel Products Limited.

Dept. PCW 50 High Street, Edgware,
Middlesex HA8 7EP. Telephone 01-951 1848

**CARTER
KEYBOARDS**

LET
US MIND YOUR
OWN BUSINESS

We offer systems for the smaller business user based on microprocessors by Apple and Microstar and supported by extensive software for a wide variety of applications. We also supply daisywheel printers by Qume, matrix printers by Texas, and a variety of video screens. We sell or lease equipment and guarantee our installations in the field. AND we offer in situ service support via our own engineers.

If you have specific requirements for individual items of hardware, come and discuss it with us.

We're Access Data Communications . . . your flexible friends.

Access Data Communications Ltd.,
228 High Street,
Uxbridge, Middx.

Tel: 0895 30831/59205



Thinking Computers?



Then come to the number one micro-computer centre

If you're wondering if a micro-computer can help you, we are here to advise you. At Lion House—London's leading centre for micro-computers—you'll find:

- * Experts who'll explain the equipment in a way you can easily understand, showing how and where it applies to *your* work.

- * Demonstration areas where you can get immediate experience of using micro-computers yourself.

- * Probably the biggest range of software in the UK.

- * Programmes can be tailored for your particular commercial needs by our In-House Analysts and Programmers.

- * Total service—including the availability of full maintenance after you've bought an installation.

- * Leasing and H.P. facilities immediately available.

- * A computer book section with publications that give you new insight into the world of micro-computers.

How will micro-computers help you? In thousands of ways—only a few can be mentioned here...

MICRO-COMPUTERS FOR BUSINESS



For business and professional, the versatility of compact micro-computers means that all the benefits of big computers are made available to all at low cost. The businessman can now computerise his accountancy, his stock control, his records and much more—cutting his overheads and improving his efficiency.

For the home, micro-computers have innumerable uses and considerable value too—sometimes in unexpected ways.

MICRO-COMPUTERS FOR THE HOME



Budgeting... investments... controlling heating or security... storing information on things like recipes... designing complex and fascinating games... education...

Come and see. We invite you to visit us and investigate the possibilities and the potential. If you're too far away, phone or write and we'll send you more information.

You need a micro-computer. We can supply it.



LION MICRO-COMPUTERS

SMALL COMPUTERS—TO MAKE YOUR BUSINESS BIGGER

Lion Computer Shops Ltd, Lion House, 227 Tottenham Court Road, London W1 (First Floor). Telephone: 01-637 1601.

Telex: 28394 Lion G.

Open 9 to 6, Monday to Saturday (Thursday to 7).



Britain's first comp

A complete personal computer for a third of the price of a bare board.

Also available ready assembled for £99⁹⁵

The Sinclair ZX80.

Until now, building your own computer could easily cost around £300 – and still leave you with only a bare board for your trouble.

The Sinclair ZX80 changes all that. For just £79.95 you get *everything* you need to build a personal computer at home...PCB, with IC sockets for all ICs; case; leads for direct connection to your own cassette recorder and black and white or colour television; everything!

And yet the ZX80 really is a complete, powerful, full-facility computer, matching or surpassing other personal computers on the market at several times the price. The ZX80 is programmed in BASIC, and you could use it to do quite literally anything from playing chess to running a power station.

The ZX80 is pleasantly straightforward to assemble, using a fine-tipped soldering iron. Once assembled, it immediately proves what a good job you've done. Connect it to your TV set...link it to an appropriate power source*... and you're ready to go.

Your ZX80 kit contains...

- Printed circuit board, with IC sockets for all ICs.
- Complete components set, including all ICs – all manufactured by selected world-leading suppliers.
- New rugged Sinclair keyboard, touch-sensitive, wipe-clean.
- Ready-moulded case.
- Leads and plugs for connection to domestic TV and cassette recorder. (Programs can be SAVED and LOADED on to any portable cassette recorder.)
- FREE course in BASIC programming and user manual.

Optional extras

- Mains adaptor of 600 mA at 9 V DC nominal unregulated (available separately – see coupon).
- Additional memory expansion boards allowing up to 16K bytes RAM. (Extra RAM chips also available – see coupon.)

*Use a 600 mA at 9 V DC nominal unregulated mains adaptor. Available from Sinclair if desired (see coupon).

Two unique and valuable components of the Sinclair ZX80.

The Sinclair ZX80 is not just another personal computer. Quite apart from its exceptionally low price, the ZX80 has two uniquely advanced components: the Sinclair BASIC interpreter; and the Sinclair teach-yourself BASIC manual.

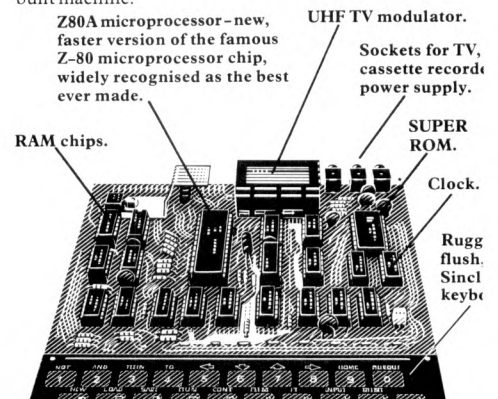
The unique Sinclair BASIC interpreter... offers remarkable programming advantages:

- **Unique 'one-touch' key word entry:** the ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST, etc.) have their own single-key entry.
- **Unique syntax check.** Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately. This prevents entry of long and complicated programs with faults only discovered when you try to run them.
- **Excellent string-handling capability** – takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison). The ZX80 also has string input to request a line of text when necessary. Strings do *not* need to be dimensioned.
- Up to 26 single dimension arrays.
- FOR/NEXT loops nested up to 26.
- Variable names of any length.
- BASIC language also handles full Boolean arithmetic, conditional expressions, etc.
- Exceptionally powerful edit facilities, allows modification of existing program lines.
- Randomise function, useful for games and secret codes, as well as more serious applications.
- Timer under program control.
- PEEK and POKE enable entry of machine code instructions,USR causes jump to a user's machine language sub-routine.

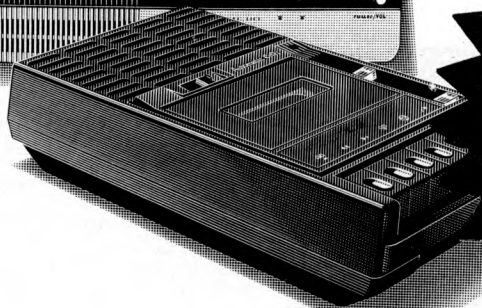
- High-resolution graphics with 22 standard graphic symbols.
- All characters printable in reverse under program control.
- Lines of unlimited length.

... and the Sinclair teach-yourself BASIC manual.

If the features of the Sinclair interpreter listed alongside mean little to you – don't worry. They're all explained in the specially-written 128-page book *free* with every kit! The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming – from first principles to complex programs. (Available separately – purchase price refunded if you buy a ZX80 later.) A hardware manual is also included with every kit or built machine.



Complete computer kit.



£79⁹⁵

**Including VAT.
Including post and
packing.
Including all leads
and components**

**Fewer chips,
compact design,
volume production –
more power per pound!**

The ZX80 owes its remarkable low price to its remarkable design: the whole system is packed on to fewer, newer, more powerful and advanced LSI chips. A single SUPER ROM, for instance, contains the BASIC interpreter, the character set, operating system, and monitor. And the ZX80's 1K byte RAM is roughly equivalent to 4K bytes in a conventional computer – typically storing 100 lines of BASIC. (Key words occupy only a single byte.)

The display shows 32 characters by 24 lines.

And Benchmark tests show that the ZX80 is faster than all other personal computers.

No other personal computer offers this unique combination of high capability and low price.

**The Sinclair ZX80. Kit: £79.95.
Assembled: £99.95. Complete!**

The ZX80 kit costs a mere £79.95. Can't wait to have a ZX80 up and running? No problem! It's also available, ready assembled, for only £99.95.

Whether you choose the kit or the ready-made, you can be sure of world-famous Sinclair technology – and years of satisfying use. (Science of Cambridge Ltd is one of the Sinclair companies owned and run by Clive Sinclair.)

To order, complete the coupon, and post to Science of Cambridge for delivery within 28 days. Return as received within 14 days for full money refund if not completely satisfied.



Order Form

To: Science of Cambridge Ltd, 6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Remember: all prices shown include VAT, postage and packing. No hidden extras.

Please send me:

Quantity	Item	Item price £	Total £
	Sinclair ZX80 Personal Computer kit(s). Price includes ZX80 BASIC manual, excludes mains adaptor.	79.95	
	Ready-assembled Sinclair ZX80 Personal Computer(s). Price includes ZX80 BASIC manual, excludes mains adaptor.	99.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	8.95	
	Memory Expansion Board(s) (each one takes up to 3K bytes).	12.00	
	RAM Memory chips – standard 1K bytes capacity.	16.00	
	Sinclair ZX80 Manual(s) (manual free with every ZX80 kit or ready-made computer).	5.00	
		TOTAL	£

NB. Your Sinclair ZX80 may qualify as a business expense.

I enclose a cheque/postal order payable to Science of Cambridge Ltd for £ _____

Please print

Name: Mr/Mrs/Miss _____

Address _____

**sinclair
ZX80**

Science of Cambridge Ltd
6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: 0223 311488

Guy Kewney, with the news, rumours and gossip — plus, this month, he speculates on the great phone-tapping controversy.



Buzby's eavesdroppings

Duncan Campbell originally revealed on February 1st in the *New Statesman* that computer technology was being used to monitor phone calls made by ordinary citizens — without the knowledge of Parliament.

Most owners of micro-computers will think only two, quickly passing, thoughts about telephone bugging. First, they will say, such bugs would only be used to trap KGB agents and IRA bombers . . . and a good thing too. Second, they will add that nothing as complicated and clever as has been mentioned in the *National Press* actually exists anyway.

On the second point, our micro man may be almost right. Duncan Campbell's original article in the *New Statesman* revealed the existence of an automatic speech transcriber. But other commentators (noting that the transcriber is said to be located in Victoria, at the same place as where a line monitor handles several thousand lines) made the (incorrect) creative deduction that the automatic transcriber could cope with a thousand conversations simultaneously. It can't.

But Campbell says it does exist and what it does is produce a print-out of a telephone conversation.

On the face of it, that may be a bit hard to swallow. After all, no less a sage than Professor Donald Michie, artificial intelligence guru, has decreed that the idea is "obviously bunk". I wish I had Michie's artificial intelligence. Even more, I wish I had the comfortable confidence in such "expert pronouncements" that some of my colleagues seem to have.

First, let us assume that a voice transcriber is something that cannot be done with equipment on the market today. I don't believe this assumption myself, but let's make it anyway. On the market, therefore, no can do.

Well, what about off the market, then? Under the joint control of the Post Office and an intelligence electronics outfit, probably in Cheltenham, there is a speech

research unit. Not surprisingly, it's called the Joint Speech Research Unit (JSRU) and it's been beaver-ing away for 33 years.

The type of equipment it produces would be a useful start to anybody planning a computer transcriber. For example, the JSRU is known to make scramblers — voice scramblers. It won't surprise any readers to hear that I haven't seen a circuit diagram for the JSRU scramblers, and that I don't know whether they are digital or analogue, or a combination of the two. I don't think it matters. The point about a scrambler is that it splits up the voice into its component parts, at one end, and then puts everything back together at the other.

If the JSRU scramblers are as up to date as the vocoders used in the production of the *Hitch Hiker's Guide to the Galaxy*, they will be devices producing a digital output, neatly analysed into the sort of sound parameters that define what vowel or consonant you are pronouncing. My guess, however, is that they are a bit more sophisticated; they probably have some feature which produces a digital value from which the sound, at any moment in time, can be resynthesised later. If a speech research unit can't get to that point in 33 years, it's a waste of taxpayers' money.

The scrambling technology can probably be expected to do some clever analysis of voice pitch, too. This would give several likely clues to where words can be expected to start — an important requirement. Existing "on the market" speech recognition devices are not wonderful. They tend to mistake "five" for "nine", and if you say "five seven" without stopping for a second between the five and the seven, these machines recognise neither word, because they think you have just pronounced something new, "fiveseven". And if a new speaker takes up the microphone, the machine recognises rather little of what he/she says.

However there are two flaws in this "proof" that the

auto transcriber will not work. First, speech recognisers that typically have a vocabulary of around 200 keywords are a tremendous overkill when it comes to the requirements of a transcriber. Japanese firms are known to have machines capable of printing somewhere over 90% of all Japanese words, from a syllabic vocabulary; apparently 68 syllables are all that you need to construct any word in that language. For various reasons, including inflexion problems, English is not as susceptible to analysis; however a machine that has to pick up syllables is not bothered by the fact that we speak sentences rather than words.

Second, a speech recognition machine has to take the right action when told something . . . it must not be vulnerable to ambiguity. It must open the door only on the phrase "Un petit d'un petit s'etonne aux Halles", and ignore all jokers who

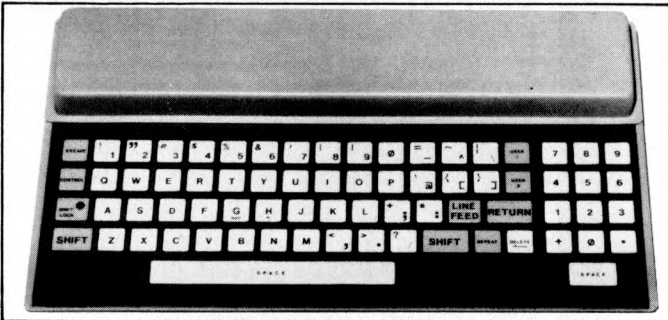
think the password is "Humpty Dumpty sat on a wall" — or vice versa.

A transcriber has no such ulcer-inducing worries; it will print out say: "um pretty dump ettisa tonn owl" in both cases. In other words, it doesn't have to produce a perfect match . . . all it has to do is correctly record the vowels and consonants spoken. If it has enough knowledge of likely words to produce the correct word, just one in ten, it will be possible — not easy, mind you, but definitely possible — to read its printout and understand the subject of conversation (for closer investigation, later, if necessary).

My best guess is that a good microphone could enable a rather small computer (something the size of an Apple II) to search through the typical Englishman's sub-3000 word vocabulary and print out a recognisable version of 60%



Magnetic tapes, magnetic diskettes, and magnetic cards, all made by Verbatim and displayed by BFI Electronics at Computermarket. The range includes an extra-length cartridge which has 450 feet, rather than 300, of quarter-inch tape . . . providing 4.3 Mbytes.



A truly touch sensitive keyboard from Star Devices. It offers full ASC11 code output, and is the Mk II version of the board which also comes in a form with a key for every ASCII code. It gives me the excuse I need to apologise to Clive Sinclair for assuming that the ZX80 keyboard was touch sensitive — it isn't. It's flexible, and when pushed down, the top surface makes contact with the back. Star Devices is electronic, rather than mechanical in operation. Details on 0635 40405.

of what he said.

The Post Office does not supply good microphones to its users — not even when it intends to bug their conversations. Nor does it supply telephone lines free from nasty distorting effects. Nonetheless, electronics can come to its aid. Have you listened to any radio phone-in programmes lately? If your mind is not totally numbed by the inanity of the typical dialogue, it will probably have been alert enough to notice that the quality of sound that any tin-pot studio broadcasts from somebody phoning in, appears rather better than one might reasonably expect. And it is. A device called a telephone balance unit is used; it compares the characteristics of the voice of the man in the studio (who is talking into the telephone) with the characteristics of his voice as reflected back down the line. From this it deduces the flaws in the line. It then compensates for these flaws and balances the incoming call, to remove them.

My guess is that the Post Office could reasonably expect to get intelligence transcripts of nearly 40% of conversations monitored. The New Statesman found that something like 30% were "acceptable" to the authorities — line noise, funny accents or other problems taking care of the rest.

As to whether Irish and Russian agents are a sufficient threat to justify the use of this transcriber, I can only refer you to your own political views. Several of my readers will insist that a computer paper has no right to thoughts on the subject anyway — a view which I find as sensible as the idea that Jews should have no views on anti-Semitism.

There will be many who will go along with Computer Weekly's pontification, that the idea of a transcriber "will raise the eyebrows of anyone

with a reasonable knowledge of computing" (Feb 7). The implication of that statement is that Duncan Campbell, writing for an arty-lefty paper like the New Statesman, must be an innocent fool who would fall for any agitator's plausible story of Big Brother Computer.

He is in point of fact an electronics systems expert, and a very experienced, sceptical writer. I know virtually nothing about this matter beyond what he has published; but I do know that his expertise in encryption, electronics (analogue and digital) and military intelligence, is greater than anything all of us this end can muster in total. The fact that "experts" say it's impossible of course impresses me. After all there's no need for alarmist talk about what are just words from the pens of sci-fi writers. Take radar for instance. . .

National power down

The American chip maker National Semiconductor has been tackling one of the most irritating problems of microcomputers — the fact that they burn up a lot of power.

A six transistor radio can run for days off a small nine-volt battery. A 7000 transistor Motorola 6800 doesn't use proportionally more, but a system using it plus a manageable amount of memory, plus a useful amount of amplifying circuitry (to make sure that the words it wants to print will reach the printer) will kill that battery in an hour.

National Semiconductor reckons that the people who have tackled this problem in the past have got it all wrong; instead it has produced the new NSC 800 micro. Not just a new computer, but a brand new chip.

What makes the NSC 800

important is that it's not in fact a brand new chip at all. It's a copy of Intel's 8085, plus a copy of Zilog's Z80 — two of the most commonly used chips in the micro business. It will run any software written for those micros, without change. But it uses 4% of the power.

In the past, the only way to get a computer to be this miserly in its use of electricity, was to build it on a special chip with two layers of impurity — both P-channel and N-channel complementing each other on the silicon (hence its name, Complementary Metal Oxide Semiconductor, or CMOS). Normal fast micros are built in N-channel, or NMOS technology — and usually, CMOS micros are a great deal slower in operation.

National's trick has taken place on two levels. First, it has found a way to speed up CMOS, and second, it has developed that faster CMOS so that the transistors are much smaller, and much closer together. In part, the first point is the result of the second.

It works like this: the transistors on a silicon chip operate by pumping electrons into or out of one of the three elements of any transistor . . . collector, base, and emitter. The exact details vary with the type of transistor you have built, but enough electrons in (or out, depending on type) can turn a piece of silicon from a good conductor into a rotten conductor of electricity; when the current flowing between the other two elements stops, the transistor has switched.

In an analogy as crude as last month's financial modelling, one can say that the bigger the transistor, the longer it takes to pump enough electrons in, to switch it. If you pump harder — that is, increase the power — the thing gets hotter, but it does speed up.

Very, very crudely, the effect of shrinking the length of a chip by x per cent can improve the speed or power

— whichever you design for — by a factor in proportion to x^3 ; that's because it affects not just the area, but the volume, of the transistor.

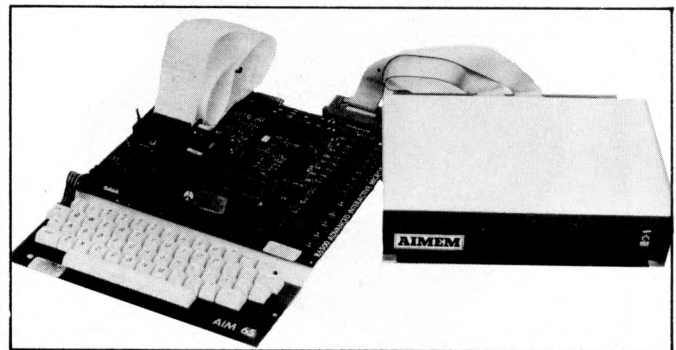
Until now, the big problem of CMOS has been that although it overcomes the limitations of speed power on NMOS, it spreads itself over a lot more silicon. In so doing it causes more capacitance effects and increases the likelihood of a chip falling on a crystallising discontinuity in the silicon wafer. The capacitance effects slow the chip down because capacitors take time to fill up with electrons; the flaws reduce the number of good chips on a wafer, and therefore increase the cost of building and testing.

A CMOS micro small enough to be economically viable was not much of a computer, as any user of an Intersil 6100 or an RCA Cosmac will have to admit. Since those devices were originally launched, however, the art of squeezing circuitry on to chips has improved. National's latest improvement involves putting an extra layer of polysilicon on the chip — it calls the process double polysilicon or P²CMOS — and this allows it to build a very complex chip indeed. Like the Zilog Z80, it runs all the 8080 instructions and also unlike the Z80, it runs the 8085 instructions and interrupts. A small difference, but quite crucial to somebody with an 8085 program that goes beyond what the 8085 can do.

It also contains quite a lot of extra circuitry for controlling memory, and input/output, which means that three of National's chips will do quite a lot of useful computing — where the Z80 would need twice as many.

Those three chips, unobtainable today, carry a \$115 price tag. A 40% price cut next year and a 30% cut the year after will still make it more expensive than Z80 or 8085, but not killingly so.

What makes it only a dream for the average home builder is the fact that, while the main chips will be avail-



Attaching 32 Kbytes to the £250 Aim computer will cost £335 from Portable Microsystems, if you buy this Aimem. It does cost more than 32 Kbytes worth of memory chipperly — but it does include its own power supply, and it will work with other 6502 micro products. Details on 0280 702017.

able by the end of this year, there are many support chips that will only be available in standard CMOS (rather slower) or perhaps, even only NMOS. One such chip is the EPROM, the ultra-violet erasable, reprogrammable permanent memory. You can mix them, certainly, but one EPROM will chew up ten times the power you just saved by switching to P²CMOS.

Believe it or not dept.

The first microprocessor, Intel's 4004, was a very simple device by any of today's standards; indeed, only by courtesy was it a processor at all. Most of the essential functions of a processor chip were on secondary, support chips. Even up to the point of the 8080, this was still true.

Now that a chip is capacious enough to carry things as powerful as Motorola's 68000, Data General has gone back to the 8080 approach — in order to squeeze its enormous Eclipse "mini" on to a single chip. The only acceptable reason for calling the Eclipse a mini is that Data General is a minicomputer company. IBM makes several smaller machines and calls them "mainframes".

The single chip that is the central processor of the Eclipse does not have room for all the instructions that can normally be added by microcode. Nonetheless, the DG microEclipse is an awesome bit of silicon, driving two megabytes of memory. I mention this machine in a "personal computer" publication just to put a little perspective on the future.

The Japanese have all announced 256 Kbit RAM chips now, and in two years, these will be available. A useable system with the microEclipse and 2 Mega-

bytes of store will occupy 20 pieces of silicon . . . the size of Clive Sinclair's ZX80. Scared?

IBM2CPM

IBM does not use the universal micro operating system, CP/M. Load an IBM diskette on to your micro with CP/M and watch it crash, no matter how important it may be that you read the data.

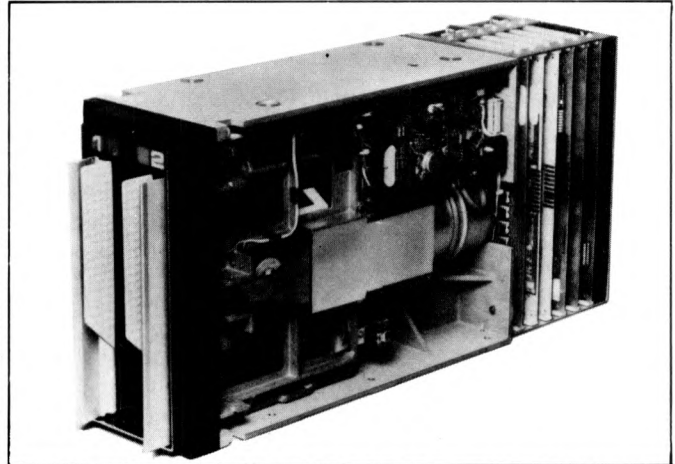
That is why Precision Computer Systems of San Jose, California has written a bit of software, IBM2CPM, which will convert between the two. It allows the user to develop programs at work on his IBM, using cross assemblers or cross compilers to generate the code; and then load the resulting IBM diskette. It also allows the micro owner to enter a batch of data on his machine and take it to an IBM mainframe for further processing. Details (or \$95 to PCS), 1737 First St, San Jose, Cal 95112.

Comart CAPs its success

When two people stick their necks out together, it does make the spectators wonder whether one is the solid citizen recommending that we trust the other, rather reckless innovator — or whether its a case of the blind leading the blind.

On balance, Comart's decision to bring its chain of stores behind the Microcobol software packages developed by CAP is probably a feather in the software house (sic).

Both firms are being watched with awe at the moment. David Broad of Comart has had his hair cut, to suit the solemn image required of the chairman of a group that now includes Byte Shop. He is also the recipient of a Charterhouse loan of £200,000, and is



Readers will remember that PCW has long predicted very high density diskette drives once the "voice coil" actuator arrives, allowing much more precise head positioning through the ability to follow any irregularities in the recorded track. This is it: a Burroughs dual drive offering 6 Mbytes. If you have to ask what it costs, you can't afford it. But it's made in Scotland. Details from the OEM division on Rickmansworth 70545.

regarded as A Success . . . nearly.

CAP has had Microcobol up on stage for two years, and has been through a rough financial time. Many believe that this rough time has been due to the slowness of the computer industry to have faith in Microcobol. The fact that David Broad has picked it up can be taken as a milestone, if for no better reason than that it indicates that the pricing on Microcobol has become reasonable, and the product retailable.

Comart is not a company to compete with Sinclair's sub-£100 system. It sells to buyers who can sign company cheques, but who don't want to do enough work to justify a Systime, a Data General, or a Honeywell £30,000 machine — it doesn't sell to home buyers. Nonetheless, Comart is a retail business; when Microcobol was launched, it would have cost more to buy the support software needed to run a program written in Microcobol, than it would have cost to buy the machine needed to run it.

That is no longer true; and Microcobol does offer one thing which the very well-known CP/M operating system claims to offer, but does not . . . compatibility. On CP/M, a program written in BASIC may be transferable from a machine using an 8080 to a machine using a Z80 or 8085 — ostensibly three chips all using the same 8080 machine instructions, ostensibly all running a standard high level language which is processor independent. More likely than not, however, there will be differences that prevent the transfer.

With Microcobol, a program written in the language will run on any machine that has the the Business Operating System

(BOS) sold by CAP. It really won't matter a bag of dingo's kidneys whether the micro chip is a Z80, a Motorola 6809, or a Texas Instruments 9900.

CP/M still offers more likelihood of finding a program written for exactly your micro, simply because there are so many CP/M users writing programs for your micro — because there are so many users of your micro. With BOS and Microcobol, the total number of machines still won't exceed the smallest single number of users of any one CP/M-based machine. But with Comart moving behind it, things may start to move a bit faster.

Colourful battle

The obvious machine to compare with the Apple II is the CompuColor, because both give colour video displays. This comparison has been highlighted by the latest aggressive marketing moves of both companies — Microsense for the Apple II, and Abacus who import the CompuColor.

Apparently in response to a price cut on the Apple (a 16 Kbyte system with disc now costs £1040 plus VAT) Derek Rowe at Abacus issued the fighting statement that "there is nothing wrong with the Apple: it's just that CompuColor is a more advanced machine and about £500 cheaper and all in one box." Almost as he said it, the situation altered. Most of the change is his own doing; he has introduced engineering modifications to the CompuColor which will cure it of one or two vices.

The main reason behind the surgery was the fact that the disc drive was being twitched by the big magnetic



The latest discs, offering 10 Mbytes in the space of a diskette, are Winchester technology — that means permanently attached. Saving the data is the job of a tape drive like this one from Sintrom, using the 450 ft cartridge drive. Sintrom is on 0734 85464.

coils that drive the colour screen. Rowe has changed both hardware and software engineering. The software is designed to offer a quicker recovery from any errors caused by this interference; some 4 Kbytes of EPROM chipperly have been added and these will eventually be replaced by mask programmed ROM.

To prevent the errors from arising in the first place, Rowe has put a four-phase stepper motor into the disc to drive the head, and has changed the power arrangements so that when the head is being moved, the screen coils are starved of current.

To pay for these changes and others, the price is going up to £1400 from the £1078 which applied when Rowe made his attack. However, some £200 worth of software — editors, assemblers and “very good tutorials” will be supplied free at this price.

Incidentally, Compucolor has announced US prices for its machines. There are three models: the 8 Kbyte costing \$1495; the 16 Kbyte costing \$1695, and the 32 Kbyte at \$1995. Abacus' parent company, Show Financial, is clearly after the 1980 Eurapple Award for Middleman Margineering.

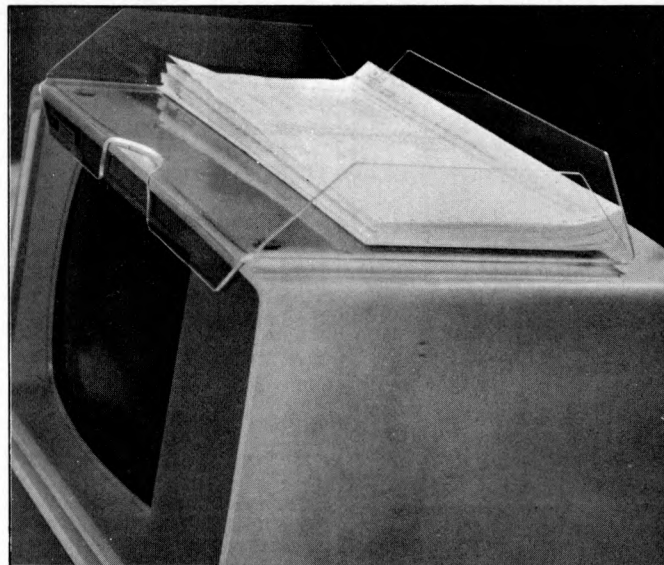
Abacus is on 01-580 8841. Microsense is on 0442 63561.

Off centre problems

Chips are very light in weight. This fact, and the consequences which arise, has evidently escaped the minds of the planners of a smart new “high technology” centre to be built in London's dockland. The trouble with building a development centre, with research “campuses” and high technology display facilities, in Surrey Docks, is the fact that Surrey Docks are far to the East of London. Heathrow Airport is far to the West.

More than in any other industry, chip-based businesses are to be found in geographical areas centred on airports. The reason is simple: chips are light enough to be cheap cargo when sent via air freight. There is no point in sending them surface mail. Chip companies like others, are moving away from the old water port, to the new airports. The fact that the centre of gravity of London has shifted is disguised by the fact that the City of London, where the wealthy congregate, is to the East of most of the metropolis. Fashionable people therefore try to live in the newly “gentrified” areas of Islington.

Nonetheless, the semiconductor firms who have offices in the South (the



Don't look at the video: look at the plastic tray. It costs £11.92, has four rubber feet, a thumb notch in the front to let you pick up paper easily, and is supplied by Data Efficiency, whose subsidiary Microsense is the Apple II importer. It may even keep spilled coffee from spoiling the electronics. Details on 0442 63561.

majority in the UK have quick access to Glasgow's airports) are in the High Wycombe, Reading, Bracknell, and Swindon areas.

The Surrey Docks project is being promoted by property people Knight, Frank and Rutley. Publicity man Michael Barton at KFR is hoping that plans to put City of London Poly there, together with Cranfield Institute of Technology, will attract established and new forms in the science and technology areas. Barton is obviously fighting a tough battle: contact him on 01-629 8171 if you think you want to help.

Double talk

Chip-maker Zilog has come to the aid of the computer builders who use the Z80 processor, by introducing two ready-built computers, both capable of talking to more than one user at the same time.

First to announce a commercial system based on these multi-terminal machines is the Basingstoke firm, Micropower.

Multi-terminal systems are not, one would obviously think, designed for the single user. This means they can stretch the budget a bit. All they have to do is be cheaper than a Data General three-terminal CS/50 at £25,000, and the people in this market will feel some inclination to see what they offer.

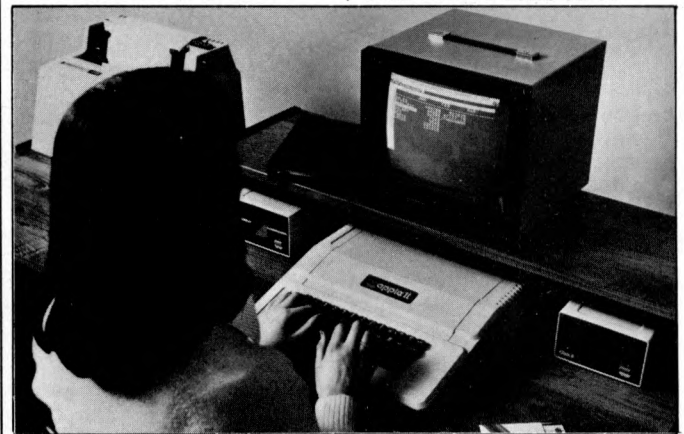
Micropower's systems are not bargain basement. At the upper end of the micro market, however, they will be seen as good value for money; the software offered is the sales key. The Micropower Production Control System has been launched to run on

the new Zilog systems. It is described as a “wholly integrated suite of programs written especially for the manufacturing environment, to enable accurate forecasting and costing of all stock requirements.” It is possible to buy it as part of the Complete Business System software launched a year ago. Details: 0256 54121.

CRA warming-up

In organisation terms, the Computer Retailers Association has sorted out the problems it was having at the end of 1979 when its major preoccupation seemed to be finding an identity. It has appointed an independent secretariat, found a permanent address, and can now get down to recruiting members. Without members to pay for the things it has to do (ie. find out which dealers and which machines are not up to scratch) it cannot do them.

It's aims are important



Another word processor package for Apple is the one supplied by the importer Microsense for £42. It's called Apple Writer. Phone 0442 63561.

enough for the customers that any retailer who doesn't join really owes us a good explanation. Alternatively, they can write to the new secretary, Mrs Helen Gibbons, at Owles Hall, Buntingford, Herts SG9 9PL, or phone Royston (0763) 71209.

The name's the same

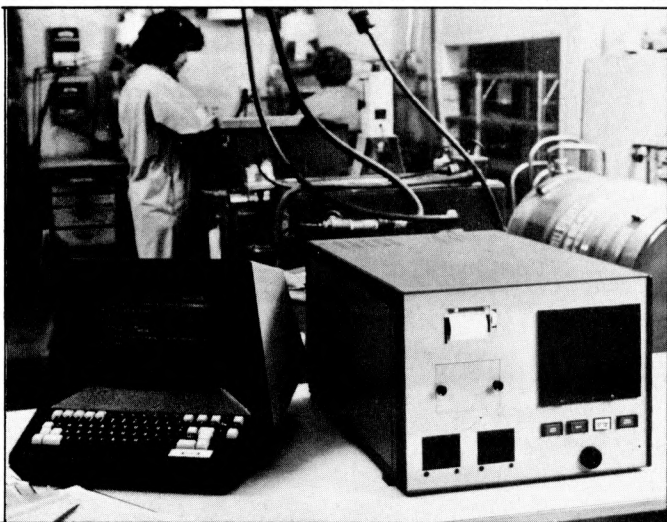
Commodore has rather blundered with one of its latest bits of software. As far as I know, there's nothing wrong with its Compay package. . . it's not even overpriced. No, the problem lies in its name!

When we told the PET makers that Compay was a name that had been around a while, they smiled and shook their heads knowingly. Either they didn't believe us, or, they'd done a deal with ICL, the big computer company that has sold Compay for something like 13 years. When we checked with ICL, it quickly became apparent that there was no deal. Accordingly, we hereby predict that the name of the PET program will change. It's just innocent fun.

Algol for the kids

Schoolchildren in Inner London can all learn to program using Algol 60 — which should reduce the demand for Pascal as an alternative for BASIC. The new language is the result of a deal between the ILEA and its exclusive computer supplier, Research Machines. The RML version of Algol is derived from a portable compiler — one which will also run on Digital Equipment PDP 8 and PDP 11 minis — written by Dr Roger Abbott of RHA Minisystems.

The compiler takes up only 20 Kbytes of memory. Users of Algol tend to be contemptuous of those who praise Pascal, saying that Pascal is a nice attempt to wean BASIC users on to



The name on the video display is Burr-Brown — normally only seen on chips and boards. This is the company's first system. It's a Data acquisition and control system. Details: 0923 33837.

something more like Algol — but not enough like Algol. These language battles are always fun, aren't they? Research Machines can be contacted on 0865 49791, while Abbott is on 08677 3625.

individual records." Stage One has also launched new business packages — for estate agents, accountants, and print shop job control. Details on 0202 23570 in Bournemouth.

Chris Evans tribute

Dr Christopher Evans, the author of the Mighty Micro — both book and TV series — died last year, leaving a bigger gap than ever between the computing experts and the average reader/viewer.

To commemorate Chris Evans' life and work, John Stewart has decided to hold a free seminar in London in May. Speaking will be Tom Stonier, one of the many who will have to try and fill the Chris Evans gap; he will be "supported by" a member of the National Physics Laboratory staff where Dr Evans worked until his death.

Anybody wanting a ticket should contact John Stewart. He's at the London Regional Management Centre which works with the five inner London polytechnics, address: 311 Regent Street, London W1R 8AL. The seminar will start at 2pm, at the building next door — the Fyvie Hall, 309 Regent Street. Phone 01-637 7583 for more details.

Petaid upgrade

As promised, Stage One Computers is busy expanding its software which will eventually turn the PET into an intelligent filing cabinet.

It has launched version 2 of Petaid; this extends the abilities of Petaid version 1 to include random access files "thus allowing the user immediate retrieval of

Angry of Finsbury Park

Personal Software, my favourite program writing outfit in the world, has just blown it — for ever!

It's produced six programs to turn your nice micro-computer into a trashy TV programme. Just look at the titles . . . "Growing Up" — helps families cope with the teenage years . . . "Talking about Sex" — offers adults the proper information and appropriate attitude for a satisfying sex life. Aaaaaaargh!

Adda snakes ahead

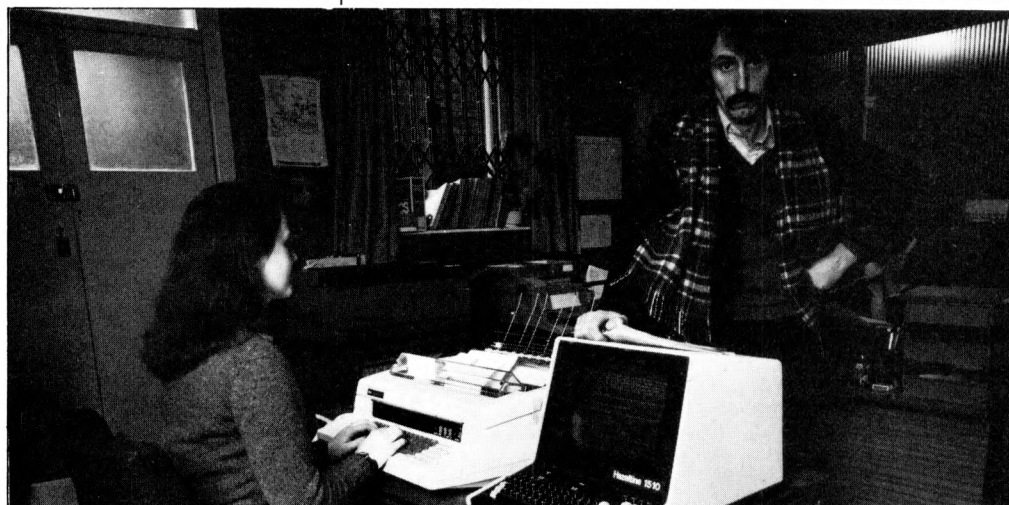
The computer store which originally opened in the West of London — in Ealing — has opened new marketing offices in the Capital's centre. Adda Computers is the name of the store; the new offices are at Abbott House, 1-2 Hanover Street, London W1. Phone 01-408 1611. The company is a PET dealer — more details

from managing director David Whitehead, who is at Ealing, tel 01-579 5845.

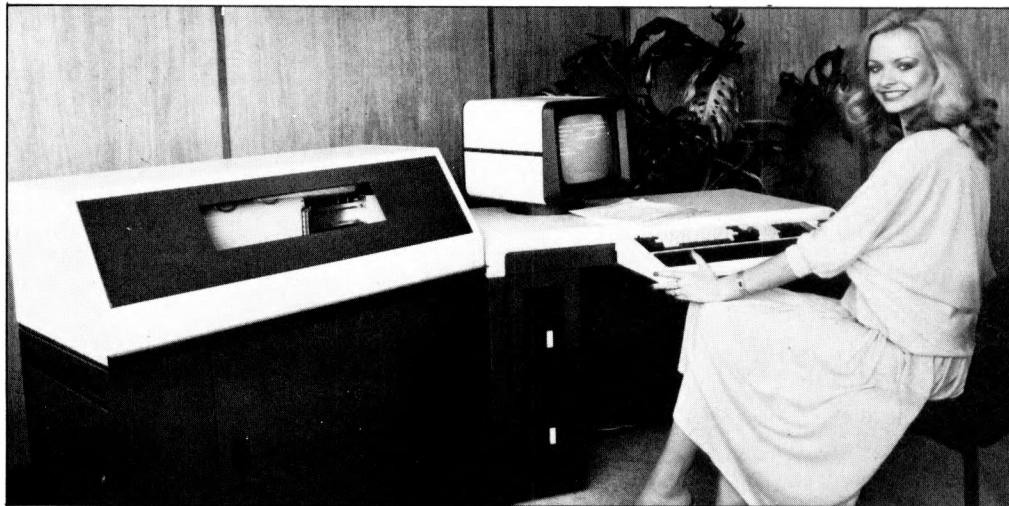
Stronger 6809 support

Software for Motorola's 6809 chip is still scarce, because the chip, an eight-bit data bus machine, has not been around long enough to have programs written taking advantage of its 16-bit internal arithmetic and logic unit. Fact: Technical Service Consultants (TSC) is by now accepted as one of the most reliable writers of software for the older 6800, usually as built into systems by SWTPC. Fact: SWTPC in this country will be importing the 6809-based SWTPC machine, not making it here.

All this is preparatory to saying that the TSC Basic for the SWTPC 6809 costs \$75, and will run on the \$500 computer; a statement which would otherwise not mean much. TSC also has written a version of the Flex operating system for \$95, and a debug package for \$75.



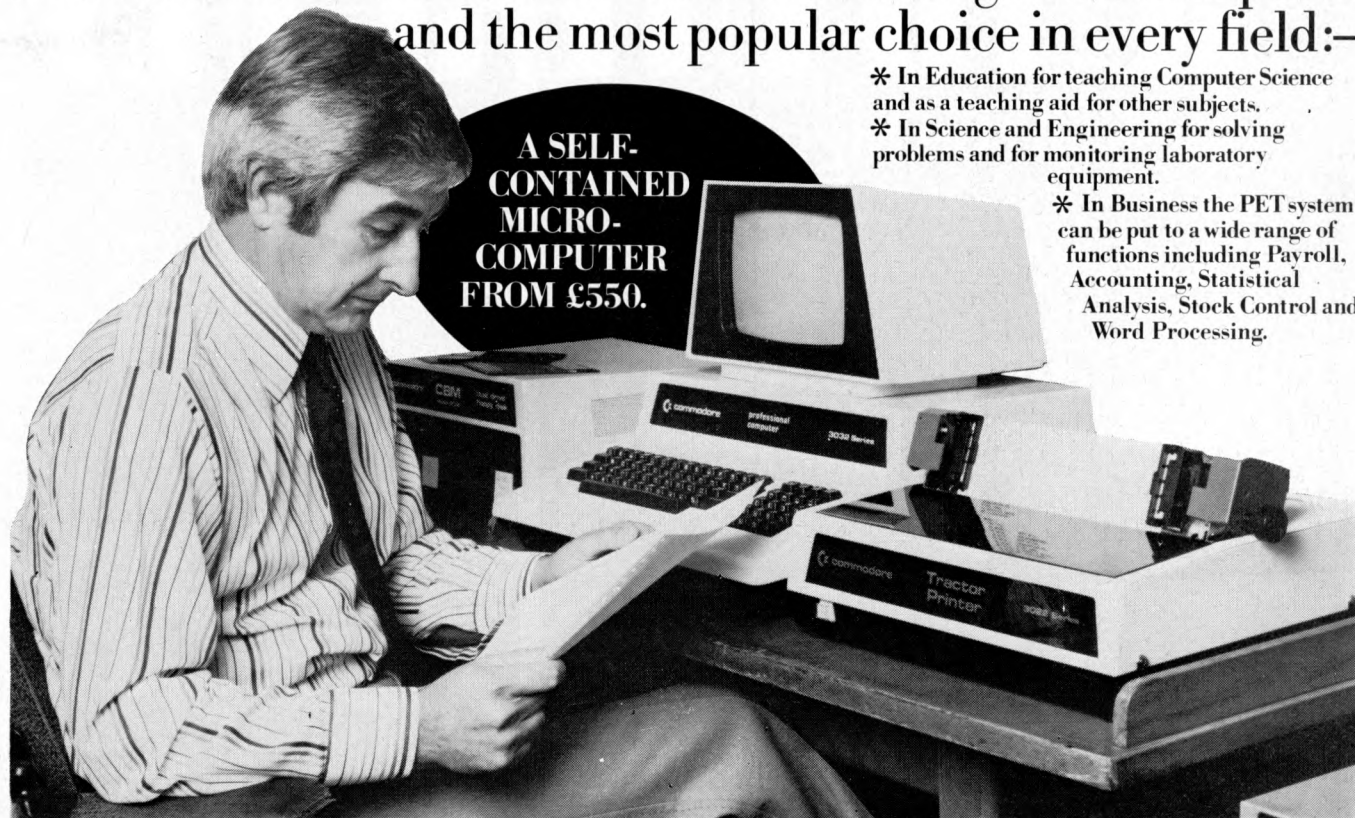
The software which turns this TEI based system into a word processor is called Magic Wand and costs £262 from Abacus. A complete system with NEC Spinwriter and diskettes costs £4900. The man with the light growing from his head is not an angry customer, but Derek Rowe himself. Details on 01-580 8841.



At £8500 with an enclosed (quieter) printer, two floppy discs and screen/keyboard, this Triumph Adler 1100C is a big change for the company. It was launched at the IMEC exhibition and the maker claims it is on one-week delivery from order.

Your Commodore PET System

The Commodore PET is Britain's best selling microcomputer and the most popular choice in every field:-



* In Education for teaching Computer Science and as a teaching aid for other subjects.

* In Science and Engineering for solving problems and for monitoring laboratory equipment.

* In Business the PET system can be put to a wide range of functions including Payroll, Accounting, Statistical Analysis, Stock Control and Word Processing.

Not least of its attractions is the price of a PET - from £550 for a self contained unit, to under £2,500 for the complete system including Floppy Disk Unit and high-speed Printer. Ask your nearest Commodore dealer below for details about Commodore hardware, software and training courses.

Our Dealer* Network

LONDON

Capital Computer Systems, W1. 637 5551
ACE (by Top TV Ltd), SW1. 7301795
Micro Computer Centre, SW14. 876 6609
Logic Box Ltd, SW1. 222 1122
Sumlock Bondain Ltd, EC1. 250 0505
Da Vinci Computers Ltd, NW4. 202 9630
L & J Computers, NW9. 204 7525
Adda Computers, W1 408 1611
CSS Business Equipment Ltd, E8. 254 9293
Advanced Management, EC2. 638 9319
Metyclean Ltd, SW1. 828 2511
Microcomputation, Southgate. 882 5104
T.L.C. World Trading Ltd, WC2. 839 3894

HOME COUNTIES

Orchard Electronics Ltd, OXON. 0491 35529
D. L. Chittenden Ltd, CHESHAM, 4441
J. R. Ward Computers Ltd, MILTON KEYNES, 562850
Dataview Ltd, COLCHESTER, 78811
South East Computers Ltd, HASTINGS, 426844
Symtec Systems Ltd, SOUTHAMPTON, 38868
Alphascan Ltd, BANBURY, 75606
Super-vision, SOUTHAMPTON, 774023
Millhouse Designs Ltd, ALTON, (042) 050374
Micro Facilities Ltd, MIDDX, 979 4546
DDM, BRENTWOOD, 230480
Stuart R. Dean Ltd, SOUTHEND, 62707
Alpha Business Systems, HERTFORD, 57423
HSV Microcomputers, BASINGSTOKE, 62444
HSV Microcomputers, SOUTHAMPTON, 22131
RUF Computers (UK), BURGESS HILL, 452111
Wego Computers Ltd, CATERHAM, 49235

T. & V. Johnson, CAMBERLEY, 62506
T. & V. Johnson, OXFORD, 721461
Petalect Electronic Services Ltd, WOKING, 23637/21776
Business Electronics, SOUTHAMPTON, 738248
Amplicon Micro Systems Ltd, BRIGHTON, 562163
Bromwall Data Services Ltd, HATFIELD, 60980/64840
MMS Computer Systems, BEDFORD, 40601
Isher-Woods, LUTON, 416202
Sumlock Bondain, NORWICH, 26259
CSE (Computers), READING, 61492
Oxford Computer Systems, WOODSTOCK, 811976

MIDLANDS & STH. HUMBERSIDE

Taylor Wilson Systems Ltd, KNOWLE, 6192
Betos (Systems) Ltd, NOTTINGHAM, 48106
Holbrook Business Systems, DERBY, 368088
Lowe Electronics Limited, MATLOCK, 2817
Davidson-Richards Ltd, DERBY, 366803/4
Arden Data Processing, LEICESTER, 22255
Tekdata Ltd, STOKE-ON-TRENT, 813631
C.S.M. Computer Systems, BIRMINGHAM, 360 6264

Business & Leisure Microcomputers, KENILWORTH, 512127
Caddis Computer Systems Ltd, HINCKLEY, 613544
Allen Computers, GRIMSBY, 40568
CPS (Data Systems) Ltd, BIRMINGHAM, 707 3866
Camden Electronics, BIRMINGHAM, 773 8240
Cliffstock (Computer Systems) Ltd, WOLVERHAMPTON, 24221

YORKSHIRE & NTH. HUMBERSIDE

Microprocessor Services, HULL, 0482 23146
Microware Computers, HULL, 562107
Computer Workshop, LEEDS, 788466
Hallam Computer Systems Ltd, SHEFFIELD, 663125
Ackroyd Typewriters Ltd, BRADFORD, 31835
Datron Micro Centre, SHEFFIELD, 585490
Yorkshire Electronics Service Ltd, MORLEY, 522181
Sheffield Computer Centre, SHEFFIELD, 53519

NORTH EAST

Dyson Instruments, DURHAM, 66937
Currie & Maughan, GATESHEAD, 774540
Wards Office Supplies, GATESHEAD, 605915

Tripont Associated Systems, SUNDERLAND, 73310
Newcastle Computer Services, NEWCASTLE UPON TYNE, (0632) 615325

SOUTH WALES & WEST COUNTRY

Computer and Design, BROADSTONE, 0202 697341
A. C. Systems, EXETER, 71718
Computer Supplies (Swansea), SWANSEA, 290047
Sigma Systems Ltd, CARDIFF, 21515
Devon Computers, PAIGNTON, 526303
Bristol Computer Centre, BRISTOL, 23430
J. A. D. Integrated Services, PLYMOUTH, 62616
Sumlock Tabdown Ltd, BRISTOL, 26685
Radan Computational Ltd, BATH, 318483
T. & V. Johnson Ltd, BRISTOL, 422061

NORTH WEST & NORTH WALES

B. & B. Computers Ltd, BOLTON, 26644
Megapalm Ltd, CARNFORTH, 3801
Tharstern Ltd, BURNLEY, 38481
Fylde Business Machines Ltd, PRESTON, 731901
Preston Computer Centre, PRESTON, 57684
RPL Microsystems, DOUGLAS, 4247/8

LIVERPOOL

Microdigital, LIVERPOOL, 227 2535
Rockliff Brothers Ltd, LIVERPOOL, 521 5830

MANCHESTER

Cytek (UK) Ltd, MANCHESTER, 832 7604
Executive Reprographic Ltd, MANCHESTER, 228 1637
Sumlock Manchester Ltd, DEANS GATE, (0618) 834 4233
Computer Workshop, MANCHESTER, 832 2269
Professional Computer Services Ltd, OLDHAM 061-624 4065

SCOTLAND

Microcentre, EDINBURGH, 225 2022
Thistle Computers, KIRK WALL, 3140
McAllister Business Equipment, EDINBURGH, 336 2402

IRELAND

Softch Ltd, DUBLIN, 784739
Medical and Scientific, LISBURN, 77533

*This is a list of dealers participating in associated advertising and not a full list.

commodore
We made small computers big business.

Commodore Information Centre, 360 Euston Road, NW1 3BL. 01-388 5702

THE BYTE SHOP & COMPUTERLAND

Still the biggest 6 in the country

London

48 Tottenham Court Road
London W185 4TD
Tel. 01-636 0647

Birmingham

94-96 Hurst Street
Birmingham B5 4TD
Tel. 021-622 7149 Telex. 336186

Nottingham

92a Upper Parliament Street
Nottingham NG1 6LF
Tel. 0602 40576 Telex. 377389

Ilford

426/428 Cranbrook Road,
Gants Hill,
Ilford, Essex IG2 6HW
Tel. 01-554 2177


Manchester

11 Gateway House
Piccadilly Station Approach
Manchester
Tel. 061-236 4737 Telex. 666168

Glasgow

Magnet House
Waterloo Street
Glasgow
Tel. 041-221 7409 Telex. 779263

Your six main computer centres, stocked up with new equipment for 1980. Complete systems carefully chosen for their reliability and availability. Plus the widest range of software for business, education and industry. For expert advice on which system suits you best call into one of the Big Six.



6 &

TINKERING WITH TECHNOLOGY

*From the House of Commons,
Ian Lloyd MP presents the first of his occasional
reports on matters associated with the
"micro revolution".*



When the editor kindly invited me to make a regular contribution to Personal Computer World I hesitated to accept on three counts. The first was that a continuing and even passionate interest in a subject which stems from an awareness of its great importance, does not qualify one to make intelligent comment, let alone to pass judgement on issues of significance. The second was the degree, and to some extent, the unpredictability of pressure on a Member's time. I foresaw deadlines arriving when the only time left in the week had been preempted by a batch of Select or Standing committee documentation which had to be read before the morning. The third was that I anticipated that there might be prolonged periods when Parliament, preoccupied with its conventional conflicts, would offer very little of interest to those readers of this magazine who, I assume, want to know what is being proposed and discussed in the House of Commons which has some bearing on the world of "information technology", "telematique" or "communications" — a bizarre, gaunt and disgraceful example of the jargon which the world of computers is inflicting on the English Language.

Your editor has, however, persuaded me that my thoughts might occasionally be of some interest and has generously agreed that I will only put pen to paper when time, opportunity and suitable topics of interest coincide. As a result I am, for the first time, succumbing to the temptation to build a small bridge between the readers of this magazine and what I know many in the world of computing consider — quite rightly — to be the remote, indifferent and largely disinterested world of Westminster.

We have, it is true, made a tentative start to improve this reputation. In the last Parliament, a Joint Select Committee of both Houses under Lord Darling's Chairmanship, recommended in a report that they should look more closely at what computing could do for them. That reactionary and elderly body, the House of Lords, proved in fact to be far less reactionary and arthritic than the Commons in responding to this proposal and moved rapidly and effectively to equip itself with modern data-processing back-up for its European legislation Scrutiny Committee. The

Commons permitted a series of equipment demonstrations and the libraries of both Houses made perceptible progress in appraisals, investigation and trials. The Select Committee which investigated the Steel Industry in 1976 took the bold step of insisting on modern information back-up for its deliberations and actually created and used models and databases — to some effect. But since then the House has fallen back, exhausted and disoriented by the experience. Our total expenditure on modern information technology cannot amount to more than 0.1 per cent of the total budget of Parliament. The exception to this rule of extreme caution is the recent introduction, as a service to Members, of the Treasury Economic Model. This has been used by a round dozen Members and by the staff of the Commons library, who act as advisers and intermediaries. For, after all, the average Member finds a computer terminal a most forbidding and nerve-racking object. My guess is that it will be fifteen years, at least, before this situation changes. I base that forecast on the assumption that it requires about a hundred like-minded

characters in this place to achieve a change which not all may perceive to be necessary. And it will be fifteen years before there is a probability that a hundred Members of the Commons will have had a general education which was based on relatively modern concepts of information processing. They will then demand, and obtain direct, on-line, access to the world's integrated data-base system (as I suspect it will then be if we have not blown ourselves and our data-bases to pieces).

In 1979 Parliament made progress in two other significant directions. We established, after some considerable difficulty, an All-Party Committee on Information Technology. This has set out, with some success, to beat the drum of the industry and the technology. Modern equipment has actually been seen operating within the precincts. Members scurrying from the Committee corridor through the Upper Waiting Hall in December might, had they paused for a moment, have seen the Order Paper for the day on a television screen called up from the viewdata memory in which it had been placed. The Leader of the House, whom I pester

every Thursday with demands for a two-day debate on microelectronics, assured me he had actually seen it. But I remain confident that it will be at least fifteen years before those with viewdata terminals will be able to call up and read the business scheduled in the Commons that day. Until then it will continue to be printed by the technology of Gutenberg and delivered by another even more venerable — a man on foot.

The other direction in which we have made quite considerable progress is in our appreciation of the fact that the microprocessor is likely to be a device of some considerable social and political significance. In 1975 the word was completely unknown. Today, even if we still await an opportunity to debate what every second conference in the country has been discussing, politicians are aware that they should heed the advice Lady Bracknell gave to her daughter in "The Importance of Being Earnest" about not being misunderstood on the platform. She was, of course, referring to Waterloo.

Parliament is beginning, then, to tinker with information technology, but the Chamber, our voting procedures, our Committees and our control of the legislative process still remain immune. This could change quite rapidly as we become more aware of invidious comparison. The most invidious are those made between ourselves and the U.S. Congress. The Bundertag is also moving rapidly ahead. The Japanese Diet has had an Information Technology Committee since the late 60s and the concept of the "Information Society" originated in that country. Last week the parvenu institution, the European Parliament, introduced an electronic voting system designed by Olivetti. But my own judgement is that one day a Government will be flooded, effectively and conspicuously by a young backbencher who has reinforced a natural capacity to ask the right questions with a highly skilled understanding of data-bases and systems analysis. On that day the House will rediscover the relationship between information and power and will appreciate that modern information technology alone will equip it to meet the Executive on equal terms.

Illustration by Ingram Pinn

PCW welcomes correspondence from its readers. Be as brief and concise as possible and please add "not for publication" if your comments/questions are to be kept private.

Address letters to: "Communications", Personal Computer World, 14 Rathbone Place, London W1P 1DE.

Pretty pictures

I must say how much I enjoyed John Yale's 380Z picture program. Very interesting results and an even more interesting program. I have yet to discover how the inter-related macros in lines 1440 and 1450 are unravelled. Can anyone explain please?

Anyone using one of the early 380Zs with a different VDU mapping, must substitute 3136 for 62656 in line 1360.

Due to typing errors (on my part) I spent some time debugging and trying to fathom the subroutine at line 1360—, and discovered a more visible and rather quicker solution. Each character cell is divided into a 2 x 3 array of graphics blobs, with one data bit of 6 assigned to each blob. The decimal equivalent of each control bit can be stored in a small array and used as a look up table.

0	1	Y1=2	1	2
2	3	Y1=1	4	8
4	5	Y1=0	16	32

X1=0 X1=1

Stored in XY(X1,Y1)

I added the following lines

```
24 DIM XY(1,2)
25 XY(0,0)=16:XY(0,1)=4:XY(0,2)=1
26 XY(1,0)=32:XY(1,1)=8:XY(1,2)=2
```

and changed these to:
1380 X1=X-2*INT(X/2)
1390 Y1=Y-3*INT(Y/3)
1400 P2=P2 AND XY(X1,Y1)

During the struggle with SUB 1360 I resorted to a bulldozer switch on wrap-around to prevent white screens. This effect is cancelled if S is selected.

Add to lines 820 through 850 the statement : P5=1

Add 855 IF P5=1 THEN IF P1=0 THEN P1=2 ELSE P1=0

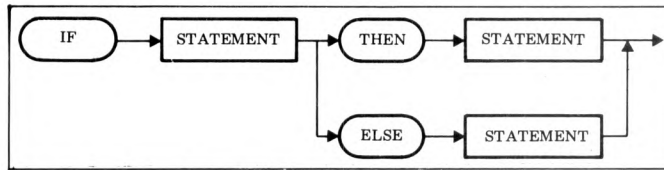
856 P5=0

This produces another pattern set, and some amusing effects.
R.W. Stranks, Cheltenham.

Pascal 1

January's "Complete Pascal" contains a diagram (box 2) illustrating the IF-THEN-ELSE syntax. Surely this is incorrect. Shouldn't the ELSE branch occur if the first expression is false as in the following diagram?

R. J. Gerrard, High Wycombe



We see what you mean and your proposal would be quite reasonable if ELSE were mandatory. The syntax diagrams, however, always reflect the logic of the compiler which, in this case, always expects a THEN whereas the ELSE is optional — Ed.

Burning Chips

The January PCW under the "Newsprint" flag had a short article called "Spiking the System" suggesting the worst thing you can do to your computer is to turn it off.

I appreciate that the main point of the article concerned itself with mains spikes but surely the first statement cannot be allowed to go unchallenged.

I had always thought that thermal ageing led to the eventual death of most electronic components and I note that my EPROMs run quite hot whilst neither the memory chips nor the CPU are quite cold.

I feel sure myself that leaving them running is likely to cause quicker demise than turning off when finished quite apart from the fact that a computer usually has a cathode ray tube which will certainly wear out whilst some even have fans, those horribly noisy mechanical devices with near plastic bearings grinding themselves to bits in abrasive dust.

How about seeking some definitive statement from a chip manufacturer — myths grow too easily.

B. R. Smith, Herne Bay

Definitive statement courtesy of Zilog coming up. Power surge and temperature fluctuation are more likely to cause problems than heat alone. In fact, even in a properly designed system, EPROMs do tend to run rather warm. So, Mr Smith, the verdict is that switching on will introduce the dreaded power surge, while switching on and off will cause temperature fluctuations. However, you are absolutely right when it comes to

electromechanical parts — these will definitely suffer from continuous use. — Ed.

Yes and no

When describing the recently published book called "Some Common Basic Programs" by Osborne/McGraw Hill, some surprise was shown by Guy Kewney in respect of the use of 0 or 1 instead of YES or NO, for input statements.

As any PET user will have discovered, when using YES as a string constant for use in a YES/NO answer situation, it is possible to cause the same effect by typing the letter Y (or any other letter or number) instead of the whole word YES.

Unfortunately, if the single letter N is typed instead of the whole word NO the true meaning will not be interpreted. In fact, if any other single letter or combination, other than the actual word NO, is typed before return, a YES answer will be interpreted.

In short while Y implies YES, N does not imply NO. Inexperienced users could become confused by this, while a user in a hurry could easily type N in mistake for NO. Consequently for beginner programmers it may well be simpler to avoid the use of string constants and remove the above anomaly.

Finally, I would like to mention that the same comments apply when using the BASIC provided by our own mainframe computer at this University, the cost of which, unlike the few hundred pounds of the PET, runs into well over £1,000,000.
D. Jones, Bath

The comment at the end of Newsprint was made by our technical editor, who still claims that Y and N are more user friendly than 0 and 1. He even goes on to suggest a small routine along the lines of:

```

IF LEFT$(A$,1)="Y" THEN.
IF LEFT$(A$,1)="N" THEN.
  
```

GOTO . . . (a retry routine)

The exact format would depend on the particular BASIC dialect in use — Ed.

Pascal 2

Your "guidelines for contributors" request them to check articles thoroughly for accuracy. It is a pity that the authors of your Pascal (not "PASCAL") series appear to ignore this advice. The following are by no means the only errors in Chapter 5, January 1980.

- IF statements do not end with semicolons (and neither do CASE nor any other statements) — as in English, Pascal semicolons are separators, not terminators;
- "i.e. ASCII" should be "e.g. ASCII" — this is not a quibble, for Pascal is machine-independent and thus it does not assume any particular character code;
- line 33 of SALES-LEGDER (enough said!) must have parentheses around both comparisons;
- EOLN is not a reserved word;
- there is no such operator as "NOT IN".

The examples violate the spirit of Pascal as badly as the letter. They are badly laid out and make poor use of Pascal's freedom in choosing identifiers. They are also badly structured and some are algorithmically incorrect.
William Findlay, Glasgow

Sue and Chris' reply:

"a) In both our programs and our text we use semicolons as statement separators. A PASCAL-like statement in the text such as IF condition THEN statement ELSE statement to point out where it is allowed—that is we were saying — never put a semicolon before the ELSE.
b) Correct — we are so used to micro implementations that we tend to think of characters as ASCII codes.
c & d) Mea culpa! This was a real Monday morning program where more than the name came out backwards.
e) In our Look Up Table we use the term Reserved Word in the loose sense to mean a special PASCAL word that should not be used as an identifier.

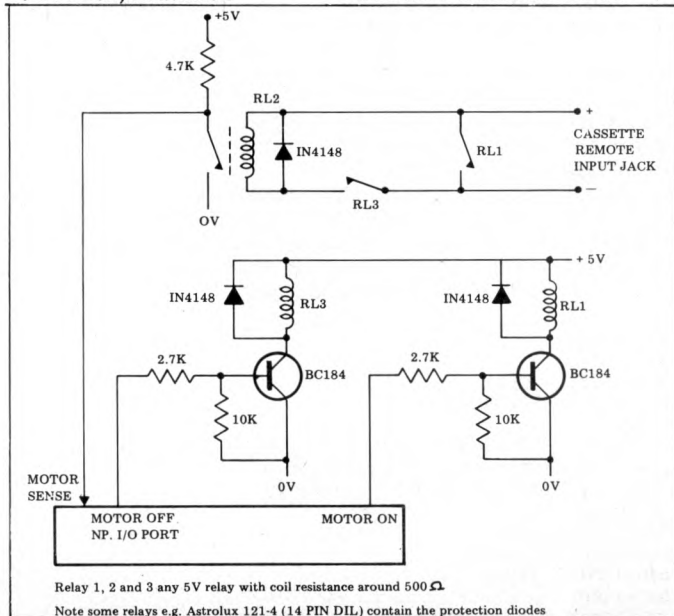
Turning to the more general points — we use PASCAL to distinguish the language from the man (Pascal) and the unit of pressure (pascal).

We produce examples from a range of applications which are programmed in an informal style on a variety of different systems. At the same time we follow, fairly strictly, a reasonable set of layout and structuring rules. Other sets of rules exist but these are surely questions of taste and don't warrant such vehemence."

Cassette control

This circuit provides remote sense and control of an audio cassette recorder in use with home computer systems. An I/O port provides the necessary interface to the microprocessor and a 2.5mm jack plug, via the remote input, to the audio cassette recorder. If no remote input is available then a normally closed jack socket can be inserted into the motor supply lead. Relay 2 provides a positive output when the cassette motor is activated by the cassette control keys, provided relay 3 contacts are closed. In some cases the relay 2 coil is in enough to prevent the cassette motor from running. In this case relay 3 can be omitted. Relay 2 will however prevent the motor from running properly. Relay 1 is used to bypass the relay 2 coil and so provide full power to the motor.

Relays 1 and 3 are provided with transistor drivers to provide the necessary low current interface to the microprocessor I/O port. S. Cornish, Bracknell



Relay 1, 2 and 3 any 5V relay with coil resistance around 500Ω

Note some relays e.g. Astrolux 121-4 (14 PIN DIL) contain the protection diodes

Winning strategy~part 3

In his letter published on p. 41 of the January PCW, Alex G. Bell whines about the winning strategy for Othello for which he paid me £2.50. OF COURSE I didn't say that "both sides will win"! Does he think that anyone will believe that? I revealed to him what Petsoft's Super Othello's Achilles' Heel is and how to use it to win. Why doesn't he mention that? If my technique is "a good rule of thumb", why isn't it built into the 4 or 5 Othello programs he mentions? Yes, use my technique and avoid traps, and you will win! However, the offer is withdrawn, as I don't have time to hold hands with every tyro who doesn't know how to avoid traps! In conclusion, let me say that Alex G. Bell was the only respondent from whom I received any objections. Let him go back to inventing the telephone; he will never get any more help from me! F. T. Chambers, Co Mayo, Ireland

Thank you Mr. Chambers, and goodnight. We feel that, both points of view having been aired, now is the time to close correspondence on the subject — Ed.

Genie vs Pet

I was annoyed to see that in your review of the Video Genie you referred to the PET numeric keypad as a "gimmick".

The numeric keypad is in fact very useful as it enables you to type in numbers and arithmetical



"Francis has his own language translator — strictly for the birds!"

operators much faster than using an ordinary QWERTY keyboard.

Just as important is the fact that without the numerals on the top row of keys you can have the symbols there which you normally have to shift for without shifting — eg the ") \$ # symbols, etc. These are used in BASIC programming a lot and having them available on the PET without having to shift saves a lot of time and effort; you can write a whole BASIC program without having to touch the shift key except when using the graphics.

So much for the "gimmick"! Jonathan J Dick, Bristol

Point taken. Our comments came from a TRS-80 fanatic. Need we say more? — Ed.

Fictitious fax

Getting involved in industrial control applications we purchased an Acorn to learn about microprocessors. The user's manual left a lot to be desired due to numerous printing errors and bad grammar. Nevertheless we have persevered and are beginning to make some sense out of it. We were pleased to see in your February issue the 6502 mnemonics, but to our dismay found further discrepancies upon which we would appreciate your comments.

Acorn manual omissions are 20, 38, 78, F8 and confusion at 4A and 5A. PCW omissions according to Acorn are at 76, 89 and 7E. A copy is enclosed for your reference. We do not wish to cause any embarrassment but trust you appreciate our efforts which may help some other poor struggler. D. Goodall, Dewsbury.

Spurred by your letter, our technical editor spent hours checking the Rodney Zaks book "Programming the 6502". Not only did he unravel the answers to your questions but he also noticed a number of other mistakes in which either the bit patterns were correct but converted into hex incorrectly or vice versa. To answer your specific points: 20, 38, 78, F8, 4A and 5A were all correct in PCW. 76 and 7E are both ROR instructions being zero page, X and absolute, X respectively.

Unfortunately, we ran out of time on the current issue to check every single code so should we encounter any more discrepancies we shall publish them next month — Ed.

Discerning reader

Congratulations on saving me up to £1.60 every month. Why? There was a time when I felt compelled to buy one or more of your rival magazines. I don't bother any more and the way PCW's standard has been rising, I expect other readers are feeling likewise.

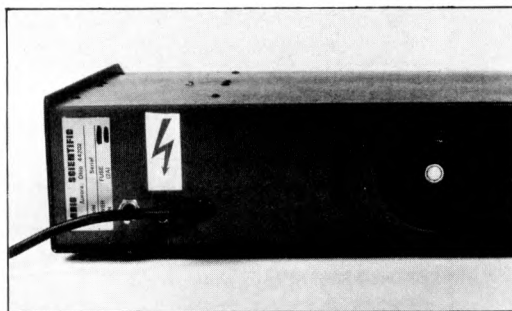
But just in case such praise goes to your head (and no letter is complete without a moan), in my February issue I counted no fewer than 7 pages devoted to In Store. I realise that PCW, unlike others, does actually update the list every month; even so, all those pages? Mervyn Burridge, Nottingham

We beat you to it — our art-room whizzkids have now successfully compressed In Store down to half its previous size. And we're keeping it; feedback tells us that it's generally much appreciated — Ed.

**BENCH
TEST**

CHALLENGER C2-4P

by Mike Dennis



Above: Looking at the back of the C2-4P note the "busy little finger" holes.
Right: A general view.

Ohio Scientific has been around for a long time and markets a wide range of computers that starts with the Superboard and ends with the mighty Challenger 3. For some inexplicable reason, they never seem to have had much exposure over here and so it was with some interest that I undertook the review of this particular model. The Challenger 2 series is in the middle of the range and is claimed to be "professional", portable and highly expandable". It was with these claims in mind that I carried out the review.

Hardware

The C2 range itself comes in a variety of options. The version that I had was without floppy disc drive but with 8K of memory. It comes ready built in a typewriter style metal case with room for a TV or monitor to stand on top and 6 unlabelled phono sockets at the rear. It's quite a robust case and the system, weighing, about 12lbs, is easily carried.

The keyboard has 53 keys with the added facility that the values of the keys can be user defined. All the keys feature auto-repeat and there is a peculiar inter-relationship between the Shift Lock, Left Shift and Right Shift keys. Normal entry is with the Shift Lock down at which time upper case letters are produced and the shift keys work normally to produce punctuation marks or numerals. When Shift Lock is released, all hell breaks loose! No seriously, it's not as bad as all that even though at times I began to wish that I had a couple of extra fingers growing out of the bottom of my wrists!

With no shift key pressed, letter keys produce lower case letters (with a little descender where necessary). To produce upper case letters then press Left Shift and the letter. To get numerals and those punctuation marks that live on the bottom half of keys, press Left Shift and the required key together (notice it's the opposite way logically thinking to the letter keys). To get the upper punctuation marks then press Right Shift and the required key together. Pressing Right Shift and a letter key produces unexpected results. Incidentally, you have to hit Return and

Left Shift to terminate the line when Shift Lock is released. This quirk of the keyboard is only of real consequence if you intend to do any word processing and normal operation with Shift lock in the down position yielded no problems at all.

A fan is fitted as standard to keep the "works" cool and on the review sample, it was noisy (I seem to be plagued with noisy fans). On a more serious note it needs a better guard to stop little fingers from coming to a premature end - OHIO PLEASE TAKE NOTE. Inside, the "works" are assembled on two high quality pcbs that contain the VDU and the CPU section.

The VDU is rather clever as you can either switch to 32x32 (actually it's 30 lines by 32 characters) or 32x64 by poking to 56900 with 0 to 1 respectively; each character slot occupies an 8x8 matrix. Furthermore, the terminal width can be altered in size to suit either the printer or a poorly adjusted TV. Mutek (the dealers who supplied the Challenger for review) have modified the VDU to the British TV standard and the result is most satisfactory; one really needs a good monitor to do justice to the 32x64 format.

An RF modulator is also fitted to which, normally, the video output socket is connected. On the review sample, the signal from this was so bad that I temporarily bypassed the modulator and fed the video signal directly into my rather ancient monitor and had no more problems. Mutek say that usually the modulators give no problem and I am prepared to take them at their word.

The VDU also features a total of 256 characters and includes numerous graphic and gaming characters like

tanks, men and planes, and provides ample opportunity for extremely good graphics. The screen display is very fast and can be accessed by the computer directly. Mutek claim that the VDU board utilises special circuitry to minimise screen disturbance during video accessing. This may be so but on the review sample some disturbance was visible, though not particularly disturbing. Space is available on the VDU board for American (NTSC) type colour generation but, of course, it's unusable over here and I don't know whether or not anyone has plans for a colour add-on.

The VDU has three bonus features incorporated, namely an audio output, DAC and AC control! The audio control is a programmable divider whose division ratio (audio frequency) can be changed by POKING location 57089. This tone can be turned on or off by POKING 56832. The output of the divider is filtered and can be fed into an audio amplifier input. This divider is also used by the Digital to Analogue Converter which has an 8 bit logarithmic law. Machine code programs are given that show how to use this output. This time, the output of the divider is unfiltered and can again be fed into an amplifier.

The AC control, although needing a separate interface to operate external equipment, is nevertheless still a very useful facility. Little documentation (of which more later) is provided on this but from the circuit, the output appears to consist of a 40KHz square wave that is switched on and off by POKING a particular location. Altogether three very useful, hardly publicised facilities that extend the usefulness of this computer.

The VDU board comes with its own 2K of static RAM and resides from D000 to D7FF inclusive. The crystal controlled oscillator on this board is used as the 1MHz clock to the CPU card.

The CPU card contains up to 8K of static RAM, the 8K BASIC ROM and also a 1K monitor ROM (although only 768 bytes are used according to the blurb from Mutek).

TECHNICAL SPECIFICATION

CPU 6502:	1MHz (2MHz opt)
Memory:	8K static RAM (2114)
Keyboard:	see text
Screen:	30 x 32 or 64 x 32 (software switchable). Good graphics,
Cassette interface:	upper and lower case (with descenders) Kansas City 300 baud (600 baud opt)
Printer:	not tested
Bus:	OHIO 48 pin bus
Software:	Microsoft 8K BASIC Basic Editor (tape)
Floppy disc:	not tested

System Operation

At switch-on the user must hit the Break key (which functions as a Reset). The screen is cleared and C/W/M? printed. Remembering to press Shift Lock (!) M will take you into the machine code monitor, W is a warm start and leaves the program intact and C is the cold start. This prompts with MEMORY SIZE? and the user can enter a limiting value, thereby reserving memory space for user routines. If a Return by itself is entered then the monitor will test the available memory and a 8K system should reply with 7423 bytes free. TERMINAL WIDTH can then be set if desired (it defaults to 72 for the printer) and then you are in BASIC — it's as simple as that.

The monitor is fairly elementary — nay, very elementary. You can load, examine and change memory, save and load a program on cassette and you can execute a program — and that's it. I was given a tape of OHIO's extended monitor and on it are such nice features as a disassembler and a memory relocater. Unfortunately, the copy of the tape was so poor that it proved impossible to load satisfactorily... a shame as I would like to have put it through its paces. Certainly for £8 it seems very good value. One minor criticism is that nowhere in the documentation could I find where it lived in memory and thus hopefully remember not to overwrite it with any machine programs.

System software

The BASIC comes from the same stable as Apple's and so has a good pedigree. It has been written by Microsoft and is claimed to out perform (in speed terms) most commonly available computers. I ran the standard Bench Mark programs and as you can see this claim is certainly upheld — the BASIC is very fast. Don't forget either that these were run on a clock rate of only 1MHz! The only sacrifice (if in fact it really is a sacrifice in practical terms) is that the precision of the arithmetic calculations is only 6½ digits. Should you wish for extra precision, then a 9½ digit BASIC is available but only on disc and it will run slower — swings and roundabouts. The available BASIC commands are listed elsewhere and as you can see most of



The CPU, the 6502, normally runs at 1MHz but can be easily modified to run at 2MHz. A Kansas City standard audio cassette interface is provided which runs at 300 baud (with an optional modification to 600 baud). It worked well with my own recorder once I had experimented a bit with the levels required. The overall impression is that it's reasonably fast and a 4K program will load in approximately 3mins. As the program is loaded from cassette, it's automatically listed on the screen, which I think is a great idea. A similar action takes place when saving, so at all times the user can see exactly what is going to and from tape. Routines in the BASIC manual tell you how to store data and sequential files on tape.

The actual cassette loading routine seems also to be fairly robust and manages to sort itself out even if some random "garbage" is deliberately introduced on the tape. A syntax error message will result but the load will then carry on to the next good bit of data leaving the user to rewind past the bad bit for another attempt at loading.

An RS232 interface is also provided (well, the pcb foils are there and Mutek can make the necessary modifications should you wish). Personally, I would have thought that for the handful of components required it would have been worth putting it in as a matter of course — you might like to suggest that they do that if you decide to buy one!

The two boards are connected together by a mother board and the OHIO 48 way bus. This uses Molex type sockets and is claimed "to look ahead to the next generation of 16 bit CPU's". This is a bit misleading as at present only 12 bidirectional data lines have been specified although up to 20 address lines can be used. Six control

lines, two interrupts and three power lines complete the line up.

The Challenger 2P has a 5V only power supply and the consumption of the boards is about 3 Amps. This power supply has been modified by Mutek to 240V working by substituting the mains transformer; the primary is used as an autotransformer to feed the fan. It seems to me that the transformer is rather underrated in its specification as it does tend to run hot. Mutek say that a custom designed transformer is under development to eliminate this minor problem. There's room and a mounting bracket available for a second supply to drive any boards that are plugged into the remaining two spare holes on the mother board. The mounting of the boards inside is best described as "adequate".

BASIC COMMANDS

CONT LIST NEW NULL RUN

Statements

CLEAR	DATA	DEF DIM	END	FOR..NEXT
GOTO	GOSUB	IF..GOTO	INPUT	LET(opt)
IF..THEN	ON..GOTO	ON..GOSUB	POKE	PRINT READ
REM	RESTORE	RETURN	STOP	

Expressions

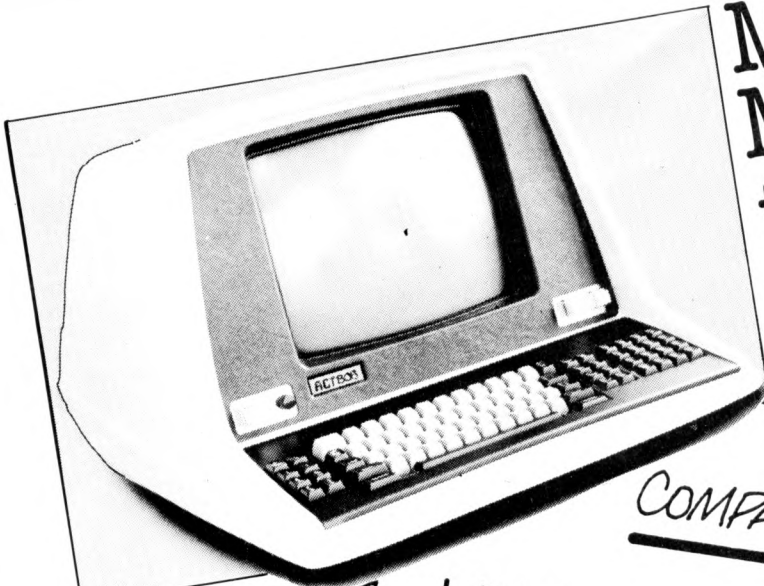
Usual arithmetic and logical functions. Range $^{-32}$ to 10^{32} .

Functions

ABS(X)	LOG(X)	SPC(I)
ATN(X)	PEEK(I)	SQR(X)
COS(X)	POS(I)	TAB(I)
EXP(X)	RND(X)	TAN(X)
FRE(X)	SGN(X)	USR(I)
INT(X)	SIN(X)	

String Functions

ASC(X\$)	CHR\$(I)	FRE(X\$)	LEFT\$(X\$,I)	LEN(X\$)
MID\$(X\$,I,J)				
RIGHT\$(X\$,I)	STR\$(X)	VAL(X\$)		



Meet tomorrow's Microcomputer — the advanced **ACT series 800**

COMPARISON CHECK LIST

DATA	TYPICAL DESK TOP MICRO	ACT SERIES 800
1. High Resolution Graphics	X	✓ 122,880 addressable Points
2. Floppy Disk Storage	up to 1Mb	up to 4.8 Mb
3. Total Semi-Conductor Memory	up to 64Kb	up to 108Kb
4. Full Size Screen	X	✓ 1,920 Characters
5. Programmable Characters Standard	X	✓ 3 Complete Character Fonts
6. Data Transfer Rate from Disk	up to 8.5Kb per sec.	up to 15 Kb per sec.
7. National Field Service	X	✓

Tomorrow's
Micro built in
California by Compu-Think
Inc. for Act—Britain's leading
computing company

ACT SYSTEM 808—800Kb of disk storage
£3,950 + VAT

ACT SYSTEM 824—2.4f.b of disk storage
£4,950 + VAT

Complete business systems incorporating the Series 800 with Centronics Printers and
ACT's own Powerful Nebula 2 Software are also available. Prices correct at time of going to press.

ACT series 800

Complete the coupon for full details and the name of
your nearest dealer who can arrange an immediate demonstration.

My Name _____

My Address _____

Tel: _____

£19.45pw.*

*5 year lease. Shorter terms available.

ACT

MICROSYSTEMS

*total
Computing*

Radclyffe House,
66-68 Hagley Road,
Edgbaston,
Birmingham B16 8PF.
Tel: 021-455 8686
Telex: 339396

Try the ACT 800 series computer at one of these dealers now:

- LONDON**
Lion House (Retail) Ltd.
 227 Tottenham Court Road, London W1P 0XH
 Tel: 01-580 7383
- THE SOUTH**
Petalec Electronic Services
 32 Chertsey Road, Woking, Surrey
 Tel: 04862-21776/23637
- Business Electronics**
 Rownhams House, Rownhams, Southampton
 Tel: 0703-734015
- RUF Computers**
 System House, Victoria Way, Burgess Hill, W. Sussex
 Tel: 04446-45211
- T & V Johnson (Microcomputers) Ltd.**
 165 London Road, Camberley, Surrey
 Tel: 0276-62506
- South East Computers Ltd.**
 4 Castle Street, Hastings, Sussex
 Tel: 0424-440099
- HSV Business Systems Ltd.**
 May Place, Basingstoke, Hants. RG21 1NX
 Tel: 0256 62444
 Southampton Street, Southampton, Hants.
 Tel: 0703 22131
- Wilson Hughes and Partners (Data Sciences) Ltd.**
 18 Chequers Square, Uxbridge, Middlesex UB8 1LN
 Tel: Uxbridge 53322
- The Accounting House Ltd.**
 54 London Road, Malden, Surrey SM4 5BA
 Tel: 01-640 9331
 Thyssen Rhein Stahl House
 Molly Millars Lane, Wokingham, Berkshire RG11 2PU
 Tel: Wokingham 783434
 52 High Street, Chatham, Kent ME4 4DS
 Tel: Medway 402718
- SOUTH EAST**
Senodiak Ltd.
 34-36 St. Helens Road, Westcliff-on-Sea, Essex
 Tel: 0702-352590
- The Computerist (Prorole Ltd.)**
 642 London Road
 Westcliff-on-Sea
 Essex
 Tel: 0702-335298
- SOUTH WEST**
ACT Bristol Ltd.
 Graphic House, Telephone Avenue, Bristol BS1 4BS
 Tel: 0272-211733
- EAST MIDLANDS**
HB Computers
 22 Newland Street, Kettering, Northants.
 Tel: 0536-520910/83922
- Lowe Electronics Ltd.**
 Chesterfield Road, Matlock, Derbyshire DE4 3HE
 Tel: 0529-2817/2430
- Arden Data Processing Ltd.**
 Municipal Buildings, Charles Street, Leicester
 Tel: 0533-22255
- Office Computer Techniques (Middletron)**
 Highcroft, Husbands Bosworth, Lutterworth, Leics.
- MMS (Steenmoor) Ltd.**
 26 Mill Street, Bedford, Beds.
 Tel: 0234-40601
- Caddis Computer Systems**
 72-74 Trinity Lane, Hinckley, Leics.
 Tel: 0455-613544
- A.J.R. (Office Equipment) Ltd.**
 3 Church Drive, Daybrooke, Nottingham NE5 6JP
 Tel: 0602-206647
- Hallam Computer Systems**
 1 Berkeley Precinct, 451 Eccleshall Road,
 Sheffield S11 8PN
 Tel: 0742-663125
- EAST ANGLIA**
Sumlock Bondain (East Anglia) Ltd.
 Grosvenor House, 32 Prince of Wales Road,
 Norwich, Norfolk
 Tel: 0603-26259
- WEST MIDLANDS**
Taylor Wilson Systems Ltd.
 Oakfield House, Station Road, Dorridge,
 W. Midlands B93 8HQ
 Tel: 021-560 6192
- MERSEYSIDE**
Stack Computer Services Ltd.
 290-298 Derby Road, Bootle, Merseyside L20 8LN
 Tel: 051-933 5511
- D.A.M.S. (Office Equipment) Ltd.**
 30-36 Dale Street, Liverpool 2
 Tel: 051-227 3301
- Aughton Automation Ltd.**
 Woodward Road, Kirby, Liverpool
 Tel: 051-548 6060
- MANCHESTER**
Cytek U.K. Ltd.
 12 Exchange Hall, Corn Exchange Building,
 Manchester M4 3EY
 Tel: 061-832 7604
- SCOTLAND**
Robox Office Equipment Ltd.
 UnR 14, Anderson Shopping Centre, Argyll Street,
 Glasgow G2 7PH
 Tel: 041-221 5401

the usual ones are present. I have, in fact, only two minor gripes. The first is that you can't easily enter control codes as data entry (numeric or string variables) as the program aborts. There are ways round it, however, possibly via the user definable feature of the keyboard. The second is that there is no true backspace and therefore easy character deletion. True, you can remove the last character with Shift 0 but the cursor does not backspace nor even reprint the character — as occurs on some systems that rely on TTYs for data entry. What does happen is that a hyphen is printed for each character deleted and you have to make a mental note when deleting more than one. However, as I say these are only minor gripes.

Mutek sent me a host of cassette tapes which included a Basic Line Editor by Sirius Cybernetics. This did feature a true backspace and was quite a useful package. It ran a bit slow, however, and you could easily beat it from the keyboard. To be fair they do point out this fact in the user text, suggesting that you operate at 2MHz or failing that, offer a fix to slightly speed things up — which is most commendable. I had great fun playing Breakthru' and can thoroughly recommend it. Many of these programs are ridiculously low in price and anyone who pirates a copy is just plain mean.

Ohio supply a Sampler Program cassette which proved indescribably, pathetically useless. Virtually every program had syntax errors and needed debugging before continuing. Mutek tell me that they use OHIO tapes for testing purposes only and heartily agreed with the quality of the programs on this tape — lousy!

Expandability

The Mutek price list features many expansion units for this system. They range from extra memory, through real time clocks, to a Centronics printer interface. To upgrade to a floppy disc is relatively painless and fairly cheap — it largely depends on what Mutek have in stock as there are several ways of achieving floppy status. If you are going to expand considerably then you ought to consider a slightly bigger version (the C2-8P) which has 6 slots on the mother board. Whichever way you go, I understand from Mutek that they offer generous trade-ins as you upgrade. Don't forget the extra facilities that are already provided — viz. audio, DAC and AC control.

Business & education potential

Serious business use will require at least one floppy disc drive and ideally two. Since the floppy disc controller indeed supports two then the hardware capability is there. There is no reason why much of the business software written for other Microsoft machines should not run on the Challenger with a little bit of modification. If you want to teach machine code programming then this machine is not for you. Admittedly, you can use the Extended monitor but since it's in RAM it's not robust enough for education. . . it crashes too easily. Quite frankly, I don't think that this

machine was every really aimed at the educational market so my comments are largely irrelevant.

Documentation

Oh boy, oh boy, oh boy — so you thought Commodore's PET documentation was bad? When OHIO documentation is good, it's very good but for the most part it's bad — very bad. There's no clear concise explanation of anything — even connecting up to the TV takes several sides of confusing options, and they can't seem to make up their minds whether to call the machine the 2P or C2-4P! It's very difficult to be objective with the criticism, it's so bad. What's desperately needed is simple instruction on how to connect everything up, turn on and what to do next. They've tried, and failed miserably. One gets the overall impression that much of it was written by several people who were inadequately briefed on what they were supposed to cover; as a result there's a great deal of duplication in the text. Such documentation doesn't inspire confidence in the machine — which is a shame. Still 'nuff said — when in doubt read the manual. It's all there — it just needs looking for. . . um, it's not *all* there — they don't supply a memory map!

Potential use

It's definitely for the person who wants a good ready-built machine with plenty of expansion. There are a lot of facilities for the money and it's immediately expandable to floppy disc — no false promises of "it will be ready in January . . . er, March. . . er, July?" Not only is it ready built but it's also *tested* so no head scratching. However, the dedicated soldering iron basher should not dismiss it out of hand too hastily as everything's buffered properly on the bus and it's easy to plug in homebrew goodies to the spare sockets. Support at this level is also readily forthcoming with the advent of the OSI UK Users group — ask Mutek for details.

Conclusion

The Challenger 2P (sometimes called C2-4P) is a highly expandable ready-to-run computer that offers several extra facilities not normally provided. It has a clearly defined upward path that can be taken in easy steps. The documentation editor (is there one?) at OHIO should be buried in a deep pit and someone else (me?) hired to provide the good beginners guide that will do much to instil confidence in the machine. There are not many microcomputers that can offer 20K of RAM and a floppy disc for under £1000 (excl. VAT)! OHIO claims the Challenger to be "professional, portable and expandable" The term professional is debatable but portable and expandable, the Challenger 2P certainly is.

BENCHMARKS (all timings in seconds)

	Challenger	PET	Applesoft
BM1	1.4	1.7	1.3
BM2	7.8	9.9	8.5
BM3	15.0	18.4	16.0
BM4	16.5	20.4	17.8
BM5	17.8	21.7	19.1
BM6	27.0	32.5	28.6
BM7	39.5	50.9	44.8
BM8	7.5	12.3	10.7

At a glance

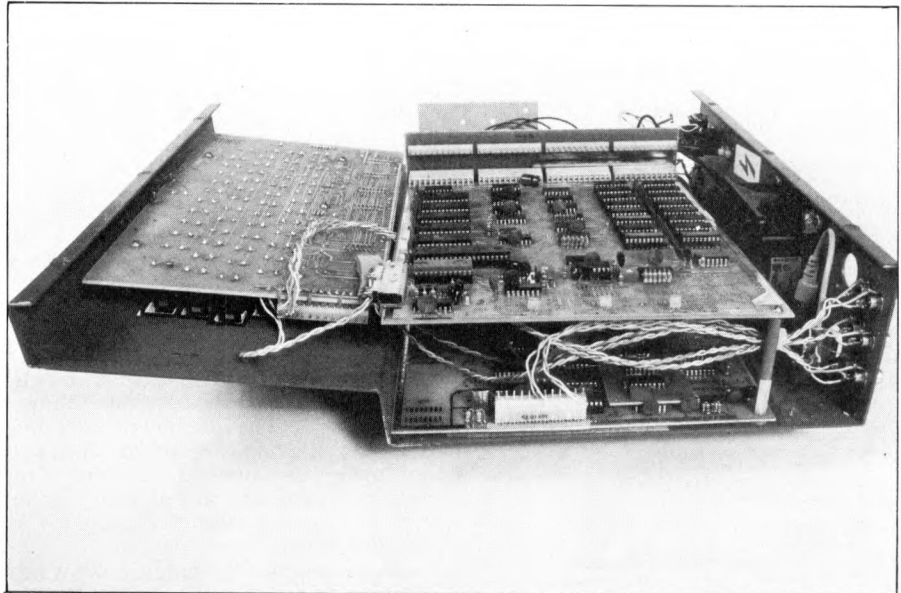
First Impression	
Looks	****
Setting up	**
Ease of use	***
High Level Language	
BASIC	****
COBOL	N/A
FORTRAN	N/A
PASCAL	N/A
OTHER	N/A
System Software	***
Packages	
Business	N/A
Education	N/A
Home	N/A
Games	****
Performance	
Processor	****
Cassette interface	****
Disc	not tested
Peripherals	***
Expandability	
Memory	****
Cassettes	not tested
Discs	not tested
Bus	****
Compatibility	
Hardware	***
Software	****
Documentation	
	*
Value for Money	

**** excellent
 *** v. good
 ** good
 * fair
 * poor

PRICES

C2-4P	£349 (includes 4K RAM)
C2-4P MF floppy	£909 (includes 20K RAM)
C2-8P	£475 (has 6 slots on motherboard)
4K RAM	£ 32
Memory expansion	£125 (includes 8K)

Floppy drive £250
 RAM but caters for 24K)
 These prices (exclusive of VAT) were supplied by Mutek, Quarry Hill, Box, Wilts.



The C2-4P turned turtle, showing the underside of the keyboard on the left with the two main boards coupled via the motherboard at the rear.

Z-89 ALL-IN-ONE COMPUTER

The new all-in-one computer from Zenith is the most versatile microcomputer available today.

- 'Intelligent' video terminal
- two Z80 microprocessors
- floppy disc storage system
- expandable to 48K RAM

Easy to programme. Simple to operate. It is capable of a multitude of high-speed functions and speaks the language of today's most popular software. Price from £1570

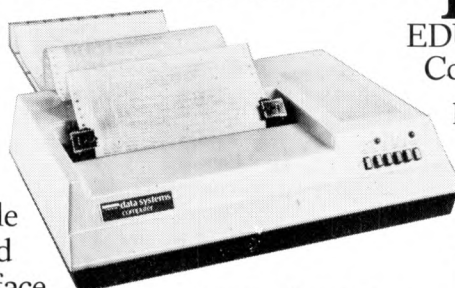


The most advanced microcomputer yet.

WH-14 SERIAL PRINTER **IMMEDIATE DELIVERY AVAILABLE**
 With a compact table-top configuration, the WH-14 is designed for a broad variety of uses in any computing environment.

Microprocessor based, it is compatible with any computer providing standard RS-232C or 20mA current loop interface connections. Price £510

Prices exclude VAT & delivery charges.



For complete specifications of these and all Zenith Data Systems products contact: Heath Electronics (U.K.) Ltd., Zenith Data Systems Division, Dept (PCW4) Bristol Road, Gloucester, GL2 6EE Telephone: (0452) 29451.

EDUCATION COURSES

Courses in microprocessors and programming are also available.

Zenith data systems

HEATH
ZENITH

THE ULTIMATE IN MICROCOMPUTERS

VIEWDATA AND THE INFORMATION AGE

Despite various half-hearted press campaigns, many people remain muddled over aspects of the viewdata concept. Dr Adrian Stokes, author of a recent book on the subject, presents his own two-part guide.

PART 1. ~FACT AND FANTASY

With the possible exception of sex, viewdata appears to be the topic which has been the most spoken about but the least acted upon during the last decade.

To its proponents, viewdata is the means of bringing into every home remote access to a large information retrieval database with interactive facilities, by way of already existing equipment. To its critics, it's the merger of two pieces of equipment which are half a century and a century old respectively — the television and the telephone — to form a system the purpose of which is to increase Post Office revenue from its heavy capital investment in plant, at times when the system is lightly loaded.

As usual, the truth lies somewhere between these two extremes; it's clear though that viewdata will not bear out its early promise, at least anywhere within the original timetable. My intention, therefore will be to give a fairly brief introduction to the concepts, history and uses of viewdata with particular emphasis on aspects of the system which are of (potential) interest to home-computer enthusiasts — an area which is starting to receive a significant amount of attention.

What is viewdata?

The entry in the Trade Marks Journal consists of 71 words and the information they convey is minimal; in fact, the registration appears under the name "Prestel" since, when the Post Office wanted to register the name "Viewdata", it was said that it was too descriptive and could only be applied as a generic term to the system. Thus Prestel is the British Post Office's viewdata (with a small "v") system.

Viewdata refers to the transmission of information from a remote information retrieval system, via a telephone line, to a receiver which consists of a modified television set. More recently, the term "videotex" has been used internationally to describe such a system.

There are other related services which, rather than being transmitted via a telephone line, are broadcast along with television pictures; these are normally known as "Teletext", although the term "broadcast videotex" is sometimes used. Teletext services are not interactive. The BBC's Teletext system is known as Ceefax ("see facts"!) and the IBA's version is called Oracle (a contrived acronym for "Optional reception of Announcements by Coded Line Electronics"). I shall be describing both viewdata and Teletext

since there are many similarities.

The history of viewdata

The original idea of viewdata was suggested nearly ten years ago by Sam Fedida of the Post Office Research Centre. The P.O. decided to undertake a feasibility study between 1972 and 1974 to examine various aspects of a national viewdata set-up, including the telecommunication system required and the target market.

After this, a viewdata-type system was implemented on a Hewlett-Packard 2100 computer with about 300 pages of data. This differed very significantly from the current public system. In particular, it was monochrome and had relatively large, upper-case characters. It was completed in 1973 and there were various demonstrations during 1973/4.

At around the same time, the BBC and IBA were discussing the possibility of broadcast Teletext services, particularly for use in sub-titling programs for deaf viewers; it seemed sensible to discuss joint standards to make the broadcast and transmitted systems compatible. This was achieved fairly rapidly and a joint standard was published in January 1976 (followed by a revised version in September). This standard defined the system currently in use, including upper/lower case characters, colour, double-height letters and flashing. The size of the characters was reduced giving pages of 960 characters.

The first public demonstration of the system was given at EUROCOMP in 1975, and permission was gained for a pilot trial at the beginning of 1976. The trial was intended to help the various suppliers of hardware and information to gain experience of the system and it was followed by a large-scale market trial which officially started in September of 1978. The idea was to involve 1500 users (roughly half business and half residential) in three areas — London, Birmingham and Norfolk.

For various reasons, it ran into pro-

blems and there were difficulties in getting the 1500 users. However, although the market trial was expected to produce useful data, the whole basis of viewdata is widespread public usage and the Post Office decided to start the full public service as soon as possible. For this reason, the market trial was renamed the "Test Service" in 1978.

The public service proper was intended to start early in 1979 but, again, there were problems and a restricted "London Residential Service" was started in March 1979 with the full public service six months later.

The Post Office are still committed to a rapid expansion of the system and a large-scale publicity campaign is planned for this month. The latest projections from the Post Office still suggest a possible one million subscribers by the end of next year, accessing the system via twelve and a half thousand ports in 30 towns.

viewdata and Teletext

While the Post Office was developing its viewdata system and making all the various trials, the television companies were getting on with the transmission of Teletext information.

Teletext is broadcast along with the ordinary television transmission in two of the unused lines (it can sometimes be seen on badly adjusted sets as flickering at the top of the screen). It's displayed on equipment very similar to that used for viewdata.

Each television channel transmits about 100 Teletext frames, simply because a single frame takes about a quarter of a second to transmit and so 100 frames give an average wait time of about twelve seconds. These frames can be changed easily and often and therefore perhaps one of the most important uses of Teletext is for transmitting transient information.

This is one of the major differences between viewdata and Teletext... a second lies in the difference in the amount of information; Teletext has its hundred or so frames, whereas the current Prestel databases consist of about a quarter of a million frames (a figure which will be

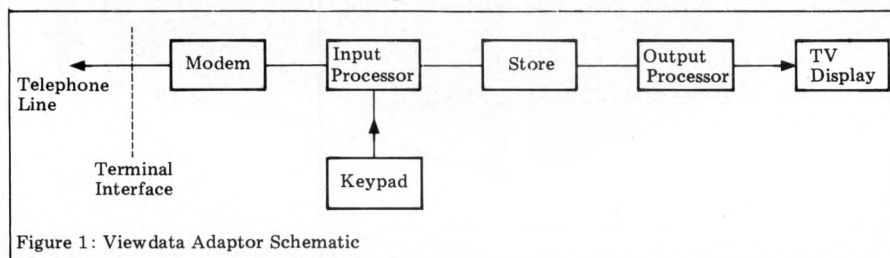
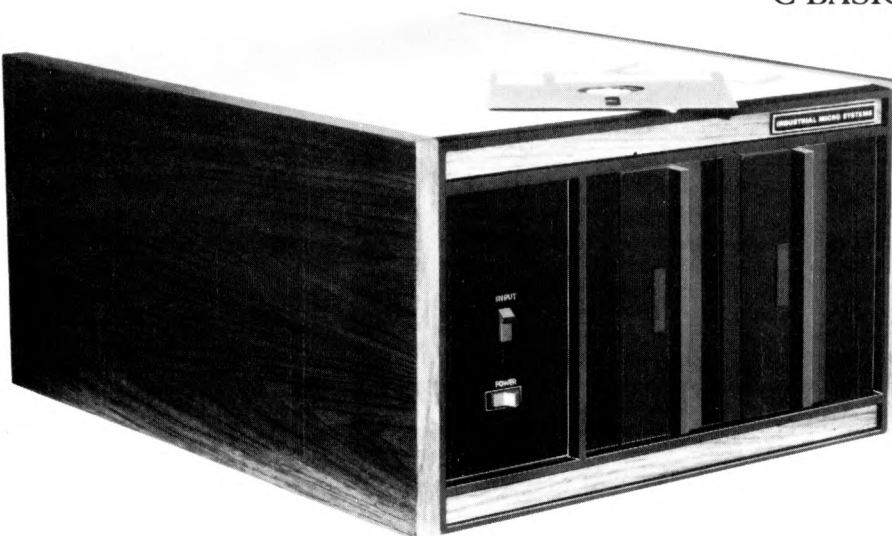


Figure 1: Viewdata Adaptor Schematic

OUR SYSTEMS CAN GROW ON YOU

When you buy one of our low price microcomputer development systems you not only get a fully burnt-in and tested system designed and manufactured to industrial standards. You also get access to an ever-increasing range of software tools. And if you require a VDU or printer now or later, there is a selection of these and other peripherals from which to choose. So your system can grow and grow.

Our systems start to grow on you at £1450. This buys you a 32KB system with dual 5¼ inch double density floppy drives. At £1675 you can have a 48KB system or for £2495 one with the extra memory storage provided by dual 8 inch double density floppy drives. All the systems are based on the powerful Z80 microprocessor and S100 bus structure and can provide memory management. Cartridge disc drives are available providing up to 40MB of storage.



The prices include an operating system and language, in this case CP/M and C-BASIC, to

give a typical system cost. But with slight cost adjustment the software options are:

Operating Systems

- CP/M ● PASCAL ● CAP MICROCOBOL BOS
- Multi-User, Multi-Tasking Operating Systems

Languages

- C-BASIC COMPILER ● M-BASIC ● FORTRAN-80
- COBOL-80 ● PASCAL ● CIS-COBOL

There is also a word and text processing system available that is ideal for report writing.

You simply take your pick from the software options. Or visit our London showroom and see the systems demonstrated.

SYSTEMS WITH CP/M AND C-BASIC: 32KB + Dual 5¼ inch Floppies: **£1450**

48KB + Dual 5¼ inch Floppies: **£1675**

48KB + Dual 8 inch Floppies: **£2495**

Prices exclude VAT. Nationwide maintenance facilities available.

EQUINOX

COMPUTER SYSTEMS LTD.

Kleeman House, 16 Anning Street,
New Inn Yard, London EC2A 3HB
Tel: 01-739 2387/9 & 01-729 4460

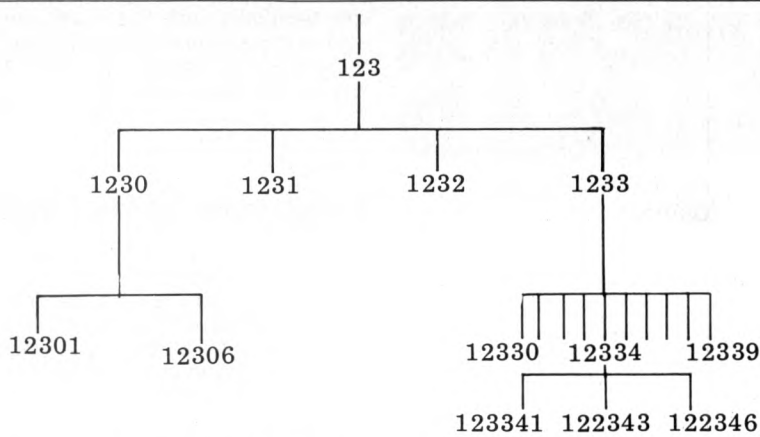


Figure 1: Schematic of Viewdatabase

doubling in the near future). The third major difference is that Teletext is not interactive whereas viewdata is.

The user's equipment

The equipment needed to access a viewdata system consists of a modified television set and a telephone. The television is modified by the provision of an adaptor. Usually, this adaptor is internal to the set but it is possible to buy external adaptors for use on existing sets. This adaptor (the block schematic is shown in Figure 1) consists of the following parts:

1. Isolation circuits to prevent the television interfering with the telephone system. The Post Office insist on some form of isolation when any electrical equipment is connected to a telephone line (as readers of David Hebditch's recent articles will know only too well!) but it is particularly important in this case because of the very high voltages involved.

2. A modem which converts the digital signals in the adaptor to analogue signals so that they can be transmitted over telephone lines, and vice versa.

3. Memory to store the information received.

4. Input and memory control which accept the signals and store them in the memory.

5. A character generator which takes the data from the memory and changes it into the format needed by the raster-scan display of the television — together with control to generate the appropriate synchronisation and control signals for the set.

In addition, a "keypad" is needed. This is a small box, usually a larger version of the remote control box supplied with many televisions, which allows the user to select normal TV pictures, viewdata or Teletext and has twelve buttons labelled 0 to 9, * and #. One of the major design criteria of viewdata was that its use should be as simple as possible; the entire system can be controlled and used by means of these twelve characters.

The viewdatabase

At the viewdata computer, the data which is supplied by various organisations, known as Information Providers (IPs) is stored in the "viewdatabase".

The structure of the viewdatabase is based on a tree (see Figure 2) with the data contained in numbered pages. More strictly, the unit of information is a

"frame" — that's the amount of information that can be displayed on a television screen at any one time. If the amount of information needed in one logical unit is larger than this, a number of frames can be grouped together into pages, the frames being referenced by lower case letters. For example, a page (1234) might consist of three frames, 1234a, 1234b and 1234c.

One frame consists of 960 character positions, arranged as 24 lines and each of 40 characters. The first and last rows are used by the system, leaving a total of 880 characters for user information. The characters which can be transmitted are the usual ASCII character set, together with "graphics" in which the character position is divided up into six squares, any combination of which may be sent. This gives rise to the possibility of sending diagrams although the resolution is low (effectively 80 by 72) and the technique is more accurately described by the term "alphamosaic".

Perhaps the most important aspect of viewdata is that all characters can be transmitted in any of seven colours: red, green, yellow, blue, cyan (light blue), magenta and white. Also, they may be made to flash — a useful facility to draw attention to parts of the screen if used carefully. Finally, there is a facility for double-height characters.

How is viewdata used?

A user who wishes to access viewdata dials up his local friendly viewdata computer (probably by means of an auto-dialler in the television — if this is not available, a short, three-digit, dialling code is used) and logs in (again, automatically in some sets). He is then presented with a "page" of information and can meander about the database at his leisure (and, of course, cost).

In general, on each frame (a "routing frame"), the user is presented with a choice of subsequent frames which are selected by a single digit on the keypad. If a "continuation frame" is required (i.e. the next frame of a page), this is selected by pressing "#". Various other functions are made available by use of combinations of the basic twelve keys (on some keypads, special keys are available for these combinations), of which the two most important are "*#" which takes the user back to the previous page seen, and "*N#" where "N" is a page number, taking the user

directly to the specified page.

One item of interest to many users is the cost of the system. It's possible to spend a great deal of money in browsing around the viewdatabase and there are a number of charges which a user can incur. The first is the ordinary telephone charge; secondly, there is a time-based access to Prestel which is similar to the telephone charge. Finally, there is a charge for access to much of the data in the viewdatabase. The IP who supplies the data decides how much to charge for it and this charge can vary from nothing to 50p per frame. Frames which are essentially advertisements tend to be free whereas specialised information frames such as the *Financial Times* index are relatively expensive; very few frames cost more than 20p (per access!). Of course, users are told of the cost of any frame before they access it.

viewdata systems abroad

The Post Office has marketed viewdata abroad and a number of countries have implemented systems based very closely on the UK's Prestel. These countries include Holland, West Germany, Switzerland and Hong Kong.

In addition, some countries are implementing their own videotex systems and it's worth mentioning two specifically. The first is Canada whose system, Telidon, is entirely different from Prestel. Telidon relies, not on the transmission of characters, but on picture description instructions (PDIs). Although each PDI requires a number of bytes, the number of PDIs needed to send a screenful of information can be very much lower than in Prestel, depending on the actual data. Also, it's possible to send high-resolution graphics (the co-ordinates being given to one part in 4096) with the additional advantage that lower resolution receivers may still receive the picture, although, of course, they can only display it at low resolution. Further enhancements to Telidon include transmitting modifications to pictures and not refreshing the picture each time, thus cutting down a great deal on transmitted data.

The second videotex system abroad which I'll describe is the French one — Antiope. Rather than the UK's eight-bit character set, Antiope uses a sixteen-bit character generated in the receiver from the transmitted eight-bit information. In the UK system, there are special characters meaning (for example, change colour) whereas in Antiope, each sixteen-bit character carries information with it (for instance, its colour). It's a more expensive system than Prestel to implement but it's more flexible and has the added advantage of probably being able to interwork with such other services as facsimile transmission.

Forthcoming attractions

In the second part of this article, I'll look at the uses of the system and particular aspects of interest in the field of personal computers — such as "telesoftware". Also, there's be a chance to look at possible future implications of the system.

EASIER COMMUNICATION FOR THE DISABLED

A. R. Berry M.Sc describes the Electraid 5602, an adaptable communication aid for the disabled.

the problems that the users may face both from personal experiences and from those of their many disabled friends. This article was produced using the system — without it, I don't think it would have been produced as quickly or as creatively.

Features of the 5602

The system is shown in Figure 1. In its simplest form, it is a typewriter which is operated not by the pressing of keys but rather by the giving of commands to an electronic controller. Optional equipment includes a large indicator and a VDU.

Why use a typewriter as an output device? There are many reasons, ranging from cheapness, through safety (certain printers fail to meet safety standards set by local authorities) to the ease with which a teacher can set up a sentence to be copied.

An important feature of the 5602 is its inherent flexibility. For example, there are ten ways of selecting letters and each of these can operate at one of six speeds. All (bar one) are based on the matrix shown in Figure 2.

Let's consider some of those available:

Q1: In this method, the system scans the entire matrix automatically, the user having merely to close a switch when the desired letter is reached.

T1: Here the cursor is stationary until the user presses a switch. It then scans down the first column until the switch is released. When the switch is pressed again, the cursor moves along the row; this continues until the switch is released again. The selected letter is then typed and the cursor returns to the start.

W2: This, and methods X4 and Y7, are extensions of T1. In W2, two switches are used, called "1" and "5"; switch "1" will cause the cursor to jump to row 1, while switch "5" causes a jump to row 5. We have used more switches to allow access to segments of the display and thus users can select letters more quickly.

If the methods described above seem a poor substitute for simply hitting the right key and getting the letter typed, try typing with the little finger of your left hand after drinking 8 pints and then imagine something about a hundred times more difficult. You will then begin to understand the sort of problems that the severely disabled face. Some users of the 5602 will probably never use the system on a setting other than Q1 and at the slowest speed. In that case, a speed of one selection every 2 or 3 minutes would be very fast (and this doesn't make allowance for the many mistakes that these users will make because of gross involuntary movements).

Methods of selection like those used in the 5602 have the following advantages:

1. The number of "channels" required to achieve communication can be reduced from 56 to a number that the user can cope with.
2. The method of selection can be chosen to suit the user's particular disability. There are methods that are useful for users who can "relax to order" and others for users who can only "tense to order". Susan, for



Fig. 1

Basic 5602 system. Typewriter is an electric office machine fitted with a solenoid block. Input switches shown are only one of many types available — others include foot switches and ones operated by blowing/sucking.

The problem

Susan is studying "O" level Computer Science at a technical college. She is confined to a wheelchair, unable to write and has severe speech defects. These disabilities render her at a grave disadvantage compared to the rest of the class — yet Susan is intelligent and determined to succeed.

This article describes a system — the Electraid 5602 — which is designed to help the many hundreds of severely

disabled people like Susan overcome their communication handicaps. Those who can write and speak normally may not realise the frustration of not being able to communicate, simply because the body refuses to do what the mind is telling it.

There are, of course, other systems like the 5602 (NPL's "MAVIS" is one of the best known). But what makes this system unique is that the team who developed it are themselves disabled. This gives them a better insight into

0	1	2	3	4	5	6	7
1	SP	t	r	o	l	p	CR
2	e	i	a	c	m	x	>+
3	n	s	h	y	k	B.S	@ ₄
4	d	f	g	q	"	£	! 1
5	u	w	j	/	-)	* -
6	v	b	z	&	:	<	% +
7	SH. REP.	'	('	,	.	ON OFF

Fig. 2
Electraid selection matrix. The positions of the letters were determined by their frequencies — the ones which occur most often are nearest to the start position of the "cursor" (0,0). Thus, in scanning modes, the quickest letters to select are the most frequent.

example, will use two large foot switches in W2.

3. The essentially analogue method of moving fingers around a keyboard is replaced by the digital method of scanning used by the system. This can be of real benefit to users with gross movements, such as Athetiods.

4. In the 5602, the methods have been carefully chosen so as to form a sequence of graded steps from slow (but simple) to quick (but fairly complex). This means that small children can use the system and as their control improves, gradually use the faster methods — indeed, most children find that the stimulus of using the system improves their ability to control their movements. It is also of benefit in progressive conditions, such as Multiple Sclerosis.

In the scanning mode, if high speeds are to be attained the user must possess a sense of rhythm and be able to anticipate the position of the cursor so as to activate his switch at the correct time.

For the less severely disabled, a selection method called "ELK" is available. In this mode, a keyboard is used, with a layout similar to a typewriter; it can be supplied very large (3' x 1') or very small (6" x 2'). In ELK mode, the controller checks that only one switch is depressed and the user can select a delay before inputs are accepted.

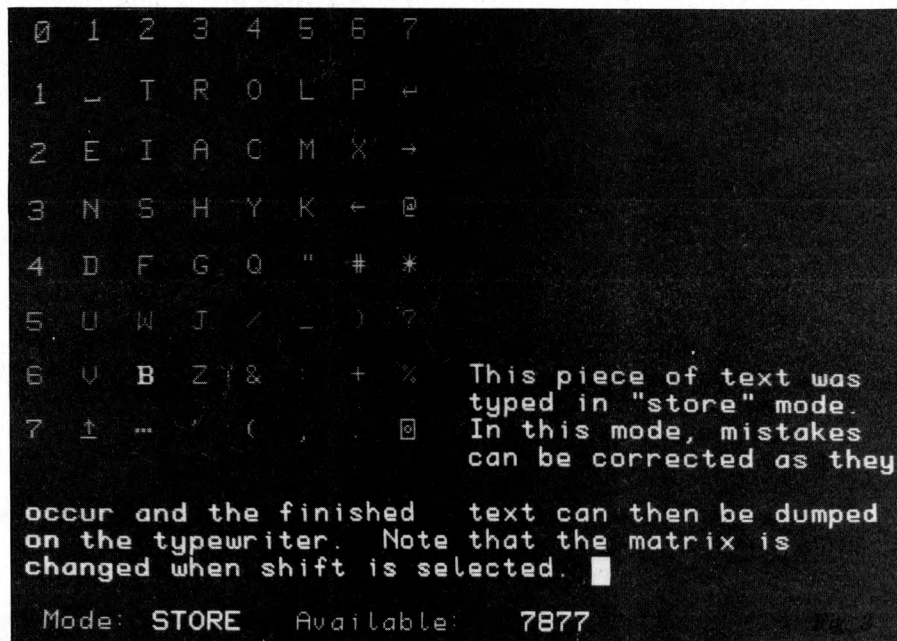
As well as all these methods of selection, the system also has a number of higher level features. The most basic of these is the "repeat mode". Once entered, all characters selected will be repeated at a fixed rate until another selection is begun. This is useful for characters such as backspace and underline but can also prove great fun for small children who frequently find that repeating carriage return provides a big stimulus. Of course, the rate at which the character is repeated is determined by the scanning speed.

Then there is a "phrase store". At present, this is a fixed set of phrases (fixed, that is, when the system is built) one of which will be typed when a position in the first row of the matrix is selected. This may appear somewhat limited but, to give an example, if one arranges one phrase to be: "Hi, my name is . . .", then this may significantly improve the user's quality of life.

To be non-communicative and experience people losing interest during the introductions is very frustrating.

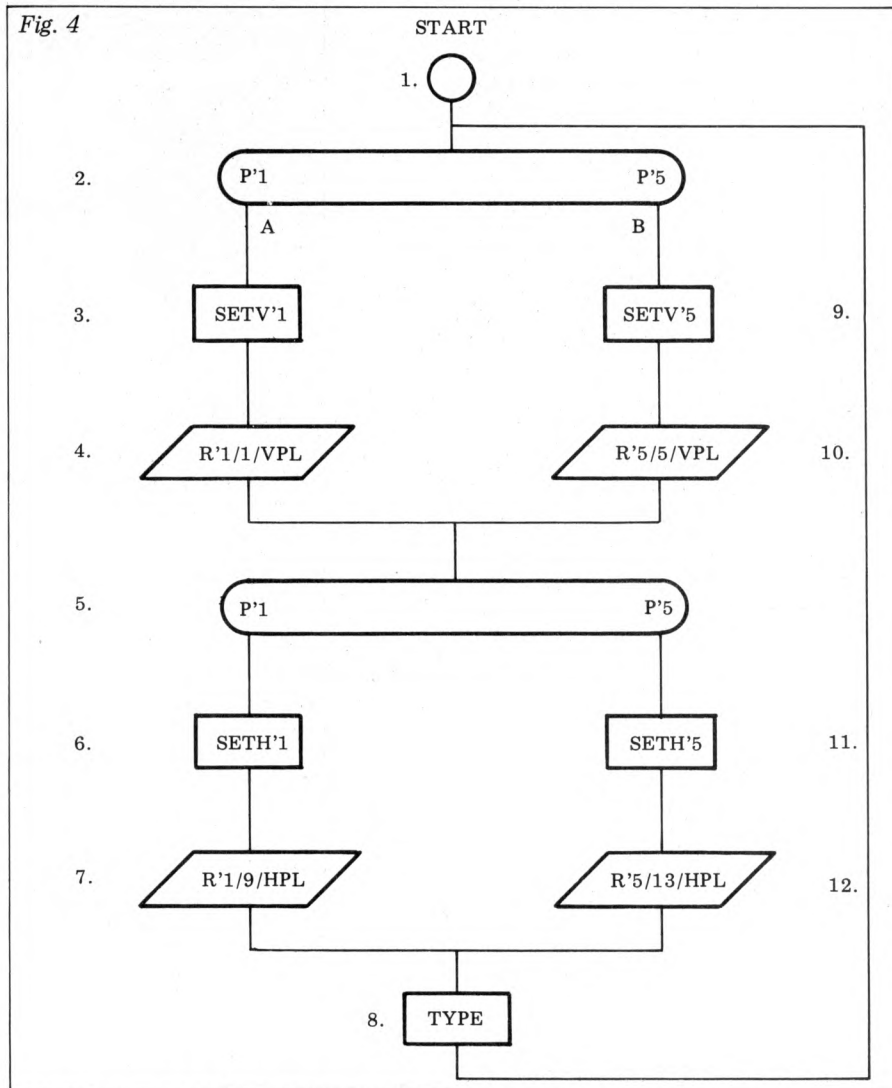
The 5602 may be used with a VDU in "store" mode. In this mode, text can be displayed on the VDU, changed

using the backspace "key" and then dumped on the typewriter, a count of the number of spaces left on the line is displayed and, should this fall to zero, a carriage return is automatically inserted. Not only that, the system has



VDU for 5602. Display format is 50 by 23 — line 23 gives status information such as mode. The selection matrix is in half brightness, the "cursor" being indicated in full brightness. Note how the matrix displays upper-case characters when shift is selected.

Fig. 4



Code-diagram and ELIC code. The shape of the box indicates its function. Box 1 means "start", box 2 means "until", box 3 is an operation and box 4 is a "do-while"-type loop. Inside each box are conditionals (P'1 means test input switch 1) and operators (SETV'1 means set cursor to row 5). Once the code-diagram has been drawn, it is translated into ELIC.

full buffering to allow fast users to continue inputting while the typewriter is printing — without keys clashing together.

Finally, a “self-test” routine is included which performs an internal check (RAM, I/O interfaces and interrupts) and tests the typewriter and the input switches.

Hardware

The controller contains a purpose-built micro-computer and associated power supply. The computer is constructed on a single Double Euro-card size board — 10" x 8". Fully populated, it is quite a powerful beastie, as it consists of:

1. 6802 micro-processor
2. sockets for 4 PROMs, either 2758 or 2716
3. 16 Kbytes of “invisible refresh” dynamic RAM
4. RS-232 port with software selectable baud-rate
5. 56 I/O lines, 24 of which can handle 2 amps at 24 volts
6. 4 16-bit timers
7. An interface to Micro Design’s MAIN-bus
8. A 1 watt audio amplifier

The RS-232 port is provided so that the 5602 can be used in place of a terminal by the disabled computer user. It is also very useful for production testing — something which is not considered in many systems available today.

Internally, the amplifier is connected to one of the timers so that it can generate tones. Some physically handicapped people have sight problems as well and the tones can help them to use the 5602 by providing information about their selections. For example, in the scanning modes, a different tone is generated when scanning vertically from when scanning horizontally. Fast users tend to rely more on the tones as well.

Figure 3 shows the optional Visual Display Unit which can be supplied with the system. This unit is a high-quality monitor with a micro-based control card which fits into the main controller box. For the user, the VDU can replace both the indicator and the typewriter although a typewriter will normally still be needed to provide hard-copy.

At first sight, it no doubt appears strange that the control card for the VDU uses another micro. The facilities offered by the VDC-09 are, however, very advanced and include: normal/inverse video, dual intensity, variable screen format and dynamically alterable character set. Most of these features are used with the 5602.

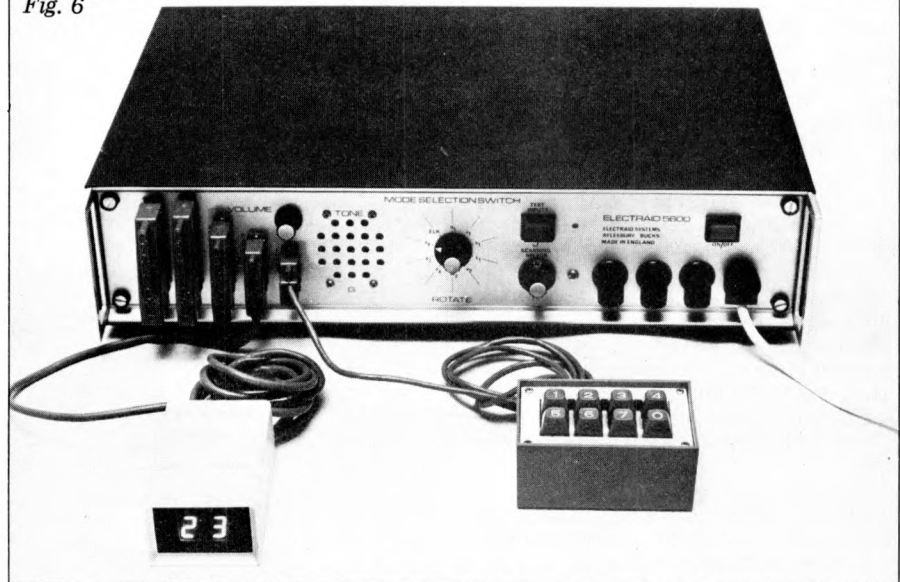
“Variable screen format” means that the VDC can display different sizes of characters — in fact, the range of formats is from 3 lines of 4 characters up to 40 x 110. It allows partially sighted people to use the system and, perhaps more importantly, means that very small children can be taught to read and “write” with the system; they can use it through school and on into their employment.

The ability to change character sets — that is, to change what pattern is displayed in response to a selection from the 5602 — has not yet been fully explored. Possible applications include the display of foreign languages (not

W2	05		defines code “05” as “W2”
1	C		the start of the code
2	U	A-P'1,B-P'5	wait until either switch “1” or “5” is pressed
3	0	SETV'1	sets cursor at row 1
4	D'1	VPL,R'1	wait until switch 1 is released, move cursor down
5	U	A-P'1,B-P'5	as node 2, horizontal movement
6	0	SETH'1	set cursor in column 1
7	D'9	HPL,R'1	note that different tone is generated “D’x”
8	0	TYPE	type out letter
9	0	SETV'5	as switch “5” pressed, go to row 5
10	D'5	VPL,R'5	as node 4
11	0	SETH'5	
12	D'13	HPL,R'5	as node 7
.EN			end of node definitions
1	-2		a flow-path from 1 to 2
2A	-3		since node has two exits, specify which
3	-4		
4	-5		
5A	-6		
6	-7		
7	-8		
2B	-9		go back to define other exit
9	-10		
10	-5		
5B	-11		
11	-12		
12	-8		
8	-2		round again. . .
.EC			end of definition

Fig. 5

Fig. 6



Top: The ELIC coding of figure 4. Above: A close look at the 5602 controller.

only those with accents, but also Russian, etc), special mathematical characters and “Bliss” symbols.

Software

A substantial part of any micro-processor project is, of course, the software. This project is no exception, a full 5602 requires about 4½ Kbytes and the VDC nearly 2 Kbytes. Most of this was written in 6800 Assembler (using “Tiny Assembler” modified to operate completely in memory) because of timing constraints. The software is modular and was designed using a meta-language called “KDL”.

Basically, the software can be divided into 5 parts:

1. Typewriter and Display control
2. Control switch processing
3. Input switch processing
4. Text manipulation
5. Self-test routine

The hardware of the typewriter inter-

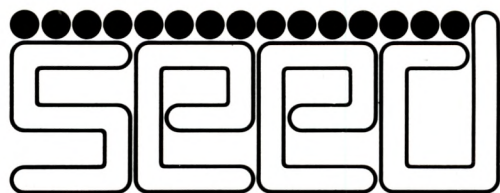
face is completely dumb — the software is responsible for all timing and code conversion functions. So as to allow the user to carry on with the selection of the next letter while the present one is being typed, the typewriter driver is split into two parts: a foreground task and a background routine. The background routine queues characters to be output in an “O/P Character Queue” (OPCQ) and then checks whether the foreground task exists. If it doesn’t, it creates it. The foreground task examines the OPCQ and, if there is a character waiting, begins the sequence of operations to output it. If there is no character waiting, the foreground task is killed. Once triggered, the foreground task is driven by interrupts from a timer and is completely separate from the background.

To reduce the cost of the hardware, the control switches (“CODE” & “SPEED”) must be scanned by the software. Every time round the base

Cont. on P. 112



MSI 6800: At the root of every good system.



Strumech Engineering Electronic Developments Limited
 Portland House, Coppice Side, Brownhills, Walsall, West Midlands. Telephone (279) 4321

Can your business, research project or teaching laboratory be made more efficient? Yes. Today's users demand complete, high performance micro computer systems. Expandable to meet future needs and with software capable of immediate application.

The North Star Horizon is the answer. A cleverly balanced configuration: Z80A processor with 12 slot S100 chassis, one parallel and two serial interface ports. Now with double or quad capacity too.

The compact design gives you value for money and economy of space. The Horizon will not break your bank or your desk top.

Quick delivery and nationwide service are only part of the attraction. Add to this the wealth of software available, including the well known CP/M, and you can see why the Horizon has already sold in thousands.

The reason for its success is simple.

The North Star Horizon reflects your needs.



For technical specification and details of your nearest dealer contact Britain's leading North Star Supplier.

 **comart**

PO Box 2, St. Neots, Cambridgeshire.
Tel: (0480) 215005. Telex: 32514.
COMART G.

**North Star Horizon
reflects a new age in computing**

**BENCH
TEST**

SINCLAIR ZX80

by David Tebbutt

Clive Sinclair has surprised the world with the launch of his attractive, hand-held personal computer. Costing less than a hundred pounds, and plugging into the domestic TV and cassette recorder, some now suggest the ZX80 to represent the thin edge of a mass consumer market wedge.



Introduction

Sinclair Research set out to build a simple to use personal computer, running BASIC and capable of breaking the psychological price barrier of £100. Well, they succeeded with their ZX80. Why ZX80? No reason really except that it's based on an NEC copy of the Z80 processor chip . . . and it sounds nice.

The machine is available through mail order either ready made or in kit form; there are no firm plans to sell it through the shops — yet. A kit will cost you £79.95 while its ready built twin will come out at £99.95. In addition to this you'll need a mains adaptor ("600ma at 9V DC nominal unregulated") . . . if you buy Sinclair's it will cost you an extra £8.95. Deliveries of the kit were expected to start in February, the ready-made in March.

The ZX80 is amazingly light, twelve ounces in fact, and easily held in one hand. The low weight is achieved through use of a moulded plastic casing just 1mm thick.

It connects quite happily to the television set and the cassette recorder, although it might take a few minutes to find the optimal settings. Once attached to the TV, it gives a rock steady display (more on that later).

Hardware

I have to say that I think it very pretty (our art director would probably beg to differ) — the casing even has go-faster stripes, which look suspiciously like ventilation slots in black and white photographs (coincidence, I'm sure). I would, however, have been happier with something rather more sturdy; ABS plastic might have done the trick, although perhaps at the cost of attractiveness.

The keyboard is most interesting; it's one of those waterproof, chemical proof, completely sealed units and it's stuck on to the main PCB. Made of a special tough plastic, the under-surface is printed with the key symbols so as to eliminate any rubbing off. Between this keyplate and the PCB containing the metal contact strips (about five per key) is a piece of sticky plastic containing forty holes which line up with the "keys". This material is about .006" thick and is just sufficient to keep the metal underside of the keyplate away from the contacts, except when touched of course.

Typing gives a sensation of drumming your fingers rather than of

doing anything useful. This is a totally mistaken impression because it really works rather well. For those who are interested, I found that a "wiping" action was more successful than the tapping movement usually associated with typing. Typists may be pleased to hear that the keys are in standard QWERTY layout although somewhat compressed compared to, say, the office IBM.

Looking inside the machine, I find that it's controlled by an NEC 780-1 processor chip . . . a copy of the well known and very successful Z80. This CPU, running at 3.25MHz, does all the work for the ZX80, including driving the TV and the cassette recorder. You'll notice that if any work is taking place, be it calculation, accepting input from the keyboard or driving the cassette, then the TV picture disappears — only to return when the activity is complete. This can be irritating to observers (at a demonstration for example) but I found it positively beneficial when keying in programs because it gave me positive feedback whenever a key made successful contact.

The BASIC interpreter, operating system, character set and editor are all held in a 4K Byte ROM. If you are feeling adventurous there's no reason why you shouldn't pop your own ROM (TMS 2532) in its place.

Memory in the basic system comprises 1K static RAM; you can add to it via the expansion port, giving a maximum potential of 16K. The memory expands with the aid of plug in modules, each designed to carry up to 3K in 1K increments. Thus five modules would be required to give the 16K maximum. At switch-on the machine does a memory check which also tells the system how much memory is on-line. Should you reconfigure the memory, then the command NEW will execute the memory check cycle again.

Moving on to the "outside world" connections, there's a cassette interface, TV socket and a hefty edge connector. The cassette interface comprises two 3.5mm jack plug sockets, securely mounted on the main (and only) PCB. One connects to the "ear" socket on the cassette recorder and the other to the "mic" socket. There is no facility for remote control of the cassette motor. Anyone with DIN sockets will have to buy a jack plug to DIN connector lead.

Although I encountered one or two problems at first, once working, the cassette interface proved trouble free. My particular recorder had a nasty habit of recording noises when the CPU was "sending out" silence. This caused

the system to get its knickers in a twist when reading from cassette because it expected silence just before the file header record. After a couple of hours (what a confession) the culprit was found — the "ear" lead, which acts as a monitor while recording, was setting up some sort of oscillation. Answer — simple — disconnect the "ear" jack when recording. Another tip which ensures trouble free loading is to move the tape into the silent section before issuing your LOAD instruction. Rumour has it that the cassette operates at around 250 baud — I believe it, although it doesn't seem terribly important when you're only loading the 1K that I was.

The television connector is simplicity itself. Plug one end of the cable (supplied) into the ZX80 and the other into the television aerial socket, tune to channel 36 and you're in business. The display is magic; rock steady and very clear although reversed characters (white on black) are not so good.

I have already mentioned the business of the display switching off every time the processor needs to do something else. If this drives you mad then you'll have to forfeit some of the undoubted pleasures that this machine has to offer. The screen is not memory mapped; it's treated like a serial file — like a printer in fact — which means that fast moving graphics are out of the question. No doubt some clever Dick out there will take up the challenge and fudge the system, just to prove me wrong. More about the reasons for this in the Software section, but anyone who is hooked on white characters on a black background can suitably modify the PCB, though why they should want to I'll never know. It's a matter of cutting one track and making a small bridge to another.

American television (525 line) users are catered for as well; all they need to do is solder in one diode and the system is converted from 50 to 60Hz standards. Do you take your computer camping with you? You'll be pleased to hear that it can run from a car battery, provided that the lead regulates the supply. I believe you can buy a cigarette lighter plug with a built in regulator . . . couple that with a portable TV and a battery powered cassette recorder and you'll be the envy of the campsite.

Now let's look at the hefty edge connector. This is where the memory expansion modules fit in, each one being "piggy backed" on the one previous. Thus there are always 44 contacts available for outside use.



There are 37 lines drawn from the CPU plus 3 power lines (at 0V, 5V and 9V); the other lines comprise two earths, a "clock" signal and an "external memory in use" indicator.

All in all, the Sinclair ZX80 is a well designed, well produced personal computer. Memory addition comes a bit expensive at £300 for the full expansion but Clive Sinclair tells me bigger RAMs are on the way — that means cheaper expansion when they appear. If you like soldering and are good at it, it'll probably take you an evening to assemble the kit; if you're at all apprehensive than I suggest that you stump up the extra cost and save yourself twenty pounds worth of heartache by purchasing the ready built ZX80.

I'm sorry that there are no pictures of the machine's innards. The fact of the matter is that I was given one of the development machines which had a couple of "Veroboarded" EPROMS and

and a selector IC floating around on the ends of some pieces of wire which in turn were soldered into the "official" ROM socket. I thought it best to spare Mr Sinclair's blushes.

Software

The software of the ZX80 comprises the BASIC interpreter, the Editor and whatever it is that does the rest of the work (Operating System seems too grand a title). Rather than looking at each separately, I shall examine them in the order they might be encountered.

First of all the keying in of programs. For two reasons it's an absolute joy! First you don't have to type in many of the BASIC instruction codes, one key is sufficient; second you cannot enter anything that is syntactically incorrect. Some BASIC instructions have to be entered the long way (these are listed above the keyboard) but 29 of the instructions may be entered with a

single keystroke, while only 8 need to be keyed in full.

As with many micros most of the instruction codes are stored in a single byte. Normal Z80 machine code can be entered using the POKE statement and executed with the USR instruction. This should keep the buffs happy after they have tired of BASIC. Syntax checking is superb — it's impossible to go wrong. Every character is checked on entry and, if the interpreter thinks that you are going to make a mistake, it signals with a reverse S (for Syntax) at the point it thinks you have gone wrong. If, later in the same line, you correct the error, then the marker disappears. What a grown up facility for such a small machine! Incidentally, the program lines are displayed very clearly with line numbers, instructions, operators and what have you being nicely spaced out.

Inside the memory, however, there's a completely different story. The lines

TECHNICAL SPECIFICATION

CPU: NEC 780C-1 (copy of Z80) 3.25 MHz
 Memory: 1K static RAM, expandable to 16K
 Keyboard: Keyplate, under-surface printed
 Screen: Use own television. Pixel graphics 24 lines x 32 chars.
 Cassette: Use domestic audio cassette recorder.
 Bus: Edge connector with 44 lines — 37 from CPU, 0V, 5V, 9V, Clock, External memory indicator and two earths.
 Software: 4K ROM containing BASIC, Editor and Operating System



A Benchmark about to be executed: note the clear display and, while you're at it, compare the size of the ZX80 with the cassette recorder.

of code are held as compactly as possible with most of the commands and operators occupying one byte each. The spaces are removed and there are very few extra bytes needed — for instance the new line code is one byte, although I did notice that the “=” operator needed one extra for some reason. I'm sure there are others, but I'm equally sure they are very few and far between. An example of the storage requirement is as follows:

```
10 FOR A=16424 TO 17424 18 Bytes
20 PRINT PEEK(A);      12 Bytes
30 NEXT A              5 Bytes
40 STOP               4 Bytes
```

So you see, the storage for that program (displaying the 1K memory) is 39 bytes long — an average of 10 bytes per instruction. I'll leave you to work out what sort of program you can get in 1K. Perhaps I should mention that the screen buffer uses part of the 1K, as does the stack and system control area. The stack is held at the top of memory and “grows” down; I put 327 entries on it before it stopped accepting them.

The program and variables “grow” up into the screen buffer thus reducing the amount of data on display. Eventually it's possible for the program or variables to grow so large that there's nothing left on display. It was while experimenting with this interesting feature that I crashed the system. It seems the software couldn't cope with someone entering a string 868 bytes long! After about 424 bytes of input the screen removed another character every time I keyed in a new one — it was most odd to watch.

Another way of crashing the system, in fact the only other way I could find,

is to hit the EDIT key while in the middle of an INPUT loop. This returns the current program line with a syntax error which is impossible to clear. For those who are feeling unhappy about all this talk of crashing systems, don't worry, it's not as bad as it sounds. In the first place you have to enter forty characters after the screen has gone blank, and in the second place you can only hit EDIT when you are also holding the SHIFT key down.

Now it may be that, having loaded your program, you wish to edit it. Well once again there is some rather excellent software to help you. The Editor enables you to move a “current line marker” up and down the program text. Wherever it is you will always be able to see the marked line and at least some of its neighbours (it's called

getting it in context). Pressing the HOME key causes the marker to disappear — it has in fact gone to an imaginary position, one above the first program line. Having reached the line to be edited press the EDIT key and the line will be presented at the bottom of the screen ready for you to do your worst. From now on it is as if you are entering the line for the first time.

The benchmark timings show the ZX-80 to be very fast, even though I had to introduce some extra code to make some of the instructions work. Specifically I had to bracket expressions like LET A=((K/K)*K)+K-K . . . if I hadn't, the expression would have exceeded the ZX80's capacity. The machine can only operate on integers and these must have values from -32768 to 32767. I couldn't execute Benchmark 8 because the machine has no logarithmic or trigonometrical functions built in.

Finally, it's possible to save programs and any variables associated with them. If you want to make use of those same variables when reloading the program, use GOTO rather than RUN. Although it's possible to SAVE programs in this way, no provision has been made to save files — yet.

That's about it for the software; once again, considering the size of machine and price, I think that it's not at all bad.

Basic

The ZX80 BASIC has been well thought-out and, while it lacks some of the elegance and sophistication of the bigger machines, it's a very usable version of the language.

The main limitations relate to file handling and mathematical functions. File handling facilities don't exist, except by SAVEing the whole of memory (which is probably not as daft as it sounds). It does mean that you can save a program with all its variables, reload it the next day, remember to kick off with a GOTO rather than RUN, and carry on from where you left off. On the small memory machine it doesn't seem that important, but on the larger memory machines it means you can hold some reasonable sized files together with your program.

The mathematical limitations are possibly more serious. The fact is the BASIC can only handle integers in the range - 32768 to 32767, no decimals,

BASIC

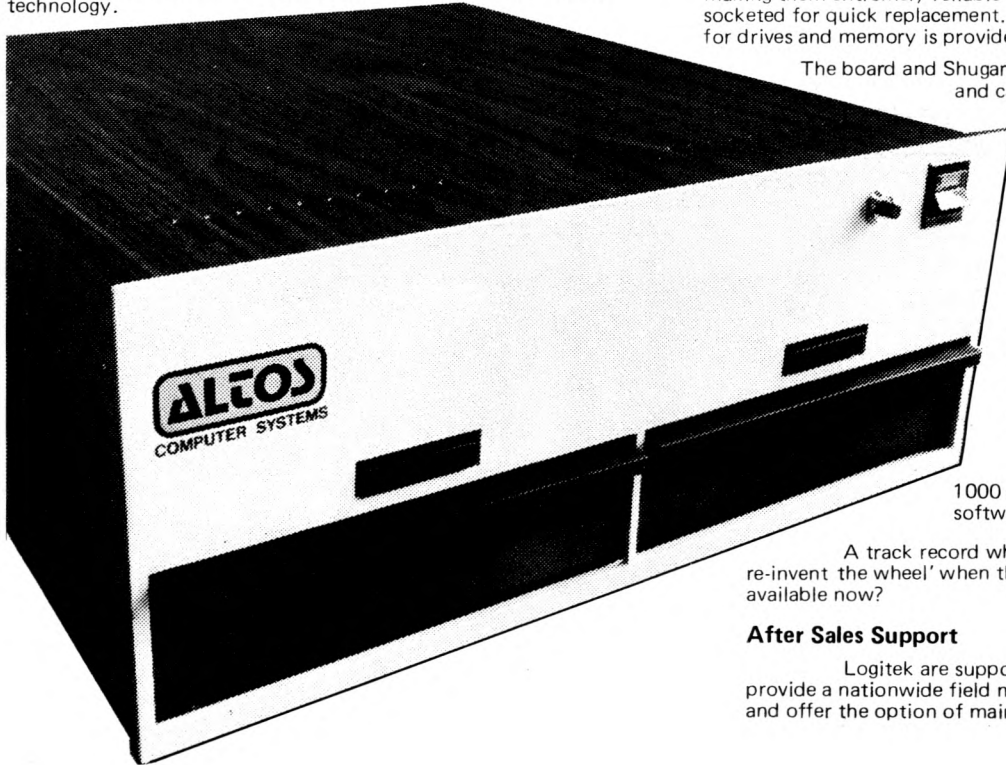
String Expressions			
CHR\$(n)	TL\$(s)	STR\$(n)	
Integer Expressions			
PEEK(n)	CODE(s)	RND(n)	USR(n)
Statements			
NEW	LOAD	SAVE	RUN n
RUN	CONTINUE	REM	IF n THEN stmtn
INPUT dest	PRINT	LIST n	LIST
STOP	DIMα(n)	FORα=n TO n	GOTO n
POKEN,n	RANDOMISE n	RANDOMISE	CLEAR
CLS	GOSUB n	RETURN	NEXT α
Operations			
n**n	— n	n*n	n/n
n+n	n — n	n = n	n > n
n<n	s = s	s > s	s < s
NOT n	n AND n	n OR n	
n = number			
s = string			
** = to the power of			

LOGITEK

The ALTOS ACS 8000 range of business/scientific micro computers creates a new standard in quality and reliability in high technology micro computers.

High Technology

Floppy Disk System The ACS 8000 single board Z80 floppy disk based micro computer utilises the ultra reliable Shugart 8 inch, IBM compatible, disc drives, double density — single sided, and providing 1 M. byte of data storage. Featuring the ultimate in high technology hardware: a fast 4 MHz Z80 CPU, 65 kilobytes of 16 K dynamic RAM, 1 kilobyte of 2708 EPROM, an AMD 9511 floating point processor (OPTIONAL) a Western Digital floppy disc controller, a Z80 direct memory access (OPTIONAL), Z80 parallel and serial I/O two serial RS232 ports, 1 parallel port) and a Z80 CTC Programmable Counter/Timer (real time clock). In essence, the best in integrated circuit technology.



Hard Disk/Multi User Systems The Winchester hard disk/multi user systems are now available supporting up to 4 simultaneous users and providing a maximum of 58 Megabytes of hard disk data storage.

The systems are truly flexible and allow expansion of the ALTOS floppy disk system to keep pace with the users requirements.

Still single board, features include * a high speed I/O section with up to six serial ports and one 8 bit Parallel port * up to 208K of on board RAM. * High speed (4 MHz) D.M.A. control as standard.

Yes, mini power and at micro cost too.

Built-in Reliability

The ACS 8000 range are true single board micro computers making them extremely reliable and maintainable. All electronics are socketed for quick replacement. Complete diagnostic utility software for drives and memory is provided.

The board and Shugart floppy disk drives are easily accessible and can be removed in less than ten minutes.

Quality Software

Unlimited versatility. The ACS 8000 range support the widely accepted CP/M and MP/M operating systems plus basic (Microsoft and CBasic), Cobol, Pascal, and Fortran IV. All available now.

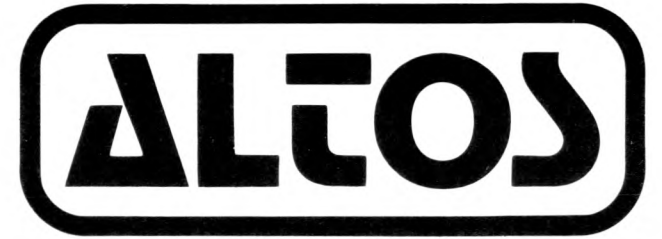
Logitek in conjunction with its own microsoftware house, Interface Software Ltd. of Camberley are able to supply a wide range of proven 'off the shelf' business software including general accounting, word processing, stock control, mailing list etc.

There are already over 1000 micro computer installations using this software.

A track record which we consider speaks for itself. Why re-invent the wheel when there is standard software of this quality available now?

After Sales Support

Logitek are supported by DDT Maintenance Ltd. who provide a nationwide field maintenance service for ALTOS products and offer the option of maintenance contracts.



Availability

Logitek carry deep shelf stocks of ALTOS hardware and compatible peripherals.

If you are a dealer who may be interested in promoting ALTOS and/or Interface Software by joining the fast growing network of approved suppliers, contact Logitek.

We can offer you something rather special now.

Approved Dealers

LONDON: Logic Box Ltd. Tel: (01) 222 1122
Boyd Microsystems (Watford) Tel: (01) 950 0303
Systematica Tel: (01) 485 3634

WEYBRIDGE Kewill Systems Ltd. Tel: (0932) 222448
CAMBERLEY Profac Computer Services Ltd. Tel: (0276) 25247
GLASGOW Robox Ltd. Tel: (041) 221 5401

PERTH Peter MacNaughton & Associates Tel: (073 888) 267
EAST ANGLIA Proloc Computer Systems Ltd. Tel: (0502) 714038
BIRMINGHAM Saba Computer Systems. Tel: (021) 643 2021
University of Birmingham (Anthony Clewett)
Tel: (021) 472 1301. Ext. 2001/2273

LINCOLN Evan-Jackson Computer Business Systems Ltd.
Tel: (0522) 30371

NOTTINGHAM East Midland Computer Centre. Tel: (0602) 267099
SHEFFIELD Sheffield Computer Centre. Tel: (0742) 53519
GLOUCESTERSHIRE Woolsack Computer Centre (Tetbury). Tel: (06666) 269
WILTSHIRE Validata Services (Melksham). Tel: (0225) 705957
BOLTON B. & B. Consultants. Tel: (0204) 26644.
YORK Derwent Electronics Ltd. Tel: (0904) 53990
WINCHESTER Software Development Services Ltd. Tel: (0962) 68956
HARROGATE Monitor Data Processing Ltd. Tel: (0423) 60670
KIRKHAM Minicom Business Machines. Tel: (0772) 686617



LOGITEK
E.I.C. Electronics Ltd.
All enquiries to:
Portland St. Chorley, Lancs.
Tel: 02572 66803

also at:
30 Kelvin Ave.,
Hillington Industrial Estate,
Glasgow G52 4LH.

hence the programmer must write a little routine for each mathematical function that requires decimals to be used. This should pose few problems for those with the larger memory machines but it will undoubtedly occupy a fair chunk of the basic 1K system.

So much for bad news; now here are some of the good features of the language.

Taking numeric functions first, the BASIC offers up to 26 single dimension numeric arrays of any length. It also allows three Boolean operations — AND, OR and NOT.

The randomising functions are worth a mention. RANDOMISE n sets a seed value, while RND(n) gives a random number in the range 1 to n. PEEK and POKE are both available so it's possible to read or modify memory contents; coupled with theUSR function, this means that Z80 machine code routines can be executed.

Up to 26 FOR . . . NEXT loops can be nested and the number of nestable subroutine calls seems to be dictated by the amount of memory available to the stack. On the 1K machine with a short (4 line) program, I was able to get 327 subroutine calls in before needing to RETURN.

String functions, while adequate, could definitely be improved. The absence of a DATA statement and the lack of string arrays caused particular frustration. Although there are ways around these problems, they can be time consuming and messy.

The functions which are available, and which form the building blocks of string handling subroutines, are STR\$, TL\$, CODE, CHR\$ and INPUT. STR\$(n) returns a string of 1 to 6 characters representing the signed, decimal value of n. TL\$ returns a string minus its first character, while CODE returns the code for the first character in a string. CHR\$(n) represents the character whose value is n and INPUT allows the operator to input numeric or alphanumeric information. A nice touch is that if the destination of input is a string variable, then the BASIC kindly provides a pair of quotes which act not only as a prompt, they also save a little bit of keying.

There is one trap here for the unwary, and I fell into it. I had this nice little loop going and after a while I got fed up with it. Could I get out of the system — could I heck! I hit everything in sight but all I managed to do was crash the system (see earlier). The trick is that if you are in an input string loop, remove the quotes and then put in an arithmetic expression which will resolve outside the range — 32768 to 32767.

So, that's the BASIC — I reckon that it's pretty good under the circumstances and in some respects I prefer it to the BASICs that do all your thinking for you.

Documentation

This comprises a programming cum operating manual. It's very well presented, being written by Hugo Davenport of Cambridge Consultants, with appendices by the mystery man from Cambridge who wrote the BASIC interpreter. (A fiver to the first reader

to identify this elusive gent.) There are a few small mistakes in the manual — none of them terribly serious and all of them being dealt with before the next reprint. It's probably good enough to learn to program from it and my only real criticisms lie in the area of what it does (or rather, doesn't do) for the raw beginner. I lent the machine to one such person for a few hours and here is his reply regarding the documentation:

"I read Chapter 2 (Getting Started) and got completely lost by the third page. One minute it's telling me how to wire everything up, the next there's something incomprehensible about storing programs on tape. I couldn't find an 'Idiot's Guide to getting started' anywhere."

Maybe the Operating Manual wasn't designed with such a person in mind — even so, novices like him must surely represent a good sized chunk of the ZX80's ownership potential."

Future plans

A new ROM is being developed which will overcome most of the shortcomings of the existing system. Being 8K instead of 4K means that file handling routines will enable us to read and write tapes — even discs! This new ROM will also include the missing trigonometrical, logarithmic and floating point arithmetic functions.

Another area of development is on the memory front. A 16K plug in dynamic RAM is a distinct possibility; this will be considerably cheaper than taking the present £300 expansion route. A printer is also likely to appear in due course.

Potential use

In its present form the ZX80 offers an ideal introduction to computing. It makes BASIC easy to learn, it's small enough for it not to be intimidating and it's cheap enough that, should you decide computing is not for you, you can give it away, sell it or whatever. Indeed it's probably cheaper to learn BASIC this way than to pay for many of the courses around.

Teachers might buy it for their students' use because at the price there is no need to go through a complicated rigmarole to get the money. The 1K version can be used for fairly simple games and activities, although it's likely you will want to expand it before very long. Later, when the file handling facilities are introduced together with floating point arithmetic, I think the machine will become really useful, though still very much at the personal level. Home accounts and engineering calculations spring to mind immediately — don't ask me why! Suddenly the machine becomes something more than a teaching machine or toy: it starts to become a real computer.

Conclusion

Having just read Science of Cambridge's claims for the machine again, I have to say I agree with most of them. The only point I would question is that it offers high resolution graphics. OK, OK, so they are playing the same game as

everyone else . . . all the same I feel that it should be explained. Just lately, people have taken to calling pixel graphics, high resolution graphics. Accordingly, what used to be called high resolution graphics now has to be called ultra high resolution graphics. To put it another way, the ZX80 offers a graphics resolution of one quarter of one character, plus you must write your own software to be able to use it. PET is in exactly the same boat, unless you want to buy the high resolution add-on at about £300.

The ZX80 appears to be a well thought out machine both in terms of hardware and software. It has an excellent editor and interpreter which between them help you avoid all sorts of nasty pitfalls. The BASIC instruction set lacks one or two fairly important facilities — namely file handling and floating point calculations. Despite this, it's still a fine machine on which to learn about computing. The new ROM expected later this year will overcome the prime limitations leaving me very little to say except that I hope Mr Sinclair and his merry men of Cambridge can cope with the expected flood of orders and, perhaps more importantly, the after sales service which is vital in this sort of operation.

Our thanks go to Clive Sinclair for lending us the machine, and to Jim Westwood (its designer) for patiently answering so many questions.

Prices

Kit:	£79.95
Built:	£99.95
Mains adaptor:	£ 8.95
Memory expansion board: (takes up to 3K)	£12.00
each extra 1K:	£16.00
Manual: (free with machine)	£ 5.00

Benchmark timings (in seconds)

BM1	1.46
BM2	4.69
BM3	9.18
BM4	8.95
BM5	12.7
BM6	25.9
BM7	39.2
BM8	not performed (see text)

AT A GLANCE

First Impressions

Looks	*****
Setting up	***
Ease of use	****

High Level Languages

BASIC	***
-------	-----

Performance

Processor	****
Cassette	***

Expandibility

Memory	***
Bus	**

Compatibility

Hardware	*
Software	*

Documentation

Documentation	****
---------------	------

Value for money

Value for money	*****
-----------------	-------

*****	excellent
****	v. good
***	good
**	fair
*	poor

Malcolm Peltu threads his way among the plethora of sci-fi "fanzines" while, back once again, we welcome Michael James to a regular new Bookfare spot entitled *Technical Reviews*.



Sci-fi sighs

There was a time when science fiction was clear cut. Bug-eyed bugs, Big Brother, brave new allegorical worlds and inter-galactic exploration and battles. Now, fact, fiction, faction and fantasy merge into one gel.

This mixture is vividly illustrated by looking round any specialist SF bookshop. Recently I visited one such — Dark They Were and Golden Eyed — nestling in the heart of London's Sex Fantasy zone, Soho.

While there are, of course, rows and rows of traditional Science Fiction and Fantasy novels, there is also a wide assortment of magazines or "fanzines" as one of them calls itself. With names like *Algol*, *New Worlds* and *Ad Astra*, their general intergalactic, sciency flavour is clear but their content is often irritatingly scrappy as they thrash around for some sort of identity.

One of the more intriguing is *New Worlds* (75p) which is co-edited by acknowledged science fantasy guru, *Michael Moorcock*. But issue 216 (no date) has an apologetic editorial which indicates the hit-and-miss (sometimes hit-and-run) aspect of these journals.

"Regular readers may have been bothered by a tendency of *New Worlds* to become significantly more obscure in recent issues," begins the editorial, which then is at pains to point out that the last issue had been produced by staff who had no previous experience on the magazine. Issue 216, however, clearly identifies the nature of each section as News, Fiction, Poetry, etc. to avoid confusing the uninitiated. Even so, it's not clear what the magazine's theme is supposed to be, except a search of "inner" space, with the *New Worlds* in the title seeming to refer to new perspectives on our current world rather than other planets. The stories and

poems are interesting, if sometimes quirky, with more emphasis on reliving earth's history and personal trauma than exploring other realms.

A note slipped in with the issue captures the "radical underground" flavour of some of the magazines. It points out that the *New World* printers, a "socialist collective", had objected to the sexist nature of an extract from a Norman Spinrad book. The editors felt this objection was "unwarranted and absurd". No compromise was reached — and the page remained blank.

The editors, however, are offering prizes to people sending in imaginary versions of the blank page and they promise to publish the full original text in the next issue which will be handled by a "less enlightened printer."

Norman Spinrad is the "feature interview" in *Ad Astra* Issue 7, (45p) a particularly disappointing magazine because it promises more than it delivers. It has an attractive full colour cover and describes itself as "Britain's premier science fact/science fiction magazine", adopting a similar formula to the glossy Penthouse-backed *Omni*, an even more over-inflated tease (*Bookfare*, January 1980).

Although Spinrad is described as "one of the most significant writers of the 20th century", the interview is so short, superficial and full of lazy writing as to be virtually meaningless. For example, the anonymous interviewer asks Spinrad if he views himself as a radical. The ridiculous response is "The answer is yes, but not as radical as whatever the word means."

Ad Astra has an interesting article by Ian Ridpath on searching for life in space but other articles on Quatermass and The Black Hole add very little to the publicity which surrounded these ventures; also the few short stories are pretty mundane.

The main fault with *Ad Astra*, as with many of the others, is a lack of confidence and conviction. This is illustrated by an editorial which celebrates its first year of publication with a sigh of relief, saying that "a whole year in existence . . . is no mean achievement given the track record of magazines of similar ilk." And there is a plaintive letter which begins "Every time I write to a



magazine or comic it folds . . ." Such poignancy is worthy of a Lennon-McCartney hit record.

Despite its name, *Algol* (£1.20) has nothing to do with programming languages. It's very much for SF devotees and filled with interviews and reviews of science fictions writers and themes. However, the Summer-Fall issue 1977 (many of the magazines are of oldish or indeterminate age) contains an example of the type of approach which could attract the less dedicated SF freaks. Fred Saberhagen writes a brief introduction to how he started writing a series of stories about *The Berserker*, a war machine that roams the universe automatically killing things.

The Berserker actually appears in some computer space war games, although Saberhagen says that it's still vastly outnumbered by the Klingon forces. Saberhagen describes how he had the idea one day in 1962 of a "functional, checker playing computer without any hardware more advanced than a game board, a few small boxes and a stock of various coloured beads." Sitting in his Chicago apartment, stirred

by this idea, off the top of his "then-ungrayed and crewcut head" he started writing. "The machine was a vast fortress, containing no life, set by its long-dead masters to destroy anything that lived . . ." And that was the start of a series of at least 20 stories about the Berserker, one of which is included in the same issue of *Algol*.

This approach provides interesting background to an outsider plus a longish story for the enthusiast to get his teeth into. If only more magazines could grasp this formula and develop it with imagination and conviction, perhaps the survival rate of SF publications will grow higher.

Another approach, which seems more commercially successful than other formulae is illustrated by *Future Life* (95p). This concentrates more on actual technological developments, plus a heavy sprinkling of films and TV to attract the fans. Although it's a bit late to bring out a February 1980 issue in the UK on *Star Trek* and *The Black Hole*, *Future Life's* main feature on "forecasting the next decade" provides an intelligent and well presented view of information

BOOKFARE

technology developments, from a comparative guide to personal computers PET Apple, Compucolor et al to micro games and Prestel information services.

Future Life does not attempt to provide fiction but its news snippets and interviews with authors like Theodore Sturgeon are serious and of a depth unseen in some of the other more amateurish efforts. And it also has a nice visual style which highlights the real creators of our images of the future — artists and designers who provide the pictorial interpretations of writers' visions, such as Robert McCall who worked on the finale of the Star Trek film and Jon Lomberg who designed the TV series, *Cosmos* (featuring scientist and Pulitzer Prize Winner Carl Sagan and due to be shown in the US at least, later this year).

Now that computing, communications technology and space travel have already turned sci-fi dreams into reality, there is clearly scope for a popular publication which explores the futuristic implications of technological developments . . . using the imagination of fiction writers to offer insights into the likely direction and impact of the technology. The lavishly-financed *Omni* has so far failed to do this in a forceful and coherent way, while others, such as those reviewed here, still see themselves too much as preaching to the converted fan rather than opening out to a wider audience.

In the meantime, for those who want to actively participate in creating, rather than consuming, dreams of the future, *Focus* (75p) published by the British Science Fiction Association (contact Alan Dorey, 20 Hermitage Woods Crescent, St Johns, Woking, Surrey GU21 1UE) contains useful, practical hints for budding sci-fi writers. Articles in the Autumn 1979 issue with titles like *Who needs an agent?* and *Writing SF for Children* indicate the style of the publication. There is also advice on the need to do research to flesh out imaginative ideas in a way that captures the right sense of "reality" — even if in a fantasy situation. And there are some worthwhile guidelines on how to approach publishers.

For passive consumers of sci-fi, however, *Future Life* promises that the 1980's will be vintage American TV

years for futurism, with the small screen following trails blazed by block-buster movies like *Star Trek*. This of course was the most successful TV flop of all time, with the *SS Enterprise* haunting out screens long after it was scrapped by the TV moguls. The mass media cosmos really moves in mysterious ways.

All the sci-fi magazines were obtained from *Dark They Were and Golden Eyed*, 9-12 St Anne's Court, London W1 at the prices quoted.

TECHNICAL REVIEWS

by Michael James

Computer Programs That Work

J.D. Lee, G. Beech and T.D. Lee (Sigma Press, 99p 24 programs, 6" x 8 1/4", (£2.55)

This book is remarkable value. The programs are far from trivial and include some rare beasts among their number. Divided into three sections, we start with Maths programs: AREA (integration), CALENDAR, DAY OF THE WEEK, LEAST SQUARES straight line, PRIMES (sieve of Eratosthenes), ROOTS (quadratic equations), STANDARD DEVIATION; continues with the Science section: LIFE (Conway's "game"), PREY (ecology), WASTE (pollution), TITRE (titration chemistry), END-POINT (potentiometric titration), ATOMIC ORBITALS (plots common orbits), WAVES (Fourier synthesis), BOMB (Monte Carlo simulation of nuclear fission), SATELLITE (Kepler's laws); and finishes with games: BATTLESHIPS, CARS, CHOMP, DRAG, FRUIT MACHINE, MASTERMIND, SPIES, TIMM (Nim).

The programs are well presented, starting with an introductory page, then a listing and a trial run. The discussions are well informed if somewhat brief. Of all the sections, the science one is most unusual, containing many programs that would be otherwise difficult to find.

The games have a distinctly educational flavour — it's not difficult to think of 6th form projects based on any of them. I am also glad to say that one or two of them are new to me!

Apart from the use of MAT statements, the BASIC used is easily within the scope of most microcomputers. (Details of it are given in the preface). It still seems a pity

(see other reviews) that we have to type these programs in and the promise of papertape copies, made on the back cover, offers little hope of obtaining a generally machine-readable form. Will we really have to perfect a computer reading peripheral before a standard interchange form is found?

An excellent book. Even if you only want one of the programs it will repay the investment many times.

Calculating with BASIC
R. Guido, 1979 (SCELBI Publications, 79 pp, 8" x 11", £4.95)

This is an unusual book in that, rather than trying to teach the reader BASIC, it attempts to show how one can use BASIC in various fields of application.

My first complaint is that the cover lists "maths, finance and statistics, mechanical engineering and electronics," and the book only deals with maths at about A-level, finance and mechanics at about O-A level, simple electronics (the behaviour of resistors, capacitors, etc.) and something that isn't mentioned on the cover — games! Having made clear the topics covered, it must also be said that none of the programs listed would be of much use to an expert, or even to someone competent in the various fields. They are all fairly simple and wouldn't tax anyone's programming skills to write.

The value of this book would very likely be missed by anyone looking at it quickly in a shop. It's not a selection of programs to solve specific problems but rather a collection of simple problems and worked solutions in BASIC. Used in conjunction with a BASIC Manual, this would form a good basis for an applied course in BASIC at school or first-year university level. That's not to say that the book couldn't be used as a self-study text; the explanations are clear and each program is developed in reasonable chunks and is well commented. However, I feel that a computer should be at hand in order to get the most from the book.

If you feel you're coping with BASIC but can't see how to use it in your own subject then *Calculating with BASIC* might convince you that it's all worth the effort.

6502 Applications Book
Rodnay Zaks, 1979 (SYBEX,

249pp., 5 1/2" x 8 1/2", £7.95)

Any new book from Rodnay Zaks is important and anything called an Applications Book must be of interest to a home computer owner? True? — no, not necessarily. There is a distinct split between hardware and software experts. (True, there is a small group who feel happily at home in both, but I've no evidence to say that this is because of their interest in microprocessors). The software people seem to be interested in "soft" projects — games, business programs, etc. Any extra hardware is usually simple — a sound box for a PET or a joystick for an APPLE. Their creative effort goes into the program and the hardware is seen as someone else's problem. The hardware people do not have quite such a clear cut time of it! Their main interest and hence creative effort goes into the hardware, but they cannot afford to ignore the software — they simply have to write a program to get their masterpiece working.

The software/hardware division in the home computer world is a problem when trying to write a book of applications. If you assume that the reader has only software knowledge, then quite a bit of time has to be spent teaching basic electronics. If you assume that the reader has only hardware experience then a course in computer science is what you finish with. If you assume a fully knowledgeable reader the book becomes redundant!

Taking all this into account one can only expect an applications book to be useful to a small group of people who happen to meet its hardware/software level. Rodnay Zaks has, however, solved the main problem by writing *Programming the 6502* before the *6502 Applications Book*. If you're a hardware expert then read the former volume first. If you're a software (6502) expert interested in hardware applications of the 6502 then this book is for you.

It starts with a discussion of the standard interface chips — the 6520, 6522, 6530 and 6532. This is tough going if you try to take it all in at once. Don't! Read it briefly and then as required to understand the later applications.

Chapter 3 gives a description of the usual one-
Cont. on p89

The multi-minded micro



The Sharp MZ-80K with BASIC, Machine Language & Assembler.

Sharp's microcomputer has three languages. There's BASIC of course and now tapes and manuals for Machine Language & Assembler Programming.

Trust Sharp, leaders in the field of electronic business equipment to come up with such a multi-minded microcomputer.

- * Z-80 based CPU
- * 4K bytes monitor ROM
- * Internal memory expansion up to 48K bytes of RAM
- * 14K extended BASIC (occupies 14K bytes of RAM)
- * 10" video display unit—40 characters x 25 lines
- * 80 x 50 high resolution graphics
- * 78 key ASC11 keyboard alphabet (capital and small) plus graphics
- * Built in music function
- * Fast reliable cassette with tape counter—1200 bits/sec
- * 50 pin universal BUS connector for system expansion—printers, floppy discs. etc.

Insist on

SHARP

Audio, Video, Business Systems, Calculators,
Cash Registers, Copiers, Microwave Ovens.

Sharp Electronics (UK) Ltd., 107 Hulme Hall Lane, Manchester M10 8HL Tel: 061-205 7321

Find out more about the multi-minded micro by filling in this coupon right away.

I would like to know more about the SHARP MZ-80K and the address of my nearest Specialist.

NAME _____

ADDRESS _____

TEL: _____

Sharp Electronics (UK) Ltd., 107 Hulme Hall Lane,
Manchester M10 8HL Tel: 061-205 7321

PCW/4

BEEFING UP THE MK.14

The alarming rate at which MK-14 microcomputers are appearing on the classified ads pages of the various computer magazines is a useful indicator of the shortcomings of this very popular device. Tim Hawkins feels the main problems centre around memory size and input/output limitations and in this article he describes a bus interface system which will allow the adding of suitable low cost options.

A problem of size

The Science of Cambridge (SOC) MK-14 is a very popular microcomputer training kit, representing for many people their first contact with the world of personal computing. Because of its very low initial cost it has become one of the mainstays of cheap, low budget computing, used by amateurs, students, schoolchildren, and anyone wishing to gain a foothold in the world of data processing. Unfortunately as a user becomes more acquainted with his/her machine and hopefully more ambitious, then the limitations of the device become increasingly apparent. The first problem is that of memory size, the 600 or so bytes available on even a fully expanded board has a pronounced damping effect on the size and complexity of the programs that may be run on the machine. Secondly, I/O problems; the Hex keyboard and 7 segment display are ideal for an educational trainer, but they hardly do justice to your latest version of "moonlander" or "shoot-out at the OK corral".

Is it little wonder that many people turn out their MK-14 in favour of something a little bigger and more flexible? On the other hand, as the MK-14 embodies most of the basic concepts of the larger machines, I see no reason why it should not form the nucleus of a more desirable system.

A pack of cards

Users of most other systems commonly have access to some form of expansion facility that allows the machine to be upgraded according to need... it's an extremely desirable feature, and the only other alternative is to change the computer every time you start to feel constricted. The normal approach to such computer expansion is the introduction of a system bus; mainly it takes the form of a mother board, often with buffered signal lines, into which memory and peripheral expansion cards can be slotted. Each card picks up the computer's address, data and control busses on its edge connector, communicating with the CPU via a bi-directional databus. The ideal expansion system for the MK-14 should:

a. have a low hardware cost, making small memory expansions economically feasible, and allowing those of us with hardware experience to construct "homebrew" hardware without having to resort to expensive prototyping systems (sometimes known as "Kluge boards").

b. Extend the addressing range from the

present maximum of 4K (of which not all is used) to a possible 64 Kbytes.

c. Leave the machine software and hardware compatible with the full range of SOC interfaces and software.

d. Have a wide range of options allowing the user to configure the machine to suit particular needs.

Careful choice of a card system is necessary in order to make the above objectives possible. In addition it's worth adding a few cost-related directives to aid the choice still further:

1. It must not use indirect edge connectors such as DIN 41612 as these items are generally very expensive.

2. It must be cheap, easily obtainable, and not likely to be discontinued in the near future.

3. It must not require a special mother board as these items are also very expensive.

Looking around the market turned up only one real possibility that fulfilled all 3 conditions — the Kemitron system. Others such as the Elektor bus and the Acorn bus were considered but they fell down on the overall hardware cost of each card. The Kemitron system uses a mother board constructed from a piece of Veroboard with 43-way edge connectors soldered across its width; no PCB — just Veroboard and connectors. Due to the use of direct connectors, pieces of Veroboard cut to a suitable size may also be plugged in to carry any user designed equipment. Kemitron make a wide range of boards ranging from RAM and EPROM cards to two different types of VDU and an EPROM programmer — about 20 options in all. Full details of the system can be

obtained from Greenbank Electronics whose address is given at the end of this article.

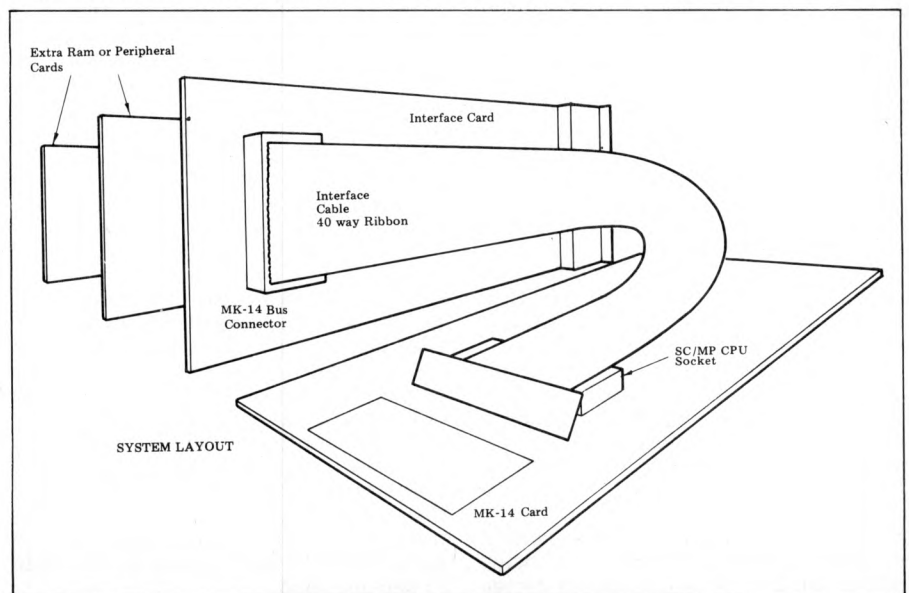
Having decided on the card system to be used it remained for me to decide a method of interfacing it to the MK-14.

A quick look at the MK-14

The interface relies heavily on the fact that there are several holes in the MK-14's address map. If we send an address which lies inside one of these holes, then all of the onboard logic will be deselected and effectively disconnected from the databus. This feature allows us to switch between the MK-14 and any external memory on the expansion busses.

One of these holes lies immediately above the monitor program extending from Hex 200 to Hex 7FF. Unfortunately this is only true of the Mark 5 boards; if you have one of these (it's legended on the reverse side of the keyboard on the PCB) then all is well. If not then don't despair as the problem can be remedied. (If you are not sure about which model you have then check the locations in memory from Hex 200 comparing them with the corresponding locations from Hex 000 upwards. If they are the same then you have an early version of the board which has 4 copies of the monitor program in the first 2K. The required modifications are detailed in a later section of the article).

The use of holes in the address map to provide deselection of onboard logic, whilst routing off-page addresses through the usual arrangement of



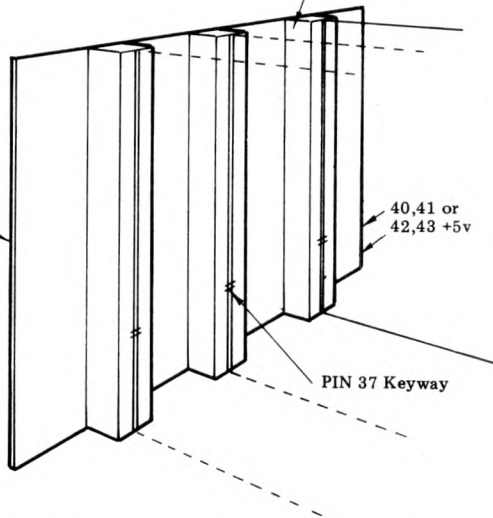
43 way 0.1" Connectors

43 Strip
0.1" Veroboard

40,41 or
42,43 +5v

PIN 37 Keyway

MOTHER BOARD CONSTRUCTION



buffers on to the mother board, allows the Mk-14 board to remain unmodified and hence compatible with SOC software and the full range of interfaces that SOC have released to date. Also, those of you who have fitted the extremely useful single-stepping facility should have no trouble at all operating it on programs developed in the expanded area of RAM. An option to implement single-step will be described in a later paragraph.

Hardware

The interface card connects to the machine via an interface cable which plugs into the CPU socket of the MK-14. The circuit works as follows. IC4 (74LS175) is used to capture the 4 most significant bits of the 16 bit addresses which are multiplexed on to the data bus whilst the NADS strobe is low. The other 4 bits of the databus carry status information during this time. The outputs of the latch are buffered via IC2 and fed to the system bus. This latch also provides a set of complementary outputs (IQ-4Q) which after being Nanded by N7 (74LS20) provides a signal which goes low if the CPU outputs a page zero address. This signal is used to control the address multiplexer IC5 (74LS157).

If the CPU selects any page other than page 0 then the output of N7 will go high, selecting the hardwired address up on S1-S4 and routing it to the most significant byte of the MK-14 address bus. This address is selected so that it points at an empty area of the MK-14 address map, and thus deselects the board. This select signal is inverted by N8 and is used to enable the data bus buffer IC1 and to allow the CPU to communicate with external hardware.

Address bus and control bus buffering is provided by IC2 and IC3 (2x81LS95) and N1-N6 (74LS04) respectively. The various I/O and interrupt pins of the SC/MP chip are shown as being wired to both connectors. In practice it is likely that a mix of signals will be needed on each connector, some not being used at all; it's up to the user to decide

which bus to use, depending on requirements.

Options

The basic system may be enhanced in several ways and the following are suggestions that have been tried and tested on the author's prototype.

A. Single Step. This circuit is from the SOC Manual and generates an interrupt (sense A high) as control is passed from the program to the user routine. This causes the CPU to execute the first instruction of the routine and jump back to the monitor, displaying the address of the next instruction and its value. By pressing the "go" key the program will stop one instruction (not one byte) at a time, so that program flow can be checked. One must be careful, however, to ensure that there are no instructions that modify P(3) in the program or the single step will start doing some funny things.

The hardware to implement this is shown in fig. 2. Seven cycles before exiting the user program the MK-14 monitor executes a halt instruction which clears the single step counter. The 74LS93 counts NADS pulses which mark each cycle, so as the CPU reaches the first byte of the user program the QD output of the counter is incrementing to one, generating an interrupt on sense A. This causes the SC/MP to execute the current instruction and return to the monitor routine. The 3 position switch selects DEBUG (sense A low, normal monitor operation), system interrupts (sense A connected to system interrupt line) and single step (sense A to QD output of 74LS93).

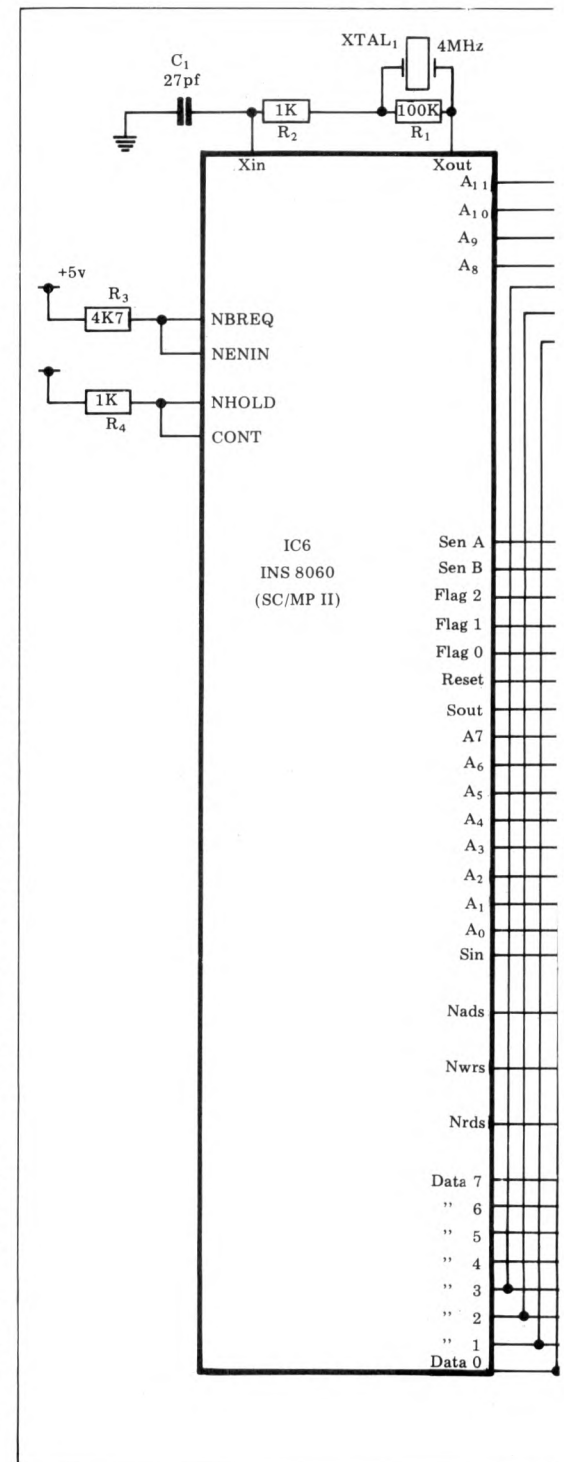
B Wait State Generator. If it is necessary to use a long interface cable (greater than half a metre) then this option will be necessary. Because of the longer length of cable there is a greater propagation delay through it, so the processor must be made to mark time until the cable signals have stabilised. The circuit shown in fig. 3 implements this. It effectively stretches the read/write cycle by the length of time needed for the signal levels in the cable to become valid.

IC1 is a 74LS122 which is triggered from the falling edge of either NRDS or NWRS; this results in the Q output going low and freezing the processor for the duration of the time period of the monostable. The clear input is connected to the output of the address decoder gate N7 (in the main logic diagram) which ensures that this freezing action only occurs on page 0.

The other method of slowing the processor down is to lower the frequency of the CPU crystal. Unfortunately this has the effect of upsetting any timing dependent (real time) programs such as the onboard tape I/O routines (SCIOS monitor only).

Construction

The prototype was constructed on a piece of Veroboard with a goldplated 43-edge connector pad. There were no real problems encountered except



that supply decoupling proved to be critical. The problem was solved by liberally sprinkling 0.1µF capacitors across the supply rails at various places. The interface cable can be constructed in many ways. I used a piece of 40-way ribbon cable with a 40 pin header on one end to mate into the SC/MP CPU socket. The other end was hardwired into the interface card. The Bus or Motherboard is relatively easy to construct and should present no problems. . . solder 0.1" pitch 43-way edge connectors across the width of a strip of Veroboard until you have as many slots as you need. I recommend that they should be spaced on 1" centres in order to make insertion of boards possible without the components touching.

Kemitron Electronics are currently working on PCBs to carry the components of the interface card, and these should be available from Green-

bank shortly. (It should be pointed out that Kemitron may change some of the components in order to make the design more economical, so if you are considering waiting until this PCB is released, then don't buy your chips yet!)

Software considerations

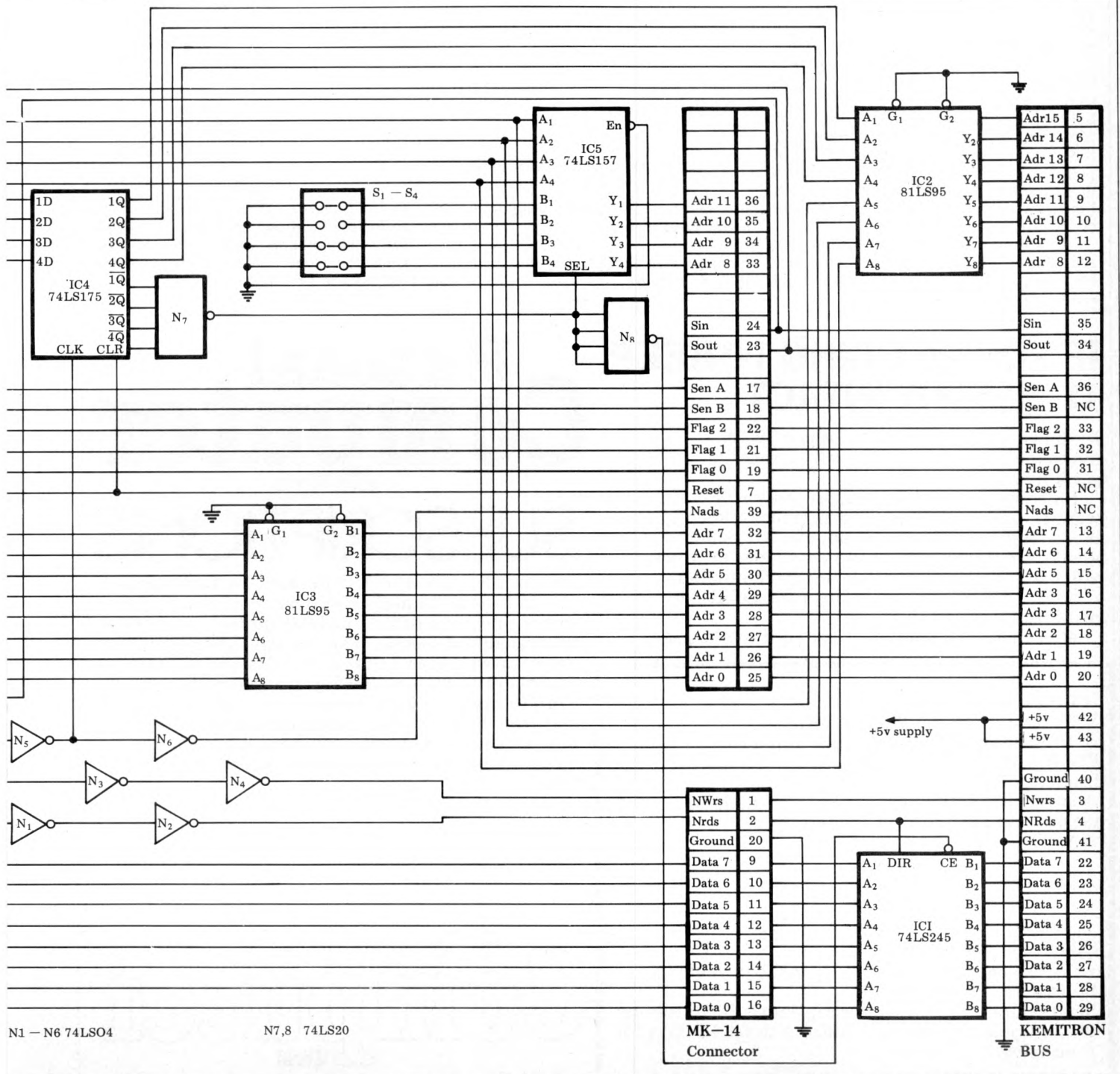
The monitor program on the MK-14 is quite capable of handling the 64K memory map, so there are few differences between the expanded and the original system. The SC/MP's memory map is organised as 16 pages each of 4K, each page being independent of the others. A program running over the edge of any of the page boundaries will "wrap around" to the start of the page it just tried to leave. Control transfer between pages is made

possible by loading a pointer with the target address and then swapping the pointer with the program counter. In fact it behaves like a much larger version of the original device.

The first programming exercise that the user should attempt is a better cassette interface program as the present SOC routines are only capable of loading or storing a maximum of 256 bytes; loading a fairly large program requires that it be loaded or saved in a series of 256 byte blocks.

Modifications for earlier models

As reported previously, the earlier models of the MK-14 cannot immediately be used under this system. This is because they have no unused portions of memory map that can be used to deselect the board, so we



N1 - N6 74LS04

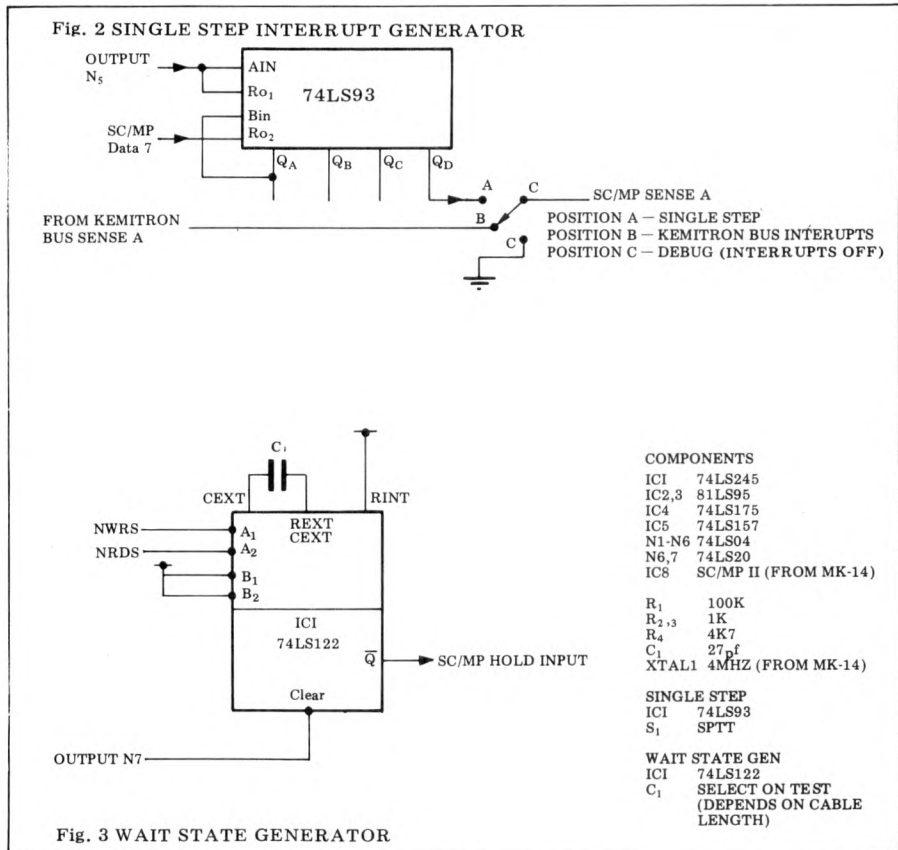
N7,8 74LS20

have to create one. We can either remove the optional RAM or the INS 8154 RAM I/O and change the hard-wired address links on the B inputs of the interface's 74LS157 (IC5) from 0100₂ to 1011₂ (optional RAM) or 1110₂ (RAM I/O). Unfortunately this means that some of SOC's software cannot now be run on the system but this is a small price to pay for the increased flexibility available. The links are marked S₁-S₄ on the main logic diagram and are "made" for a logic 0.

Conclusion

This is probably the only project I have been involved in that has at its completion achieved no real visible increase in the machine's abilities — indeed, in some cases its capabilities have been reduced. But it must be remembered that a bus system is designed to allow additional hardware to be added easily to the computer. The decision on whether to build or buy is yours, and it depends on whether or not you have any experience with construction of memory and peripheral devices. I chose the Kemitron bus because of its low cost: each board, sold without components, costs between £5 and about £9 — and the user provides his own chips. This means, for instance, that buying an 8K RAM board lets you build up your memory in increments of, say, 1K until the 8K limit is reached, at which time another board becomes necessary.

If you decide to build your own gear then, as I've explained, a piece of Veroboard 43 strips wide with a key



slot on strip 37 can be used to bread-board your own designs.

Further information on the Kemitron system can be obtained from Green-

bank Electronics. Send a sae to the following address and ask for leaflet MP4. Greenbank Electronics, 92 New Chester Road, New Ferry, Wirral, Merseyside L62 5AG.

IF YOU'RE GOING TO KEEP IT~KEEP IT INTACT

In the very near future this issue of PCW magazine is going to be virtually impossible to get hold of.

Since we feel certain that not only will you want to keep it, but are also anxious to keep it in the best possible condition, our Art department have designed a smart new binder in which you can secure all your valuable back numbers.

And at just £2.95 (including postage) its an offer that's bound to please!

Just check the coupon at the foot of the page.

UK Subscriptions: £8.00
 USA Subscriptions: £22.00 (airmail)
 Europe Subscriptions: £13.00 (airmail)
 Elsewhere: £25.00 (airmail)
 Binders: £2.95
 Please send me the next 12 issues of PCW
 Please send me PCW Binders
 NAME _____

ADDRESS _____

(Block capitals please)

I enclose cheque/P.O. for £ _____ made payable to SportsScene Publishers Ltd.
 Send coupon to PCW (Subscriptions), 14 Rathbone Place, London W1P 1DE. Allow at least 14 days for processing.

Personal Computer World

SUBSCRIPTIONS

Just over 2 years ago PCW became the first magazine in Europe to deal exclusively with the home and business use of Personal Computers. It has been an unqualified success. The current subscription list stands at well over 3,000, with a staggering 70% renewal rate! PCW reader loyalty is already a by-word in the publishing business. We aim to keep it that way. So if you are having difficulty in obtaining PCW at your newsagent, why not take out a subscription and have the magazine mailed to you direct?

Personal Computer World

THE 3rd Personal Computer World SHOW

will be held at the Cunard International Hotel
in Hammersmith, London on

4,5 & 6 SEPTEMBER 1980

Organizations interested in exhibiting should contact

TIMOTHY COLLINS

of Montbuild Ltd on

01-486 1951

THE 3rd Personal Computer World SHOW

will be held at the Cunard International Hotel
in Hammersmith, London on

4,5 & 6 SEPTEMBER 1980

Organizations interested in exhibiting should contact

TIMOTHY COLLINS

of Montbuild Ltd on

01-486 1951

THE 3rd Personal Computer World SHOW

will be held at the Cunard International Hotel
in Hammersmith, London on

4,5 & 6 SEPTEMBER 1980

Organizations interested in exhibiting should contact

TIMOTHY COLLINS

of Montbuild Ltd on

01-486 1951

THE 3rd Personal Computer World SHOW

will be held at the Cunard International Hotel
in Hammersmith, London on

4,5 & 6 SEPTEMBER 1980

Organizations interested in exhibiting should contact

TIMOTHY COLLINS

of Montbuild Ltd on

01-486 1951

Happy Memories

21L02	450ns	83p	16K Memory Upgrade Kits for TRS-80, Apple and Sorcerer All at	42.50
21L02	250ns	1.00		
2114	450ns	4.95		
		4.25	Vero S100 Products:	
4116	300ns	4/50	6 Slot Card Frame with Power Supply	241.36
			Prototyping Cards (3 types) ea.	13.66
4116	150ns	5.50	Extender Card	21.70
2708	450ns	4.95	Motherboard with 6 connectors	67.65
2716	5v	16.95		

IC Sockets:			Ithaca Intersystems Products:	
Pins	Solder	W/W	S100 Z80 CPU Card 4MHz A/T	176.81
8	10p	24p	" " " " 2MHz "	150.94
			" " " " Bare	

14	11p	36p	Board	30.19
16	12p	39p	S100 Video Display Board A/T	128.06
18	16p	46p	" " Bare Board	21.56
20	17p	58p	S100 16 x 2708/2716 A/T	73.31
22	19p	61p	" " Bare Board	21.56
24	21p	65p	S100 Proto Board (Plated Through)	21.56
28	27p	70p	See Ithaca's own advertisement for full range	
40	37p	109p	VERBATIM Mini-discs (Pet, TRS-80 etc)	10 19.95

SAA5050	14.85	Cannon MIN-D 25 way Connectors: Female	1.65
SAA5020	7.99	Male 1.45; Hoods 57p	
81LS96	1.50	Other sizes available	
81LS97	1.54	DIN 41612 Euroconnectors	
		64 way: Female	3.17
		Right-angled Male 1.93	
		Other sizes available	

74LS series:
Lots of them POA
DIP Switches: 4, 7 & 8 way all at 85

We stock a full range of Wire-Wrapping equipment and supplies for you to choose from; we have shelves of books- give us a ring with your requirements and avoid crippling postage charges. Our stocks are too numerous to list here- free price lists sent upon request

The shop is open from 10 until 6 Monday to Saturday and is worth a visit to catch a surplus bargain- Keyboards at 39.50 today, we may have some left when this gets to print ? 18 slot S100 Mother Boards at 22.50 ? Double Eurocard prototyping boards for a pound

ALL PRICES INCLUDE VAT. POSTAGE FREE ON ORDERS OVER 10 POUNDS IN VALUE, OTHERWISE ADD 25p. ACCESS AND BARCLAYCARD WELCOME, YOU MAY TELEPHONE WITH YOUR CARD NUMBER AND REQUIREMENTS. TRADE ACCOUNTS ON APPLICATION, GOVERNMENT & EDUCATIONAL ORDERS WELCOME £10 MIN.

**19 Bevois Valley Road, Southampton,
Hants. SO2 0JP Tel: (0703) 39267**

Dept EC.W.

aculab Ltd

> ACULAB 735, a fully self-contained interface for IBM 735 output golfball typewriters

The ACULAB 735P INTERFACE is a self-contained controller for IBM I/O typewriters and printers. The 735P accepts standard 7-bit parallel ASCII data and provides all of the handshake protocol, code conversion and solenoid voltages to run the printer at full speed using any correspondence or ASCII golfball to produce letter quality printing at 15 chars/sec ... £155.00 + VAT

The TRS-1 PARALLEL PORT DECODER plugs into the bus connector on the TRS-80 keyboard and decodes the port used by the ELECTRIC PENCIL and the LPRINT and LLIST commands in TRS-80 BASIC. ... £55.00 + VAT

The IEEE TO PARALLEL PORT CONVERTER plugs onto the PET IEEE bus connector and converts it into a parallel printer port. It also converts PET's unique version of ASCII to standard ASCII and provides a switch to give UC/LC compatibility with the new PET ... £45.00 + VAT

The ADDRESSABLE IEEE PARALLEL PORT DECODER has all of the features of the converter but may be set to answer to any of the available addresses on the PET IEEE bus and so be used along with the PET disc or any other bus compatible devices ... £66.00 + VAT

These last three devices are all fitted with 2 metres of heavyweight cable and a metal shrouded Centronics compatible connector.

aculab Ltd.
24 Heath Road,
Leighton Buzzard, Beds.
LU7 8AB

For further information
Telephone. 0525-371393.

INTERRUPT

This month "Conscientious Cowboy" questions the raison d'être of the Computer Retailers' Association and David Firnberg debates the uses to which computers are being put in schools today.

Who needs the C.R.A.?

You are choosing a micro system for your business. Each shop sells a different type of micro, alleged to be better than all the others. But they all agree on one thing: "Don't go to a new, small, 'unregistered' or 'unqualified' firm". . . whatever that may mean. Software is only a sideline for them, but they whisper meaningfully: "Beware the small man".

On the subject of qualifications, all you need to get up a computer shop is a bank reference and some connection with the computer world. Many computer businesses started as a partnership between a salesman and a mainframe buff; all the "experience" came on the job. Now they have a couple of smart shop assistants, two lads at the back, thousands of pounds worth of computers on the shelves — and they talk partronisingly of inexperienced newcomers and cowboys. Unfortunately if you're wanting some of their expertise they may be too busy to give you much of their time. . . you'll have to see the new trainee programmer. No doubt they belong to a trade association, but so what? — they're still too busy.

You may suppose that belonging to a trade association means that a firm is honest and reliable. You suppose wrong; all it means is that nothing has actually been proved against them. The snooty attitude of the established computer equipment business and the "trade association badge" retailer may be just another way of luring customers away from a rival concern. Many trade associations, despite the high ideals with which they are formed, soon become price rings or mutual admiration societies. Outsiders are discreetly damned with faint praise and hinted warnings of disappointing experiences. There's nothing unusual about this; you just have to take it all with a pinch of salt.

Let's consider some existing trade associations and your chances of getting a good deal from one of their members. Take solicitors and franchised garages. Lawyers have a very tight association, The Law Society, with compulsory exams, tribunals to investigate alleged misconduct and so on. And yet there is believed to be a larger proportion of crooks and incompetents in the law than in any other learned profession. Often, anyway, your work is quite likely to be handled by an unqualified clerk or trainee.

I wonder how many of you have entrusted your car to a franchised garage, expecting the highest standards? Independent research shows that you might well have been sadly disappointed. Suppose that by secretly marking parts of your car you discover they didn't actually service it at all — a deliberate swindle, and you complain. "I'm very sorry sir, the new girl (or the floppy disc) put your job sheet in the 'out' tray by mistake. We'll do it at once." Will you complain to the trade association? Probably not. If another garage knows what goes on, are they likely to make trouble for themselves by sneaking? No. So another crook stays on the register.

The fact is that the big firm, being a system (in the Systematics sense, see PCW book review Jan. 1980) has considerable opportunities for causing, excusing and glossing over all kinds of incompetence and even gross dishonesty. In a small business, at least you know where the buck stops. They are also probably more in need of your payment and your goodwill, and in the event of a serious dispute are more likely to settle quickly than to try to get you tied up with bureaucracy and other tricks.

So you need the services of a software consultant. What are these qualifications that are so essential? A

university degree in computing? A chap who can write a program to sort a million files in 10 seconds may not be very practical in his suggestions on how to plan for future developments in your business. In any case, the best predictor of success as a programmer is apparently English "O" level. Also, if he'll excuse my mentioning it, what qualifications does he have to make him a businessman? The fact is, if you can deliver the goods you have enough, and if you can't, they are irrelevant. It's like defining a gentleman. Everyone does it so as to include himself but to exclude the chap he thinks is one rung down the ladder. Remember, the strongest conservationist is the man who has just built his bungalow.

Let's get down to cost. A well-known, trade-registered all-singing-all-dancing consultant may well charge £13 per hour for programming. If you buy a complete turnkey system from a large firm they may subcontract the programming to the same chap and price it at £20 per hour. Compare this with what one man, working from home, might charge.

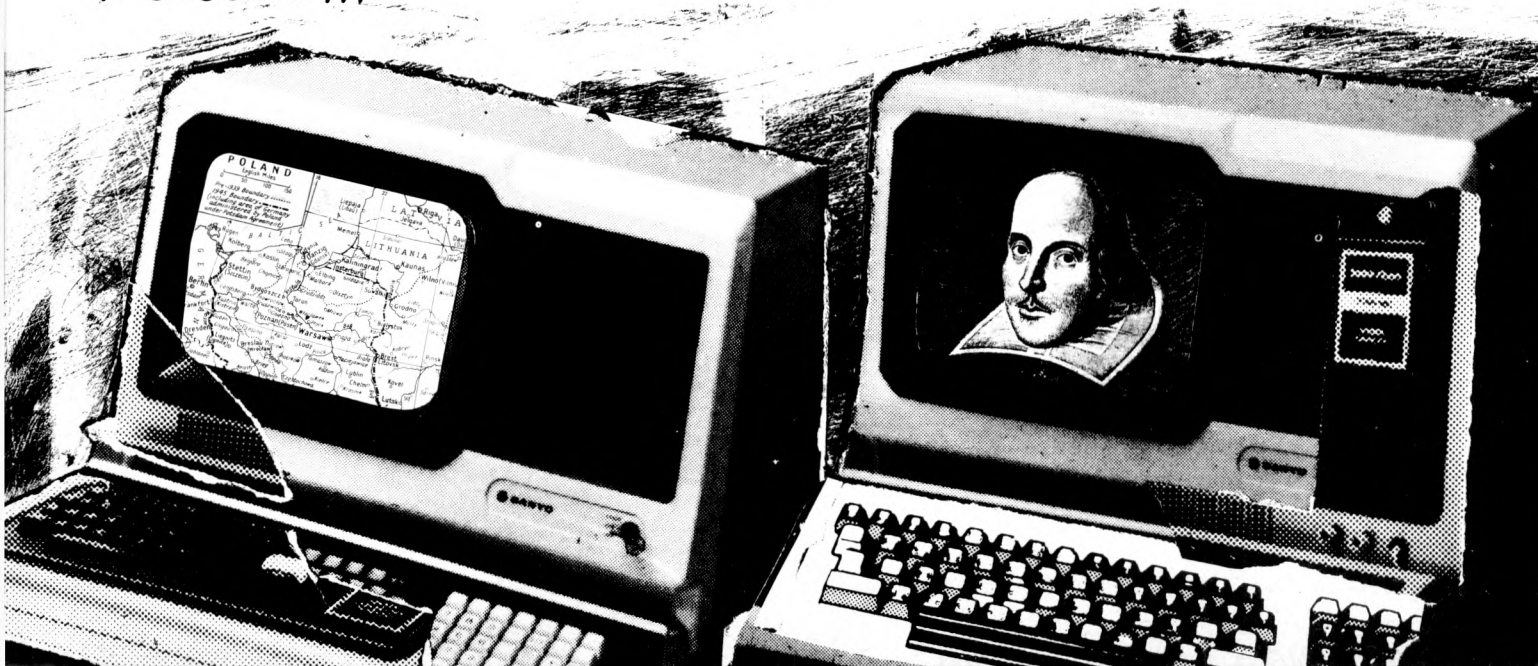
There is another disadvantage of the hardware only shop. Unless you get everything from the same firm — computer, printer, disc unit, interfaces, the lot — if something goes wrong it is difficult to prove that one particular supplier is responsible for the fault.

I know a small man who leases only complete systems. He writes the programs and supplies the hardware too. If a hardware fault develops, he exchanges the faulty unit for one from his office while the repair is effected. I think he is giving as near a guarantee of satisfaction as you can find in this imperfect world. Perhaps this will catch on among the micro fraternity.

Incidentally, I have nothing against shops, or trade associations. . . my intention is simply to show the other

2, LITERACY

1. GEOGRAPHY



side of the coin. I don't even think small is beautiful. I believe dishonesty and incompetence to be common in both large and in small businesses. . . it all really depends on the people involved. As it says in the Bible, "every man proclaims his own honesty, but who can actually find an honest man?"

The new trade association may help, and I wish them well; but I can't afford to join myself — yet.
Conscientious Cowboy

Schools-nice means, shame about the end

So, the Physics Department has got its hands on a micro, has it! Think of all the exciting binary and electronic lessons that can now follow. Hours. . . periods. . . months of fascinating programming. Let the physics or maths teachers have their way and the next generation will be full of electronic whizz kids.

But who wants electronic whizz kids? A few will be needed for product and systems design, but with the advent of ever higher level languages and more and more packaged solutions, what is really required is a generation that can relate the capacities and scope of computing to the reality of the world around, with all its imperfections and compromises, rather than one which gets lost in the absolute logic of electronics and programming.

Think back twenty or thirty years. Computing started as a scientific activity and the academic world still rates computer science above computer applications. They have developed most elegant algorithms for most abstruse calculations, but we have all failed to construct computer based systems that work and are readily accepted in the outside world. Slowly these are emerging. . . but there are real dangers that

our hard-won progress will be thrown away by the physics and maths teachers with their micros going back to the algorithms.

Very few of the children at school today will design computer based systems tomorrow, but they will all live in an age in which they will be surrounded by computing and communications technologies. The task for the schools is to ensure that the children are at ease with these technologies, not alienated by them, and can apply them to the reality not the abstraction.

Computing, as we so often glibly say, is a tool. It is a tool which can, and should, be used to support every curricula subject. Computing can be used to help teachers teach and pupils to learn.

Computing adds four facilities to tackling a problem or undertaking a task:

Firstly, it can be used as a device on which data can be stored, retrieved and analysed. There are history classes in which pupils can access details from the parish registers recording 1790-1810, the critical period in the Industrial Revolution. From such analyses, the pupils can learn an immense amount about the social, cultural and economic trends of that period. Because they can explore the data themselves, they gain a new excitement in learning.

Secondly, computing can be used for simulation. Interactions which are on too large a scale (or, as in chemistry, are too dangerous) can be explored through simulation. Think of pupils in a geography class relating direction and temperature of sea currents to rainfall and climate on land, and then to agriculture, crops and national economics. How much more alive geography can become!

Thirdly, computers calculate. . . they compute. And how! The computers which are just emerging today can

already perform ten million calculations in one second. . . ten million! There is indeed a challenge for the maths teachers. Not teaching binary or logic, but teaching the children how to use ten million calculations, and, having used them, how to look at the result and say "that looks about right!" Yes, we certainly need numeracy, but numeracy based on a technology which removes the chore of basic mathematics and opens up extraordinary horizons.

Finally, through communication links, computers open up a world of information. All known knowledge is available at the touch of a button. Lockheed — SDC — Euronet — Infoline — Videotex — these and others exist to make information available. But how do we select the information? How do we isolate the particular piece of information needed? That is what the teachers ought to be teaching!

The children at school today will be in the middle of their careers in twenty years time. A lot has happened over the past twenty years. . . much more will happen over the next. Many of the teachers of today received their training more than twenty years ago, and yet the schools have the unenviable task of preparing today's children for their careers tomorrow.

So, teachers of mathematics and physics, put away your bits and bytes, your circuits and logic gates. Start *applying* computing and facing up to the opportunity and challenge computing presents. Measure your success not by the number of programs your pupils have written, but by the number of programs that are *used* in parts of the school curriculum other than your own.
David Firnberg
(Managing Director, Urwick NEXOS Limited)

Illustration by George Snow

NUMERACY

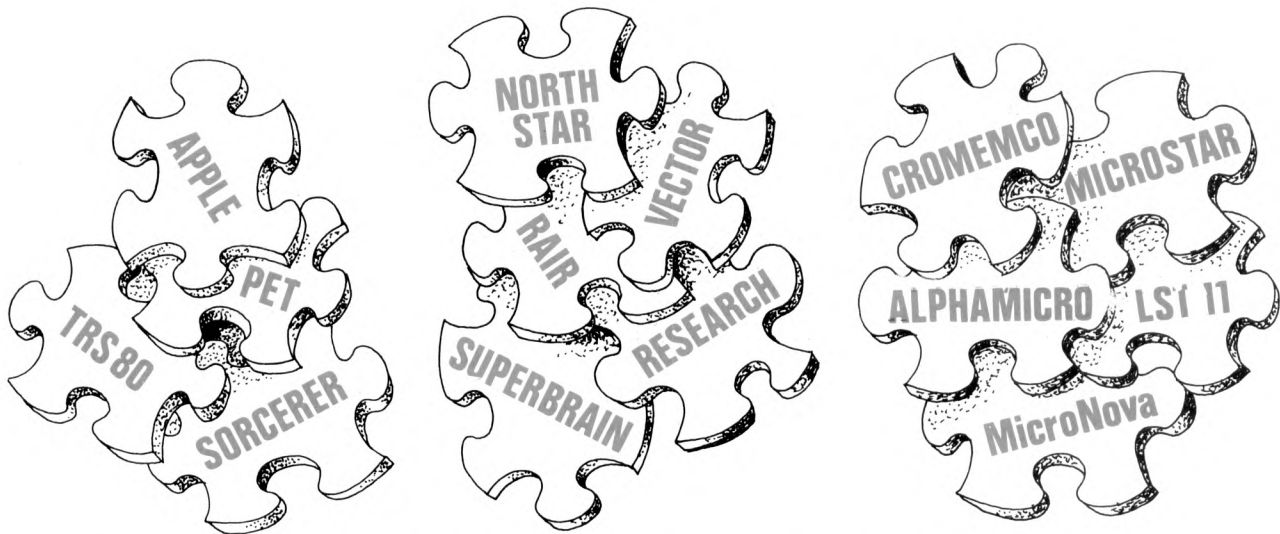
4. TRUANCY



CUSTOMER
ADVERTISEMENT

APPLY MICROS
IN THE 1980's

If only buying a microcomputer was as simple as using one



With so many micros to choose from, how do you select the best to meet your needs?

Just look at the advertisements in this magazine. When can you find time to digest them all?

There are millions of chips, thousands of boards and hundreds of peripherals, software systems and application packages. How do you pick the right ones to meet your requirements?

And put them together? And make them work? And add the specials you want?

At Digitus we have computer professionals working full-time putting systems together. Absorbing information. Testing equipment and software. Writing programs. Training users.

At one stop you can commission a complete system to fit your requirements.

Last year we supplied systems for: number processing, word processing, data processing,

graphics and machine control. Advised accountants, surveyors, archaeologists and engineers. Helped DP departments and small business men. Developed software for personnel, incomplete records, order processing, business games, linear programming, process control and terminal emulation. And were retained by other computer companies to advise on micros.

This year we can put even more experience to work so that you can benefit from micro technology . . . in comfort.

Come and see us. Spend a few hours discussing your requirements. Attend a training course. Select a machine. Test drive some software.

Solve the micro puzzle. Buy an operational system that fits your needs.

Call for an appointment with one of our consultants.

Digitus

Alan C. Wood Digitus Limited 9 Macklin Street Covent Garden London WC2 Tel: 01-405 6761

RECRUITMENT
ADVERTISEMENT

MAKE
YOUR CAREER
IN MICROS
IN THE 1980's

Are you a Computer Craftsman* who enjoys implementing complete systems?

There's nothing quite so satisfying as seeing the printer burst into life on the first operational run of your system.

A stream of elegant stationery . . . hard won praise from the users . . . release from the strain of producing results despite vagaries of machine, operating system and language. Just rewards for understanding, designing, programming and implementing complete systems.

At Digitus we need craftsmen and women able to take total systems responsibility. And in microcomputing we implement more systems, with more variety of machine, language and application, more rapidly than has ever been possible in mainframe or mini computing.

*Or Woman

Job Profile

Take the six month job profile of one of the Digitus team. Week 1, teach micro programming to systems analysts; Week 2-8, design and program business management game in BASIC on Apple; Week 9-15, design and program in FORTRAN system to analyse solar heating data on Cromemco Z80; Week 12-20, implement in PASCAL oil blending system using linear programming techniques; Week 18-24, study surveyor's requirement for system, evaluate options, write report and recommendations. When not otherwise engaged: test PASCAL on North Star, Apple and CP/M systems; evaluate graphics hardware and software; select suitable plotter; advise customers on graphics and PASCAL.

Company Profile

Digitus is building a centre of micro excellence with the best equipment, software and people we can find. Last year the company shipped 40 systems. This year we will ship over 100. Some will be standard commercial applications, accounting, wordprocessing, personnel and stock control; some will be management science applications, modelling, critical path, maths and stats; some will be new applications made possible by novel micro devices and by micro economics.

The company is continually evaluating new hardware and software, using available equipment and packages wherever possible, implementing new components when necessary, developing products to fill gaps in the market.

Personnel Profile

Microcomputing is not a career for everyone. Changes in technology are rapid; timescales to implementation short; variety of hardware and software endless. For these reasons we need high calibre people.

- Professional Designers/Programmers with three to seven years proven project experience.
- Senior Specialists with eight years plus experience in control, communications or commercial systems.

We provide almost infinite job variety, opportunity to keep pace with technology, good salaries, profit sharing, stimulating colleagues to learn from and nitty technical work.

If you wish to develop your career in micros, forward a professional C.V. detailing your project experience and call for an appointment.

P.S. There are also a few openings for computer science/engineering graduates with up to two years' experience.

Digitus

IMPHEX=HEX+AI²

An improved version of Hex, the artificial intelligence game

By Tyrone Crudis

A previous article (PCW, October 1979) described ways of improving the graphics displays for HEX, the Artificial Intelligence Game and other board games, and promised that an improved version of HEX would follow; IMPHEX now arrives to fulfill that promise. If you pronounce it correctly, "IMP-HEX", you will be recognized as an aficionado and will become in every way more like those characters in the TV commercials who are richer, thinner, better dressed, and more attractive to the opposite sex after partaking of the sponsor's product. If you pronounce it incorrectly, "IM-PHEX", everyone else will know that you have not read this article and probably don't even read the right magazine. Be warned, however: in the process of studying what follows (and it will take some study!) you may learn things about games design in general, derive hints and kinks for use elsewhere, decide to buy a PET, gain insight into artificial intelligence, or be motivated to belabour the editor about his selection of writers and their ability or lack thereof.

Artificial intelligence

There is a natural human tendency to define intelligence as any ability with abstract processes that humans have but computers don't. To sustain this stance requires rapid footwork, however, as the list of machine abilities advances inexorably. One by one the sacred cows of yore have been led to the butcher: Memory, Logical Processes, Goal-Seeking Behaviour, The Ability to Prove Euclid's Theorems of Geometry, The Ability to Play Chess Well, The Ability to Play Chess at Expert Level: all have at one time or another been advanced as defining the difference between computers and humans, and all have been inexorably converted to hamburger. The circular fallacy of defining intelligence as an ability possessed only by humans and recognizable by other humans, even if undefinable, is defeated by the famous program ELIZA which, when controlling a large-scale computer, is impossible to tell from a human psychologist communicating through a teletypewriter. Science fiction often predicts the replacement of doctors and lawyers by computers and it would seem from their over-reaction in real life to the threat of computerization that they subconsciously see and fear the possibility. The idea that there may be types of intelligence not yet known to humans is apparently sacrilegious or scatological; certainly it is never mentioned. But who has proved that inductive and deductive reasoning are the Only Ways, or that the scientific method is the most efficient? After a few drinks many scientists, engineers, and inventors will admit, if

they think you are trustworthy, that their best ideas come to them in a flash and that they have subsequently to tortuously develop the necessary step-by-step rationalization and analysis. Intuition? The muses of antiquity? Revelation? Communication from alien beings

on another plane of existence? I think we should keep an open mind about thought processes and be ready for the day when the first computer becomes aware of itself as an entity.

IMPHEX will not make any humans redundant. It will, however, demon-

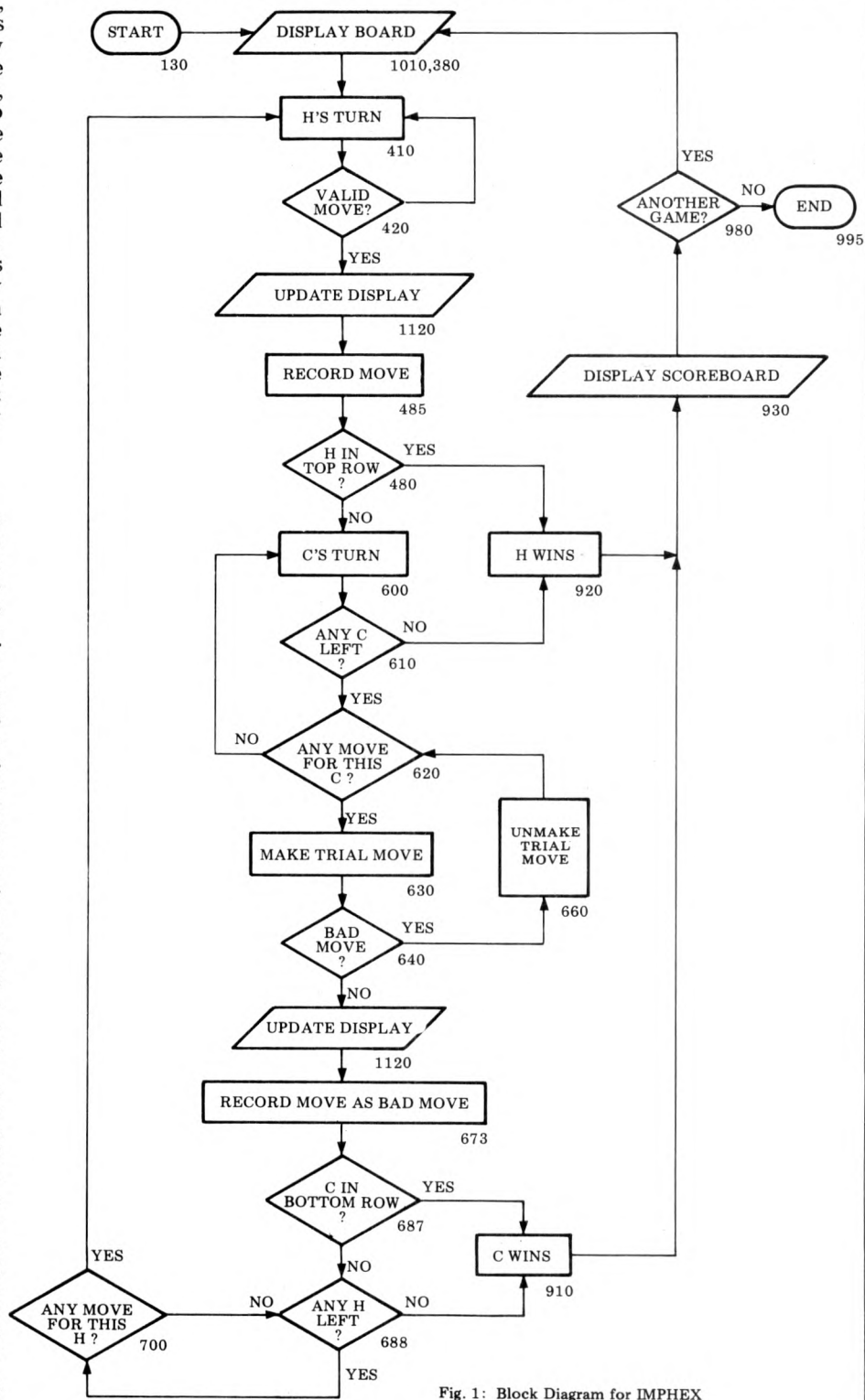


Fig. 1: Block Diagram for IMPHEX

strate one type of behaviour that we can all agree partakes of intelligence: it learns from its mistakes. So well does it do this that you can sit down at the keyboard and win a few games to demonstrate the rules to a visitor, turn the keyboard over to the visitor, and be sure that he will be beaten soundly in spite of his best efforts. Sound intriguing?

The problem

Whether called HEX, HEXPAWN, or HEXAPAWN, it's all the same game, and commercial programs are available. What's wrong with them, aside from uninspired graphics? There are three major criticisms: 1) You'd think that all cheating moves should be detected, but this is not the case; 2) The computer's series of responses is always the same; 3) The program informs the computer before the game of all possible board positions and all the legal moves from each position. Now you may have a version to which one of these criticisms does not apply, but I'll wager that no one has a version to which none apply. Therefore we will proceed to prevent all types of cheating, provide an option for random play (reproducible play is desirable initially, when studying how the computer goes about learning), and we will force the computer to learn without knowing any moves ahead of time.

The solution

Crudis' Compendium of Games-Writing Standards consists of all the items in italics (unless the editor, who has a *thing* about italics, sneaks a few extra in). Stand by for the first one: You've heard it before and I'll say it again: *draw a block diagram*. It should describe the sequence of required operations and be independent of the computer language used. It should use generally-accepted symbols. It should be so simple that it can be contained on one page. Figure 1 is an example of what I mean. After the program is written, line numbers are added to the block diagram and will be of inestimable convenience to anyone studying the program in the future. Next, if not sooner, *draw a screen layout* showing the position of the various subsections of the display. Figure 2 is the kind of thing needed. For the case in hand it shows that there is a square 20 x 20 board display whose upper left corner (origin) is 18 cursor-right steps from home, a 7 x 14 scoreboard with origin at 3 cursor-downs, and a 1 x 39 prompt message with origin at 22 cursor-downs.

Thirdly, make up a preliminary *list of variables*. The names of all variables should be *mnemonic*; that is, they should give a clue to their usage. If your

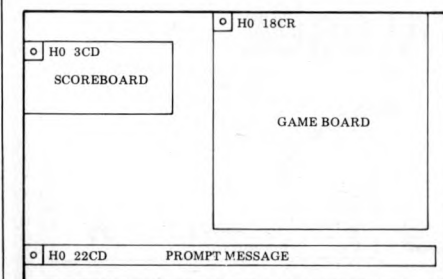


Fig. 2: Screen Layout for IMPHEX

variable names, you have a right to feel cuckolded. All manufacturers should provide for two-letter and letter-digit names. Having performed these three steps, you will undoubtedly find that your mind is cleared of cobwebs and that you realize that you don't understand the problem. This is normal. Do not under any circumstances start to write the program at this point. Instead, iterate the three steps until satisfaction sets in.

Some sensible standards for variable names:

Reserve J, K, and L for counting variables in FOR-NEXT loops.

Reserve X, Y, and Z for coordinates. Reserve D for delays, often useful in games to provide an impression of thoughtful response by the computer or just to give the human time to think.

There's nothing magic about the following list of variable names specific to IMPHEX, but you will find that, like a pair of new shoes, they will become comfortable after a few wearings and will seem to have been always right.

IMPHEX variables

Y,X: board coordinates.

HI, HF: human initial and final position, numerical keypad coordinates.

FNC(X): converts keyboard to X,Y coordinates.

XI, XF, YI, YF: X, Y initial and final positions.

W: relative move in X.

XT, YT, WT: trial ordinates.

XD, YD: display update scan ordinates.

BD(4,3): board array; stores current position.

BM(3, 3, 15): bad move array; stores up to 15 "bad move" positions.

SI, SF: temporary store values of BD during trial moves, initial and final; used to rewrite BD array if trial move not accepted.

P(3,3), M(3): position array and move array used to check that all positions and moves have been tried when in random scan mode.

N1, N2: position and move count when in random scan mode.

C: computer's turn

H: human's turn

TU: turn

CW: number of computer wins

HW: number of human wins

F1: illegal move count

F2: has "I needed that" been used?

F3: who won last game?

D\$: down string; positions cursor on prompt line.

E\$: erase string; erases prompt line.

BP\$: board position string; positions cursor to write first piece on board.

BD\$: board down string; moves cursor down on board row.

BL\$: board left string; moves cursor left three board columns.

C\$: computer piece

H\$: human piece

BE\$: board erase string; erases one piece

BU\$: board up string; moves cursor up one board row.

Keypad to X,Y conversion

We are all agreed, aren't we, that it is desirable to use the familiar keypad format for inputting the human moves, but to convert each move to X, Y format to simplify computer analysis of their validity and legality and to make them compatible with the computer's moves and with storage in an X, Y array for analysis, yes? (If you are happy to input your moves at the keyboard in X, Y format at four digits each, initial X, initial Y, final X, final Y, then you can skip the following section.)

Fig. 3a

7	8	9
4	5	6
1	2	3

Keypad Orientation

Fig. 3b

31	32	33
21	22	23
11	12	13

X, Y Coordinates

Fig. 3: Naming the Cells of the IMPHEX Board

What is wanted is an algorithm to convert fig. 3A to fig. 3B. I'll give two examples, the second of which is a bit shorter. If anyone can come up with an even more compact solution, I'll be glad to have it. For those who may not be familiar with "DEF FNA(V)", this BASIC statement allows the user to define his own function which can subsequently be called up just as is any built-in function such as SIN, SQR, etc. V is a dummy variable. The function name is FN followed by any legal variable name.

The first time I saw a line like $(X > 6) * (6 - X)$ I was, to say the least, bemused, and attributed the ">" to the misprint gremlin who lives in all typewriters, linotypes, and similar inventions of the devil. However, as most of you no doubt know, $(X > 6)$ has the value 0 if false and -1 if true, and $(X > 6) * (6 - X)$ is therefore a very convenient way of implementing IF $X > 6$ THEN $FNA(X) = X - 6$ and compacting it within a more complex expression. Work out for yourself how line 10 below utilizes this technique.

Solution No. 1

```
10 DEF FNA(X)=(X > 6)*(6-X)+
(X <= 6)*(3-X)-(X <= 3)*3:XI=FNA
(HI):XF=FNA(HF)
20 DEF FNB(Y)=(Y <= 3)-(Y > 6)*3-
(Y <= 6)*2:YI=FNB(HI):YF=FNB(HF)
```

Solution No. 2

```
30 DEF FNC(X)=X+10-(X > 3)*7-
(X > 6)*7:YI=INT(FNC(HI)/10)
40 XI=FNC(HI)-YI*10:YF=INT(FNC
(HF)/10):XF=FNC(HF)-YF*10
```

Using an array to store the board

An array is a set of numbers arranged by coordinates. A one-dimensional array is no more than a list. A two-dimensional array is like a checkerboard, and arrays of any number of dimensions are theoretically possible. Some dialects of BASIC are sadly lacking in the number of arrays which can be set up simultaneously, the number of dimensions possible, and the size of the number which can be stored at each set of co-

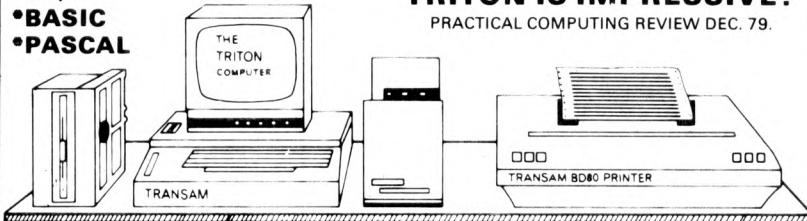
TRANSAM

COMPONENTS AND SYSTEMS FROM TRANSAM COMPUTERS

•CP/M
•BASIC
•PASCAL

TRITON IS IMPRESSIVE!

PRACTICAL COMPUTING REVIEW DEC. 79.



TRITON COMPUTER SYSTEM.

Designed for ease of construction and flexibility. Kits come complete and all components and software are available separately. UK designed and supported. Fully documented hardware and software and a totally flexible approach to system building. Powerful and easy to use system monitors - a range of languages available. Firmware is Eprom based and upgrading from one level to the next is easy.

L5.2 with 1.5k monitor 2.5k basic £294.00
L7.2 with 2k mon 8k extended basic £409.00
L8.2 4k ed/mon 20k res pascal £611.00
L9.2 CP/M disc based system P.A.O.
8k ram card kit (21141) £97.00
8k eprom cars (EXCL 8 x 2708) £31.00
Motherboard expansion 8 slot £50.00
Trap-res asm/edit etc (8 x 2708) £80.00
Transam BD80 bi-dir printer £595.00
TVM 10 video monitor 9" £79.00
Eprom prog (2708) kit £29.50
SEND FOR OUR CATALOGUE FOR FULL DETAILS OF TRITON FEATURES!

CP/M AVAILABLE NOW FOR TRITON

Disc operating system complete with text editor, assembler, debugger, system utilities and complete file management. Makes Triton fully CP/M compatible and able to run CP/M based software. Triton will support up to four 5 1/2 or 8" drives single or double density full CP/M software user group facilities available. SAE for details. CP/M Disk + manuals (6) £75.00

DISK DRIVES & POWER SUPPLIES

SHUGART



SA400 5 1/2" drive £205.00
SA800 8" drive £380.00
Power one quality power supplies
CP249 1 x 5 1/2 PSU £33.00
CP323 2 x 5 1/2 PSU £60.00
CP205 1 x 8" PSU £56.00
CP206 2 x 8" PSU £76.00

TCL PASCAL CP/M compatible

A standard Pascal compiler available on a resident (20k) Eprom based configuration* or available to run under CP/M on 8" disc plus documentation. CP/M version £90 - P.O.A.
TCL Pascal Manual and Specification £6.50

FULL RANGE OF MICRO SUPPORT CHIPS - IN STOCK

SN74LS00N	22	SN74LS54N	21	SN74LS138N	95	SN74LS195AN	85	SN74LS325N	255	SUPPORT	RAMS	2.32
SN74LS01N	22	SN74LS55N	21	SN74LS139N	95	SN74LS196N	120	SN74LS326N	255	8212	2.20	2101
SN74LS02N	28	SN74LS563N	150	SN74LS145N	120	SN74LS197N	120	SN74LS327N	255	8216	2.80	2102L.4
SN74LS03N	28	SN74LS573N	35	SN74LS148N	175	SN74LS221N	125	SN74LS352N	135	8224	2.80	2111
SN74LS04N	28	SN74LS74N	40	SN74LS151N	85	SN74LS240N	220	SN74LS353N	150	3853 (F8)	10.00	2112
SN74LS05N	28	SN74LS75N	48	SN74LS153N	80	SN74LS241N	190	SN74LS355N	65	8228	4.20	8810
SN74LS08N	20	SN74LS76N	35	SN74LS154N	160	SN74LS242N	190	SN74LS366N	65	8726A	1.75	8154
SN74LS09N	22	SN74LS78N	35	SN74LS155N	125	SN74LS243N	195	SN74LS367N	65	8728	1.90	2114L.450
SN74LS10N	18	SN74LS83AN	115	SN74LS156N	125	SN74LS244N	210	SN74LS368N	65	8522	8.75	2114L.250
SN74LS11N	28	SN74LS85N	110	SN74LS157N	80	SN74LS245N	300	SN74LS373N	175	8251	5.00	74C920
SN74LS12N	25	SN74LS86N	40	SN74LS158N	99	SN74LS247N	125	SN74LS374N	170	8253	11.00	74C921
SN74LS13N	55	SN74LS138N	95	SN74LS160N	115	SN74LS248N	195	SN74LS375N	72	8255	5.00	74C929
SN74LS14N	95	SN74LS139N	99	SN74LS161N	115	SN74LS249N	195	SN74LS377N	175	8257	£11.00	4027
SN74LS15N	25	SN74LS152N	90	SN74LS162N	115	SN74LS251N	145	SN74LS378N	132	8259	12.50	4044
SN74LS20N	20	SN74LS159N	85	SN74LS163N	90	SN74LS253N	125	SN74LS379N	140	8155	12.50	4045
SN74LS21N	28	SN74LS164N	150	SN74LS164N	150	SN74LS257N	140	SN74LS381N	385	6402	5.00	4060
SN74LS22N	28	SN74LS165N	175	SN74LS165N	175	SN74LS258N	95	SN74LS386N	57	6821P	4.50	2107
SN74LS26N	29	SN74LS166N	175	SN74LS166N	175	SN74LS259N	145	SN74LS390N	198	6850P	4.80	4116/58 for 8100
SN74LS27N	35	SN74LS167N	39	SN74LS167N	39	SN74LS260N	39	SN74LS393N	150	6852P	5.50	4118
SN74LS28N	35	SN74LS168N	195	SN74LS168N	195	SN74LS261N	350	SN74LS395N	180	AT 5.2376	11.50	280P10
SN74LS29N	35	SN74LS169N	39	SN74LS169N	39	SN74LS262N	39	SN74LS396N	170	MC14411	12.00	280CTC
SN74LS30N	25	SN74LS170N	44	SN74LS170N	44	SN74LS263N	39	SN74LS397N	170	MC14412	12.43	280AP10
SN74LS32N	27	SN74LS171N	220	SN74LS171N	220	SN74LS264N	185	SN74LS398N	275	MS7109	12.43	280ACTC
SN74LS33N	39	SN74LS172N	79	SN74LS172N	79	SN74LS265N	180	SN74LS399N	180	MS7160	10.00	280ACTC
SN74LS37N	29	SN74LS173N	90	SN74LS173N	90	SN74LS266N	175	SN74LS424N	450	MS7161	10.00	EPROMS
SN74LS38N	29	SN74LS174N	115	SN74LS174N	115	SN74LS267N	180	SN74LS445N	125	TMS6011	5.00	1702
SN74LS40N	29	SN74LS175N	105	SN74LS175N	105	SN74LS268N	175	SN74LS447N	145	81L595	1.80	5204
SN74LS42N	79	SN74LS176N	150	SN74LS176N	150	SN74LS269N	180	SN74LS447N	145	81L596	1.80	2708
SN74LS43N	79	SN74LS177N	85	SN74LS177N	85	SN74LS270N	175	SN74LS447N	145	81L597	1.80	2516
SN74LS47N	95	SN74LS178N	75	SN74LS178N	75	SN74LS271N	175	SN74LS447N	145	81L598	1.80	2532
SN74LS48N	95	SN74LS179N	39	SN74LS179N	39	SN74LS272N	220	SN74LS447N	145	81L598	1.80	2532
SN74LS49N	109	SN74LS180N	40	SN74LS180N	40	SN74LS273N	180	SN74LS447N	145	81L598	1.80	2532

DIL PLUG SOCKETS & SWITCHES

W/WRAP SKTS	DIL SKTS	DIL PLUGS	DIL SWITCHES
8DIL 0.20	8DIL 0.1"	14DIL 0.60	4DIL 1.20
14DIL 0.35	14DIL 0.15	18DIL 0.65	7DIL 1.75
16DIL 0.42	16DIL 0.17	SCOTCHFLEX	8DIL 1.80
18DIL 0.60	18DIL 0.24	14DIL 1.30	16w ZIF* 4.95
24DIL 0.52	20DIL 0.27	16DIL 1.50	24w ZIF* 6.20
28DIL 0.74	24DIL 0.30	24DIL 2.80	
40DIL 0.95	28DIL 0.38		
	48DIL 0.50		

ZERO INSERTION FORCE

COMPUCOLOR II - FULL COLOUR

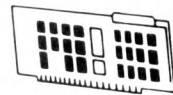
- 13" 8 colour crt display
- Built in 5 1/4 disk
- 16k extended basic in rom
- 71 key keyboard - detached
- R5232 - 50 pin bus
- 8k user RAM - fully expandable



SPECIAL GRAPHICS PACKAGE
£985 Plus VAT

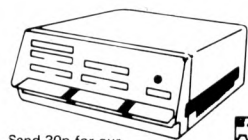
S100 DISC CONTROLLER £195 Plus VAT

DOUBLE DENSITY
As used on Triton. Fully built will drive 8 x 8" or 8 x 5 1/2" drives. Single or double density. Works with all Shugart compatible drives. Uses the 1791 chip on board crystal - CPU independent



DPS.1 MAINFRAME - PASCAL SYSTEM

S100 to IEEE spec



Send 30p for our ITHACA catalogue

ITHACA

PASCAL/Z build your own Pascal Micro Development system. IEEE-3100 bus system using DPS1 main-frame. Supports K2, ASSEMBLE/Z and PASCAL/Z on 8" disc

Complete system: £2,910.00

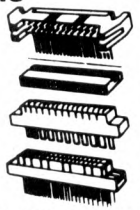
S100 BOARDS

8k Static RAM board (450ns)	£99.00
8k Static RAM board (250ns)	£119.00
Z80 cpu board (2MHz)	£105.00
Z80 cpu board (4MHz)	£123.00
2708/2716 EPROM board	£57.00
Prototype board (bare board)	£15.00
Video display board (64 x 16, 128U/L Ascii)	£108.75
Disc controller board	£131.25
K2 disc operating system	£45.00
ASSEMBLE/Z Macro Assm	£37.50
PASCAL/Z compiler	£205.00
PASCAL/Z CP/M	£235.00
16k Static RAM	£275.00

WE STOCK THE FULL RANGE OF S100 CARDS AND ACCESSORIES

MULTIWAY CONNECTORS

INSULATION PIERCING	35/70	4.60
20 way plug	2.30	36/72
26 way plug	2.70	40/80
34 way plug	3.30	43/86
50 way plug	4.80	50/100
20 way skt	3.40	
28 way skt	4.00	
34 way skt	4.80	6/12
30 way skt	6.00	10/20
		12/24
		15/30
		18/36
EDGE CONN PCB		
GOLD 1" PITCH		
22/44	3.20	22/44
25/50	3.80	28/56
28/56	3.80	36/72
30/60	4.15	43/86
		64 way DIN male 2.50
		64 way DIN female 4.50



VISIT OUR SHOWROOM

WE ALSO STOCK: a comprehensive range of books and magazines, VERO products including S100 and Eurocard and Wire Wrap equipment, Weller soldering equipment, Ribbon Cables, tools, tapes, diskettes, connectors and OK Tool range.

Systems continuously on display in our showroom.

CRYSTALS	4MHz	2.10	F8 (3850)	9.50
100k	4.43M	1.00	8080A	6.33
200k	5MHz	2.70	6809	24.00
1MHz	6MHz	2.70	280	8.00
1008k	7MHz	2.70	280A	15.00
1843k	7.168M	2.50	8085A	12.85
2MHz	8MHz	2.70	6502	8.00
2457k	10MHz	2.70	SCMP11	10.00
3276k	10.7M	2.70	6802	13.85

ALL PRICES

Exclude VAT & P/P
VAT 15% P & P 40p on small orders.
For larger items please Tel.
Telephone credit card orders accepted subject to £5 min.
RAPID MAIL ORDER SERVICE

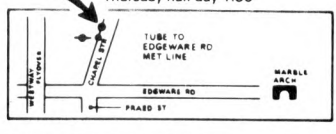


CATALOGUE

NEW A4 SIZED* ONLY 40p & S.A.E.

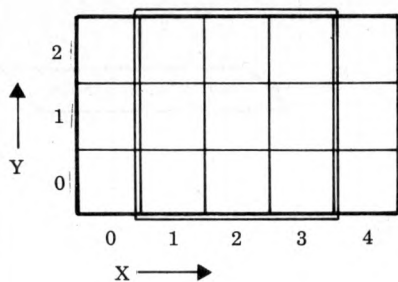


VISIT OUR SHOWROOM SOON
9.30-5.30 Mon-Fri
1.30-2.30 closed lunch
9.30-5.00 Sat
Thursday half day 1.30

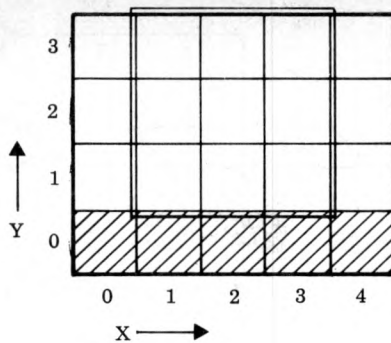


TRANSAM COMPONENTS LTD, 12 CHAPEL STREET, LONDON NW1

Tel: 01-402 8137 Telex: 444898



a



b

Fig. 4: The Board Array

ordinates. In PET's BASIC the number of arrays is limited only by the number of possible names, the number of dimensions is limited to about 34, and the number of elements to 255. Even this limitation is to be overcome in future ROMs. (Commodore's early literature refers to their arrays as matrices: I object to this usage as it implies that matrix arithmetic is provided, which it is not). To set up an array we program a line such as 50 DIM F(4,5) which defines an array F having two dimensions and coordinates 0 to 4 by 0 to 5. The contents of each coordinate point are automatically initialized at zero. Note that in PET the coordinate names start with 0: in some dialects they will start with 1. The array which we will implement to store the board position for IMPHEX is shown in fig. 4. The two extra columns shown at 4a simplify the computer's move-selection algorithm, as will be shown subsequently. We could define array BD by DIM BD(2,4), but then the rows would be numbered 0 to 2 instead of 1 to 3, so to avoid confusion we can throw away a bit of storage facility and define it as DIM BD(3,4) as shown at 4b which has the desired coordinates for the 3 x 3 board. The bottom row will not be used at all.

Similarly we are going to want another array to store bad moves, defined as the board pattern just before the human made his winning move. Pragmatic tests indicate that storage for 15 such patterns is more than enough, so this array can be defined as DIM BM(3,3,15). Here we don't need the extra columns, but have retained and wasted the zero X, Y, and Z ordinates so as to keep the numbering system straightforward. Array BM can be visualized as looking like fig. 5.

Detecting invalid and illegal moves

As part of the process of accepting human moves the computer must check them to determine if they are valid (correspond to agreed-upon nomenclature) and are legal (correspond to the agreed-upon rules). This is because humans tend, unlike computers, to misunderstand instructions, make mistakes, make mischief, or try to cheat. Fig. 6 blocks out the requirements, all of which can be written in two lines, thanks to the use of X, Y coordinates.

Any confusion on board nomenclature can be detected and responded to by:

```
420 IF HI<1 OR HI>9 OR HF<1 OR HF>9 THEN PRINT "NOT IN THIS GAME!" followed by another move query or a kindly and sympathetic offer to show the instructions again. If BD(XI, YI) is not equal to 1 (line 440) then the move is illegal because the initial cell is not occupied by a human piece (value +1). No human move can change the Y coordinate by other than +1, so if YF-YI is not equal to 1, (line 440) the move is illegal. A move can only be straight up or diagonal, so moves like 3, 4 are prohibited. These are tested for with IF ABS(XF-XI)>1 (line 440). When the human move is on the diagonal, it should be because he is capturing a computer piece (value -1).
```

```
Line 450 tests for this with IF ABS(XF-XI)=1 AND BD(XF,YF)<>-1 and similarly line 445 tests for the vertical move to an empty cell with IF XI=XF AND BD(XF,YF)<>0. No doubt we will always have with us the jokester who tries all illegal moves, so we can opt to cater for him by counting the number of illegal moves attempted and having the computer print an apt remark when the number reaches, say, 4. This printout should be positioned where it will not impede any other current display, so we will place it in the area reserved for the scoreboard, which is only seen at the end of each game (lines 510-540). Notice that reversed
```

text should not be displayed nakedly, but needs a surrounding border. Later on I shall give you a "before and after" test to try out if you need any convincing on this point.

The computers move

Since we are not providing the computer with any strategy initially, its choice of piece to move can be made by one of two techniques, sequential or random. The sequential technique consists of looking at the board in an arbitrary fixed order, say, cells 7, 8, 9, 4, 5, 6. (No need to look at 1, 2, or 3 since the computer would have already won if it had occupied any of these cells.) The advantages of the sequential technique are that it is slightly easier to program for and that it makes it easier for the human who is studying the computer's responses to follow its learning processes. The advantages of the random technique come into play when the human player, after many sets of games, has learned to eke out his winning streak as long as possible by taking advantage of the computer's blind spots. Then converting from sequential to random selection makes for "a whole new ball game", as our American cousins say. I will append a discussion of random move generation as an option subsequently.

Having selected a trial piece, the computer must scan the possible moves for that piece until it finds a legal one. This scan also can be implemented either sequentially or randomly. If the move so selected is not a "bad move", it can be carried out and announced. A "bad move" is one which led to a win for the human in a previous game. In the implementations of HEX which I have seen to date, this process of identifying a bad move took place as follows: one array stored all possible board patterns (there are 33 of them). This entire array was scanned, board by board, line by line, cell by cell, until the pattern corresponding to the current game condition was found. Another array stored all possible computer moves for each possible pattern. As the end of each lost game occurred, the

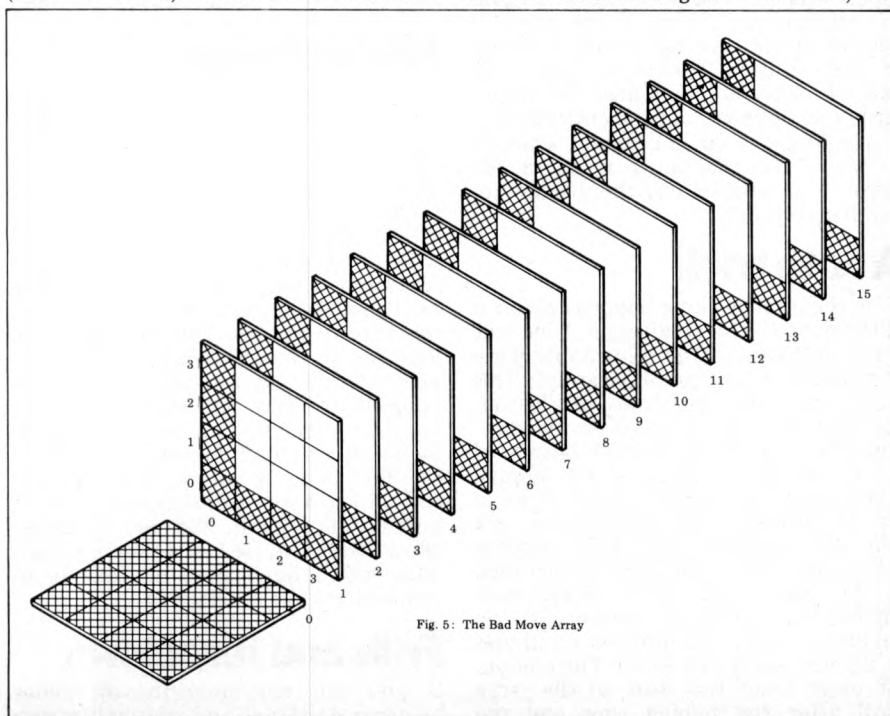


Fig. 5: The Bad Move Array

move leading to it was erased from the move array. If the computer determined that a board pattern it found itself in had no moves, it would resign, and that board pattern would be erased from the pattern array. Eventually only winning move series would exist in the two arrays. The best one can say of it is that this is a brute force technique!

The great improvement

To replace this technique, which on second thought I am willing to categorize as clumsy, inefficient, and lacking in charisma, I offer the following: The Bad Move array, which is tabula rasa or blank at the beginning of the game, will be used to record only the pattern reached in any game where the next move was a win for the human opponent. Then, before making any move, the computer will compare it with the Bad Move array and will reject it if it is found therein. In addition to the obvious appeal of its build-up from nothing, this technique is much more efficient in that it does not scan the whole Bad Move array but only the number of elements corresponding to the number of human wins to date. Also the scan of any board within the array can be cut off the moment the first cell being examined is found to be different from the corresponding cell in the contemplated move. And clearly the total memory requirement is much less.

Concept of trial move

I trust that you are all referring to fig. 1 as you read and will have noted that the test for a human win is economically combined with the computer's search for a move. Having found a legal move, the computer generates the position which would result from the move. This position is called a trial move since the computer is prepared to retreat from it if it is found to be a Bad Move.

To make a trial move, the computer stores the current position of the piece to be moved and the current condition of the space to be occupied as SI and SF respectively. Then, if the move is determined to be a bad move, it reverts to that position. Notice that only one pair of binary numbers need be temporarily remembered, not the entire board. If the Snark is not a Boojum, which is to say if the trial move is not a bad move, it is retained and the display updated accordingly.

Acute trick

Now the strange thing happens which is labelled on the block diagram, "See text for explanation"! The Acceptable Move is recorded in the Bad Move array!! This is so cute (in the sense of "clever, shrewd, ingenious") as to be unbelievable. Do you see the devilish beauty of it? If, on the next move, the human wins, it will have been the right thing to do. If, however, the human does not win, the computer will make another move and that move will be recorded in the same level of the array, overwriting the previous record. If the computer wins, the process continues to the next game and so on. The computer never scans this level of the array until after the human wins and the

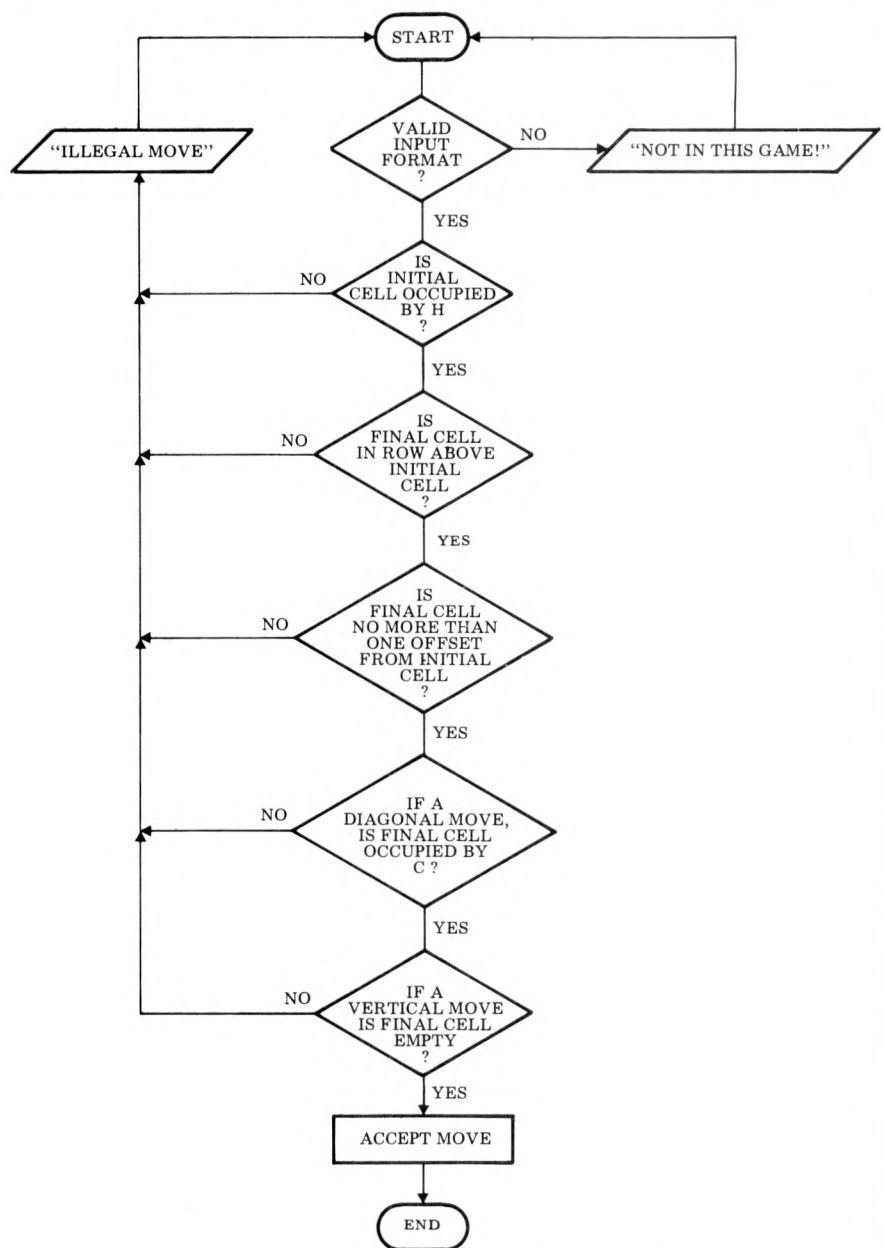


Fig. 6: Block Diagram for Checking Human's Moves in IMPHEX

variable HW is incremented by one!

Nested loops

Figure 7, which is a diagram of the nested loops which carry out all these inter-related decision-making processes, shows the various ways of falling out of or being pushed out of the nest. Fortunately for PET owners, PET can leave a FOR-NEXT loop before it is finished, with no ill effects. This is not the case for some other computers which shall be nameless because the editor needs the advertising fees. One more thing to look for on Brand X when you go shopping! (Don't ask the salesman: test it yourself. He may not know or he may lie. Remember that he got where he is by being unsuited for other positions. The PET 2001-16 with proper keyboard and all has a machine-language monitor resident in ROM: did my salesman know that? No, he had a very nice cassette which he insisted on loading to demonstrate the monitor!)

Frills and furbelows

If you can remember the difference between stalactites and stalagmites, you

will have no difficulty in keeping straight the difference between frills and furbelows: frills are the unessential but attractive arrangements along the top edge of a dress, while furbelows perform a similar function on the bottom edge. In this category I offer a number of suggestions. (One of Crudis' Compendium of Games-Writing Standards - PCW Oct' 79 - you will recall, is that one might as well use the entire memory as not).

1. *End of Game*: As the whole point of IMPHEX is to see the computer demonstrating what it learned in the previous games, we must be prepared to cycle back to the all-games initialization point in the program on request (line 980). Likewise we can feel justified in allowing the computer a somewhat tart response if the human elects not to continue (line 995). Note that the first-game initialization point differs from the all-games initialization point in that the former defines functions, dimensions arrays, and sets win counts to zero. I recommend that all games, not just IMPHEX, should include an *ANOTHER GAME?* option. There is nothing more lacklustre than a program which retires into READY with a flash-

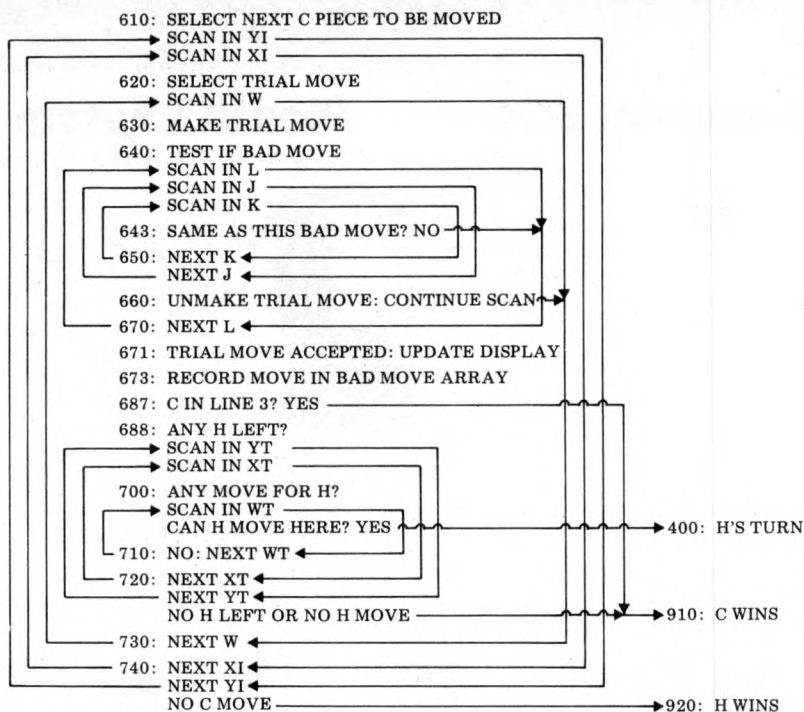


Fig. 7: Nested Loops in IMPHEX

ing cursor as soon as it has completed one tour of duty. Incidentally, note the positioning of "READY" in line 2 when the game sequence is finally ended. This avoids either an unattractive scroll-up with loss of part of the board display or two lines of readout with no space between them, the sign of a rank amateur (unless I do it for some special reason). See for yourself why the semi-colon is required in line 995.

2. *Invalid and Illegal Move Response:* As it is easy to differentiate invalid from illegal moves, we can provide two different responses: "NOT IN THIS GAME!" for the former; "ILLEGAL MOVE" for the latter with, in both cases, erasure of the previous human input and a flicker to indicate a new message.

3. *Unsolicited Computer Responses:* One can go too far with this kind of thing, of course, but a little bit is like the right amount of salt in the soup. After each lost game, the "I HAVE LEARNED. . ." response (lines 1080-1095) is presented in varying form. If 6 games have passed before the computer wins its first one, we get "I NEEDED THAT!" (line 975). Children and clergymen are especially responsive to this sort of touch. In this category we also have the "HOW MANY TIMES DO I HAVE TO TELL YOU?" response, touched on previously, resulting from a selected number of illegal moves.

4. *Instructions:* Complete, concise instructions should always be included in the program, but display should be optional (lines 130, 140). Note that only two tests determine if IS\$ is "Y", "N", or neither one. Don't mix GET and INPUT in the same program; it invariably leads to the user bombing out by pressing READY at the wrong time. Note that PET permits a printout combined with an INPUT command as in INPUT "INSTRUCTIONS ('Y' OR 'N')"; IS\$. For some other computers you may have to rewrite this as PRINT "INSTRUCTIONS ('Y' OR 'N')"; INPUT IS\$. Always show the acceptable

responses unless they are self-evident, and don't require the user to spell out "YES" and "NO". If you want to guard against someone writing "YES" when only "Y" is required, you can write IF LEFT\$(IS\$,1)="Y" instead of IF IS\$="Y"

5. *Starting the Game after Reading the Instructions:* In line 1500 the command WAIT 59410,4,4 waits for the space key and no other to be depressed. This is the only exception to the rule that each input must be followed by RETURN; but the uninitiated user, I have found, sees the double-sized space key as a special function key related to and alternative to the double-sized return key, and learns to expect its use as (and restricted to) the start-of-game function. Therefore I recommend the use of WAIT 59410,4,4 to start games after reading instructions or to turn pages of the instructions. If you use it at all, you should standardize on it throughout your library.

6. *The Scoreboard:* A little attention to details here (lines 935-950) pays off in visual appeal. The use of black letters on a white background sets off the scoreboard and isolates it from other elements of the display. You will see that there is a little trick in line 950 which permits us to write the values of a variable in reverse mode without worrying about how many digits long it is or generating unwanted black spaces. Don't be so lazy as to write an isolated line of reverse characters. Since the characters all touch the top but not the bottom of the 8 x 8-dot pixel, such a technique gives a raw, unbalanced look. Instead, surround the reversed characters with a bit of a border. To see what I mean, compare these two printouts:

```

10 PRINT "[CS 2CD 16CR RE] BEFORE"
20 PRINT SPC(15)"[5CD RE SL]88888888"
30 PRINT SPC(15)"[RE SP]AFTER![SP]"
40 PRINT SPC(15)"[RE SL]""""""""""[SR]"
  
```

Note the minor subtlety that using reverse shifted "8" instead of shifted quotes gives the same number of scan lines above as below, making the letter-

ing appear accurately centered
7. *Ensuring that the Display is Up-to-Date:* Another sign of sloth, inebrity, or slovenliness is to leave no-longer-current displays on the screen. Don't leave no-longer-current displays on the screen! Go to a little trouble to generate suitable erasure strings such as E\$, and use them to sweep off the offending prompt or no-longer-valid remark, just as you use similar strings such as EB\$ to erase portions of the board.

Board graphics

Methods of designing and implementing graphics for board games were treated in a previous article, with HEX as an example. For any reader who doesn't have this issue available, I will explain that lines 1120-1260, which update the display, go to some trouble to erase a piece and then write it in the new position in rapid sequence so that the piece appears to move from one spot to the other, due to the persistence of human vision.

Choosing the next move randomly

As previously explained, the options open to the computer are to look for its next move along a programmed scan sequence or to choose randomly which piece shall be moved next. Both approaches have advantages and it is instructive to see both in operation. For my own use I have incorporated both methods into the program and you may choose to do the same.

It is not enough to call for Y=INT(2*RND(1)+2):X=INT(3*RND(1)+1). That would indeed generate Y= 3 or 2 and X= 3, 2, or 1 but it might generate the same set of ordinates twice or three times or indefinitely. What is needed is an algorithm which sets up a random sequence of the cell ordinates but allows each position to be generated only once and for each position sets up a random sequence of trial moves but allows each trial move to be generated only once. The problem is congruent to shuffling a deck of cards, and the simplest implementation I have been able to generate is as follows:

Set up an array for piece selection DIM P(3,3) and one for move selection DIM M(3). These will be used simply to record that each position and move has been tried.

750: zero the piece selection array.
755: select Y randomly from the values 2 or 3: select X randomly from the values 1, 2 or 3.

760: if this pair has been used before on this turn, try again.

765: if there is no computer piece at this point, go to 855.

770: if there is a computer piece at this point, zero the move array.

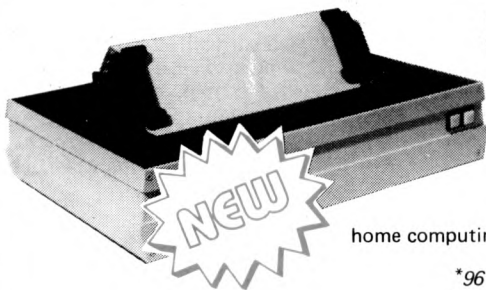
775: select a move randomly from the values 1, 2, or 3.

780: if this move has been used before, try again.

785: if this move is not legal, go to 850.

850: put a 1 in the move array to show that this move has been tried. Increment the move count, N2. If all three moves have not been generated, try again.
855: put a 1 in the piece array to show that this cell has been tried: increment the position count, N1: try again until

Continued in Programs — P.113



Super Print 800

80 COLUMN HIGH PERFORMANCE
IMPACT PRINTER

The ideal companion for PET, Apple,
TRS80, Exidy, Superboard, Compukit
and most Micro's

Rugged metal enclosure makes it ideal for
home computing, small business systems, data logging etc.

- *96 character ASC II Standard
- *Auxilliary User Defined Character Set
- *Accepts 8 1/2" max. paper - pressure feed
- 9 1/2" max. paper - tractor feed

OPTIONS:-

- *Tractor & Fast Paper Feed/Graphics(model ST)
- *2k Terminal Buffer

Tractor & High Speed-Model 800ST
ONLY £389+VAT

Atari VCS System

Most popular top range micro-video game



Current carts. include:- Air-Sea
Battle, Space War, Outlaw, Video
Olympics, Breakout, Basketball,
Surround, Blackjack, Basic Maths,
Hunt & Score, Miniature Golf,
Skydiver, Street Racer, Chess,
Backgammon and many more.

Cartridges mostly - £13 + VAT
Chess (8 levels) - £39 + VAT
Backgammon - £30 + VAT
Superman - £20.80 + VAT
Indy 500 - £30 + VAT

Coming Soon - BASIC Computing, Space
Invaders plus many more!

Buy a VCS, introduce a friend to buy one
and get a Keyboard FREE worth £19
(limited Ingersol Offer)

Atari VCS NOW ONLY £113 + VAT
+ your first cart. - £6.90 + VAT (worth £13)

Just look at these standard features:

- *RS-232, 20mA, IEE 488 and Centronics 1/0
- *16 Baud Rates to 19,200
- *60 Lines per minute - Bidirectional
- *5 print densities 72,80,96,120 or 132 Chr/Line
- *Self Test Switch

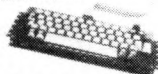
Standard Feed-Model 800
ONLY £329+VAT



Nascom-2

MICRO COMPUTER

ONLY £295 + VAT



FREE 16k
RAM Board

Z80A 8 bit. This will run at 4 Mhz but is
selected between 1/2/4/ Mhz.
On-board, addressable memory. 2K
2K Monitor-Nas-sys 1. 1K Video RAM
(MK4118). 1K Work space/User RAM
(MK 4118). 8K Microsoft Basic
(MK 3600 ROM). 8K Static RAM/
2708 EPROM

Superboard II - OHIO - Challenger 4P

At these prices why waste time and money on
unauthorised kit copies?



New 50 Hz version
No Flicker

NOW AN
UNBELIEVABLE
£149.95
+ VAT

610 Expansion Board 8k RAM
ONLY £149.95 + VAT

IP CD3P Minifloppy Disc, Cased, PSU,
2 copies of DOS - ONLY £289 + VAT
Set of 4k RAM (Superboard users only)
ONLY £24 + VAT
Plastic Case - Beige ONLY £26 + VAT
Challenger IP - Metal Cased, Superboard,
PSU modulator - ONLY £188 + VAT
Discs & Cassettes available

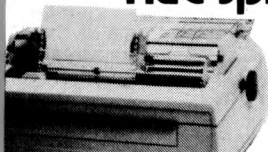
PAL COLOUR AND SOUND

A major breakthrough
in price/performance
for personal/
business educational
micro's
- Single RF O/P
provides both
sound & vision
to colour TV.
(Colour sets
only).

*8k Microsoft 8k User RAM *16 colours,
32 rows x 64 cols. *Programmable tone
generator and DAC *Joystick and keyboard
interface.

Challenger 4P - 8k Basic in ROM 8k RAM
expandable to 32k - ONLY £425 + VAT
Challenger 4P MF - Same as 4P but with Mini-
floppy 24k RAM, expandable to 48k -
ONLY £950 + VAT
Complete range of accessories available

NEC Spinwriter



- for the
professional
word processing
system
£1795 + VAT

NEC's high quality printer uses a print "thimble" that
has less diam and inertia than a daisy wheel. Giving a
quieter, faster more reliable printer than can cope
with plotting and printing (128 ASC II chs.) with up
to 5 copies, friction or tractor fed. The ribbon and
thimble can be changed in seconds. 55 chs. per sec.
bidirectional printing with red/black, bold, subscript,
proportional spacing, tabbing, and much much more.



SOFTY

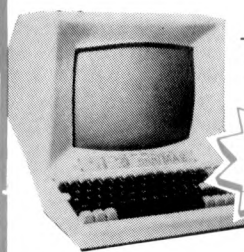
INTELLIGENT
EPROM PROGRAMMER

Built or in Kit form
Connects directly
to TV. Develop,
Copy, Burn,
Verify 2708,
2716 and with
modification 2516.

Softy is a versatile product and each application will
be different by definition. When Softy is connected
via a serial (RS 232) or parallel link with any small
computer capable of supporting an assembler a
simple and capable Product Development System
is formed. For product developments with less than
2k of firmware Softy may be the only development
tool you will need.

*Fast cassette interface-over 2000 baud eqiv.
*Ideal Training Aid-useful control computer
*Equivalent dev. systems cost over £500+
ONLY £120 + VAT Built & Tested
£100+VAT Kit, £20+VAT Built Power Supply

miniMAS Terminal



- the intelligent VDU
ONLY £588 + VAT

*Utilises the new advanced and powerful
Z8 Micro *12" P4 Phosphor high resolution
display *24 lines of 40 or 80 characters -
25th line status *9 x 13 field displaying
128 ASC II characters - 4K RAM - 2 page
*RS232C or RS432 - 16 independent baud
rates for each 1/0 *Full 92 keyboard -
sophisticated cursor controls *Emulates
DEC VT52



Video 80

- based on probably
the world's largest
selling video monitor
-over 100,000 in use!

ONLY £69 + VAT

*Ideal for home, personal and business
computer systems *12" video display
*Composite video input *Compatible
with many computer systems *Solid
state circuitry *Stylish rugged plastic
housing

Mighty Micro

In association with Watford Electronics

Please add VAT at 15%. Carriage extra, will advise at time of order. Official orders
welcome. Product details on request. Trade and export enquiries welcome.

33 CARDIFF ROAD, WATFORD, HERTFORDSHIRE

Tel: (0923) 40588/9 Telex 858747. Open 9 am to 5.30 pm Mon - Sat.

Close to Watford Football Ground. Nearest Station - B.R. Watford.

BUY IN CONFIDENCE - In the event that we are unable to deliver your goods within 7 days, we
do not bank your remittance until such time as we have the goods to despatch. If on receipt of
your order the goods do not meet with your satisfaction, return within 7 days for full refund.



COMPUTER GAMES



SPEEDING~UP THE SEARCH

In last month's article we introduced the extremely powerful Alpha-Beta algorithm for searching two-person game trees, and we saw how dramatic the effects of alpha-beta pruning can be when the branches of the tree are searched in their optimal order. Although optimal ordering is impossible to achieve (if we knew what the best move was, there would be no need to search the game tree to find it), there are a number of techniques which form the subject of this month's article.

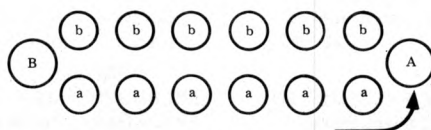
Ordering by short look-ahead

Consider a program which searches a game tree to a depth of 10-ply. If the average branching factor is 36, as in chess, the tree will be enormous and any saving that can be achieved by optimizing the order of the search will be well worthwhile. One way in which this might be done is to carry out a much shorter look-ahead search, to a depth of 3-ply for example, and then order the moves on the basis of this shallower search. Once this has been done, the search routine moves down the tree and performs its full search of the tree, the first 3-ply of which have already been put into an approximate order. As a result of the approximate ordering, the full look-ahead search is conducted in a more efficient manner, with considerable savings in time. The following example should help the reader convince himself of the value of conducting a preliminary search.

Let us suppose that in a chess position there are 36 moves. On the basis of a shallow search it appears that move m_1 wins the opponent's queen, move m_2 wins only a pawn, and no other moves force the win of any material. At the other end of the scale, move m_{35} appears to lose a pawn while m_{36} looks as though it loses a bishop. The program

now orders these 36 moves on the basis of its preliminary look-ahead, and it first carries out a full 10-ply search on the move that appears to win the queen, m_1 . Unless there is some deep reason why this move does not win the queen, the program's alpha-beta search will return a score to the root of the tree that indicates its opinion that move m_1 wins a queen, and so the number of branches which are pruned off during the search process will be high. The same thing happens when the full search process examines $m_3, m_4, \dots, m_{35}, m_{36}$. The reason why we need to order all 36 moves is that our ordering will not be absolutely correct, but the effect of an error in one or more value judgements will be minimized if we make the preliminary ordering as accurate as possible. For example, if move m_{36} actually turned out to win a bishop instead of losing a bishop, the move would still be inferior to m_1 (winning a queen) so we would still wish to examine m_{36} after examining m_1 .

Some interesting results on preliminary ordering were discovered by Richard Russell who wrote a Kalah program in 1964. Kalah (or Oware) is one of a family of games that go under the generic name Mancala. These games are played in Asia and Africa, and the rules vary slightly from one region to another. The game presents an ideal programming exercise because the rules are simple, the branching factor is typically no more than 6, and it is relatively simple to devise a satisfactory evaluation function.



Each player controls a number of pits or bowls (often pits in the sand) and one large pit or bowl called his Kalah. In

the above diagram the pits labelled "a" and Kalah labelled "A" all belong to one player, pits "b" and Kalah "B" belong to his opponent. At the start of the game each pit contains an equal number of stones, say 5, and each Kalah is empty.

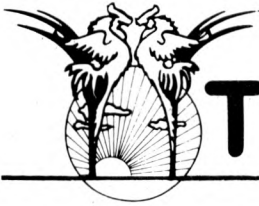
The players move alternately. To make a move a player picks up all the stones in one of his pits and, moving his hand in an anti-clockwise direction, drops one stone into each pit and into his own Kalah, but not into his opponent's Kalah. When his hand holds no more stones the player has had his turn, and it is then his opponent's turn to play; but if the last stone lands in a player's Kalah he has another turn, so it is advantageous to plan the game so that you will have two or more turns in succession. The other important rule is that if a player's last stone lands in an empty pit on his own side, he captures all of the stones in the opposite pit and places them, together with the stone making the capture, in his own Kalah.

At the end of the game the player with the most stones in his Kalah is the winner.

Russell experimented with preliminary searches of various depths. With a full look-ahead of 10-ply he discovered that the program consumed the minimum CPU time when 90% of its total search time was spent in the short look-ahead of 5-ply. He then found a method for improving the search speed still further. Rather than begin a new 5-ply search at each ply, he used the fact that the short look-ahead searches overlap — the 5-ply search conducted at one position in the tree could be used as a 4-ply search of a position at the next level down in the tree. This means that a short look-ahead of 5-ply would have its own short look-ahead ordered: to a depth of 4-ply the first move, 3-ply on the next move, 2-ply on the third move and 1-ply on the fourth. So when the program is executing the short look-ahead routine it can take advantage of this partial ordering within the short look-ahead, and the short look-ahead itself is speeded up. In the case of Russell's Kalah program this technique produced a reduction in total search time of approximately 65%.

One of the problems of implementing this short look-ahead method on a personal computer is the need to store the whole of the short look-ahead tree. For most games this will be impossible without a floppy disc system, and even then there will be games for which there is insufficient memory to cope with anything more than a 2-ply or 3-ply short look-ahead search. Nevertheless, the idea is worth remembering, either for games with relatively small branching factors, or for the day when you upgrade your micro by adding a bubble memory. But with even the smallest memory configuration you can utilize this method to some extent, simply by restricting your short look-ahead to a 1-ply search! Let us see how this might work in practice, using noughts and crosses (tic-tac-toe) as our example.

The program generates the three, essentially different first moves: the central move (location 5), a corner move (location 1) and a move in the middle of an edge (location 2). Those of you who have followed my earlier



TERODEC

Announce Business Software from A. Osborne/McGraw-Hill

Here, at last, is low-cost business software complete and ready to run on many of today's inexpensive microcomputers. The programs are written in CBASIC version 2, a popular commercial BASIC for 8080/Z80 microcomputers which use a CP/M operating system.

The documentation includes a complete operators manual, with screen display formats and sample reports. And there is more: file descriptions and layouts, an explanation of pertinent CBASIC features, suggestions on how to change the programs, and program and data file installation instructions. In addition, the source listings themselves are thoroughly documented with in-line remarks.

ACCOUNTS PAYABLE & ACCOUNTS RECEIVABLE — CBASIC GENERAL LEDGER — CBASIC

Features Include:

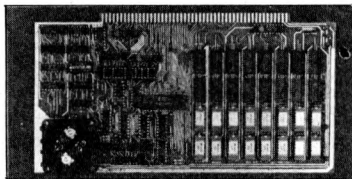
- accounts payable check printing with invoice detail
- accounts payable invoice aging
- automatic postings to general ledger
- accounts receivable progress billing
- accounts receivable partial invoice payments
- accounts receivable customer statements

Features Include:

- accumulation of postings from accounts payable and receivable
- trial balance
- income and expense statement
- balance sheet
- cash journal

TERODEC sell these programs because we use them in our own business. They're on line now, working for us and others around the country.

CENTRAL DATA RAMS



New RAM Prices.

Frm The Dynamic Memory Company.

- Deselectable in 2K increments — the deselect allows 2K areas of memory to be switched off to avoid memory overlap
- Z-80 and 8080 compatible at both 2 MHz and 4 MHz
- Fully socketed — allows the user to expand the board
- Power saving Dynamic RAM with invisible refresh
- Plug selectable addressing
- S-100 compatible
- Reliable — one year guarantee.

16K — £205 32K — £270
 48K — £335 64K — £400

4 MHz Boards at £5/16K additional

COMPUTER SYSTEMS SALES

MICROMATION Z-PLUS: 4MHz Z-80 CPU; 64Kbytes of RAM; 3 Serial RS232 Ports; Single/Double Density Disk Drive Controller; 1Mbyte of Floppy Disk Storage (2 SS/DD drives); CP/M1.4. Ex Demo System £1995.00

MICROMATION DOUBLER: S-100 8080/Z-80 Single/Double Density Disc Controller for Persci 277 or Shugart 801 Compatible Drives, with RS232 Serial Port and Boot PROM. A&T £220.00

TERODEC SYSTEMS LTD
 16-17 College Place,
 Southampton, Hants.
 Tel: (0703) 39611-5

TERODEC
 (MICROSYSTEMS) LTD
 17 The Gallop, Yateley,
 Camberley, Surrey.
 Tel: (0252) 874790
 (0344) 51160

All information is correct at the time of going to press. Prices exclude VAT and delivery.

PAYROLL WITH COST ACCOUNTING — CBASIC

Features Include:

- Interactive data entry with easy correction of data entry errors
- Monthly, quarterly, and yearly cumulative totals for each employee
- Summaries of the current year's paychecks for each employee
- Job costing (labor distribution) with cumulative totals and overhead calculations
- Flexible deduction schedule for every employee
- Check printing with full deduction and pay detail
- 16 different reports

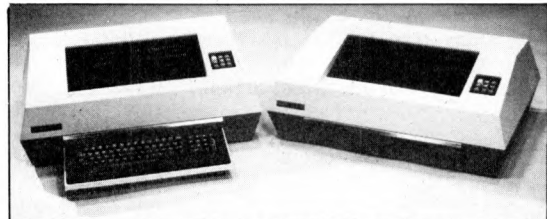
Each package £150 — Documentation only 12 Programs require CBASIC-2

HIGH LEVEL LANGUAGES

CBASIC-2 — A very powerful pseudo-compiler which has been used to great success in many business applications. Low cost and high performance together with minimal memory requirements dictate consideration of CBASIC for a run time basic only or for new design compatability.

CIS Cobol — Version 3	£295/£25	OPERATING SYSTEMS	
Version 4	£395/£25	CP/M Ver 1.4	£85/£15
Disc Extended Basic	£155/£15	CP/M Ver 2.0	£170/25
Fortran-80	£205/£15	MPM	£200/£30

DECISION DATA PRINTERS



Bidirectional Printer with microprocessor versatility.

- Baud rate switch selectable.
- Variable character size and density.
- Quick change cartridge ribbon.
- Robust 7 x 9 dot matrix print head.
- Bidirectional paper movement.
- Table top design.
- Easy serviceability.
- Bi-directional printing for high throughput.
- Industry standard RS232C and Centronix parallel interfaces.
- Microprocessor controlled.
- Quiet operation.
- Horizontal and vertical tabs.
- Graphics capability.
- Self test.
- KSR and RO models.
- 150 character/sec.

3241 150cps 132 col RS232C RO	£1250.00
6541 150cps 132col RS232C KSR	£1375.00
Centronics Interface	£75.00

CROMEMCO Z-2: 4MHz Z-80 CPU; 64Kbytes of RAM; 1 Serial RS232 Port; PFD with 512Kbytes of Floppy Disc Storage (Persci 277 and power supply); Mini-Floppy; Disk Drive Controller; Software (CDOS, Data Base Management, Word Processor, FORTRAN4, COBOL, BASIC, Macro Assembler). Ex Demo System £2495.00

CP/M1.4, BIOS, BOOT and Utilities available for the Micromation Doubler.

BARCLAYCARD

VISA

articles will know that the moves may actually be generated in that order by the application of an elementary understanding of the game.

The program evaluates the resulting positions, i.e. the positions it has found from a 1-ply search, and sorts them so that the best move is examined first. We shall assume that our evaluation function retains the order in which the moves were generated, in which case the program next produces the moves from position P_1 , the position arising after making the central move (location 5). In reply to this move there are two, essentially different moves, a corner (location 1) and the middle of an edge (location 2). We generate these moves in exactly that order, and then we evaluate the resulting positions (P_{11} and P_{12}) using our evaluation function. Let us assume that the scores for P_{11} and P_{12} indicate that P_{11} is a better position than P_{12} from our opponent's point of view. Then on the basis of the 1-ply search conducted from position P_1 we can say that the next set of moves to be generated should be the successors of position P_{11} . Here there are four, essentially different moves: a corner on the same edge as the X (location 3), the opposite corner (location 9), the middle of an edge adjacent to the X (location 2), and the middle of an empty edge (location 6). The program then evaluates all four of these positions, and on the basis of the 1-ply search conducted from P_{11} it orders them in such a way that the move most favourable from its own point of view is the one which will be expanded first.

Thus the process continues. As each bunch of successor moves is generated, the resulting positions are evaluated

and then sorted. Admittedly the sorting will be nowhere near 100% accurate, but it should certainly be sufficiently accurate to result in effective pruning when the program reaches the bottom of the tree and begins its alpha-beta search.

I touched briefly on this method in my previous article, but I felt it worthwhile re-iterating my point by means of this example, because the notion of an ordered search is so very fundamental to efficient tree-searching, and this method is relatively painless to program.

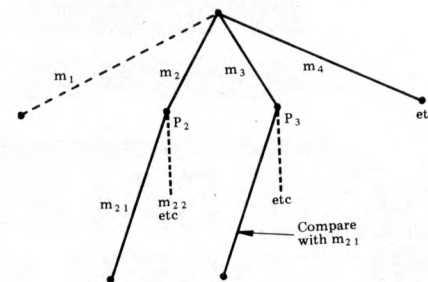
The killer heuristic

Imagine that you are playing a game, thinking about which move you should make next. You come up with the idea of making move m_1 , but then you notice that if you do play this move your opponent has the very strong reply ZAP at his disposal, completely wrecking your position. You therefore stop thinking about m_1 and start to think about another move, m_2 , but now you have been forewarned because you have already spent some of your thinking time on the discovery of the refutation move ZAP. You therefore look to see whether m_2 can be met by ZAP, and if so, with what result.

The logic behind this approach is not difficult to understand. If ZAP kills your prospects of victory after you make the move m_1 , it is quite possible, even likely, that ZAP will ruin you after you make the move m_2 . In chess and many other games there is the concept of the threat, and ZAP moves often fall into this category. If your queen is threatened and you play a random

move, the chances are that your opponent will be able to capture your queen on his next turn. Each time you think of a move you should first look to see if it loses your queen in the same way, and if it does so then you will have pruned off large chunks of the game tree simply by finding the refutation move (sometimes called the "killer" move) early in the search.

The implementation of the killer heuristic is not difficult, but it does require the use of extra RAM. At each level in the tree, keep a note of which move produced the last cutoff (this is the killer move) and try that move first when examining the next group of positions at the same level. This method becomes clearer from an examination of the following example.

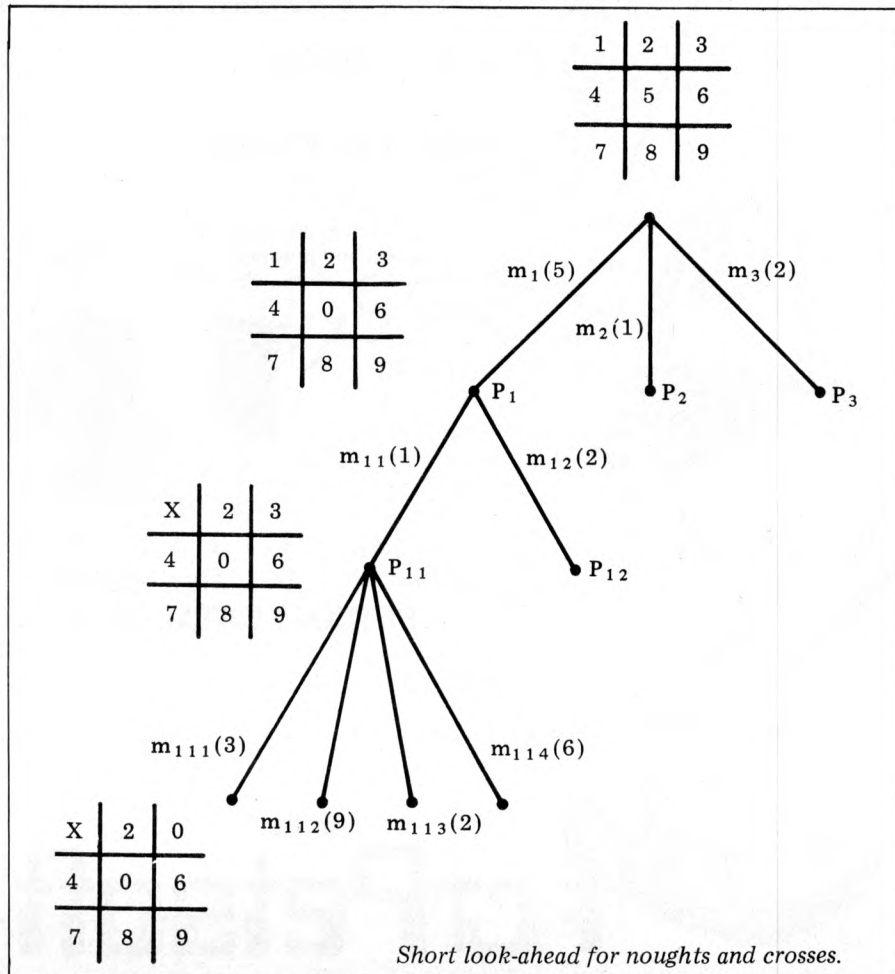


The program has already looked at the first move from the root of the tree, and returned a score to the root position. It now examines move m_2 , leading to position P_2 , and soon discovers that in reply to m_2 if its opponent chooses $m_{2.1}$ then the opponent will have improved on his score which is currently at the root of the tree. In other words, move $m_{2.1}$ refutes move m_2 , and the program need not look at $m_{2.2}$, $m_{2.3}$, ..., etc.

Next the program examines move m_3 . It knows that $m_{2.1}$ refuted m_2 so it first looks at its list of legal moves from position P_3 to see if the same move as $m_{2.1}$ can be found in this list — if so it examines that move first, in the hope of finding that here too the same move provides a refutation, thereby terminating the search from m_3 after examining the minimum number of branches. If it turns out that m_3 is refuted by a different move, then this new killer move replaces the original one and it is this new killer which is looked for first when examining the successors to m_4 .

There are various ways in which this heuristic may be refined and expanded, but each of them requires still more RAM. Instead of storing just one killer move at each level, the program could store (say) the first five killer moves that it encountered at each level and keep a note of how often each killer was used as a refutation move at that level. Each time the count for one of the killers was updated, all five killers could be ordered so that the next time the program reached this level of look-ahead it examined the most frequently used killer first, then the second most frequently used, and so on.

Another idea is to store killer moves linked to the moves that they refute, and then use this information at different depths of search. For example, if it was discovered that in a chess position the move e2-e4 by White was refuted by the reply c7-c5, then wherever the move e2-e4 was found in the tree,



Short look-ahead for noughts and crosses.

Introducing the PET COLLECTION



... A suite of powerful business programs at a budget price – from ACT Petsoft, the professional software specialists!

ACT SALES LEDGER £120

Commodore Disk £95 Cassette version

Full facilities for the maintenance of the Sales Ledger, the preparation of a list of outstanding balances and printing of statements. All data including new customer details, invoices, credits, cash and transfers are entered under step by step guidance on the display screen. Printed results include Audit List, Aged Debtors List, Control Account and Statement.

For 32K PETs

Both Sales Ledger and Purchase Ledger are...



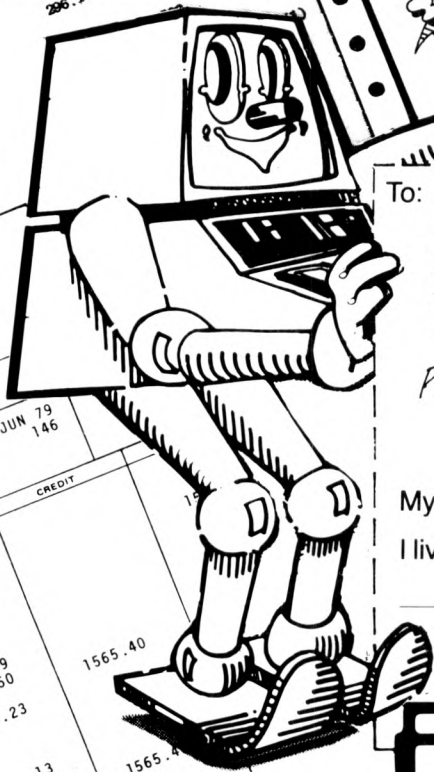
ACT PURCHASE LEDGER £120

Commodore Disk £95 Cassette version

Full facilities for maintenance of the Purchase Ledger, the preparation of a list of outstanding balances and printing of remittance advices. The system produces the following printed results: Audit List, Aged Creditors List, Control Accounts, Purchase Ledger Record, Remittance Advice, Cheques and Payment List. For 32K PETs

DEBTORS CONTROL LIST		TOTAL BALANCE OUTSTANDING	CREDIT LIMIT	REPORT
JUN STEEL		206.18	500	1
JONES WILSON LTD				
184.22	108.46			
KENSON & CO LTD				
273.46	98.20			
LEBIDGE CONSTRUCTION				
1732.44	962.35			
MAYTON SAVILLE LTD				
369.75	462.20			

DATE	REFERENCE	TRANS	DEBIT	CREDIT
MAR 79		B/F	1565.40	
APR 79		B/F	836.45	
MAY 79		B/F	1941.64	
			366.09	1565.40
			1017.50	
			1096.23	



ACT INVOICING WITH STOCK £75

A powerful, easy-to-use system for the CompuThink Disk, handling 1200 or 2400 stock items per diskette.

ACT PAYROLL 200 £50

For up to 200 employees, on disk or cassette.

ACT WORDCRAFT £325

The ultimate PET Word Processor, now on CompuThink Disk.

... and over 200 more business programs, games and programming aids in the NEW **PETSOFT CATALOGUE**.

To: ACT PETSOFT
Radclyffe House,
66-68 Hagley Road,
Edgbaston, Birmingham
B16 8PF. Tel: 021-455 8585
Telex: 339396



Please rush me information on... 1 2 3 4
 5 also the NEW **PETSOFT CATALOGUE**

My Name is _____

I live at _____

Tel. No. _____

ACT Petsoft

whether it be at 3-ply, 5-ply, 7-ply or deeper, the first move to be examined for Black would be c7-c5. Again the logic behind this use of the heuristic is easy to understand — a decision which is bad today will probably be bad in a similar situation tomorrow.

The principal continuation

When a program has finished its search of the game tree, and has decided on its move, it will have in its memory the path through the tree which it considers to represent the best play by both sides. Its own best move will be at the top of the tree, then the move which it expects its opponent to make in reply, then the move which it thinks is the most likely reply to its opponent's expected move, and so on. It seems a pity to waste this information when so much effort has been put into its acquisition, and no more memory is required to take advantage of the information than one needs for the killer heuristic. Simply use the 3rd ply move from the current search as the first move to be examined when the program next begins to compute a move. The 4th ply move in the current search can serve as the "killer" at ply-2 in the next search; the 5th ply move now can be the first killer at ply-3 next time, and so on. Very little computation time will be taken up with this method, and it is as well to start your search looking at vaguely sensible moves.

The Alpha-Beta window

This is another trick, inexpensive in terms of code, which will often speed up the search process. Under certain circumstances it may actually slow down the speed of search but if the para-

meters are carefully chosen the overall effect will be beneficial.

In most games it is true to say that in general it will not be possible to force a substantial gain within the next ply, nor will it be likely that the player whose turn it is to move must concede a substantial loss. In view of this it seems unreasonable to set the values of alpha and beta to $-\infty$ and $+\infty$ respectively at the start of the search. Let us take chess as our example. We can start our search by assuming that White (whose turn it is to move) cannot force the win of more than two pawns, and that White is not faced with the inevitable loss of more than two pawns. We can therefore set the "window" to be four pawns wide, by assigning to alpha and beta the values of minus two pawns and plus two pawns respectively. This means that when searching for a move for White the program will only examine moves which, at worst, lose two pawns for White, and when looking for Black moves the program will ignore all moves which permit White to win more than two pawns. This process will speed up the tree search provided that the true value of the root position does lie within the window. Occasionally though, it will be possible for White to win more than two pawns or impossible for White to avoid conceding more than two pawns. Under these circumstances the search will terminate without the values of alpha and beta undergoing any change, and the program must then think again, widening its window.

The flowchart

The flowchart that follows illustrates how the alpha-beta algorithm works when backing-up in the tree search. This diagram is an abbreviated form of figure 4 from Whaland's excellent article (see bibliography).

(i) is the ply number currently under

investigation.

$L(i)$ is a pointer to the list of moves possible at level i (all sharing the same parent move at level $i-1$).

$m(i)$ is the move, at level i , currently being processed.

$E(i)$ is the evaluation of this move.

The left hand part of the tree assigns values to the nodes as the search proceeds. A value of $+\infty$ is assigned as initial values to nodes at odd depths, and $-\infty$ as initial values to nodes at even depths. These are the values which are to be bettered if a candidate node is to be acceptable. The program compares the value of $E(i)$ with $E(i-1)$ and replaces $E(i-1)$ with $E(i)$ if $E(i-1)$ is "worse than" $E(i)$. To be worse than $E(i)$, it is necessary for either: $E(i-1)$ to be greater than $E(i)$ and i to be even; or $E(i-1)$ to be less than $E(i)$ and i to be odd.

When there are no more moves to consider from a particular node, the value of $E(i-1)$ is compared with $E(i-2)$, and so on, back up through the tree, until $E(1)$ replaces $E(0)$ whereupon the move leading to the evaluation $E(1)$ is the best move found so far from the root of the tree. Once all moves from the root have been examined (or search time is exhausted), this move is played.

The right hand side of the flow chart performs the pruning made possible by the alpha-beta algorithm. When a new value of $E(i)$ is found, the alpha-beta routine compares it with the evaluation at ply $i-1$. If a cutoff is found the pointer $L(i)$ is set to zero to terminate the search of nodes at level i .

Task for the month

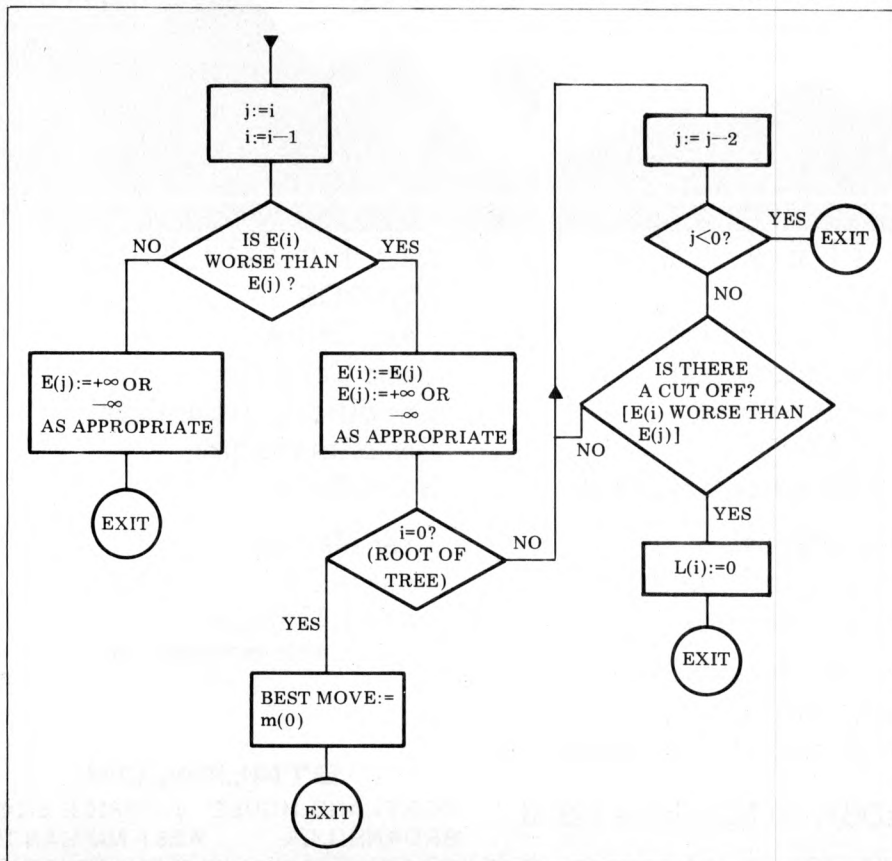
(If you have finished last month's task you will find this one much shorter.) Write a program to play noughts and crosses, taking advantage of symmetry and employing the alpha-beta algorithm. Search the whole of the game tree using the primitive evaluation function: program win = +1, opponent win = -1, draw = 0. Generate moves in the order: centre, corners, middle of edges. (Thus far as in last month's task.)

Add, in turn, routines to use the killer heuristic in its simplest form, and a modification to set the alpha-beta window to -0.9 and $+0.9$. Note the effect that each of these changes has on the time taken to search the whole of the game tree from the initial position. Add a routine to make use of the principal continuation, and test this by timing the program's computation, with and without this routine, after one move has been made by each side (remember to use symmetry here also).

The results should bear out the assertions contained in this article.

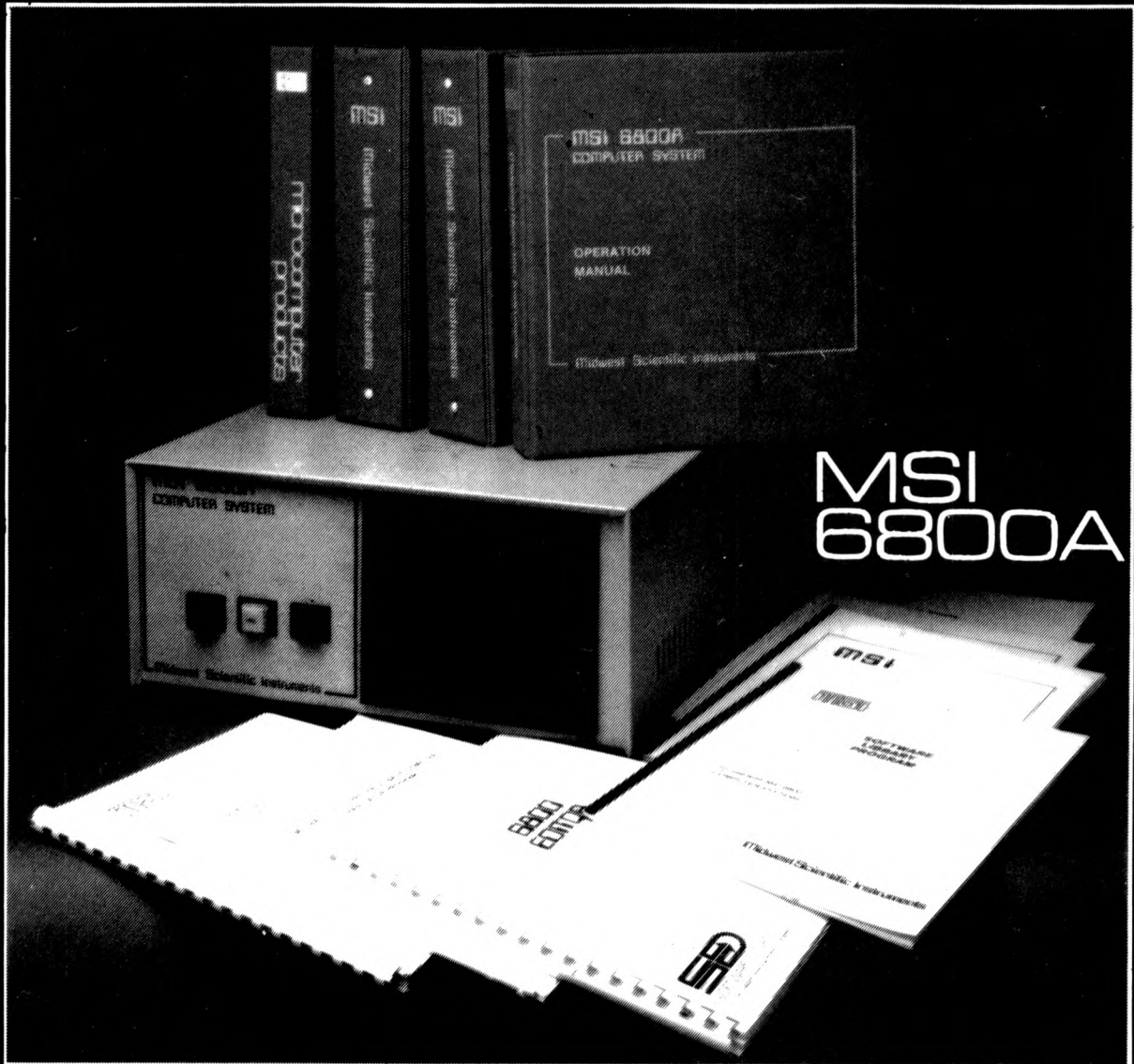
Bibliography

- Frey, P.W.: *Chess Skill in Man and Machine*. Springer-Verlag, 1977.
 Russell, R.: *Kalah — The Game and the Program*. Stanford Artificial Intelligence Project, Memo No. 22, September 3rd 1964.
 Russell, R.: *Improvements to the Kalah Program*. Stanford Artificial Intelligence Project, Memo No. 23, September 3rd 1964.
 Whaland, N.D.: *A Computer Chess Tutorial*. Byte, vol. 3, pp. 168-181, October 1978



SEED

PLANT EARLY FOR SPRING



MSI 6800A

JUST PLOUGH THROUGH THESE FEATURES

SDOS

Text Editor
Basic Compiler
Conditional Assembler
Basic Interpreter
Sort/Merge

User Manuals +
Source Code for most
system Utilities

Optional Compiler
Translator Programme

FLEX

TSC Text Editor
Basic Interpreter
Text Processor
Sort/Merge
+ Flex System Utilities

User Manuals +
Source Code for most
system Utilities

TSC Business Basic
Precompiler for above
6800/6809 Cross Assembler

MSI DOS

Text Editor
Basic Compiler
Conditional Assembler
Basic Interpreter
Sort/Merge

User Manuals +
Source Code for most
system Utilities

SEED

STRUMECH

PORTLAND HOUSE, COPPICE SIDE,
BROWNHILLS, WEST MIDLANDS.

TELEPHONE: BROWNHILLS 4321

SDOS & FLEX will support the HD8R 10 Megabyte Fixed /
Removable hard disc

WORD PROCESSING

Compiled and edited by Mike Knight of Mike Rose Micros

We've all read about the micro revolution in the office. Visions are created of rooms filled with robots communicating with humans via television-type screens or in squeaky dehumanised voices and speaking to each other by means of an all powerful computerised master controller.

The reality is somewhat different. The major office revolution is in fact occurring in word processors, and it's to that area that we are turning our attentions this month.

Objectives

The objectives of a word processing system are to enable the acceptance, storage, amendment and manipulation of textual style information, allowing for its printing out to a predetermined format and including (if necessary) variable external data.

Who would be likely to use a word processing system? Well almost anyone who uses writing to communicate, qualifies: obviously that includes anyone whose writing is published — such as authors, reporters and contributors to magazines such as myself. But publication is not the sole preserve of the media industry . . . what about anyone who submits written reports? Almost any manager would qualify on that basis.

In fact if you consider most products or services offered by businesses, the process through which they go almost demands written communication in order that they succeed. Potential customers have to be informed, whether by direct media advertising, sales brochure or mail shot. Our "prospect", once attracted, will probably need to be told in detail exactly how he will benefit, once again probably in a written proposal. Having decided to "buy" he will need to know how to use the product or service.

Where will he get this information? Probably from user guides, manuals, operating instructions or system descriptions — all written in normal fashion. And he'll almost certainly need to know exactly what he's getting for his money — and this is usually contained in a written contract.

In fact, once having attracted a customer the whole process starts again since he is likely to be a good potential client for other products and services. So a word processing system can help us to get customers, to hold their interest and to expand the revenue we get from them.

Functional requirements

Once he has decided that a word processing system might be of use to his business, the potential user will need to know exactly what he can expect from it.

There are two divisions of the functional requirements, Editing and Printing, and these can be sub-divided into essential and preferable features.

Editing

1. It is essential to be able to enter text and have it displayed on a screen. Then we must be able to find any part of that text by scrolling the screen up or down to the correct line or passage.

2. We must be able to insert to and delete from any part of the text by referring to a character, word, line or paragraph. We must also be able to move any part of the text around. To do this we must be able to mark the part to be changed.

3. We will expect no less of our word processor than of our typewriter and so will wish to be able to set and clear tabs to allow for indented or columnar format.

4. We will want to be able to change a word or string of words throughout the text without having to search through manually.

Other useful functions that we would like are:

1. Word-wrap . . . the ability to carry on entering text without regard to line length; a word which is too long will automatically be transferred to the next line.

2. If we have many letters to send with the same content we will wish to be able to take names and addresses automatically from another file.

3. A repeat function and automatic centring are useful for text design, particularly if our output is to be used for advertising or sales work.

4. Another very useful feature is on-screen text formatting which enables us to see the "look" of our text without printing hard copy.

Printing

1. We must be able to set both vertical and horizontal margins.

2. We will require a variation of line spacing — just as we have on our typewriter.

3. We will also want to be able to set our page length so that on long documents we can continue on to the next page automatically.

4. We should have the ability to set for right hand justification so as to be able to produce "blocked" printed matter.

Other useful functions include:

1. The ability to underline any part of the text.

2. The ability to double strike or bold-face any part of text for added impact.

3. The ability to number or title pages.

4. The ability to include both upper and lower case.

5. The ability to create in-text diagrams, using normal keyboard (eg. graphs).

In the next two sections I look to see how eight of these packages meet these requirements.

Evaluations

WORDSTAR

This package is supplied on disc at an average cost of £250. It's available from many outlets throughout the country. . . here's a short list:

Compelec Business Systems, London (01-636 1392) who market the system under the name Simpelec Word Processing System, Byte Shop/Computerland group who are based in London but have countrywide outlets (01-554 2177), Metrotech, Uxbridge (Uxbridge 57780), London Computer Store, London (01-388 5721), Telesystems Ltd, Gt. Missenden (02406 5314) and Lifeboat Associates, London (01-379 7931).

The package comes supplied with an extensive user's manual covering every aspect of use, starting with an overview of the system and going through each function in turn. There are also sections on System Requirements, Installation and Modification. For the technically minded amongst us this manual gives all necessary information but for those not fully acquainted with computer jargon, I feel a training course would be advisable.

MicroPro International Corporation, the authors of the software, recommend an 8080/8085/Z80 Microcomputer with a minimum of 44K RAM, a screen, CP/M or a similar operating system, two floppy disc drives and a printer. Although they state that the system will run perfectly well on this minimum hardware they do recommend that more RAM is added for systems which will be used intensively in word processing applications involving documents more than a few pages long.

The cost of this minimum hardware varies from around £3400 (London Computer Store) to £6300 (Simpelec System 1). Most of these outlets offer installation services and software maintenance, including replacement of corrupted discs or bug fixing — often at a small cost. Training however is not always provided — so check before you buy.

THE ELECTRIC PENCIL

This product is supplied as part of a complete hardware/software package selling under the trade name of

SYSTEMS

TASKS	Wordstar	Electric Pencil	Wordcraft	XTAL	Templeman	T.A.P.	C.M.C.	Magic Wand
EDIT								
Video editing	*	*	*	*	*	*	*	*
Scrolling	*	*	*	*	*	*	*	*
Insert/delete	*	*	*	*	*	*	*	*
Move	*	*	*	*	*	*	*	*
Cursor motion	*	*	*	*	*	*	*	*
Set/clear tabs	*	*	*	*	*	*	*	*
String search/replace	*	*	*	*	*	*	*	*
Word wrap	*	*	*	*	*	*	*	*
Read to/write from additional files	*	*	*	*	*	*	*	*
Repeat	*	*	*	*	*	*	*	*
Automatic center	*	*	*	*	*	*	*	*
On-screen text formatting	*	*	*	*	*	*	*	*
PRINT								
Vertical/horizontal margins	*	*	*	*	*	*	*	*
Vary line spacing	*	*	*	*	*	*	*	*
Vary page length	*	*	*	*	*	*	*	*
Right justify	*	*	*	*	*	*	*	*
Underline	*	*	*	*	*	*	*	*
Double strike/boldface	*	*	*	*	*	*	*	*
Number/title pages	*	*	*	*	*	*	*	*
Upper/lower case	*	*	*	*	*	*	*	*
Text diagrams	*	*	*	*	*	*	*	*
COSTS								
Software	£ 250		£ 325	£ 140	£ 500	£ 25	£ 25	
Hardware (minimum)	£3400 -£6300		£2900	£1425tape £1800disc	£1400+ printer	£1200	£1250tape £1990disc	
Both	£3400 -£6550	£1950	£3225	£1825tape £2200disc	£1900+ printer	£1225	£1275tape £2015disc	£4300

Wordstation. It's supplied by London Computer Store, London (01-388 5721) for the inclusive price of £1950.

The full system contains a TRS 80 Level II microcomputer with a 16K memory, keyboard, cassette recorder and a daisywheel printer. The system is supplied with an excellent, easily understandable operators manual and I'm sure any experienced typist could familiarise themselves with the system in a very short time.

London Computer Store will supply full hardware maintenance for 12% of the cost and will replace any tape which corrupts.

WORDCRAFT

This product is available from two major distributors, Dataview Ltd, of Colchester (0206 78811) and Hipposoft of Derby (0332 366803) and is available countrywide from Commodore and Petsoft dealers. The cost of the package is £325.

There are two versions of this software and both are on disc. The first is designed to run on a 32K Commodore PET, with a 3040 Dual Diskette drive and a choice of output printers (available from Commodore dealers) and the other on Computhink Disc Drives, designed to run on both the PET and ACT series of computers (available from Petact dealers).

The minimum hardware is estimated to cost from £2900.

There are about fifty users of the Commodore version and twelve users of the Computhink disc version. Dataview offers an "open line" for dealers and customers alike to answer any queries about using the program.

The manuals come with the package. Full technical documentation is supplied in the first and the second is an excellent step by step instruction book designed specifically with the novice in mind.

XTAL TEXT PROCESSOR VERSION 1.1

This is available from Crystal Electronics, Torquay (0803 22699) and is supplied on tape or disc, price £140 plus V.A.T., which includes a hardware lower-case generator.

The minimum hardware required to run the system is a 32K disc-based Apple system which, with Applesoft and a printer (Anadex), costs approximately £1800. Tape users can run on a 16K system with printer at an approximate cost of £1425.

Crystal Electronics give a 12 month guarantee for any defects or major updates which should have been included in the first instance. The package is supplied with limited instructions in hard copy and step by step instructions are held within the program.

TEMPLEMAN SOFTWARE WORD PROCESSING PACKAGE

This package is available from Templeman Software Services, Stratford on Avon (0789 66237) or from ITT distributors. It contains two programs which are linked automatically and comes supplied with operating instructions. The program is written in Palssoft BASIC and is supplied on disc.

The minimum hardware required to run the system is a 48K processor, 1 disc drive and a screen which

Templeman estimate to cost around £1400 — to which must be added the cost of a printer. The hardware can be expanded with the addition of more discs for extra on-line storage at the approximate cost of £425 each. The software alone is sold for £500.

On site installation service with full telephone backup is available plus ½ day training at no charge. Longer training courses can be arranged if required. If a user corrupts the supplied program a new disc is supplied and bugs are immediately rectified. Templeman do not feel personalisation is required for a word processing package but will customise a package if required.

HARTFORD SOFTWARE TEXT AND ADDRESS PROCESSOR

At present Hartford Software, Hartford (0606 76265) are the sole distributors of this package. It's supplied on cassette at a cost of £25 but a disc based version is planned in June. The software is supplied with full and concise documentation and it's claimed that formal training is unnecessary. The system is very simple and I believe the documentation does meet Hartford's claim.

The minimum hardware required to run the system is an 8K PET although two cassettes are needed to be able to use all the facilities. The minimum configuration would cost from £1200 depending on the type of printer used. A second cassette tape unit would cost £55. The later, disc based, version will require a further outlay of £900 for a disc drive unit. No installation service is



microtrend

Scintillating Software

The bright spark of brilliance comes to
PET, TRS-80, Apple, Nascom, CompuColor
and CP/M Systems.



microtrend

Microtrend Ltd., P.O. Box 51, Pateley Bridge, Harrogate, North Yorkshire HG3 5DP

"Micro mania hits London—staggering success—the sort of frenzy usually seen at January sales." Datalink (16/7/79)



The Big One

See you at The Wembley Conference Centre
22-24 July, 1980

Last year's Show broke all records and made headline news in many newspapers. The 1980 Show with its exhibition, international conference and one-day seminars, adds up to the most significant microcomputer event ever held.

Join the top names in the business and reserve your space now—and remember exhibitors who have also booked for the Mersey Micro Show are entitled to a 10% discount on both events!

Seminars held on the first two days will inform the business man of the many ways micros can be used as a commercial aid, both in the office and the home. The seminar on the third day will be devoted to education applications.

In addition, a two-day international conference will examine the state of the art in microelectronics with distinguished speakers from the UK and overseas.

Return this coupon or call Jane McBarnet at Online Conferences Ltd.,
Argyle House, Northwood Hills HA6 1TS.
Telephone: Northwood (09274) 28211

onTime

Please send 1980 Microcomputer Show exhibitor details
 Please send Mersey Micro Show details

Name _____
Address _____
Tel. No. _____

Continued from page 61

board 6502 systems KIM, SYM and AIM 65. The rest of the book makes reference to the SYM system in nearly all its programs but this need not worry any AIM, KIM or even PET owner because the software changes required to use alternative 6502 systems are slight (only I/O port addresses).

Chapter 4 is where it all starts and where I become slightly uneasy. The applications are developed using two "applications boards" with relays, speakers, LEDs, etc. In the first list of parts is "120 V AC plugs", indicating on which side of the Atlantic this book is more at home. Extreme care should be exercised when connecting any 240 V device to a relay for computer control — PCW would hate to lose any of its readers!

After dealing with the use of relays and loudspeakers, we have our first application — a Morse code generator, quickly followed by a time-of-day clock, a home control program (based on the time-of-day clock) and a telephone dialler (not for the UK). The second part of the chapter gives examples of useful techniques — a siren, sensing an input, pulse measurement and a simple music program. All very interesting and very basic.

Chapter 5 "Industrial and Home Applications" is a collection of fairly major projects — a traffic light

controller, a 5 x 7 dot matrix LED, a music program, a burglar alarm, a motor controller and a heat sensor. All are well described and interesting. The book ends with a pleasant surprise — a 6502 Assembler written in BASIC — the bad news is that it is Hewlett-Packard BASIC which is as unlike most micro BASICs as is possible. However, it would not take long to convert it and it's an additional reason to buy the book!

All the control programs are written in 6502 assembler. It may seem almost unnecessary to make this point because high level languages are well known to be of little use in control tasks, but it should be noticed that there are BASIC extensions specially for control applications — XYBASIC, LAB BASIC — that would minimise the software problems. I hope that one day someone will write a book on general control applications without making reference to a particular micro, by using a high level language.

In conclusion — the 6502 Applications Book is well written, interesting, stimulating and an excellent companion for *Programming the 6502*, but we still have a long way to go before microprocessor control is an easy subject.

All three books in this section are available from LP Enterprises.

THE 3rd Personal Computer World SHOW

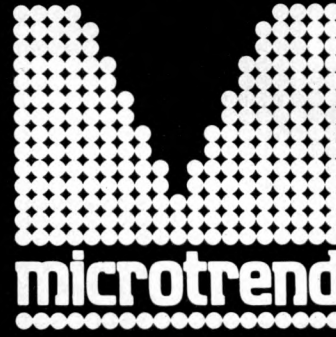
will be held at the Cunard International Hotel
in Hammersmith, London on

4,5&6 SEPTEMBER 1980

Organizations interested in exhibiting should contact

TIMOTHY COLLINS
of Montbuild Ltd on
01-486 1951

WHY CHOOSE



SOFTWARE?

1

QUALITY

All Microtrend programs have been developed by our own staff or specialist commissioned, and are subjected to thorough testing to ensure the highest quality.

2

SCOPE

Microtrend programs are available now for the PET, Apple and TRS-80, for home, educational, small business and professional users. Products for Nascom, CompuColor and CP/M based systems will be announced soon.

3

AVAILABILITY

Programs are available through our direct mail and telephone ordering service. Alternatively, programs can be bought through the Microtrend network of 25 authorised dealers.

4

PRICE

All Microtrend products are competitively priced — in many cases the Per Program cost can be as little as 50% of equivalent products.

Microtrend — the software you and your computer have been waiting for.

FREE DATA CARD

Write now for the free Microtrend data card — packed with useful information that no computer enthusiast should be without, or phone 0423 711878 any time!

Name _____
Address _____ PCW

System _____

Complete the coupon and send to:

Microtrend Ltd., P.O. Box 51, Pateley Bridge,
Harrogate, North Yorkshire, HG3 5DP.

Non U.K. enquiries to:

Microtrend International BV., Postbus 71012
1008 BA Amsterdam, Nederland.





COMPUTER ANSWERS

Each month Sheridan Williams and his panel of consultants answer readers questions. Topics may be hardware — from kits to mainframes, or software — from differential equations and statistics to file handling or sorting; the choice is yours. Send your questions direct to Sheridan Williams at 35 St Julians Road, St. Albans Herts.

American purchases

I'm going to New York shortly and am considering the purchase of a PET or an Apple whilst there. Will you please advise me about such things as modifications required and the availability of parts if I require to operate it in the UK. Also, what is the position regarding customs VAT?

AGA Mascarenhas,
Wembley

Personally, I'm all in favour of this type of purchase although it does have a few disadvantages. However, first the choice of computer and the question of what modification are required. Both machines will be 110V and the simplest solution is to purchase an auto-transformer. The capacity required is not large (150VA is adequate although 250VA will give the extra margin). Suitable sources are RS Components or Barrie Electronics Ltd., The Minorities, London, EC3 (01-488 3316). Alternatively, you could modify the internal power supplies. The Apple, however, has a switched-mode supply and is not easily modified — you would be better off buying a new 240V supply from ITT (approx. £110) and keeping the 110V supply for spares. The PET uses a normal supply and you could replace the transformer with a 240V primary (£35): (by the way, don't bother asking Commodore for one — they don't like people bypassing their dealers). However, some dealers may be prepared to supply you with a transformer on the "QT". Also, some reader out there may have done the same modification but using a different transformer — I'd like to hear from you.

Apart from the mains voltage, the PET needs no further modifications. The Apple will come without a UHF modulator board so for a better display you ought to consider buying a small monitor (£90) — or, alternatively, take a good look at the article in March's PCW on cheaply converting a TV set to a monitor. You won't be able to use the

Apple colour facility because you won't have the PAL board — nor will you be able to buy it over the counter in NY. Eurocolour boards are advertised in this country but as far as I know they aren't available and therefore the quality is unknown.

In my opinion, the Apple is still the better machine to buy but only get a 16K version and then buy the extra 32K of RAM for \$130 (total) from the States (try ringing California Digital on 213-679 9001 while you are over there and use Access or Barclaycard). Don't get conned by the big memory PET. It might seem reasonable to upgrade the 16K version to 32K by only buying an extra 16K of RAM — WRONG! You have to throw away the "funny" memory already fitted and buy a complete set of 32K chips — which, I personally, think is a bit of a nerve and NOT VERY WELL PUBLICISED.

I was surprised to find hardly any computer shops in New York. The only one that I used was The Computer Factory, 485 Lexington Avenue (0101-212 687 5001) but even they were out of stock of the items I wanted. Therefore, ring them before you go to check on the availability of your Apple (!) and, if possible, reserve it. Agree too on the method of payment and be prepared for quite a heavy sales pitch. Resist the temptation to buy any software as most of it is unadulterated rubbish.

Both computers come adequately boxed and can be shipped as excess baggage but check with the airline that they can take it when you are confirming your return flight reservation in NY. Don't come back on the TWA 1700hrs flight as it's very, very popular. The Apple is in a conveniently sized box that can just about be carried under one arm. The PET box is huge and you need both arms and large biceps to carry it. Don't forget too that the PET has a fragile cathode ray tube that could get broken if handled roughly in transit by the luggage people at either end. The Apple is therefore infinitely more robust in this respect. Beware also of irate American ladies who berate you for taking your pet on an aeroplane without putting airholes in the box for it to breathe — a true story!

When you enter England, declare your computer and

produce your receipt. With only one, you may be lucky and just have to pay at the desk to the duty officer. More likely you will have to find your way to the clearance (?) office and go through the rigmarole of incomprehensible forms. But do not despair, there are people to help you (for a small, reasonable fee) called Customs Clearance Agents. I used Greyhound Courier Service (01-570 1018 0975) who for a flat fee of £15 eased me through the paper jungle. Again, give them a ring beforehand and confirm meeting arrangements, method of payment etc for import duty and VAT.

The only disadvantage now is if your computer goes wrong. You obviously have no claim anywhere in this country. If it's an Apple that you have bought then I for one repair those, but if you have instead opted to choose a PET then I suggest that you try Petalect in Woking as my dealings with them have always left a very favourable impression.

Hopefully, this and previous replies have answered all the queries regarding the purchase of components and computers from America. We, in this column, feel that perhaps it is now time to call a halt on this topic — at least for a while.

M. Dennis

Sporting times

In order to record the finish times of a large number of orienteering (a form of cross-country running) competitors, our club would like to purchase a digital clock with a print-out and storage facility. On the print-out we need a reference number and the competitor's time (to the nearest second). Storage is needed to cope with the situation of competitors finishing closer together than the printer is able to keep up with.

R. Matthews,
Lichfield, Staffs

I am delighted to see that you feel micro-electronics may have a way of helping such a rapidly growing sport as orienteering.

I am not immediately aware of the commercial availability of precisely the equipment you have in mind, but the same results can certainly be obtained, and in a variety of ways. As usual, the more refined the

method, the greater the cost. At the one extreme you could do the job with a domestic battery digital clock and a "Polaroid" camera. At the other, £1500 should buy you a "PET" computer with a built in timing function, a printer, and a converter to give you mains power from a car battery. The latter highlights one of the main problems with most of the sophisticated approaches — the need to provide 240 volts A.C. in the middle of a field!

In between these extremes one real contender is the Rockwell "AIM 65". £370 will buy you the machine complete with 20 column printer, a BASIC interpreter and, I suspect, enough memory for your purposes. It only needs 6 volts DC, apart from the printer which takes 24 volts (and which would run off two car batteries in series). At that price the equipment is uncased. For about another £100 you could get a specially fitted case for the "AIM 65", ideal for transportation to events. At about £650 there is a version complete with case, mains power pack unit, and an acoustic coupler for connection to other computers via a telephone line. . . but that's going way beyond your presently envisaged needs.

The only snag with this system may lie with the timing — there could be a need for some assembly language programming. Hopefully the supplier would be able to do this for you. . . alternatively one of your members may already have the necessary skills. Then again you could approach your nearest computer club. By keeping the 5-volt power on the whole time you could record start times as well as finish times (in each case the operator would just have to enter the competitor's number on the keyboard); the time taken by each competitor could then be automatically printed out. Of course, this depends on there being enough time to move the unit from the start to the finish point — in between the last competitor setting out, and the earliest one getting home — which in turn depends on the course and the number of competitors (or so my limited knowledge of orienteering suggests).

If you could interest the British Orienteering Federation in establishing a demand for a reasonable number of

COMPUTER ANSWERS

using PEEK and POKE because if you get the value wrong and POKE a wrong location you could quite easily corrupt your program, or even the BASIC interpreter itself. In the majority of cases, PEEK does not suffer from this problem; however some circuits may detect a specific address and reset a latch (or some other similar function) when they see this address. You should therefore use as much care with PEEKing as you use with POKEing. Don't forget that you cannot POKE a memory location that doesn't exist (i.e. there's no RAM or ROM there). Perhaps therefore you can see why mainframe computers do not allow you to use PEEK and POKE.

I am afraid that your computer requirements are rather vague. If by a PET you mean a kit complete with metalwork, TV screen, computer etc. then I'm afraid there are none that I know of on the market. If, however, you mean that you want to start programming in BASIC as quickly as possible using an existing TV set then three kits spring to mind. They are the OHIO superboard, the Compukit UK101 and the NASCOM 2.

If you want immediate expansion to a disc based system then only the OHIO

currently offers this (though I personally haven't seen one). None of the three is what I would call well supported by the manufacturers — loud promises for no goodies seems to be the order of the day and I have to say that I find this situation appalling. Out of the three kits, the NASCOM 2 offers more bytes per buck than the other two, but don't forget that the disc drives have been promised for a long, long time. And, by the way, since they are all in popular demand, don't part with your money unless you have been guaranteed that they are in stock.
M. Dennis.

Facts on FORTH

I should be most obliged if you could tell me about FORTH, including references to books, articles etc. I should also be interested to know whether it has been implemented for CP/M. Incidentally, I have a Sorcerer and believe there is a suitable compiler for the TRS80.
H. Martin, York.

FORTH is an interactive language. It's ideally suited to microcomputers as it only requires 5-6K bytes for a complete system consisting of the interactive FORTH

compiler running stand-alone as its own operating system, assembler written in FORTH and a text editor.

About 2K bytes written in assembly language form a kernel of some 40 FORTH words, sufficient to define the rest of the language. Other "words" are then defined in terms of these or using the FORTH assembler. These definitions are stored in a "dictionary" which is a list of addresses of the words making up a definition.

Typing a FORTH word on the keyboard causes the dictionary to be searched for that word, and if found it is executed. Certain words allow the definition of new words or even new data types. Parameters are passed between words using a reverse-Polish stack familiar to users of the Hewlett Packard calculators. Global variables and constants may also be used if required.

Normally a disc is used for program storage; it's also used as "virtual memory" organised as any number of 1K byte blocks. Only two blocks can be in memory at any one time. If access is requested to a block not currently in memory, the FORTH will first free a buffer by writing its contents back to disc if it had been changed, and then reading the requested block from disc. Thus "virtual

memory" for program or data storage is only limited by the disc space available.

FORTH was developed by C. H. Moore around 1970 and he now markets the language through FORTH INC. He's represented in the UK by D.E. Butler, 239 Kimbolton Road, Bedford. FORTH products are also available from COMSOL Computer Solutions Ltd, 87 Briar Road, Shepperton, Middx. Two FORTH Inc books are available from COMSOL, *The Microforth Primer* and *Using Forth* and they come out around £8 and £13 respectively, post paid.

A CP/M version called STOIC is available on Vol. 23 of the CP/M users group manual. FORTH for the PET using cassette is available from Petsoft as is a version called FIFTH, which is said to combine the advantages of FORTH and PASCAL. The following references may be of interest:

1. "FORTH a new way to program a minicomputer" 1974 Astron. Astrophys. Suppl. 15 pp. 479-511.
2. "FORTH for Microcomputers" Dr. Dobbs Journal No.25 pp.21-27.
3. "FORTH dump programs" Dr. Dobbs Journal No.28 pp.26-28
4. "FORTH's forte is tighter programming" Electronics March 15 1979.

John Yale.

data tablet digitizer

Summagraphics ID

The latest advancement in the sphere of data input through a tablet digitizer has a flexibility that gives it a wide application in technical, industrial and scientific projects. The 'ID' (intelligent digitizer) has a built-in microprocessor which implements important features such as a relocatable origin, incremental mode, output data formatting and many other valuable advantages inherent in the Summagraphics 'ID'.

Write, phone or complete coupon for full information.



Terminal Display Systems Ltd

Hillside, Whitebirk Estate,
Blackburn, Lancs. BB1 5BR
Telephone (0254) 662244
Telex 63162 TDS G

More information please on the data tablet digitizer.
Send to Terminal Display Systems Ltd, Hillside, Whitebirk Estate,
Blackburn, Lancs. BB1 5BR.

Name _____

Address _____



Cassette Duplicating Supplies

NOW OFFER YOU

PYRAL

MICROPROCESSOR CASSETTES
POSTAL PACKS

	C12	C15	C20
10 Pack	£4.85	£5.05	£5.35
50 Pack	£21.45	£22.45	£23.95
100 Pack	£40.55	£42.55	£45.55

PYRAL

FLOPPY DISCS —
for example 5 1/4" postal packs

5 Pack	10 Pack	50 Pack	100 Pack
£17.00	£28.35	£127.00	£240.00

The price quoted includes packaging, postage and VAT. Cheques or postal orders with order please, payable to 'Cassette Duplicating Supplies'.

Orders and enquiries to:-
FRANK WHIPP — 0296 622837

● ○ ○ ○ Sales Office:
○ ○ ○ ○ 15 Icknield Close
○ ○ ○ ○ Wendover
○ ○ ○ ○ Aylesbury
○ ○ ○ ○ HP22 6HG
○ ○ ○ ○ Tel: 0296 622837



THE COMPLETE PASCAL

BY SUE EISENBACH AND CHRIS SADLER[®]

CHAPTER 8 TOP-DOWN DESIGN

The principles involved in top-down design are of universal application — regardless of language; use of this clear and logical method will invariably result in quicker and more successful writing of programs.

In this chapter of The Complete Pascal we shall tackle a large-scale text formatting program from scratch, showing how it can be constructed from the top down. We have chosen this particular program because it offers readers something very much worth implementing, whatever their particular interest in personal computing.

1. INTRODUCTION

The question is often posed as to which language is “the best”. As with so many things, there is no hard and fast answer since the most appropriate language usually depends somewhat on the application for which the programs are being written. In this series, BASIC has frequently come in for a (perhaps unwarranted) drubbing, largely because some familiar basis was required with which to compare PASCAL. Having now covered the major features of the language, the time has come to slot PASCAL into its rightful place — suitable for medium to large applications with complex logic where the advantages of *structure* can make themselves felt and which are going to be run sufficiently frequently (i.e. not “one-off”) to make the bother of compilation and linking worthwhile.

If, in the course of the discussion which follows in Section 3, you should ever feel overwhelmed by the complexities of interpreting formatting commands or shuttling segments of text backwards and forwards, you should consider the joys of implementing the same problem in, say, FORTRAN where text-handling can be a nightmare, or the much abused BASIC whose strings are easy to manipulate as a whole but difficult to fragment. Above all compare the readability of the PASCAL code with that of its would-be rivals. All the formatting can be elegantly contained in a single data structure and all the conditionals can employ named Boolean variables rather than numerical flags.

2. TEXTFILES

Before embarking on a specification for a text formatting program and discussing the programming strategies associated with a top-down implementation it will be necessary to consider the provision PASCAL makes for the control and manipulation of textual data. During execution, the program may need access to a variety of external media. On discs or magnetic tapes the program will access a *file*. As described in Chapter 6, the key features of a file are that it is external to the program; and its components are all of the same, predefined data type; and that the program communicates with the file by means of a *buffer variable* and the reserved words GET and PUT. By contrast, when the program communicates with a terminal

or line printer, the reserved words READLN and WRITELN are used to manage input or output in *lines*.

Clearly the disc (or tape) file is merely a form of storage for the program (perhaps an inconveniently slow but permanent form of memory), while the terminal is the primary means of communication with the human user. The *textfile* exists as a compromise between these two “media”: it is stored on and accessed from a disc, yet it is set up for output on a VDU or lineprinter. It can contain all the *printable* characters recognised by the terminal together with a non-printable “control” character, used to separate one line of text from another, and called the *line separator*. In ASCII, the line separator is actually a pair of control characters — carriage return and line feed.

A declaration of the form

```
VAR ROUGHCOPY : TEXT
```

has the effect of declaring ROUGHCOPY as a textfile via the standard type TEXT defined as a FILE OF CHAR. Since this will be a file of characters, the buffer variable (ROUGHCOPY ↑) will be of type CHAR and access may occur by means of GET and PUT operations. However, in a textfile there are likely to be a large number of characters to manipulate so that Wirth provides, as a shorthand, the standard procedures:

READ (FILEID, CHARBUF), which has the effect of CHARBUF:=FILEID↑; GET (FILEID)

WRITE (FILEID, CHARBUF), which has the effect of FILEID↑:=CHARBUF; PUT (FILEID) where FILEID is a declared file identifier and CHARBUF stands for “character buffer”.

Note that this still only deals with one character at a time, and only with textfiles. Note also that in the case of READ, the FILEID↑ buffer contains the *next* character to be read (as a result of the GET operation) while CHARBUF contains the character of immediate interest. When the GET operation encounters the line separator character, FILEID↑ becomes blank and the Boolean EOLN (FILEID) is set to TRUE. This is in order to help the programmer to deal with the line-nature of the textfile. A following READ would just transfer the blank in FILEID↑ to CHARBUF before advancing the file window but this is undesirable and liable to lead to errors. As a conse-

quence, a second standard procedure, READLN (FILEID), exists whose function is to move the pointer beyond the line separator and clear EOLN (i.e. make it FALSE again) without placing the (spurious) blank in CHARBUF. After a READLN, FILEID↑ will contain the first character of the *next* line and the program is thus ready for succeeding READs. If the READLN is called before all the characters on the line have been read, the pointer will skip to the beginning of the next line anyway. In a similar fashion, WRITE (FILEID, CHARBUF) transfers a character to an output file and WRITELN (FILEID) will append a line separator.

This scheme is sufficiently useful in general programming that a non-standard extension, sanctioned by Wirth in his “Report”, has been developed to allow more generalized READ and WRITE procedures. The first enhancement concerns the *type* of the variable permitted in a READ or WRITE call. In general, any variable of type INTEGER or REAL may be specified. The interesting point here is that the file type must still be a *textfile* so that some sort of conversion must be done (implicitly) between the character string in the textfile and the number in the program. Incidentally, variables of type Boolean may also appear in WRITE or WRITELN statements in which case TRUE or FALSE will appear in the output file — although you are unlikely to find this feature implemented on a micro system yet. The second extension allows more than one variable to appear in a READ or WRITE statement. Thus

```
READLN (FID,VAR1, VAR2, VAR3)
```

is equivalent to
 READ (FID, VAR1); READ (FID, VAR2); READ (FID, VAR3); READLN (FID)

which represents a considerable compression.

On large main-frame implementations of PASCAL, the mode of operation is usually non-interactive and communication with a program would be through two standard textfiles called INPUT and OUTPUT which are regarded as *defaults* so that their identifiers need not be specified. Thus

WRITELN	refers to	WRITELN (OUTPUT)
READLN	” ”	READLN (INPUT)
EOLN	” ”	EOLN (INPUT)
EOF	” ”	EOF (INPUT)
READ (VAR)	” ”	READ (INPUT, VAR)
WRITE (VAR)	” ”	WRITE (OUTPUT, VAR)

Note that RESET (INPUT) and REWRITE (OUTPUT) are assumed to be implicitly called and must *never* explicitly appear in a program. Readers with access to micro-based PASCAL systems are more fortunate in that access is interactive so that the "file" INPUT refers directly to the terminal keyboard while OUTPUT refers to the VDU screen or teletype roll. This brings the formal definitions of PASCAL input/output procedures into line with the syntax which will have been familiar to anyone who has been following this series.

UCSD PASCAL makes a few changes to the Wirth definitions to take into account the interactive nature of their system. These changes are summarized in the Look-Up table at the end of the Chapter. In our text formatting program we felt the need of a buffer big enough to take a whole line of characters at a time (i.e. a string) and of procedures to move the line to and from a textfile in one operation. Accordingly we have developed our own input/output procedures to access textfiles in lines. These appear in Box 1. The call FREADLN (INFILE, BUFFER) will read the next line of text from the textfile INFILE into the STRING (: ARRAY [1..MAXLINE] OF CHAR) called BUFFER. In line 6, the line separator from the previous line is disposed of. The buffer is then filled, a character at a time, until the line separator is detected (EOLN (INFILE) is TRUE, lines 8 to 11). At this point a check is made that the line was not a blank line. If it was, it is ignored and the next line is read; if not, the remainder of BUFFER is filled with spaces (line 13). This is important since the spaces will overwrite any characters left over in BUFFER from a (longer) previously read line. FWriteln (lines 15 to 20) merely outputs the printable characters in the buffer onto the indicated OUTFILE and appends a line separator.

3. THE TEXT FORMATTER

The idea of a text formatting program is to exploit the text handling capabilities of the computer (together with its capacity to control the line printer) to produce correctly formatted textual output. First the required text is entered into a file using the system editor and without much attention being paid to the layout of the text. If this file were to be offered as input to a text formatting program, the program would accept one line at a time and "pack" an output buffer, producing an output file each line of which is constructed according to some standard format; for example, each output line would be filled with the maximum number of whole words possible.

Invariably, however, a simple line-width specification will not be adequate for most text formatting tasks and the user will want to impose other conditions on the text output. The lines of text may perhaps be divided into pages, consisting of a fixed number of lines, which may or may not be numbered and the lines may be single, double or triple spaced. Furthermore, the text may need to be subdivided into paragraphs, each line could be right-justified — spaced out evenly between the left and right margins. Sometimes

the formatting scheme may need to be temporarily suspended in order to deal with a title or heading or a table of specially "hand" — formatted material.

All this information has to be passed to the formatting program and this can most easily be done by embedding *formatting commands* in the input text. While the program is processing the input text, it can *trap* each formatting command and dynamically alter the formatting specification to meet the requirements dictated by the new information. Box 2 tabulates some of the functions which could be implemented under such a scheme. Note particularly the syntax of the formatting commands. Each command will appear on a line of its own, and each command begins with a "." which is a very unlikely character for a line of text to start with! In this way the program can recognize which lines of the input file are formatting commands and which are just plain text.

Most of the formatting commands relate to the text which follows the command, although some commands (e.g. Break) relate to the text immediately before the command. For this reason a great deal of care must be taken, during programming, to keep the input and output file buffers independent, and to "look ahead" at the incoming line of text before writing out the latest line of output text. It is also important to distinguish between those commands which are effective for one line only (like .B) and those which alter the output format for all the ensuing text until new commands are issued (like .M).

Due to space considerations we had the choice of breaking the program into a number of boxes or presenting the complete listing. Although the former choice would have simplified the discussion, it would have made the actual program difficult to read or use, so, with some reservations, we chose the latter course. The problem specification for PROGRAM PROFF is as follows:

Write a program that allows a user to produce formatted textfiles from named unformatted textfiles in which are embedded the set of commands listed in Box 2.

Assuming the string handling procedures described in Chapter 7 and the file accessing procedures from Box 1, the first step is to consider the main data structures needed for the problem. Both the input and output files are textfiles and can be referenced by the file identifiers INFILE and OUTFILE provided these are declared as such (line 19). Likewise INFILENAME and OUTFILE-

NAME are strings which will contain the external file names, as specified by the user. Finally, a look at Box 2 will show what a complex formatting "environment" the program must maintain, utilize and occasionally amend. Clearly, the record structure lends itself to the easy association of data types suggested by the fields of FORMAT lines 5 to 15). While manipulating the text, the program will format according to the specifications held in a FORMAT record, and when obeying a formatting command, the program will alter a field in a FORMAT record.

Having chosen the data structures, the next step is to design and test the main program (lines 497 to 514). This should begin by calling STANFORMAT to initialize the FORMAT fields with the predefined default values (see box 2). This technique minimizes the number of commands used since only requirements at variance with the defaults need to be explicitly mentioned. In order to enable a series of files to be formatted successively, the remainder of the main program is placed in a loop (lines 499 to 513). Within this the user is asked for the input file name (and can exit with "E") and an output file name. The files are initialized for reading and writing respectively, and the text is formatted (line 509). This is the major ploy of top down design — once the current details (like filenames) have been dealt with, the "buck" is passed to another procedure down the line — in this case TEXTFORMAT. Finally, the files are closed — our program shows the UCSD instruction to close an external file (lines 510 and 511). Other micro PASCAL systems are likely to adopt a similar approach although Wirth PASCAL stipulates that external files must be explicitly passed to the program in the program heading (e.g. PROGRAM PROFF (ROUGH.TEXT, FINAL.TEXT)).

At this point it is necessary to test the code currently written. No matter how trivial this may seem, it's specially important at the initial stages of the design since a logical error at this level of the program could have devastating results on the outcomes at lower levels. To test, dummy procedures or stubs must be written for STANFORMAT and TEXTFORMAT.

e.g. PROCEDURE TEXTFORMAT;

WRITELN('THIS IS TEXTFORMAT')

END;

Thus when the main program calls TEXTFORMAT some sort of action occurs, enough to test the continuity of the main program. For procedures

```

1:  PROCEDURE FREADLN (VAR INFILE:TEXT ; VAR BUFFER:STRING) ; ①
2:
3:  VAR I, J : INTEGER ;
4:  BEGIN
5:    REPEAT (*BLANK LINES*)
6:      READLN (INFILE) ;
7:      I := I + 1 ;
8:    REPEAT
9:      READ (INFILE, BUFFER(I)) ;
10:     I := I + 1
11:    UNTIL EOLN(INFILE)
12:    UNTIL EOF(INFILE) OR (LENGTH(BUFFER) > 0) ;
13:    FOR J := 1 TO MAXLINE DO BUFFER(J) := ' '
14:  END ; (*FREADLN*)

15: PROCEDURE FWriteln (VAR OUTFILE:TEXT ; BUFFER:STRING) ;
16: VAR I, J : 1..MAXLINE ;
17: BEGIN
18:   FOR I := 1 TO LENGTH(BUFFER) DO WRITE (OUTFILE, BUFFER(I))
19:   Writeln (OUTFILE)
20: END ; (*FWriteln*)

```


Box 2

FORMATTING FUNCTION	OVERRIDING COMMAND	RESULT OF COMMAND	DEFAULT
PAGE CONTROLS:			
+LENGTH — NUMBER OF LINES TO THE PAGE.	.L n	SETS NUMBER OF LINES PER PAGE TO "n".	n=58
+NUMBER — SUCCESSIVELY NUMBER EACH NEW PAGE.	.N n	STARTS NUMBERING AT "n".	TRUE n=2 FALSE
+SPACING — INTERSPERSE BLANK LINES BETWEEN TEXT LINES.	.O .S n	SUPPRESSES PAGE NUMBERING. INTERSPERSES "n -1" BLANK LINES BETWEEN TEXT LINES.	FALSE n=1
LINE CONTROLS:			
+MARGINS — INSERTS SPACES TO LEFT AND RIGHT OF TEXT ON EACH LINE.	.M l r	FIRST CHARACTER OF TEXT AT POSITION "l" AND LAST AT "r".	l=0 r=60
+FILL — PACK AS MANY WHOLE WORDS AS POSSIBLE INTO EACH LINE.	.F .U (UNFILL)	INVOKES FILLING SUPPRESSES FILLING	TRUE FALSE
+JUSTIFY — REARRANGE WORDS IN LINE SO LAST WORD ENDS ON LAST CHARACTER POSITION.	.J .R (RAGGED)	INVOKES JUSTIFICATION SUPPRESS JUSTIFICATION	TRUE FALSE
ONE-OFF COMMANDS: (APPLY ONLY TO IMMEDIATE TEXT AFTER WHICH PREVIOUS FORMATTING RESUMED.)			
+INDENT — INSERT SPACES AT BEGINNING OF NEXT LINE.	.I n	INDENTS "n" SPACES	
+BREAK — TERMINATE LATEST LINE WITHOUT JUSTIFYING OR FILLING.	.B n	TERMINATES LINE AND INSERTS "n" BLANK LINES.	
+PARAGRAPH — TERMINATE CURRENT LINE AND INDENT FOLLOWING LINE.	.P i n	EQUIVALENT TO .B n FOLLOWED BY .I i	i=5 n=1
+CENTRE — POSITION NEXT LINE OF TEXT IN CENTRE OF OUTPUT LINE. (FOR HEADINGS)	.C		FALSE

which return values, the stub has to be more sophisticated and actually fake the return values to enable testing of the logic of the module under scrutiny. In this way the program can be built up as a collection of tested procedures and stubs which combine to form a test harness for the procedure currently under consideration.

The next step is to implement the procedures STANFORMAT and TEXTFORMAT. STANFORMAT assigns the default values to the fields of the record FORM (lines 101 to 109). Another run through the program will test STANFORMAT in its test harness. TEXTFORMAT however, is more complex. Local data structures include (i) USERFORMAT — the current formatting environment record — since TEXTFORMAT has to process an entire file, (ii) the two strings INBUFFER and OUTBUFFER which act as windows on the files INFILE and OUTFILE, (iii) the Boolean flags EMPTYINBUFFER and EMPTYOUTBUFFER to keep an eye on the status of the INBUFFER and OUTBUFFER. Our processing algorithm will depend on the state of these two flags. Only when EMPTYINBUFFER is TRUE can another line of input text be read in, while a TRUE EMPTYOUTBUFFER signals that OUTFILE has already been written to.

The while loop (lines 472 to 491) will ensure that the entire input file is processed, reading one line at a time into INBUFFER (line 474). The contents of INBUFFER must either be a command (which must be OBEYed — line 477) or text. The text must be transferred to OUTBUFFER, with reference to the conditions imposed by the formatting record USERFORMAT. An initial stab at this algorithm could be:

```

WHILE NOT EMPTYINBUFFER DO
BEGIN
  FILLOUT; (*transfer max. number of whole words
           to OUTBUFFER observing MARGINS*)
  IF READYTOOUTPUT
  THEN
  BEGIN
    IF JUSTIFY THEN ADJUST; (*Right justify the line*)
    CLEAR(OUTBUFFER) (*write it to OUTFILE*)
  END
END

```

Unfortunately, some of the formatting commands make the solution more complicated than this. In particular, those that apply to foregoing text (i.e. that which is in OUTBUFFER before the command is encountered) require that the text be retained in OUTBUFFER while the next input line is checked to see if it affects the format ("look-ahead"). Also there is no reason to suppose that just because INBUFFER is empty OUTBUFFER is completely filled. The differences between FILL and UNFILL, together with the conditions imposed by BREAK, PARAGRAPH and EOF(INFILE) will all have an effect on the state of READYTOOUTPUT. The conditional (line 483) reflects the complexities of the conditions on which READYTOOUTPUT would depend. Testing at this level requires stubs for OBEY, FILLOUT, ADJUST and CLEAR. OBEY should display the command passed (to test whether the interface between the procedures is correct), FILLOUT could simply transfer INBUFFER to OUTBUFFER and CLEAR could write this to a disc file. If all is well at this stage, OUTFILE should contain the text of INFILE without the embedded formatting commands. The logical paths dictated by both states of FILL should be tested in turn (i.e. change the default

value to false in STANFORMAT).

OBEY is clearly a straightforward application of the CASE statement and as such does not warrant particular scrutiny here. FILLOUT, on the other hand (line 303 onwards) offers more interesting possibilities, since for the first time the details of handling a line of text must be considered. Does one deal with words or characters, for instance? In our program we opted for a character subdivision. The available space in OUTBUFFER is calculated by taking into account the margin and indent format specifications and any possible OUTBUFFER contents from a previous INBUFFER (PROCEDURE STARTINGPOINT lines 309 to 323). We then count down from the right hand side of INBUFFER until a space is found (i.e. there are a whole number of words to the left) such that the left-hand substring would fit into OUTBUFFER (c.f. FINDSTRING lines 325 to 337). The actual transfer is handled by PROCEDURE MOVESTRING (lines 340 to 346).

PROCEDURE ADJUST (lines 362 to 424) distributes the spare spaces, left over at the end of the text line, between the words on the line. This is known as "right justification". The technique is to advance down the textfile from right to left searching for spaces. When a space

is found, another space from the pool of surplus spaces (GAP) is added in. Care must be taken that two adjacent spaces are not doubly added to, and also that, when the left margin is reached, the process can be "turned around" and used in the opposite direction.

The lower level procedures are fairly easy to understand and do not contribute to the overall strategy of the solution. There are a variety of other commands which could have been implemented (some are suggested in the exercises in the Look-Up Table) and obviously there are different tactics for tackling problems like ADJUST and FILLOUT. Nevertheless, we hope that this program may serve as an illustration of the close parallel between an algorithm, as it is thought out, and its expression in PASCAL code.

PCW thanks Equinox Computers Ltd., for making their North Star Horizon available to us.

Look up table

Computer Jargon
Buffer
Default
Look-ahead
Program Stub
Test harness

PASCAL words
TEXT
READ, READLN
WRITE, WRITELN
INPUT, OUTPUT

UCSD Exceptions
Standard data type INTERACTIVE identical to TEXT except that READ (INFILE,CH) expands to GET(INFILE); CH: INFILET rather than the other way about.

Exercises
Implement the following enhancements to the text formatting program.
(i) .T — skips to top of new page
(ii) .Z — return to predefined standard format (Zero)
(iii) .N n p — where "p" is a flag which directs the page number to the left hand, centre or right hand side of the page.
(iv) .H — checks if there is enough space below heading for first line of text and if not skips to a new page.



```

001: PROGRAM PROFF;
002:
003: CONST MAXLINE=80;
004:
005: TYPE FORMAT=RECORD
006:     NUMBER : BOOLEAN ;
007:     FILL : BOOLEAN ;
008:     JUSTIFY : BOOLEAN ;
009:     PAGENUMBER : INTEGER ;
010:     INDENT : 0 .. MAXLINE ;
011:     LEFTMARGIN : 0 ..MAXLINE ;
012:     RIGHTMARGIN : 0 .. MAXLINE ;
013:     LINES : INTEGER ;
014:     SPACING : 1 ..10
015:     END ;
016:     STRING = ARRAY[1..MAXLINE] OF CHAR ;
017:
018: VAR INFILENAME,OUTFILENAME : STRING ;
019:     INFILE,OUTFILE : TEXT ;
020:     STANDARD : FORMAT ;
021:
022: FUNCTION LENGTH(S:STRING) : INTEGER ;
023: VAR TEMP : 0..MAXLINE ;
024:     FOUND : BOOLEAN ;
025: BEGIN
026:     TEMP := MAXLINE ;
027:     FOUND := FALSE ;
028:     WHILE (TEMP>0) AND NOT FOUND DO
029:         IF S[TEMP] = ' '
030:             THEN TEMP := TEMP - 1
031:             ELSE FOUND :=TRUE ;
032:     LENGTH :=TEMP
033: END ;(*LENGTH*)
034:
035:
036: PROCEDURE STREADLN (VAR S:STRING) ;
037: VAR I, J : 1..MAXLINE ;
038: BEGIN
039:     I := 1 ;
040:     READLN ;
041:     REPEAT
042:         READ(S[I]) ;
043:         I := I + 1
044:     UNTIL EOLN ;
045:     FOR J := 1 TO MAXLINE DO S[J] := ' '
046: END ; (*STREADLN*)
047:
048: PROCEDURE STWRITE (S:STRING) ;
049: VAR I, J : 1 .. MAXLINE ;
050: BEGIN
051:     IF LENGTH(S)>0
052:     THEN FOR I := 1 TO LENGTH(S) DO
053:         WRITE(S[I])
054:     END ; (*STWRITE*)
055:
056: PROCEDURE COPY (SOURCE:STRING;VAR DESTINATION:STRING;INDEX,SIZE:INTEGER) ;
057: VAR I, J : 1 .. MAXLINE ;
058: BEGIN
059:     FOR I := 1 TO SIZE DO
060:     BEGIN
061:         J := INDEX + I -1 ;
062:         DESTINATION[I] := SOURCE[J]
063:     END ;
064:     FOR I := SIZE + 1 TO MAXLINE DO
065:         DESTINATION[I] := ' '
066:     END ; (*COPY*)
067:
068: PROCEDURE DELETE (VAR DESTINATION:STRING ; INDEX,SIZE:INTEGER) ;
069: VAR I : 0 .. MAXLINE ;
070: BEGIN
071:     FOR I := INDEX + SIZE TO MAXLINE DO
072:     BEGIN
073:         DESTINATION[I-SIZE] := DESTINATION[I] ;
074:         DESTINATION[I] := ' '
075:     END ;
076:     FOR I := 0 TO SIZE-1 DO
077:         DESTINATION[MAXLINE-I] := ' '
078:     END ; (*DELETE*)
079:
080:
081: PROCEDURE INSERT (SOURCE:STRING ; VAR DESTINATION:STRING ; INDEX:INTEGER) ;
082: VAR I, SIZE : 1 .. MAXLINE ;
083: BEGIN
084:     SIZE := LENGTH(SOURCE) ;
085:     IF SIZE + LENGTH(DESTINATION) > MAXLINE
086:     THEN WRITELN ('STRING OVERFLOW -- INSERTION NOT MADE')
087:     ELSE
088:     BEGIN
089:         IF LENGTH(DESTINATION)>=INDEX
090:         THEN FOR I := LENGTH(DESTINATION) DOWTO INDEX DO
091:             DESTINATION[I+SIZE] := DESTINATION[I] ;
092:         FOR I := 1 TO SIZE DO
093:             DESTINATION[INDEX + (I-1)] := SOURCE[I]
094:         END
095:     END ; (*INSERT*)
096:
097: PROCEDURE STANFORMAT ( VAR FORM : FORMAT ) ;
098: BEGIN
099:     WITH FORM DO
100:     BEGIN
101:         NUMBER := TRUE ;
102:         FILL := TRUE ;
103:         JUSTIFY := TRUE ;
104:         PAGENUMBER := 2 ;
105:         INDENT := 0 ;
106:         LEFTMARGIN := 0 ;
107:         RIGHTMARGIN := 60 ;
108:         LINES := 58 ;
109:         SPACING := 1
110:     END ;
111: END;
112:
113: PROCEDURE TEXTFORMAT ;
114: (* READS FROM INFILE, FORMATS AND WRITES FORMATTED TEXT TO OUTFILE *)
115:
116: VAR USERFORMAT : FORMAT ;
117:     INBUFFER, OUTBUFFER : STRING ;
118:     EMPTYINBUFFER, EMPTYOUTBUFFER : BOOLEAN ;
119:     CURRENTLINE: INTEGER ;
120:
121: PROCEDURE FREADLN (VAR INFILE : TEXT ; VAR BUFFER : STRING) ;
122: (*READLN INTO BUFFER FROM INFILE*)
123: VAR I, J : INTEGER ;
124: BEGIN

```

Cont on p114

CALCULATOR CORNER

Dick Pountain takes PCW's second look at the Hewlett Packard HP-41C with an eye to how it actually operates, rather than to add to the "is it a computer or a calculator?" debate.

HP-41C

Alpha and omega of programmables?

In its basic configuration the HP-41C is a conventional looking (but beautifully made) hand held calculator, with 441 bytes of user memory. This may be expanded by plugging in further 448 byte modules up to a total of 2233. The memory is organised into 7-byte registers and the number of registers reserved for data storage is chosen by the user, as on the Texas TI-59.

The display, an advanced liquid crystal one, uses a "starburst" grid for character formation; this allows the production of an upper and lower case alphabet and symbols, in addition to numbers. The lower display also has a variety of keyword "annunciators" to indicate calculator status conditions e.g. low battery, angular mode etc. As with the new Casios, the low current requirement allows continuous memory (ie protected) on all registers — even the stack and display — whilst giving up to 1 year battery life.

The display can hold up to ten digits, though like the Texas (but unlike the Casio) only 8 digit mantissas may be shown in scientific notation. Internal operations retain a 10 digit mantissa plus 2 digit exponent, so in maximum Fixed Point configuration the tenth digit may be unreliable (Texas uses 13 digits internally, Casio 12 for full 10 digit accuracy). As one would expect from H-P the logic is Reverse Polish; I marginally prefer the True Algebraic but wouldn't make a big fuss about it.

Built in functions and alphamode

The real sophistication of the 41C becomes clear when one discovers how use has been made of the alphanumeric capability.

Alpha characters are not merely an appendage, as on the TI-59, for labelling results and programs; instead they are the main means of communicating with the calculator.

The 41C has four modes of operation, Normal, User, Program and Alpha

plus 130 built in functions. The 34 key keyboard (plus shift) allows 68 functions to be executed from it in Normal mode. So how do you get at the rest? Well, each function has a mnemonic or symbolic name, (e.g. clear storage registers is CLRG) and it may be executed by pressing the XEQ key followed by spelling its name in Alpha Mode — i.e. XEQ CLRG. Since this involves 5 key strokes it's tedious if repeated frequently, hence the User Mode. In this mode any function may be assigned to any key where it remains active until re-assigned. So a whole alternative keyboard may be set up to the user's fancy.

Not only built-in functions but also user's programs may be assigned in this way, and also Special Application Functions from the many ROM packs which are available. Two means are at hand to keep track of what is available. Firstly each key, when depressed for less than half a second, displays its function name before executing. If held for longer, the function is cancelled and NULL appears without execution. Secondly the CATALOG function displays a scrolled menu of what is in the calculator; CATALOG3 is built in functions, 1 is user's programs, 2 is ROM pack functions (if present).

Functions such as STO and RCL, which require a register address, prompt you by displaying a dash for each digit required e.g. STO—.

The Alpha Mode treats its characters rather like quoted strings in BASIC; they cannot be mixed with numeric data. If numerals are required a special set of "alpha" numerals are available which cannot be the subject of arithmetic operations. Alpha strings are chained together and stored in a separate register which holds 24 characters and scrolls when containing more than a display-full. Alpha characters may also be stored and recalled in data registers using ASTO and ARCL, but give rise to DATA ERROR if accessed by arithmetic operations.

The reason I have taken up so much space describing this system is that here

lies the essence of the 41C's originality. From now on your programs (and even subroutines) will have names and not numbers. Once you have mastered naming and assigning functions, writing programs becomes utter simplicity, since subroutines may be treated almost like Procedures in Pascal. . . i.e. self contained programs which can be called by name.



Programmed operation

Although in hardware terms program memory is a single block of registers in RAM, to the user it behaves more like the modular system of the Casio-fx502. Memory management is fully automatic. A program file is opened and line numbers beginning at 1 are automatically provided. The first step is always the Alpha name of the program. There are of course no key codes; the function names appear directly in the pro-

CALCULATOR CORNER

gram. All instructions are merged so that one instruction occupies one program line (though not necessarily only one byte). Once END is written the file closes, memory is packed and the number of free registers is displayed. The next program now begins with a new name, and line numbers starting again at 1.

Any number of programs may be stored within the limits of available RAM. Once the file is closed a program may only be entered by GTO (program name) which sets the pointer to step 1, by XEQ (program name) which runs the program or by assigning to a key. Once in a program the editing functions are excellent and logical. The current step is always displayed and insertion rather than overwriting is automatic. Forward and back single stepping are provided (but backstep is rather annoyingly the shift of forward step, rather than a separate key) while GTO n takes you straight to line n. DEL nnn deletes nnn lines starting from the current one.

All branching is to labels (no absolute addresses) and subroutines may be either XEQ-ted by name if outside the main program, or by numeric label if inside. There is no GOSUB as such; routines are called like any other function. A compiling feature allows control to "remember" the location of all numeric labels in a program after the first search - which speeds execution (whereas outside Alpha labels require a search of the whole of program

memory).

Most of the built in functions may be used in programs. Special points worthy of mention are:-

i) INDirect addressing is available on memory, branching, flag and Alpha storage operations and the stack registers may hold indirect addresses.

ii) The loop control functions ISG and DSE are more general than the usual ISZ and DSZ. Both may start and finish at any specified numbers and increment/decrement by specified steps. If not specified they step 1 and skip on zero.

iii) PROMPT. This commands halts a program and displays an Alpha message (e.g. a request for input) which is contained in the previous line.

iv) Ten conditional tests are available including ,praise the Lord, $x < y$? as well as $x > y$? Two of the tests $x = y$? and $x \neq y$? will accept Alpha data and can be used for string comparisons.

v) TONEn. This sounds one of ten audible tones via a built in acoustic diode. Since it's indirectly addressable the 41C can compose simple tunes.

vi) 30 user flags, 11 of which are in Continuous Memory are provided plus six flag set, clear and test functions; 25 system flags are also accessible by the user.

The 41C operating system makes extensive use of Alpha error messages and prompts, some of which like TRY AGAIN and NONEXISTENT can provoke mirth or fury the first time you encounter them.

Peripherals

The 41C has four I/O ports which will accept RAM expansion modules, ROM Application Packs, a printer or a card reader (if either is in use only 3 RAM/ROM modules can be present). The thermal printer is small, quiet and highly portable, being rechargeable battery operated. It can LIST, TRACE and produce user defined symbols in addition to full alphanumeric.

The card reader stores 32 registers per magnetic card - i.e. 2 cards per module.

Conclusion

It's not possible to more than skim the HP-41C's capabilities in this review. I hope I've given a feel of how different and exciting a calculator it is.

My only serious gripes are that the Alpha keyboard is awkward to use (the characters are printed *under* the keys in alphabetical order) compared to a QWERTY set-up, and that processing, while faster than the TI-59 is still not up to the speed of the Casio.

The Alpha facility has been seriously used to make what is after all a formidably powerful calculator, more friendly and less intimidating to the first time user; for the experienced user the result is readable programs and flexible, modular program design. If it isn't yet the pocket micro, it's certainly a superb pocket calculator.



MASTER PACK[®]

FOR

COMPUKIT UK101

30 Original, High Quality BASIC Programs on Cassette
Incredible value at ONLY £19.95 inclusive - less than 70p each!

with sophisticated Graphics and full User Instructions supplied

GAMES

LUNAR LANDER (1)
LUNAR LANDER (2)
BOMBER PILOT
WIPEOUT
ROULETTE
SUPER FRUIT MACHINE
CODEBREAKER
ADDICTIVE ADDITION
SADISTIC SUBTRACTION
MURDEROUS MULTIPLICATION
DIABOLICAL DIVISION
ROADRUNNER
A DAY AT THE RACES

TWOGETHER
TWIXT TWISTER

EDUCATIONAL

SPELLING TEST
MATH EXERCISER
MULTIPLICATION TABLES
DECIMAL/FRACTION CONVERTER

PERSONAL COMPUTING

BIORHYTHMS
DIET CALCULATOR
WEIGHT CALCULATOR

CALENDAR & DAYS BETWEEN
DATES CALCULATOR
COMPOUND INTEREST
GAMES SCOREBOARD

ROUTINES

POWERFUL KEYBOARD
SCANNING ROUTINES
ALPHABETICAL SORT
BINARY/DECIMAL/HEX
CONVERTER
PRECISION RANDOM NUMBER
GENERATOR
ALPHANUMERIC TO ASCII
CODE CONVERTER

FREE INSTANT CLEAR SCREEN
ROUTINE - TAKES NO
USER RAM

FREE SIMPLE INSTRUCTIONS FOR
UPGRADING YOUR UK 101
TO SAVE AND LOAD AT 600 BAUD -
TWICE NORMAL SPEED!

Available ONLY direct from PREMIER PUBLICATIONS
(Over 50,000 Programs sold to date)

Send cheque/PO for £19.95, quoting product ref.101/A
TO PREMIER PUBLICATIONS, 12 Kingscote Road,
Addiscombe, Croydon, Surrey. 01-656 6156
10-day money-back guarantee of satisfaction.

What will you do with a 12-year old programmer when he reaches 16?

Any microcomputer is a major investment for an educational establishment. Many potential users feel that a BASIC only computer is ample for their needs. That may be fine today, but with computer education starting so early you may in a surprisingly short time find you want more than current implementations of BASIC.

The 380Z is a computer that can grow to match your needs.

In the design of the 380Z our target user is the graduate research scientist. This ensures that the expandability and versatility needed tomorrow has been provided for in the computer you buy now.



Might you want to add disc storage in the next few years?

If you do:

Given good hardware, software availability completely determines the flexibility and usefulness of your system. There is absolutely no question that a Z80 based micro-computer which uses the industry-standard CP/M* disk operating system has several times more software on the market available to it than non CP/M computers.

Today you can purchase a mature CP/M BASIC, FORTRAN, COBOL or Text Processor for the 380Z. Soon there will be CP/M Pascal and Database Management systems.

CP/M software is several years ahead of software available for non CP/M family machines.

If you don't:

Remember that professionals writing packages for your cassette system will themselves often use a disk 380Z, and the power of their tools will influence what they produce.

For many people a disk machine is too expensive – but at least the 380Z

approach will allow your students to advance.

380Z BASIC is not frozen in ROM. An enhanced BASIC could be loaded in mid 1980 and a BASIC with structured features sometime later.

On the 380Z the memory used by a BASIC interpreter can also be used for other software.

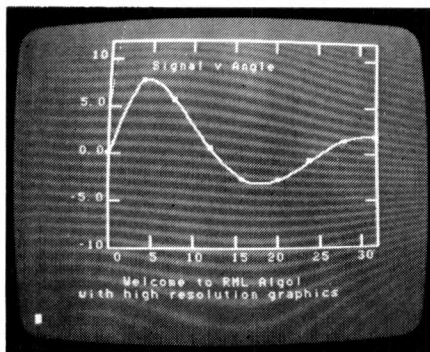
Does our research-oriented design pay off in classroom hardware?

Our scientific graphics was produced for the professional user. Interest in it for classroom use has been surprising.

The 380Z has the best graphics now available on a microcomputer,

allowing multiple resolutions, multiple paging, fading and accurate control over colour. All these features help bring excitement to efforts in computer assisted learning.

Our standard machine comes with low resolution graphics and support for this from BASIC allows you to plot a point directly with a plot command – useful for training and teaching.



It is worth remembering too that neither our low resolution graphics nor our optional scientific (high resolution) graphics has any limiting effect on your memory usage, and in both you can



freely mix upper and lower case text and diagrams.

Mains noise can cause system crashes which result in loss of programs and data. All current 380Zs include a mains filter which significantly reduces the chances of this happening.

Don't buy a 380Z on patriotic grounds.

Please only buy it if you would have bought it anyway. But remember, because it is designed and manufactured here you are bound to have better access to us for influence and help than if we were on the other side of an ocean.

Prices range from a 16K cassette 380Z @ £897 to a 56K Dual Full Floppy Disk 380Z @ £3322.

LOWER COSTS

Three things have happened which make it easier to buy a 380Z.

ONE: From 1st November 1979 most prices have been reduced.

TWO: Schools and some colleges can now get a 5% discount on computer orders.

THREE: A new Local Authority quantity discount scheme has been introduced to make it easier for more users to benefit from quantity purchasing.

Please contact the Sales Office for details.

RESEARCH MACHINES

RESEARCH MACHINES Ltd,
PO. Box 75, Mill Street, Oxford, England.
Telephone: Oxford (0865) 49791/2/3.
Please send for full sales information.
Prices do not include shipping costs or VAT @ 15%.

*Trademark, Digital Research.

Personal Computer

World

PAST FEATURES: PART TWO

On P. 77 of February PCW we provided a sectionalised breakdown of the contents of earlier editions of the magazine, up to and including Volume 2 number 4.

This month, in Part 2, we extend the list to include all the remaining editions in Volume 2.

From our next issue on we shall be publishing a list, cumulative issue by issue, for our current 3rd Volume.

Hardware Interfacing Analogue to digital converter	2-6	Grow your own — (programmer development)	2-7
Hardware Projects SC/MP UVEPROM burner	2-5	A chance for the disabled	2-8
Hardware features Hard discs — Secure or not?	2-7	Communications On the line (series)	2-5,6,7
Evaluations Compucolor II — (Benchtest)	2-5	Package evaluations (Systems)	2-7
Heuristics Speechlab — (Checkout)	2-5	Introduction to series Stock control	2-8
Cromemco System Three — (Benchtest)	2-6	Special Features Using PET graphics	2-6
Sharp MZ-80K — (Mini Benchtest)	2-6	PET betting shop case study	2-6
HP 41C — (Checkout)	2-6	PCW show guide "Finger printing"	2-7
Petsoft Programmer's Toolkit — (Checkout)	2-6	sentence structure	2-7
Casio FX 501P	2-6	Program Features ESP testing on PET	2-5
Challenger C3 S1 — (Benchtest)	2-7	6800 operating system monitor	2-7,8
FA-1 (Cassette interface for Casio Fx 501/502P)	2-7	Play tunes with word display on Nascom 1	2-8
Micromation Z-Plus — (Benchtest)	2-8	Programs Revas (Reverse Assembler for Z80)	2-7,8
Lexicon and Craig translators	2-8	CESIL interpreter (BASIC)	2-7
Micro controlled toys — Survey	2-8	Feeding bytes to PET (BASIC)	2-8
TI 59 analysed	2-8	Limited time response subroutine (6800 Ass)	2-5
Fact Sheets (Fax)	2-8	Glitch free loading (NASCOM 1)	2-7
8080 mnemonics arranged by opcode	2-7	PET read & write routines	2-7
Z80 mnemonics arranged by opcode	2-8	Memory test (Apple BASIC)	2-5
Personal opinion (Interrupt)		Spaceship for Fx 201P Orbital simulation (PET BASIC)	2-5
Frogs on the hop — (the Nora report)	2-5	PET as a digital clock	2-5
Micro mania	2-5	Acronym deciphering (BASIC)	2-5
Say that again? — (documentation standards)	2-5	PET Breakout	2-6
On the trail — (cowboy dealers)	2-6	Power Boat SWTP 6800 (BASIC)	2-6
The hardware they come the software they fall (software standards)	2-6	Graph generation TRS-80	2-6
Let not the right hand . . . (VAT moans)	2-6	Apple worms	2-7
Future — what future?	2-7	Golf for HP33E	2-8
Micromania revisited	2-7	Air Attack for PET	2-8
		Space Slalom (Applesoft)	2-8

PLEASE NOTE THAT THE FOLLOWING
ISSUES ARE
SOLD OUT

VOLUME 1 Nos. 4, 5, 6, 7, 9, 12

VOLUME 2 Nos. 5, 6

ALL OTHER ISSUES MAY BE
ORDERED USING THIS FORM. →

Personal Computer

World

BACK NUMBERS

THINK OF THE FUTURE-LOOK BACKWARDS!

PCW has long been regarded as by far the most authoritative journal in its field.

Every issue published has contained a wealth of detailed technical information on all aspects of the rapidly growing Personal Computer Market.

Demand for our limited stock of back numbers has also become something of a rapid growth industry!

Consequently, early back numbers of PCW are going to be increasingly difficult to get hold of, so make absolutely certain of getting yours by checking the coupon at the foot of the page.

Volume 1 No. 1 May 1978
Nascom 1/77-68: The Mighty
Micromite/A charity system

Volume 1 No. 2 June 1978
Research Machines 380Z/
Computer in the classroom/
The Europa Bus.

Volume 1 No. 3 July 1978
Buzzwords — A to Z of
computer terms/Pattern re-
cognition/Micro music

Volume 1 No. 8 December
1978 Computers and Art/3-D
Noughts and Crosses/Mickie
— the interviewing micro.

Volume 1 No. 10 February
1979 Review — the Attache/
Word on word processing/
Micro assembler for the
6800/Sinclair to MPU inter-
face/Draw pictures, written
in Tandy Level II

Volume 1 No. 11 March 1979
Turning the Tables — a pro-
gram for the TI57/Motorola
on sixteen cylinders/SYM 1/
The Pet Bus.

Volume 2 No. 1 May 1979
Small computers for small
organisations/Sorcerer graph-
ics/Chess Programming Hints/
Parkinsons Revas.

Volume 2 No. 2 June 1979
MSI 6800/Witbit — disassem-
ble your programs/The Multi-
lingual Machine/Polytechnical
Processing.

Volume 2 No. 3 July 1979
Vision link: Interfacing and
Software for the Superscamp
VDU/Pet Preening/Extended
cursor graphics for the TRS-
80.

Volume 2 No. 4 August 1979
The North Star Horizon/High
Speed Cassette Interface for
the SWTP 6800/Garage Acco-
unting program/Apple Medi-
cal Application.

Volume 2 No. 7 November
1979 PCW Show issue/6800
Bug/Hard disc security/
Detecting literary forgeries/
Benchtest — the Challenger
C3

Volume 2 No. 8 December
1979 Micro-controlled toys/
NASCOM — words and
music/Systems — stock con-
trol/Benchtest — the Micro-
mation Z-Plus.

Volume 3 No. 1 January 1980
CRA aims/Benchtest ABC 80
/Homebrew Z80/Computer
Games — Series

Volume 3 No. 2 February
1980 Benchtests — ACT 800,
WH89/Micro Astrology/
Checkout — Video Genie/
IEEE-488 analysed.

Volume 3 No. 3 March 1980
Benchtest — Panasonic JD-
700U/Checkout — Symtec
Light Pen/Introduction to
programming/TV to Monitor
Conversion.

Any one issue 95p; Any two issues £1.75; Any three
issues £2.50; Any four issues £3.00. All additional issues
@ 50p each. Binders @ £2.95. All prices include post and
packing. Cheque or P.O. payable to (PCW) Sportscene Pub-
lishers Ltd., 14 Rathbone Place, London W1P 1DE. Please
allow up to 3 weeks for delivery and don't forget to state
clearly your name and full address with your order.
Please send me the following copies of PCW. I enclose a
cheque/P.O. for £

Volume 1	Volume 2	Volume 3
1 2 3 8 10 11/	1 2 3 4 7 8	1 2 3
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Name _____

Address _____

*Tick appropriate boxes

Shopping List

Super software from the world's leading microsoftware supplier.

Software with Manual / Manual Alone

DIGITAL RESEARCH

- CP/M* FDOS - Diskette Operating System complete with Text Editor, Assembler, Debugger, File Manager and system utilities. Available for wide variety of disk system including North Star, Helios II, Micropolis, (ICOM) (all systems) and Altair. Supports computers such as Sorcerer, Horizon, Cromemco, Ohio Scientific, RAI Black Box, Research Machines, Dynabyte, etc. £75/£15
- CP/M version 2 (not all mats available immediately) £95/£15
- MP/M £195/£25
- MAC - 8080 Macro Assembler. Full Intel macro definitions. Pseudo Ops include RPC, IRP, REPT, TITLE, PAGE, and MACLIB. Z-80 library included. Produces Intel absolute hex output plus symbols file for use by SID (see below) £55/£10
- SID - 8080 symbolic debugger. Full trace, pass count and break-point program testing system with back-trace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values £45/£10
- ZSID Includes Z80 mnemonics requires Z80 CPU. £50/£10
- TEX - Text formatter to create paginated, page-numbered and justified copy from source text files, directable to disk or printer £45/£10
- DESPOOL - Program to permit simultaneous printing of data from disk while user executes another program from the console £30/£1

MICROSOFT

- BASIC-80 - Disk Extended BASIC Interpreter Version 5, ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records £155/£15
- BASIC Compiler - Language compatible with Version 5 Microsoft interpreter and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes Macro-80. Also linkable to FORTRAN-80 or COBOL-80 code modules £195/£15
- FORTRAN-80 - ANSI '66 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below) £205/£15
- COBOL-80 - ANSI '74 Relocatable object output. Format same as FORTRAN-80 and MACRO-80 modules. Complete ISAM. Interactive ACCEPT DISPLAY, COPY, EXTEND £325/£15
- MACRO-80 - 8080/Z80 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included £75/£10
- XMACRO-86 - 8086 cross assembler. All Macro and utility features of MACRO-80. Mnemonics slightly modified from Intel ASM86. Com. Utility data sheet available. £155/£15
- EDIT-80 - Very fast random access text editor for text with or without line numbers. Global and intra-line commands supported. File compare utility included £45/£10

EIDOS SYSTEMS

- KISS - Keyed Index Sequential Search. Offers complete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80 etc. £190/£15
- KBASICS - Microsoft Disk Extended BASIC with all KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS REL as described above, and a sample mail list program. £295/£25
- Users of Microsoft BASIC 80 (IM BASIC) £215/£25

MICROPRO

- Super-Sort I - Sort, merge, extract utility as requires executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating, fixed point, exponential, field justified, etc. Also. Even variable number of fields per record! £125/£15
- Super-Sort II - Above available as absolute program only £105/£15
- Super-Sort III - As II without SELECT/EXCLUDE £75/£15
- Word Master Text Editor - In one mode has super-set of CP/M's ED commands including global searching and replacing, forward and backwards in file. In video-mode, provides full screen editor for users with serial addressable-cursor terminal £75/£15
- Word Star - Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center, underscore and PRINT. Edit facilities include global search and replace, read/write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning. £255/£15

GRAFFCOM

- PAYROLL - Designed in conjunction with the spec for PAYE routines by HMI Taxes. Processes up to 250 employees on weekly or monthly basis. Can handle cash, cheque or bank transfer payments plus total tracking of all year to date figures. Prints emp master, payroll log, payslips and bank giro. Requires CBASIC-2 £475/£15
- COMPANY SALES - Performs sales accounting function. Controls payments of invoices and prints sales ledger and aged debtors report. Suitable for any accounting period. Comprehensive VAT control and analysis of all sales invoices. Requires CBASIC-2 £425/£15
- COMPANY PURCHASES - Performs purchase accounting function. Controls invoices, credit & debit notes. Prints purchase ledger, aged creditors report and payment advices. Comprehensive VAT control and analysis of all purchases. Interfaces with the NAD system. Requires CBASIC-2 £425/£15
- GENERAL ACCOUNTING - Produces Nominal Ledger, Trial Balance, P/L and Balance Sheet. Define your own coding system. Interactive data entry plus optional data capture from Company Sales and Company Purchases. Requires CBASIC-2 £375/£15
- STOCK CONTROL - Maintains stock records, monitors stock levels to ensure optimum stock holding. Displays include stock desc., product code, unit, unit price, etc. on hand or order/minimum. Stock analysis reports can be weekly, monthly, quarterly etc. Interfaces with Order Entry & Invoicing system. Requires CBASIC-2 £325/£15

ORDER ENTRY & INVOICING

- Performs order entry and invoicing function. Handles invoices for services and consumable items, part orders and part quantities. Sales Analysis report shows sales movements and trends for user-defined period Interfaces with Stock Control, NAD and Company Sales systems. Requires CBASIC-2 £325/£15
- NAD - Complete control of all your names & addresses including suppliers, clients, enquiries etc. Assign your own coding system and select all output via the report generator. Will print anything from mailing labels to directories. Requires CBASIC-2 £225/£12
- COMPLETE ACCOUNTING PACKAGE - Combined Company Sales, Company Purchases, General Accounting, and NAD systems £950/£45
- SALES ORDER PROCESSING PACKAGE - Combined Stock Control, Order Entry and Invoicing and NAD £550/£30

STRUCTURED SYSTEMS GROUP

- ANALYST - Customised data entry and reporting system. User specifies up to 75 data items per record. Interactive data entry, retrieval and update facility makes information management easy. Sophisticated report generator provides customised reports using selected records with multiple level breakpoints for summarisation. Requires CBASIC-2, 24 x 80 CRT, printer and 48k system £125/£10
- LETTERIGHT - Program to create edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen to assist editing. Designed to integrate with NAD for form letter mailings. Requires CBASIC-2 £105/£15
- NAD Name and Address selection system - interactive mail list creation and maintenance program with output as full reports with reference data or restricted information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC-2 £45/£12
- QSORT - Fast soft/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created. Parameter file created optionally with interactive program which requires CBASIC-2. Parameter file may be generated with CP/M assembler utility £50/£12

SOFTWARE SYSTEMS

- CBASIC-2 Disk Extended BASIC - Non-interactive BASIC with pseudo code compiler and runtime interpreter. Supports full file control, chaining, integer and extended precision variables etc. £75/£10

GRAHAM-DORIAN SOFTWARE SYSTEMS

- APARTMENT MANAGEMENT SYSTEM - Financial management system for receipts and security deposits of apartment projects. Captures data on vacancies, revenues, etc. for annual trend analysis. Daily report shows late rents, vacancy notices, vacancies, income lost through vacancies, etc. Requires CBASIC-2. Supplied in source code. £300/£25
- INVENTORY SYSTEM - Captures stock levels, costs, sources, sales, ages, turnover, markup, etc. Transaction information may be entered for reporting by salesman, type of sale, date of sale, etc. Reports available both for accounting and decision making. Requires CBASIC-2. Supplied in source code £300/£25
- CASH REGISTER - Maintains files on daily sales. Files data by sales person and item. Tracks sales, overrides, refunds, payouts and total net deposits. Requires CBASIC. Supplied in source code £300/£25

MICRO FOCUS

- STANDARD CIS COBOL - ANSI '74 COBOL standard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal £400/£25
- FORMS 2 - CRT screen editor. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. Output is COBOL data descriptions for copying into CIS COBOL programs. No programming experience needed. Output program directly compiled by CIS COBOL (standard) £100/£12

OTHER

- PASCALZ - Z80 native code PASCAL compiler. Produces optimised portable reentrant code. All interfacing to CP/M is through the support CRT. The package includes compiler companion macro assembler and source for the library. Requires 56K and Z80 CPU. Version 2 includes all of Jensen/Wirth except variant records £155/£15
- Version 3 Upgrade with variant records and strings expected 2/80 £205/£15
- PASCAL/MT - Subset of standard PASCAL. Generates portable 8080 machine code. Symbolic debugger included. Supports interrupt processing and BCD arithmetic for real variables. CP/M file and assembly language interface supported. Lacks sets, Enumeration and Record data types. Manual explains BASIC to PASCAL conversion Requires 32K £65/£17
- Source for PASCAL/MT run time package. Requires MAC (See under Digital Research) £30
- tiny C - interactive interpretive system for teaching structured programming techniques. Manual includes full source listings £45/£30
- BDS C COMPILER - Supports most major features of language, including Structures, Arrays, Pointers, recursive function evaluation, linkable with library to 8080 binary output. Lacks data initialization, long & float type and static & register class specifiers. Documentation includes "C" Programming Language book by Kernighan & Ritchie £80/£10
- WHITESMITHS' C COMPILER - The ultimate in systems software tools. Produces faster code than Pascal with more extensive facilities. Conforms to the full UNIX Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Compiler output in A-Natural source. Supplied with A-Natural. Requires 60K CP/M £325/£20
- POLYVUE/80 - Full screen editor for any CRT with XY cursor positioning. Includes vertical and horizontal scrolling, interactive search and replace, automatic text wrap around for word processing, operations for manipulating blocks of text, and comprehensive 70 page manual £70/£12

Software with Manual / Manual Alone

- POLYTEXT/80 - Text formatter for word processing applications. Justifies and paginates source text files. Will generate form letters with custom fields and conditional processing. Support for Daisy Wheel printers includes variable pitch justification and motion optimization. £45/£10

- ALGOL 60 Compiler - Powerful block-structured language featuring economical run time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling, direct disk address I/O etc. Requires Z80 CPU £110/£12
- Z80 Development Package - Consists of (1) disk file line editor, with global enter and intra-line facilities; (2) Z80 relocating assembler, Zilog Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file for CP/M LOAD, DDT or SID facilities £50/£12

- ZDT - Z80 Debugger to trace, break and examine registers with standard Zilog/Mostek mnemonic disassembly displays. Facilities similar to DDT £20 when ordered with Z80. Development Package £35/£7
- DISTEL - Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files. Intel or TDL Xitan pseudo ops optional. Runs on 8380. £35/£7
- DISILOG - As Distel to Zilog Mostek mnemonic files. Runs on Z80 only £35/£7

- TEXTWRITER III - Text formatter to justify and paginate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertion. Ideal for contracts manuals, etc. £75/£3

- POSTMASTER - A comprehensive package for mail list maintenance. Features include keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Requires CBASIC £75/£15
- WHATSIT? - Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access with interactive screen to edit. Designed to integrate with NAD for fast response. Requires CBASIC £70/£15

- XYBASIC Interactive Process Control BASIC - Full disk BASIC features plus unique commands to handle bytestreams and shift, and to test and set bits. Available in integer, Extended and ROMable versions. Integer Disk or Extended ROMable £165/£15
- Extended Disk or Extended ROMable £215/£15

- SMAL/80 Structured Macro Assembly Language - Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs £40/£10

- SELECTOR III-C2 - Data Base Processor to create and maintain multi key data bases. Prints formatted, sorted reports with numerical summaries or mailing labels. Comes with sample applications including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC Version 2. Supplied in source code. £185/£12

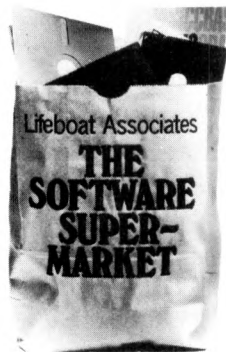
- CPM/374X Utility Package - has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files £125/£7

- BASIC UTILITY DISK - Consists of (1) CRUNCH-14 Compacting utility to reduce the size and increase the speed of programs in Microsoft Basic and TRS-80 Basic; (2) DFUN - Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic arc sin, etc. Furnished in source on cassette and documentation £30/£10

- THE STRING BIT - Fortran character string handling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source £30/£10

- BSTAM - Utility to link one computer to another also equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. We use it! It's great! Full wildcard expansions to send *.COM, etc. 9600 baud with wire, 300 baud with phone connection. Both ends need one. Standard and M versions can talk to one another £75/£15

- Fippy Disk Kit - Template and instructions to modify single sided 5 1/4" diskettes for use of second side in singled sided drives £6



Orders must specify disk type and format, e.g. North Star-Horizon single density. Add VAT to orders for software (not manuals alone) Add 50p per item postage and packing (minimum £1). All orders must be prepaid (except COD or credit card). Make cheques, P/s etc payable to Lifeboat Associates. Manual costs are deductible from subsequent software purchase. The sale of each proprietary software package conveys a license for use on one system only.

Lifeboat Associates
32 Neal Street
London WC2H 9PS
01-379 7931

Modified version available for use with CP/M as implemented on Heath and TRS-80 Model 1 computers.
User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.
*CP/M is a trademark of Digital Research
**Z80 is a trademark of Zilog Inc.
The Software Supermarket is a trademark of Lifeboat Associates.

Software for most popular 8080/Z80 computer disk systems including NORTH STAR HORIZON, VECTOR MZ, OHIO SCIENTIFIC, CROMEMCO, PROCESSOR TECHNOLOGY, RAI BLACK BOX, DYNABYTE, SD SYSTEMS, RESEARCH MACHINES, ALTAIR, EXIDY SORCERER, IMSAI, HEATH, and 8" IBM formats

Britain's most up-to-date and comprehensive guide to the selection of microcomputer equipment, compiled for PCW by Richard Olney of Heuristic Consultants.

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 80 (£790)	CCS Microsales: 01-444 7739 (TBA)	16-40K RAM; Z80A; C: 12", 16x40 b&w VDU: 4680 bus; IEEE 488; RS232 port: option — dual 5¼" F/D (160K, own DOS), £895	DOS: BASIC:	Graphics loudspeaker with 128 effects: Viewdata compatible: (S)
Act System 800 (£3950)	ACT: 021-455 3585: (50)	48K RAM; 6502: dual 5¼" F/D (800K); 12", 30x64 VDU: 1 S/P: 1 P/P	MDOS: BASIC: A: PL/M: Fifth	Fully IBM compatible K/B: high resolution graphics: available with dual 8" F/D (2.4MB), £4950: (E)
Alpha Micro (£8,200)	Alpha Micro (UK) Ltd 01-250 1616 (TBA)	64K-16M RAM: 16 bit: dual 8" F/D (2.4MB); 6 S/P: modular	multi-user O/S: BASIC: M/A: Pascal: U	Expands to 1200 MB, 32 terminal system: (E)
Altos ACS 8000 (£3,398)	Logitek: 02572 66803 (TBA)	64K RAM; Z80: 1K ROM: dual 8" F/D (1MB); 2 RS232: 1 P/P	CP/M: BASIC: Fortran: Cobol: Pascal: M/A	(S&H)
Apple II (£810)	Microsense: 0442 63561 (80+)	16-48K RAM; 6502: 8 I/O slots: option — single 5¼" F/D (116K), £425	O/S: BASIC: Pascal: games:	280x192 high res graphics: integer BASIC in 6K ROM (S)
Athena 8285 (£7955)	Butel-Comco Ltd: 0703 39890 (TBA)	64K RAM; 8085A: dual 5¼" F/D (644K); 12", 25x80 VDU: 150 cps printer: RS232C port: options — dual 8" F/D (2MB)	AMOS: T/E: BASIC: Cobol: Fortran: Pascal: APL: M/A	Extended ASCII K/B with numeric pad: graphics: many fully integral configurations possible: (S)
Attache (£7,000)	R.H.Thorpe Ltd: 0276 29492. R.J.Spiers Ltd: 0603 416573 (TBA)	48K RAM; 8080: dual 8" F/D (616K); 9", 16x64 b&w VDU: 180 cps printer	ExBASIC: Fortran	(S)
Billings BC-12FD (£4,295)	Mitech: 04862 23131 (TBA)	64K RAM; Z80A: dual 5" F/D (640K); 12", 24x80 b&w VDU	DOS: BASIC: Fortran: Cobol: A	8" F/D (2MB) to replace 5", £6,000: additional dual 8" F/D, £2,750 (S)
Canon BX-1 (£3,850)	Canon Business Machines (UK) Ltd: 01-680 7700	64K RAM; 6800: Single 5¼" F/D (65K); 12", 25x80 VDU: 5xV24 ports: options — single 5¼" F/D (65K), £1,500	DOS: ExBASIC: A:	Also supplied with integral thermal printer instead of VDU: (S&H)
CBS Mk 1, 2&3 (Mk1, £5,413; Mk2, £5,900; Mk3, £8,648)	Compelec: 01-636 1392 (N/A)	64K RAM; Z80: dual 8" F/D (1MB); 12", 24x80 VDU; 132 col, 30 cps printer: 2 S/P: 1 P/P	CP/M: BASIC	Mk. 2 with 2MB F/D, £5,900. Can upgrade to Mk.3 — £8,150 (11MB H/D and 4 more S/Ps): Desk mounted: Up to 44MB H/D possible, £4,529 extra: multi user system with 208K RAM, £10,648: (S&H)
Challenger 1P & C2 (1P, £238; C2, £404)	CTS: 0706 79332; MBM: 01-980 3993. Mutek: 0225 743289. Millbank Computing: 01-549 7262. U-Micro-computers: 0606 853390. Byte Shop: 01-518 1414	4-32K RAM; 6502: C int: RS232 port:	O/S: BASIC: A: ExBASIC	D/A conv: col capability: 8K microsoft BASIC in ROM: option — dual 5¼" F/D (160K), £550: for C2, dual 8" F/D (1.15MB) and 20MB H/D: runs OSI business software on 8" F/D. (S)
Challenger C3 (£2,334)	As above	32-56K RAM; 6502, 6800, Z80: dual 8" F/D (1.15MB): 2-16 S/P	OS65U: BASIC: CP/M: Fortran: Cobol	Also C3B & C3P H/D modules: 74MB for about £10,000: (S&H)
Comma VO3 (£4,200)	Comma: 0277 811131: (N/A)	32K RAM; LSI 11: dual 8" F/D (512K): 4 serial DLU11S ports: modular	RT11 O/S (£750): BASIC: Cobol: Fortran	Many configurations possible: (H)
Compelec Series (£2,400)	Compelec: 01-636 1392: (N/A)	32K RAM; Z80: dual 8" F/D (512K): 2 RS232 ports: 1 P/P	CP/M: A: CBASIC: cobol: Fortran: Pascal	Also with double density F/D (1MB), £2,900: 1K EPROM: (S)
Compucolor II (£998)	Abacus: 01-580 8841: (6)	8-32K RAM; 8086: 13", 32x64 8-colour VDU: single 5¼" F/D (51K): RS232 port	ExBASIC (ROM): A	16K module, £1,078: 34K, £1,209: maintenance and programming manual available: (I)
Compucorp 625 (£6,000)	Compucorp: 01-952 7860: (17)	60K RAM; Z80: dual 5¼" F/D (700K): 9", 16x80 b&w VDU: 40 cps printer: 1 RS232 port	A: BASIC: U	Also 655 model with 320K F/D capability and 12", 20x80 VDU — £4,345 (B)
Comp Workshop System 1 (£1,600)	Comp Workshop: 01-491 7507 (N/A)	32K RAM; dual 5¼" F/D (170K): 9", 16x64 b&w VDU: modular	A: BASIC: Fortran: Flex: Pascal: Pilot	This is an example configuration from a fully compatible modular range: (E)
Cromemco System 2, System Z2H, System 3 (£1,995/£4,998/£3,293)	Comart: 0480 215005; Datron: 0742 585490; Microcentre: 031 225 2022 (20)	64K RAM; Z80: dual 5¼" F/D (346K) Sys 2 and Z2H... dual 8" F/D (1.24MB) Sys. 3: S/P: P/P	CDOS: BASIC: Cobol: Fortran; Multi-user BASIC: A:	All systems expandable to multi-user (2-7 users), £3,455 £6,400: 1.1 and 22MB options: also dual 8" F/D (996K) on Sys. 2 and 3: (E)
DAI (£998 48K version)	Data Applications (UK): 0285 2588 (TBA)	12-48K RAM; 8080: C int: 24x60 VDU int: RS232 port: Over 20 industrial ints: 2 C ints	BASIC (ROM): U (ROM)	Up to 255x335 resolution graphics: 3 notes and noise generator: PAL output to TV: games paddle
Digital Microsystem DSC-2 (£5,395)	Modata: 0892 39591 (TBA)	64K RAM; Z80: dual 8" F/D (2.28MB): 4 RS232 ports: EIA port	CP/M: BASIC-E: CBASIC: Cobol Fortran: Pascal	Up to 6 additional F/D units possible: (H)
Durango F-85 (£8,250)	Comp Ancillaries: 07843 6455 (12)	64K RAM; 8085: dual 5¼" F/D (1MB); 9", 16x64 green VDU: 132 col 165 cps printer: N/P	O/S: DBASIC	Takes up to 5 work stations: fully integrated system: options — additional dual 5¼" F/D (1MB) and 12 MB H/D: (S)
Dynabyte DB8/1 (£1,500)	Dynabyte UK/Europe Ltd: 0723 65559 (6)	32-64K RAM; Z80: S100 bus: 2 RS232 ports: 1 P/P	CP/M: BASIC: Cobol: Pascal	Expands to multi-user system: option — dual 8" F/D (1MB), £2,000: also DB8/2 with dual 5¼" F/D (400K), £3,000 (E)
Equinox 200 (£7,500)	Equinox: 01-739 2387 (N/A)	64-256K RAM; Z80: 10MB H/D: 1 S/P: 1 P/P	CP/M: CBASIC: cobol: Fortran:	Multi-user MVT/FAMOS available in place of CP/M: (S/H)

List of Abbreviations

A Assembler	F/D Floppy disc	M/A Macro assembler	S/P Serial port
B BASIC	G/C Graphics card	N/A Not available	T/E Text editor
C Cassette	H Hardware	N/P Numeric pad	TBA To be announced
E Extensive	H/D Hard disc	O/S Operating system	U Utility
	I Introductory	P/P Parallel port	
	Int Interface	S Software	

Please note: Software items listed in *italics* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Euroc (£7,995)	Eurocalc Ltd: 01-405 3113 (TBA)	64K RAM; 8080A: dual 8" F/D (1MB); 15", 25x80 b&w VDU: 132 col 140cps printer	CP/M: CBASIC: A: U:	A year's maintenance and stationery supply inc: (S)
Executive Minicomputer	Binatone 01-903 5211	See Video Genie		
Exidy Sorcerer (£650)	Liveport Data Products 0736 798157 (27)	8-32K RAM: Z80: RS232: 1 P/P: S100 connector: 30 x 64 VDU I/O	O/S: ExBASIC (ROM): Editor: A: CP/M: Algol: Fortran	High res graphics capability: 16K version, £760: 32K £859: 48K, £960: option — dual 5 1/4" F/D (630K), £1,200: User programmable character set: (I)
HP 85 (£2,240)	Hewlett Packard Ltd: 0734 784774 (16)	16-32K RAM: C.P.U.: 5" 16x32 b&w VDU: C (200K): 64 cps printer: RS232 port: 4 P/P	BASIC:	Full dot matrix graphics: N/P: compact portable unit: (S)
IMS 5000 (£1,935)	Equinox: 01-739 2387 (20)	32-64K RAM: Z80: dual 5 1/4" F/D (320K)	CP/M: CBASIC: Cobol: Fortran:	3 drives option: (S&H)
IMS 8000 (£3,515)	As above	64-256K RAM: Z80: dual 8" F/D (1MB)	CP/M: CBASIC: Cobol: Fortran: MicroCOBOL	Multi-user MVT/FAMOS available in place of CP/M: (S&H)
IMSAI VDP 42 (£3,900)	Computermarket: 0603 615089 (TBA)	32-64K RAM: 8085: dual 5 1/4" F/D (400K): 9", 24x80 b&w VDU: 1 S/P: 1 P/P	IMDOS (CP/M comp): A: ExBASIC: U: CBASIC: Cobol: Fortran	Supports 8 additional F/D drives: also available, VDP 44 with F/D (780K), £4,400: (H)
IMSAI VDP 80 (£6,200)	As above	32-64K RAM: 8085: dual 8" F/D (1.2MB): 12", 24x80 b&w VDU: 1 S/P: 1 P/P	IMDOS: A: ExBASIC: U: CBASIC: Cobol: Fortran	(H)
ITT 2020 (£867)	ITT: 0268 3040 (15)	16-48K RAM: 6502	Monitor: A: ExBASIC: Dis A:	360x192 high res graphics: Ex-BASIC in 6K ROM: options — single 5 1/4" F/D (116K), £425; 16K RAM, £110; RS232 port, £96: 32K system, £931: 48K system, £995: (B)
LX-500 (£3,500)	Logabax Ltd: 01 965 0061 (13)	32K RAM: Z80: dual 5 1/4" F/D (180K): 12" 25x80 b&w VDU: 100cps printer	DOS: BASIC: A	Other printers available: (S)
Megamicro (£6,080)	Bytronics: 0252 726814 (5)	256K: 8080A: dual 8" F/D (1MB): 12", 20x80 b&w VDU: 120cps printer: 2 S/P: 2 P/P	CP/M: U	(H&B)
Microstar 45 Plus (£4,950)	Microsense: 0442 41191 (20+)	64K RAM: 8085: dual 8" F/D (1.2MB): 3 S/P: RS232 port	STARDOS: CP/M: BASIC: Cobol: Fortran	(E)
MSI 6800 (£1,203)	Strumec: 05433 4321 (5)	16K RAM: 6800: C: 9", 16x64 b&w VDU: 1 S/P	BASIC: Mini A: U	Up to 8 serial or parallel ints possible: (S&H)
MSI 6800 System 1 (£2,175)	As above	32K RAM: 6800: dual 5 1/4" F/D (160K): 9", 16x24 b&w VDU: 1 RS232 port	DOS: BASIC: U: A: Fortran	As above: option — dual 8" F/D (624K), £1,640: (S&H)
MSI 6800 System 2 (£7,500)	As above	56K RAM: 6800: single 8" F/D (312K): 10MB H/D: RS232 port: 9", 16x64 b&w VDU	DOS: BASIC: Multi-user BASIC: A	Rack mounted: options — dual 8" F/D (624K), £1,640; 10MB H/D, £4,250: (S&H)
MSI System 7 (£5,200)	As above	56K RAM: 6800: dual 5 1/4" F/D (640K): 9", 16x24 VDU: 1 P/P	DOS: BASIC: A	Choice of FDOS, SDOS or Flex: also option — 10MB H/D: (H&S)
Nanocomputer (£420)	Midwich: Waltham Cross 29310 (TBA)	4K RAM: 2K ROM: Z80: C int: 8 digit LED: K/B: RS232 port: 4 P/P	Machine language: BASIC: A: T/E:	Designed for hardware education: expandable to 64K RAM system with F/D: (E)
North Star Horizon (48K, £4,650)	Comart: 0480 215005; Comma: 0277 811131; Equinox: 01-739 2387 (20)	24-56K RAM: Z80A: dual 5 1/4" F/D (360K): 15", 24x80 b&w VDU: 150 cps printer: 2 P/P	DOS: BASIC: CP/M: Cobol: Fortran: Pascal	(E)
Oxford Mini-computer	Binatone 01-903 5211	See Video Genie		
Pascal Microengine (£2,080)	Pronto: 01-599 3041 (TBA)	64K RAM: MCP 1600: 2 RS232 ports: 2P/P: options — dual 5 1/4", F/D (1MB), £1550: dual 8" F/D (2MB), £1950	BASIC: Pascal	CPU has user written word set:
PET 8K, 16K & 32K (£550, £675 & £795)	Commodore: 01-388 5702 (150)	8-32K RAM: 6502: C: 9" 25x40 VDU: IEEE488 port	O/S: BASIC: A: Forth Pilot:	BASIC in 8K ROM: options — dual 5 1/4" F/D (353K), £795; same, but (800K), £995, plus, with the 2001-8, £30 for the disc operating ROM: (I)
Powerhouse 2 (£1,175)	Powerhouse Micros: 0422 48422 (TBA)	32-64K RAM: Z80A: 5", 27x96 b&w VDU: 1 P/P: RS232 port	FDOS: BOS: BASIC: ExBASIC: (14K EPROM), £260	Graphics card available, £190: option — dual 5 1/4" F/D (700K): (I)
Rair Black Box (£2,300)	Rair: 01-836 4663 (N/A)	32-64K RAM: 8085: dual 5 1/4" F/D (160K): 2 RS232 ports	CP/M: BASIC: Cobol: Fortran: M/A	16K RAM expansion, £250; dual 5 1/4" F/D (520K), £1,000: (H)
Research Machines 380-Z (£1,048)	Research Machines: 0865 49791 (N/A)	16-56K RAM: Z80A: C: RS232 port:	Tiny BASIC: graphics: A: ExBASIC: CBASIC: Cobol: Fortran: Algol: CP/M: U:	Designed for education: high res graphics being developed: options — dual 5 1/4" F/D (168K), £895 and dual 8" F/D (1MB), £1,695: 56K version, £1,654: (S)
SDS 100 (£4,290)	Airamco: 0294 57755 (11)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: S100 bus: RS232 port: N/P: 1 P/P	CP/M: A: ExBASIC: Cobol: Fortran	Facility for 8K PROM: (E)
S.E.E.D. System One (£2,175)	Strumec: 05433 4321 (4)	32-56K RAM: 6800: dual 5 1/4" F/D (160K): 9", 16x24 b&w VDU: RS232 port	DOS: BASIC: U: Fortran: Cobol: M/A	Up to 8 I/O ports: max of 4 F/D drives: option — dual 8" F/D (624K): (E)
Semel 1 (£2,900)	Strutt Electrical: 0822 5439 (N/A)	16-64K RAM: Z80: single 8" F/D (250K): 12", 24x80 b&w VDU: RS232 port	BASIC: Cobol: Fortran	Supports up to 8 drives option — single 8" F/D (250K), £500: (I)
Sharp MZ-80K (£520)	Sharp Electronics (UK) Ltd: 061 205 7321 (22)	6-34K RAM: Z80: C: 10", 24x40 b&w VDU	BASIC: A:	Graphics: loudspeaker: BASIC in 14K RAM: 34K machine, £740: (B)
Simpelec Mk 1 (£7,421)	Compelec: 01-636 1392 (N/A)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: 2 S/P: 1 P/P	CP/M: BASIC	Also Mark II with 2MB F/D, £7,900; will upgrade further: (S&H)
Sinclair ZX80 (£100)	Science of Cambridge: 0223 311488 (N/A)	1-16K RAM: 780-1: C int: T.V. int: full K/B: 44 pin expansion port	4K BASIC in ROM	CPU is NEC 3.25 MHz version of Z80A: available as kit, £80: mains adaptor £9:(S)

DIRECT ACCESS

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Sirocco (£3,900)	Elvingate Computers: 069 245189 (TBA)	64K RAM: Z80: dual 5 1/4" F/D (940K); 12", 24x80 VDU: RS232 port	CP/M: CBASIC: Cobol: MBASIC: Fortran	Direct memory addressing: memory mapped VDU: free standing keyboard: option — 10MB H/D
Smoke Signal Chieftain 1 (£3,050)	Windrush Micro Designs 069 245189 (TBA)	32-64K RAM: 6800: dual 5 1/4" F/D (160K); 12", 24x80 VDU: 112 cps printer: RS232C port	DOS: BASIC: DBASIC: RBASIC: A: Fortran: U	Also Chieftain 3 with dual 8" F/D (1MB), £3,950 (E)
Solitaire WP & BS200 (£6,750 & £7,950)	Solitaire KPG: 01-995 3573 (TBA)	64K RAM: 8085: 14" VDU (with own CPU): 45 cps printer: CPU port: dual 5 1/4" F/D (700K) with "WP", and dual 8" F/D (960K) with "BS200"	DOS: BASIC (optional on the "WP")	All Solitaire systems are compatible: graphics on 11x13 dot matrix: (S)
Solitaire/HBS100 (£9,500)	As above	64K RAM: 8085: 10MB H/D: 14" VDU (with own CPU): 200 cps printer: CPU port	DOS: BASIC	Up to 8 interface terminals can be used: also HBS200 with 20-80 MB of H/D: HBS100 limit is 40MB: (S)
Sord M100 ACE (£2,650)	Midas Computer Services Ltd: 0903 814523	48K RAM: Z80: single 5 1/4" F/D (143K): 12" 24x64 col VDU RS232 port	O/S: BASIC	With colour graphics: 8K ROM: option — single 5 1/4" F/D, £300: (I)
Sord M223 (£3,500)	As above	64K RAM: Z80: single 5 1/4" F/D (350K); 12", 24x80 b&w VDU: S100 bus: RS232 port	O/S: BASIC	Other configs possible: extra F/D, £450: (I)
Superbrain (£1,995)	Icarus: 0632 29593 (TBA)	64K RAM: 2xZ80: dual 5 1/4" F/D (320K); 12", 25x80 b&w VDU: S100 bus: RS232: TRS80 port	CP/M: A: BASIC: Cobol: Fortran: APL Pascal	Limited graphics: mainframe int available: options — dual 5 1/4" F/D (320K); dual 8" F/D (2.4MB): 8-120 MB H/D: (S&H)
Tandberg EC10 (£5,000)	Tandberg: 0532 35111: (N/A)	50K RAM: 8080A: single 8" F/D (250K): 12", 25x80 b&w VDU: RS232 port	ExBASIC (24K): Multi-user BASIC: A: U: Cobol	(S&H)
Tandy TRS 80 Level I (£380)	Tandy: 021 556 6101 (200)	4-16K RAM: Z80: C: 12", 16x64 b&w VDU	BASIC: A:	BASIC in 4K ROM: upgradable to level 2: (I)
Tandy TRS 80 Level II (£515)	As above	4-48K RAM: Z80: C: 12", 16x64 b&w VDU: RS232 int: 1 P/P	BASIC: M/A: Fortran	16K machine includes N/P: 4-16K upgrade, £120 (£85 without pad): max config, £1,005: option — single 5 1/4" F/D (78K), £478 (max of 4): (I)
TECS (£1,600)	Technologics: 051 724 2695 (TBA)	16-56K RAM: 6800: 8K PROM: RS232 port: C int	BASIC: T.DOS: Prestel: Monitor:	256 ch graphics: Prestel compatible: plugs into standard TV: option — dual 5 1/4" F/D (320K), £800: (S&H)
TEI 208 (£3,841)	Abacus: 01-580 8811 (5)	32-60K RAM: 8080/8085: dual 5 1/4" F/D (320K); 9", 24x80 green VDU: 3 S/P: 3 P/P	CP/M: BASIC: Cobol: Fortran: Pascal: Algol	(S&H)
TEI 212 (£4,886)	As above	32-60K RAM: 8080/8085: dual 8" F/D (1MB): 15", 24x80 green VDU: 3 S/P: 3 P/P	CP/M: BASIC: Cobol: Fortran: Pascal: Algol	(S&H)
Terodec DPS 64/1-4 (£3,014)	Terodec (Micro-systems) Ltd: 0344 51160: (TBA)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 b&w VDU: 2 S/P: 3 P/P	CP/M: BASIC: Cobol: CBASIC: Fortran: Algol: Pascal	TMZ 80, enhanced model in integral work station, £5,495 (with 4MB F/D): DPS 64 with 2MB F/D is £3,319: options — dual 8" F/D (1MB), £1,150: dual 8" F/D (2MB), £1,455: (S&H)
Vector Graphics MZ (£2,595)	Almarc: 0602 625035: Sintrom Microshop: 0734 85464: Metrotech 0895 57780: (5)	56K RAM: Z80: dual 5 1/4" F/D (630K): 3 S/P: 2 P/P	DOS: BASIC: A: CP/M2: Algol: CBASIC: Cobol: Fortran: Pascal	Includes PROM burner: also System B with graphics and N/P, £3,195: (E)
Video Genie EG 3003 (£378)	Lowe Electronics: 0629 2817: Binatone: 01-903 5211 (N/A)	16K RAM: Z80: 500 bps C: 32x64 TV int: extra C int: 1 P/P	BASIC: M/A: Fortran	BASIC in 12K ROM: graphics available: F/D under development: Binatone call their 16K model "Executive Minicomputer" and a 4K version, "Oxford Minicomputer" — prices TBA: (I)
Zenith WH-11A (£4,359)	Heath Ltd 0452 29451 and 01-636 7349 (N/A)	LSI 11: 16-32K RAM: 25x80 VDU: S/P: P/P	O/S: BASIC: Fortran: A: U:	PDP 11 compatible: option — dual 8" F/D (512K): (S&H)
Zenith Z89 (£1,490)	As above	16-48K RAM: Z80: single 5 1/4" F/D (102K): 12", 25x80 b&g VDU: RS232	BASIC: A: H.DOS: CP/M: MBASIC: CBASIC: Fortran	3 drives option: (I)
Zentec (£5,700)	Zigal Dynamics Ltd: 02405 75681 (1)	32-64K RAM: Z80: 2x8080: dual 5 1/4" F/D (512K): 15", 25x80 b&w VDU: RS232 port	O/S: A: U: BASIC: Micro Cobol	User programmable character set: option — dual 8" F/D (1MB): (S)
Zilog MCZ 1/05 (£4,200 — portable)	Micropower: 0256 54121: Memec: 084421 5471 (N/A)	64K RAM: Z80: dual 8" F/D (600K): RS232 port	RIO O/S: M/A: U: BASIC: Cobol: Fortran: Pascal	Debug in 3K PROM: also available as desk top unit or R/M model, both £4,800: (S&H)
Z Plus (£4,000)	Rostronics: 01-874 3665 (TBA)	32-64K RAM: Z80: dual 8" F/D (1MB): 2 S/P: 2 P/P	CP/M: A: U: BASIC: Cobol: Fortran: Pascal	(S&H)

SINGLE BOARDS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Acorn (£65)	Acorn: 0223 312772 (N/A)	1.1/8K RAM: 6502: EPROM socket: Hex K/B: C int: 8 digit LED display: up to 16 ports: options — Eurocard 64 way connector: VDU card: Full K/B card	1/2K monitor: BASIC	Kit: programmable address linking; on board 5V regulator: available assembled, £79 (S&H)
Aim 65C (£265)	Pelco: 0273 722155 (4)	1-4K RAM: 6502: 12K ROM: full K/B: 20 char LED display: 20 char thermal printer: Cx2: RS232 port.	A: Dis A: T/E: 8K monitor in ROM	Available as S100 system with A or BASIC in ROM (£480) from Portable Micros (0280 702017): they also have briefcase version (£750) (E)
Cromemco SC (£260)	Comart: 0480 215005 (17)	1K RAM: Z80A: 8K EPROM sockets: RS232 port: 3 P/P: option — S100 bus.	Monitor and control BASIC in EPROM	5 program interval timers: can put own BASIC programs in EPROM (E)
ELF II (£114)	Newtronics: 01-348 3325	1/4K RAM: RCA 1802: Hex K/B: 2 digit LED: TV int: C int: RS232 port: options — 4K RAM, £69; full K/B: VDU card	1K monitor: A: Dis A: T/E: BASIC: 244	TTY, n-line decoders: low resolution graphics (high resolution available) kit (H)

IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Explorer (£295)	Newtronics: 01-739 1582 (15)	4K RAM: 8085: Hex K/B; RS232 port: S100 bus: C int; options — 6 slot S100 £32; 8K EPROM sockets £50.	2K monitor: CP/M: BASIC	Programmable 14 bit counter: kit (S&H)
H8 (£262)	Heath: 0452 29451 (TBA)	4K RAM: 8080A: Octal K/B: 6 digit LED; speaker: options — single 5¼" F/D (102K), £399; 16K RAM, £314; C int, £72	1K monitor: BASIC in RAM: FORTRAN: T/E: A: U:	Kit (S&H)
Hewlett 6800S (£299)	Hewlett: 0625 22030 (N/A)	16K RAM: 6800: full K/B: VDU int: 2x C int; 1 S/P: 2 P/P: option — 16K RAM, £90	1K monitor: A: T/E	Can be upgraded with 6809 (H)
Hewlett 6800 MkIII (£152)	As above	1K RAM: 6800: VDU board: options — single 5¼" F/D (75K), £350; PROM programmer, £32: calculator board, £32	1K monitor	(H)
Mk 14 (£39.95)	Science of Cambridge: 0223 311488 (N/A)	8060: 1/4-2K RAM: Hex K/B: 7 char LED: options — VDU int (32x16 with graphics), £29; C int, £6; PROM prog, £10, 2K memory expansion, £15	Machine code	Designed for control applications rather than high level computing expansion (H)
Microtan 65 (£69)	Tangerine: 0353 3633	1K RAM: 6502: 16x32 T.V. int: options — TANEX board, 7K RAM, 6K ROM, 8K BASIC; 3S/P	1K TANBUG monitor: BASIC	Optional 64x64 pixel graphics:(E)
Nascom 1 (£165)	Nascom: 02405 75155 (20)	4K RAM: Z80: full K/B: TV int: 2 P/P: 1 S/P	2K monitor: BBASIC: tiny BASIC: A: T/E: U	Now available as Nascom 2 with 8K RAM and 8K microsoft BASIC in ROM, £295
77/68 (£90)	Newbear: 0635 30505 (N/A)	4K RAM: 6800: LED: C int: VDU int.	1K Monitor: BASIC:	Expandable to racked Nascom compatible system: (B)
SBC 100 (£135)	Airamco: 0294 57755 (11)	1K RAM: Z80: 8K ROM: S100 1 S/P: 1 P/P: option — voltage regulator	1K monitor: DOS in ROM	Kit: available assembled, £196 (E)
Superboard (£188)	MBM: 01-981 3993 (N/A)	4-8K RAM: 6502: 10K ROM: full K/B: VDU int: C int: options — RS232; single 5¼" F/D (100K), £316; 8K RAM, £188	BASIC in 8K ROM:	Available with 32K RAM and single 5¼" F/D, £867 (S&H)
SYM-1 (£160)	Newbear: 0635 30505 (N/A)	1-4K RAM: 6502: bps C int: VDU int: 2x6522 ports: option — TV int.	4K monitor: BASIC: A	Can be expanded to 64K RAM (S&H)
Triton 4.1 (£286)	Transam: 01-402 8137 (N/A)	2K RAM: 8080: 3K ROM: full K/B: 16x64 VDU or TV int: C 1 S/P: option — 2K RAM, £30	1K monitor: 2K BASIC: U	64 character graphics: 8 levels interrupt: kit (S&H)
Triton 5.1 (£294)	As above	2K RAM: 1K VDU RAM: 8080: C int: T.V. int	1½K monitor: 2½K BASIC: A: Dis A: 8K BASIC: Pascal	Graphics facility: disc interface running CP/M, about £200: (S&H)
Tuscan (£170)	As above	8K RAM: 8K ROM: Z80: 6xS100 slots: RS232 int: T.V. int: C int	8K monitor: or 8K BASIC	DD disc controller, £195: graphics: (S&H)
UK 101 (£219)	Computer Shop: 01-440 7033	4K RAM: 6502: full K/B: 16x48 VDU or TV int: C int: RS232 port: option — 4K RAM, £49	1K monitor: 8K BASIC: Dis A: U	Graphics: will run Superboard software (S&H)

List of Abbreviations

A Assembler	F/D Floppy disc	M/A Macro assembler	S/P Serial port
B BASIC	G/C Graphics card	N/A Not available	T/E Text editor
C Cassette	H Hardware	N/P Numeric pad	TBA To be announced
E Extensive	H/D Hard disc	O/S Operating system	U Utility
	I Introductory	P/P Parallel port	
	Int Interface	S Software	

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

USER GROUPS INDEX

DIRECT ACCESS

As promised, here is a complete printout of our User Group Index. If we have failed to include YOUR group, then please address the relevant information to PCW (User Group Index), 14 Rathbone Place, London W1P 1DE. Notification of changes will also be appreciated. The next full listing will appear in PCW's August edition. In the meantime we shall of course continue to publish User Group Index update information — as and when it reaches us.

NATIONAL

11s Users Group. A sort of help service only. No meetings no newsletter. Contact: Pete Harris, 119 Carpenter Way, Potters Bar, Herts., EN6 5QB. Tel: 0707 52091 or 01-248 8000 Ext. 7065.

The 6502 Users Club. Hoping soon to hold regional and national meetings, they offer "support, encouragement and fellowship". Contact: Walter Wallenborn, 21 Argyll Ave., Luton, Beds LU3 1EG.

77/68 Users Group. Quarterly Newsletter. Free membership for 1st year if you buy the 77/68 instruction manual, £1.50 thereafter. Contact: Newbear Computing Store, 40 Bartholomew St., Newbury, Berkshire.

9900 Users Group, TIMUG. Contact: Chris Cadogan, 21 Thistle Downs, Northway Farm, Tewkesbury, Glos.

Amateur Computer Club — 2650 Library. No meetings, no newsletters, the library serves to act as a help point for disseminating 2650 related data on demand. Contact: Roger A. Munt, 51 Beechwood Drive, Feniscowles, Blackburn, Lancs BB2 5AT (0254 22341).

Minicomputer Users in Secondary Education (MUSE). MUSE is the national organisation for coordinating activity in schools, teacher training institutions, colleges of technology and so on. Meetings are held on both a regional and national basis. For full details on MUSE's range of activities, contact the Treasurer, R. Trigger, 48 Chadcote Way, Catshill, Bromsgrove, Worcestershire.

Exidy Sorcerer Users Group. Newly formed, and a division of the U.S. User Group. Fee is £5 p.a. Write, stating what hardware you own, to: Andy Marshall (Micro44), 44 Arthurs Bridge

Road, Woking GU21 4NT (04862 66084).

UK Intel MDS Users Group. Contact: Lewis Hard, 29 Chaucer Rd., Bedford.

Ithaca Audio S100 bus UK User Group. Contact: Dave Weater, 16 Eive Place, Cumbernauld, Glasgow O67 4JE. Phone 02867 36570.

MK14 Club. Bi-monthly magazine called "Complement and Add". Contact: Geoff Phillips, 8 Podsford Rd., London NW9 6HP.

Independent PET users Group. Contact: IPUG, 57 Clough Hall Road, Kids Grove, Stoke-on-Trent, Staffs.

Research Machines Ltd. National User Group. Contact: M.D. Fischer, PO Box 75, Oxford, OX4 1EY, for a registration form.

UK Apple Users Group, Contact: Andy Witterick (Keen Computers)

5 The Poultry, Nottingham. Tel: 0602 583254/5/6.

Central Program Exchange. Full membership (£25 Europe, £40 overseas.) provides 30 free programs p.a. Small User Service (£10 Europe, £20 overseas) provides 10 free programs p.a. Contact: Mrs Judith Brown, The Polytechnic, Wilfruma St., Wolverhampton, WV1 1LY.

Cosmac Users Club (proposed) For People using the RCA 1802, Cosmac ELF, ELFI, Super ELF etc. Those interested contact James Cunningham at 7 Harrowden Court, Harrowden Road, Luton LU2 0SR (enclosed sae, please).

Sorcerer Program Exchange Club. No meetings. Regular newsletter. Members welcome worldwide £2 p.a. Contact: Colin Morle, SPEC, 32 Watchyard Lane, Formby, Nr. Liverpool.

TRS-80 Users Group. Contact: Brian Pain, 40a High St., Stony Stratford, Bucks.

The ITT 2020 from DDP

The microcomputer for perfectionists, patriots, penny-pinchers and potential agents everywhere.

The ITT 2020 microcomputer is now available nationally from Distributed Data Processing Ltd. To help celebrate this fact, this advertisement lists a few of the many people in Britain today for whom the ITT 2020 is bound to have rather special attractions. . .

Perfectionists

Nobody with even the most basic appreciation of high standards can fail to be impressed by the level of excellence with which we support the ITT 2020. Through Five Star Computing you are protected by the experience we have gained as the Company with the highest volume of ITT 2020 UK sales. Furthermore, features like introductory training, software vetting and software customising mean that with our ITT 2020s you can be closer to perfection than with any other comparable microcomputer.

Patriots

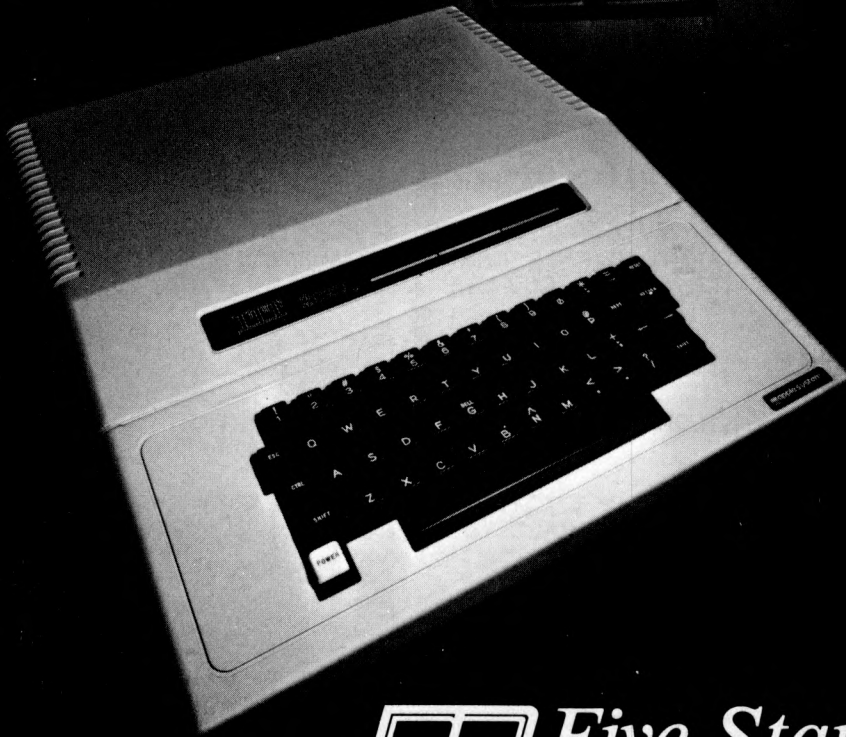
If you are proud of your country, then you can be equally proud of DDP's ITT 2020s. Like all ITT 2020s, they are designed specifically for the British user and what's more, they provide jobs for British workers who build them just around the corner to us - at ITT's factory at Basildon in Essex.

Penny-Pinchers

Together with the national launch of our ITT 2020s, we are introducing new highly competitive price levels. This will be unpleasant news, of course, to all those people who have always insisted that Five Star Excellence means a Five Star Price.

Potential Agents

Now DDP ITT 2020s are going national, there's never been such a good opportunity for profit. If you'd like to find out how, please contact Nick Yates at DDP immediately.



 **Five Star Computing**

A Commitment to Excellence from Distributed Data Processing
DDP Ltd, Essex House, Cherrydown, Basildon, Essex
Tel: Basildon (0268) 282155

THEYDON COMPUTER SERVICES. (MAIL ORDER).

PRICE LIST APRIL 1980

ALL PRICES EXCLUSIVE OF DELIVERY & V.A.T.

I.T.T. 2020 WITH COLOUR CARD AND PALSOFT IN ROM.
16K £739.00 32K £799.00 48K £859.00

I.T.T. 5.25 INCH DISK DRIVES :-
CONTROLLER CARD £49.00 DISK DRIVE £299.00
PRINTER CARD (PARALLEL) £79.00
MEMORY UPGRADE (16K) FOR I.T.T.2020 £60.00

ANADEX DP8000 PRINTER £449.00

ALSO NEW ANADEX APPLESIDER AND DP-9500.

11.5 BY 8.5 PAPER 4000 SHEETS £18.00
5.25 INCH MINI FLOPPIES (BOX OF TEN) £19.50
ALL CONSUMABLES AVAILABLE !!!

TRAINING GIVEN, COURSES FROM IDIOT LEVEL UPWARDS !
SOFTWARE WRITTEN OR AVAILABLE EX-STOCK
ALL ENQUIRIES WELCOME

*
* WE RECOMMEND THE **BRITISH MADE** ITT 2020 MICROCOMPUTER *
*
* BECAUSE WE HONESTLY FEEL THAT IT REPRESENTS THE *
*
* BEST VALUE FOR MONEY CURRENTLY AVAILABLE. *
*

FULL SUPPORT WITH ALL SERVICING AND "HANDS ON" COURSES AVAILABLE
SOFTWARE ASSISTANCE !!!
BEFORE PURCHASE. LET US SHOW YOU HOW TO WRITE YOUR OWN PROGRAMS....

ALL MAJOR CREDIT CARDS ACCEPTED. DON'T DELAY, PHONE TODAY.

WE APPRECIATE THAT NOT EVERYONE SPEAKS COMPUTERESE AND WE TRY TO
GIVE NEWCOMERS TO THE MICRO-CHIP ERA EVERY ASSISTANCE POSSIBLE.
FOR ADVICE AND DETAILS OF OUR COURSES AND SUPPLIES, JUST LIFT THE
TELEPHONE AND DIAL :-

THEYDON BOIS (ESSEX) 4321

ONLY FIVE MINUTES FROM THE LONDON UNDERGROUND (CENTRAL LINE)

WARNING FROM THEYDON COMPUTER SERVICES.
DEALING WITH OTHER COMPANIES CAN DAMAGE YOUR PURSE.....

USER GROUPS INDEX

UK Pet Users Club. Contact: Commodore Systems Division, 360 Euston Road, London NW1 3BL.

British TI Users' Club. A loose association of owners and users of Texas Instruments programmable calcs, the club exists for the purposes of information and program exchange (and is in no way sponsored by TI). The main activity is production of a (roughly) monthly newsletter and membership costs £5.50. Details from 2 Woodside Crescent, Clayton, Newcastle-under-Lyme, Staffs ST5 4BW.

SOUTH

Independent PET Users Group — South. Free membership — meetings the first Wednesday of every month. £1.50 to receive monthly newsletter. Contact: John C. Nuttall, 56 West Street, Shoreham-by-Sea, Sussex BN4 5WG.

NORTHWEST

Amateur Computer Club — North west group. Meetings 1st and 3rd Thursdays monthly at St. Peter's Chaplaincy, Precinct Centre, Oxford Rd., Manchester. Contact: Jane Lomas, 9 Crescent Court, Alderfield Rd., Chorlton, Manchester, M21 1JX. Tel: 061 881 1933.

TRS 80 — North West Group. Subscription £5. Newsletter £3 (for 6 issues). Meetings last Wednesday monthly (not Dec) at the Stag Hotel, Carswood, Nr. Wigan. Contact: Melvyn D. Franklin, 40 Cowlees, Westhoughton, Bolton, BL5 3EG. Tel: 0942 812843.

IRELAND

Computer Education Society of Ireland. A voluntary organisation that consists of a national body and an expanding number of local branches. Their brief is to monitor computer education in Ireland. *National CESI* (£3 p.a.) — Dairmuir McCarthy, 7 St. Kevin's Park, Kilmacud, Blackrock, Co. Dublin. *Cork branch* (£1 extra) — Michael Moynihan, Colaiste an Spioraid Naomh, Bishopstown, Cork. *Dublin branch* (£1.50 extra) — Jim Walsh, C.B.S. Naas, Co. Kildare. *Limerick branch* (£1 extra) — Sr. Lourda Keane, Convent F.C.J., Laurel Hill, Limerick. *Waterford branch* (£1 extra) — Mr. Hugh Dobbs, Newtown School, Waterford. *Kilkenny branch* (£1 extra) Sr. Helen Lenehan, Presentation Secondary School, Kilkenny.

WALES

Gwent Amateur Computer Club. Covering the Gwent and Cardiff areas, the club has its own computer room and technical library. Meetings are held once a week on Wednesdays at 10 Park Place, Newport. Contact Ian Hazell on 0633 277711 (office hours).

SCOTLAND

The Grampian Amateur Computer Society. They meet every 2nd Monday of the month at the Holiday Inn, Bucksburn, Aberdeen and there's a monthly newsletter. For more details, contact M. Basil, Orton Cottage, Burnside, Lumphanan, Kincardineshire, Grampian Region (033 983 284).

The Scottish Amateur Computer Society. Meetings are on the 1st Wednesday of each month in the Lothian Room of the Grosvenor Hotel, Edinburgh — also in Fife on the 4th Wednesday of each month. . . locations variable. Details from Secretary, Alistair MacPherson, 6 Curriehill Castle Drive, Balerno, Edinburgh 14.

AVON

Bristol Computing Club, £3.00 p.a. Meetings 3rd Wednesday, monthly. Contact: Leo Wallis, 6 Kilbirnie Rd., Bridge Farm Estate, Bristol, BS14 0HY. Tel: Bristol 832453.

Brunel Technical College

Computing Club. The club divides into two sections. . . the "skilled" and the "not skilled". They share alternate Wednesdays at the College. Contact: S.W. Rabona at 18 Castle Road, Worle, Weston-Super-Mare, Avon, BS22 9JW (0934 513068).

Compukit User Club. Details, contact P. Crabb Esq., 21 Jones Close, Yatton, Avon (0934 834808).

BERKSHIRE

The Thames Valley Amateur Computer Club. Meetings are on the first Thursday of every month and from November on, that will be at "The Southcote", Southcote Lane, off the Bath Road, Reading, Berks. Starting time, 7.00pm. Contact: Brian Quarm (Camberley 22186) OR Brian Steer (Slough 20034).

CLEVELAND

Cleveland Micro Computer Users Group. Meetings second Tuesday monthly. Bi-monthly newsletter. Junior section. Contact: J.H. Telford, 63 Raby Rd., Ferryhill, Co. Durham.

DEVONSHIRE

Exeter and District Amateur Computer Club. General meetings 2nd Tuesday monthly, specialist meetings 3rd or 4th Tuesday. £5.00 p.a. Contact: Doug Bates, 3 Station Road, Pinhoe, Exeter, Devon.

Plymouth and District Amateur Computing Club. Subscription £5.00 p.a. Meetings last Wednesday monthly. Contact: Keith Gould, c/o JAD Ltd., 21 Market Ave., Plymouth G2616 or 2 Brook Rd., Ivybridge 2399.

COUNTY DURHAM

Computer Club. Business & Word Processor section meets Fridays 7.30, Scientific & Recreational Saturdays 10.00. Contact: L. Boxell, 8 Vane Terrace, Darlington. Tel: 0325 67766.

Northeast PETS. Contact: Jim Cocalis, 20 Worcester Road, Newton Hall Estate, Durham. They meet the 2nd Monday of each month for software tuition and the 3rd Monday for hardware tuition (both in addition to normal activities). They start at 7.00pm and meet in the PET Lab, Newcastle Polytechnic, Ellison Building, Newcastle upon Tyne.

EAST ANGLIA

Anglia Computer User Group. Contact Jan Rejzl, 128 Templemere, Sproutson Road, Norwich NR3 4EQ.

ESSEX

TRS80 User Club (Chelmsford). Now part of the National TRS80 User Club. Contact: Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.

The Colchester Microprocessor Group. Meetings held at the University of Essex on the second and fourth Wednesdays of each month — 7.30 pm start. Membership is open to all, on payments of £5 annual sub (£1 for full-time students). Contact: the Information Centre at the University on the evening of the meeting.

Compukit User Club. Details, contact Adrian Waters, 117 Haynes Road, Hornchurch, Essex RM11 2HX (Hornchurch 40490).

GLOUCESTERSHIRE

Cheltenham Amateur Computer Club. Meetings, 4th Wednesday monthly, 7.30pm start. Contact: Mr. M. Pullin, 45 Merestones Drive, The Park, Cheltenham, GL50 2SU (Cheltenham 25617).

HAMPSHIRE

Southampton Amateur Computer Club. Meetings 1st Wednesday monthly (not July, Aug, or Sept.). Contact: Paul Dorey, Department of Physiology, University of

Southampton, Southampton, SO2 3SU or Tel: Paul Maddison on Winchester 4433 Ext. 6955.

HERTFORDSHIRE

Harpenden Microprocessor Group. They hold meetings every fortnight, cover a wide range of interests and attract members from the area around Luton, St. Albans and Welwyn. Contact: David James, 5 Ox Lane, Harpenden, Herts AL5 4HH (05827 5366).

KENT

Medway Amateur Computer and Robotics Organisation. Contact: Tony Aylward, 194 Balmoral Rd., Gillingham, Kent. Tel: Medway 56830.

North Kent Amateur Computer Club. Meetings, the second Tuesday of each month — usually at the Charles Darwin School, Jail Lane, Biggin Hill, Kent. The sub is £2.50 per annum (£1 for students). More members are needed. . . contact: Barry Biddles at 3 Acer Road, Biggin Hill, Kent (09594 71742).

LANCASHIRE

Merseaside Microcomputer Group. Several sub-groups including: 380Z User's Group (Alan Pope on 051-548 500 Ext 189); Computer Education Society (Mr M. Trotter on 051-652 1596); SC/MP Special Interest Group (Bob Perriego on 051-677 6716); PET Special Interest Group; 6800 and 77/68 Special Interest Group; Apple Special Interest Group. The Secretary is John Stout of the Dept. of Architecture, Liverpool Polytechnic, 53 Victoria Street, Liverpool L1 6EY (051-236 0598).

North Lancs User Group. Contact John Robinson, 12 Harold Ave., Blackpool, Lancashire.

LEICESTERSHIRE

The Leicestershire Personal Computer Club. Meetings held the 2nd Monday in each month, at Leicester University and Loughborough University alternately. They start 7pm. Membership is £2 per annum (£1 for over 16s). Contact: Miss Jill Olorenshaw (Club Secretary) c/o Arden Data Processing, Municipal Buildings, Charles Street, Leicester (0533 22255) OR Mr Dick Foden (Club Chairman) at 11 Gaddesby Lane, Rearsby, Leicester.

LINCOLNSHIRE

Lincolnshire Microprocessor Society. Various meeting places. For up-to-date information, contact the Hon. Sec., Mr Eric Booth, Senior Common Room, Bishop Grosseteste College, Newport Lincoln.

LONDON

Southgate Computer Club. Meetings 1st Wednesday and 3rd Thursday monthly during term time. Newsletter. Contact: Paul Woolley, Southgate Technical College, High Street, London N14 6BS. Tel: 01-888 6521.

East London Amateur Computer Club. Meetings 3rd Tuesday monthly. £2.50 p.a. (½ price to school students). Contact: Dr. Graham Crisp, 45 Leadale Ave., Chingford, London E4 8AX. Tel: 01-520 6010.

The North London Hobby Computer Club. General meetings held on a Wednesday evening, once a month — specialised topics on three evenings each week. Location: The Polytechnic of North London. Contact: Robin Bradbeer (Chairman) at the Dept. of Electronic and Communications Engineering, Polytechnic of N. London, Holloway, N7 8DB (01-607 2789).

SELMIC (South East London Microcomputer Club). £5 subscription. Meetings at Woolwich Polytechnic. Contact: John Williamson, 129 Greenvale Rd., Eltham Park, London SE9 1PG. Tel: 01-850 4195.

MIDDLESEX

Harrow Computer Group. Meetings (term time) at the Harrow College of Higher Education and (other time) the "Traveller's Rest" Public House, in Kenton, Middlesex — on alternate Wednesdays at 7pm. Contact: Bazyle Butcher, 16 St. Peter's Close, Bushey Heath, Watford (01-950 7068) or P. Lecker, 23 Moss Lane, Pinner, Middx.

Sunbury Amateur Computer Club. Membership free. Contact Mr S N Taylor, 8 Priory Close, Sunbury on Thames, Middlesex. TW16 5AB. Tel: Sunbury 86649.

OXFORDSHIRE

Oxfordshire Microcomputer Club. £5.00 p.a. Contact: S. C. Bird, 139 The Moors, Kidlington, Oxford OX5 2AF Tel: Kidlington (08675) 6703.

Microsoc the Oxford University micro group holds shared meetings with the Oxford Microcomputer Club. Contact: M. Bourla, St. John's College, Oxford.

SURREY

Richmond Computer Club. Held the second Monday of each month at the Richmond Community Centre (20p per meeting), members have the use of a good range of equipment. Contact: Robert Forster, 18a The Barons, St. Margarets, Twickenham, Middx (01-892 1873).

Surrey Microprocessor Society. (SUMPS) Covering Surrey plus bits of South London and other adjacent counties. Anyone interested in joining, call Mike on 01-642 8362.

WARWICKSHIRE

ACC (Midland) Group. They meet every 3rd Saturday in room P109 at Lanchester College, Coventry . . . no sub, no magazine. Contact: Roy Diamond (Chairman), 27 Loweswater Road, Coventry, Warks (0203 454061).

WEST MIDLANDS

Research Machines 380Z. West Midlands User Group. Further details from: Peter Smith, Birmingham Educational Computing Centre, Camp Hill Teachers Centre, Stratford Road, Birmingham, B11 1AR. Tel: 021 772 6534.

West Midlands Amateur Computer Club. Meets the 2nd & 4th Tuesday of each month, usually at Elmfield School, Love Lane, Stourbridge, West Midlands. Annual sub is £3 (£2 if full time student). . . visitors welcomed without obligation. For more information contact John Tracey of 100 Booth Close, Kingswinford, West Mids (0384 70097).

Compukit User Club. Details, contact S.H. Grisvenor Esq., 11 Bernard Road, Oldbury, Warley, West Midlands (021-422 3298).

YORKSHIRE

South Yorkshire Personal Computing Group. For details of the SYPCG, contact Tony Ryecraft, 88 Spinneyfield, Moorgate, Rotherham, 8. Yorks. (Tel: Rotherham 74889, eve).

ShIPLEY College Computer Group (Sorcerer/6800). They meet Tuesdays (software) and Wednesdays (hardware/advanced) between 7.00 & 9.00 pm. Contact Paul Channell on ShIPLEY 595731.

West Yorkshire Microcomputer Group. Formed following an inaugural meeting on October 23rd, a varied diary of events has been drawn up. For details contact the Chairman, Phillip Clark, Care Computer Services, 15 Wellington Street, Leeds LS1 4DL (0532 450667) OR the Secretary, Keith Knaggs, Price Waterhouse & Co., Leeds (0532 448741).

YOUR OWN DATA PROCESSING DEPARTMENT. FOR £570



To find out more... phone or write to:

Keen Computers

5b the Poultry, Nottingham NG1 2HW.
tel: 0602 583254
telex: 37297 (keenco)

The remarkable Sharp MZ80, representing a new concept in data processing, puts real computing power at your fingertips, for less than the price of a programmable calculator. It brings large capacity in a small package to Engineers, Research Scientists, Mathematicians and technical people – people who require on the spot processing power.

Advanced features include:

- BASIC language, providing easy programming even for those totally unfamiliar with computer operation.
- Optional Machine Language, Assembler, Editor, Loader and Debugger.
- 10in. VDU for 1000 characters or 80 x 50 high-resolution graphics.
- Storage of programs and data in a commercially available cassette recorder.
- Built-in clock.
- Editing using a cursor control.
- Internal memory expansion up to 48 K bytes of RAM.
- 50-pin universal bus connector for system expansion – printers, floppy discs etc.

The MZ80 opens the world of programming to your own fresh ideas for less than the price of a programmable calculator.

New Apple, North Star Horizon & S100 products.

APPLE IEEE488 Interface

This is a general purpose Listener/Talker/Controller type implementation for operation within the IEEE488-1978 GPIB Standard. A really superior product imported directly from the manufacturer by Keen Computers Limited.

Salient Features
Supports Daisy Chain Interrupts with on board arbitration logic. Allows DMA Daisy Chain (pass through).

Order Number: K00621A **£212.00.**

BCD A-D Converter

The converter is designed to measure an input potential between 0 and +3.999 volts and convert it to four Binary Coded Decimal numbers that your Apple II can understand.

Order Number: K00622A **£180.00.**

Arithmetic Processor

This has got to be the most exciting interface for the Apple to date. This powerful hardware floating point unit will significantly improve the execution speed of your Applesoft II programs. Decrease execution time by an order of magnitude!

To help achieve true power these additional functions have been added and are available through the USR() function:

ASIN (X), ACOS (X), COGIO (X), SINH (X), COSH (X), TANH (X), INVERSE (X), PI and several others.

All existing Applesoft II arithmetic options are still available but are now performed by the processor unit where a speed advantage is needed.

Gaining this speed has a trade in reduction of nine sig. figs. to seven but just look at the gains.

Using CCSOFT each floating point function was timed over 5000 repetitions. The following was achieved:

Function	Overhead	CCSOFT	AS II
FDIV	11.4 sec	17.6 sec	27.3 sec
SQR	13.8	17.1	248.9
TAN	13.8	28.7	244.8
ACOS	13.8	30.6	554.8

If you want increased speed then this is for you (bolt your Apple to the bench – it is that fast!) Try it – you'll like it.
Order Number: K00623A **£240.00.**

PIA Interface

This interface opens up your Apple to a variety of peripherals such as printers, paper tape equipment or another computer. It is a parallel input/output card. Apple has output parallel interfaces but there are not that many parallel input cards around. We think this is a good one. It has two 8 bit bi-directional parallel ports and four handshake lines. TTL compatible Side A and B with a CMOS Drive capability on Side A. All external lines via a DB-125 Type Connector. In our opinion a good solid interface.

Order Number: K00624A **£180.00.**

Synchronous RS232C Interface

What more need be said! Synchronous Serial interfacing has been a problem in the past. Now we have the answer. If any extra protocol is required this can easily be catered for.

DATA Transfer mode:
7 or 8 data Bits. OPP, EVEN or NO parity, 1 or 2 stop bits. Synchronous Serial by word. Serial by bit.

DATA Transfer Rates:
50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, BAUD, EXTERNAL.

PROGRAM Memory.
ROM (Mask) or PROM (Fuse Link) or RAM (Static 2112's)
NOTE: ROM/PROM Auto power down.
Order Number: K00625A **£180.00.**

Light Pen

The Symtec Light Pen is now imported by ourselves directly and is in our opinion the best light pen for the Apple. Complete with software you can now read a coordinate on the hires, page or text page. Ideal for Computer aided

graphics or simple data entry. Try one.
Order Number: K00310A **£165.00.**

PASCAL Light Pen Driver

Use the light pen in turtlegraphics with K.C.L.'s advanced library software.

Order Number: K01201A **£265.00.**

Other goodies you may not know about.

Supercolour

No colour for Apple? If you want colour now and of the highest quality then you need our Supercolour system.

Look at these features:

1. Switch selectable text colour
2. Switch selectable low res choice
3. Switch selectable Hires choice of colours
4. Black and White only switch for photographs
5. Intensity switch

Colours are sent out directly to TV, guns and hence are dense and clear. Our Supercolour KV 1400 automatically switches out UHF signals – your display is crisp and stable. When you remove the connector it automatically reverts to TV.

Designed and manufactured exclusively by K.C.L. to the highest standard. Don't miss out. Get one now and use Apple's unique colour ability.

Order Number:
K00680A (Supercolour interface) **£90.00.**
K11502A TV. (Supercolour KV1400) **£345.000.**

Micromikes Time Sharing Software

Specially designed for North Star Horizons. Five share and Four share allow you to link up to

5 or 4 terminals to your Horizon system. Special introductory offer of **£35.00.** You need some more terminals then?

We hold the following range:
Cifer 2960, Order Number: K11910T.
TVI 912, Order Number: K11800T.
TVI 920, Order Number: K11801T.
Lear Siegler ADM 31, Order Number: K11703T.
Lear Siegler ADM 3A, Order Number: K11704T.
Lear Siegler ADM 42, Order Number: K11705T.

S100 Clock Card

This 100,000 day clock/calendar card is a worthwhile addition to any North Star or other S100 system. Complete with its own rechargeable battery it is excellent in any business application.

Order Number: K11600Z. **£180.00.**

New Software Announcement Apple Pip

Would you like to rid yourself of the sickening feeling when Apple goes "Disk I/O Error"? Apple Pip is for you.

Look at the uses:

1. Recover deleted programs
2. Repair corrupt disks
3. Hide programs from Catalog
4. Edit the disk Catalog
5. Determine exact program length
6. Change DOS commands
7. Change Tokens in Basic Programs

Order Number: K011365 **£95.00.**

To find out more... phone or write to:

Keen Computers

5b the Poultry, Nottingham NG1 2HW.
tel: 0602 583254. telex: 37297 (Keenco)

DIARY DATA

DIRECT ACCESS

Glasgow, Scotland	Computermarket '80. Couchmead Ltd., 42 Great Windmill Street, London W1V 7PA. Telephone: 01-437 4187	Mar 18 - Mar 20
London, England	The Home Video Show. "The Home Video Show", Link House Magazines (Croydon) Ltd, Pembroke House, Wellesley Rd., Croydon CR9 2TA. Tel: 01-686 7181	March 21 - March 25
London, England	Computermarket '80. Couchmead Ltd., 42 Great Windmill Street, London W1V 7PA. Telephone: 01-437 4187	Mar 25 - Mar 27
London, England	Viewdata '80 Exhibition. Online Conferences Ltd., Cleveland Road, Uxbridge, UB8 2DD. Tel: 0895 39262	Mar 26 - Mar 28
Brighton, England	Computer Aided Design Conference & Exhibition. Iliffe Promotions Ltd., Dorset House, Stamford Street. London SE1 9LU. Tel: 01-261 8000	Mar 31 - Apr 2
Harrogate, England	Mini/Micro Computers, Word Processors and Business Machines Exhibition - BIZTRONIC. Groundrule Exhibition Co., 7 Market Street, Altrincham, Cheshire, WA14 1QW. Tel: 061-928 0406	April 15 - April 16
Plymouth, England	S.W. Business Efficiency and Office Equipment Exhibition, Gwen Shillaber Design, 13 Alma Vale Road, Clifton, Bristol, BS8 2HL. Tel: 0272 312850	April 15 - April 17
London, England	Peripherals '80 Exhibition. Iliffe Promotions Ltd., Dorset House, Stamford Street, London SE1 9LU. Tel: 01-261 8000.	Apr 16 - Apr 17
London, England	All Electronic Show. All Electronic Show, 34-36 High Street, Saffron Walden, Essex. Tel: 0799 22612	Apr 29 - May 1
Liverpool, England	Mersey Micro Show. Online Conferences Ltd., Cleveland Road, Uxbridge UB8 2DD. Tel: 0895 39262	April 30 - May 2
Brussels, Belgium	Compec Europe Exhibition. Iliffe Promotions Ltd., Dorset House, Stamford Street, London SE1 9LU. Tel: 01-261 8000.	May 6 - May 8
Manchester, England	Business Efficiency & Office Equipment Exhibition, Gwen Shillaber Design, 81 Whiteladies Rd., Clifton, Bristol BS8 2NT. Tel: 0272 312850	May 13 - May 15
Anaheim, USA	National Computer Conference and Exhibition (NCC). 210 Summit Ave., Montvale, NJ 07645	May 19 - May 22
Dallas, USA	Int. Telecommunications Exbn - INTELCOM. Horizon House - Microsil Inc., 25 Victoria Street, London SW1H OEX. Tel: 01-222 0466	May 19 - May 23
London, England	International Word Processing Exhibition and Conference. Business Equipment Trade Association, 109 Kingsway, London WC2B 6PU. Tel: 01-405 6233	May 20 - May 23
Dublin, Ireland	International Computing Exhibition - COMPUTEX. SDL Exhibitions Ltd., 68 Fitzwilliam Square, Dublin 2, Ireland. Tel: Dublin 763871	June 17 - June 19
Geneva, Switzerland	International Microcomputers, Minicomputers, Microprocessors & Data-communications Exhibition - IMMM/DATACOMM. Kiver Communications S.A., 171/185 Ewell Road, Surbiton, Surrey. Tel: 01-390 0281	June 17 - June 19
Newcastle-Upon-Tyne, England	Mini/Micro Computers, Word Processors and Business Machines Exhibition - BIZTRONIC. Groundrule Exhibition Co., 7 Market Street, Altrincham, Cheshire, WA14 1QW. Tel: 061-928 0406	July 3 - July 4

TRANSACTION FILE

For sale

Powertran Comp-80 . . . 5K RAM BASIC, full graphics and plotting. TV Monitor; cassette recorder; metal case. Offers around £250. Tim Brown on Stafford 850244.

New professional ASCII keyboard . . . KB756. £40 or best offer. Andy Robson, 40 Loveridge Ave, Chanterland, Hull. 0482 443316 (after 4pm).

Shugart SA400 . . . pair, £295. 020-881 3649 after 6pm

Teletype ASR33-20ma current loop . . . Auto stop/start reader punch. Good cond., all manuals & logics, pedestal. £375 ono. 01-543 2430 (evenings)

Superboard II . . . PSU, modulator, case, 7K user RAM, extended monitor, cursor control utilities & other software (games etc.) Modified cassette interface, switchable baud rate - 300/600. £230 ono. 051-487 9586.

Sinclair Enterprise programmable . . . 79 steps, 7 memories, trigs, logs etc. Full program library, mains adaptor & instruction manual. £10 ono - first over £12 takes the lot (£11 if you'll collect). H L Thomas, Plasparcraig, St Clears, Carmarthen, Dyfed SA33 4DW.

Teletprinter, Creed 75 . . . with tape punch, teletype tape reader and rolls of paper. £40 or will exchange for good ASCII keyboard, video board or WHY 0274 47235.

MK-14 . . . with extra RAM, manual & Science of Cambridge mains adaptor, £45 ono. D J Nutley, 13 Sycamore Rd, Bishop's Waltham, Hants.

ITT 2020 . . . 16K, Palsoft, colour modulator, 4 months old, perfect. Includes tapes and Microchess. £720. 051-334 2405 (evenings).

Compukit UK101 . . . 7K RAM, cased, £320 ono. Hemel Hempstead 3040 (evenings).

MK-14 . . . complete & socketed with new VDU & character generator, edge connector, graphics, modulator etc. New RAM I/O, Univac 45 keypad plus original keyboard, £65. 0282 67677.

MK-14 . . . PSU, 640 Bytes, I/O chip, single stepping, cassette interface, £50 ono. Buyer collects. Ilminster 3301.

TRS80 . . . 16K, Level II, Video, Cassette, Manual & 3 programs, £570 ono. Medway 31757 after 7.30 pm.

Cipher Cub VDU . . . nearly new, £250. Upper/lower case, RS232/V24, switchable baud rate etc. Leatherhead 74674.

TRS-80 Level I . . . 4K RAM, VDU, cassette etc. Boxed, as new £300 ono. 0438 52901 (after 6pm).

SWTPC 6800 . . . 24K RAM, triple floppy, IBM Selectric printer, FLEX & INDEX DOS, lots of tape & disc software, extras. Will deliver, £1500 the lot or will split - offers? 097-081 267.

PET 2001-8 . . . Fitted upgrade ROM, manuals, many programs (utilities and games), £475. 0253 869108 (evenings/weekends).

Nascom 1 . . . cassette, case, PSU, B-Bug, BASIC, approximately 60 taped programs, £375. Buckfastleigh 2383.

NASCOM 1 . . . PSU, documentation, software, spares, cased, £200. P Watson. Oakley 2867.

Heathkit 5" oscilloscope (IO18U) . . . Will swap for a well-constructed or unopened Nascom 1 kit. Keith on 0635 63074.

Compukit UK101 . . . 8K memory, 8K Microsoft BASIC, full documentation, games tape, built, Kansas City interface, £300. 0274 27635 or 29 Wingfield Mount, Bradford, West Yorkshire.

TRS 80 Level II . . . (new Oct), 16K, numeric pad, VDU, cassette, tapes/books, £495. 01-989 0430.

MK-14 . . . improved keyboard, power supply, cassette interface programs & manuals, £65. 02357 4753 (weekends or after 5pm).

Aim 65 . . . 3K RAM, PSU, edge connectors, thermal paper, some software - Pilot, Chess & Utilities. Offers around board only price. Chelmsford 351704 (evenings).

Nascom I . . . PSU, monitor. Any reasonable offer. Electronic organ, switch selectable string, brass or wind, £220 ono. 061-225 9951 after 6pm.

Exidy Sorcerer . . . 32K, S100 expansion box, reverse video, colour graphics & full manuals. Most currently available software. £850. Pete Scargill, Newcastle upon Tyne 573905 after 6pm.

PSU bits, 5V 5A . . . 100VA transformer, 12A bridge, 15000 microfarad 16V electrolytic, 78H5 5A regulator. All used but in good nick - £12 ono. 6800 CPU chip, £5 ono. 9112 (same as 2112) 256x4 RAMS (suit 77-68) - £1.25 each. Phone Weymouth

73426 (office hours) or call in at 44 Leamington Road, Weymouth (evenings & weekends). Ask for Mr. K Morris.

2102 RAMS . . . tested and unused, 50p each. Phone E. Badcock on 0793 721627.

ICL high speed tape punch . . . 110cps, very compact, vgc - £40 ono. Also electronic tape feeder, prevents jamming, use with punch and readers, vgc, £20 ono. Ring 061-761 4566 after 6.

Casio FX502P . . . Casio FA-1 cassette interface, Masterpac user manual & program library, cassette recorder, all as new £100. Greenwood, Skipton 60811
Programming the 6502 by Rodnay Zaks. Will swap for a good BASIC manual. B Shuttleworth 061-643 3196.

Wanted

NCR 500 program display panel . . . phone 01-866 1179 (evenings/weekends).

PCW Vol 1 numbers 9 and 10 . . . phone Greg McNelly after 5pm Taunton 88844.

Kim owner . . . living near Dewsbury, West Yorkshire. Purpose: to assist me with the cheap video cookbook. D Goodall Dewsbury 450185.

Cont. from page 52

loop, the last value accepted is loaded into the scanner and the output is checked to see whether the switch is still in the same position. Only if it isn't does the system make a complete scan.

Since flexibility had to be the keynote of the 5602's design, it was recognised very early that some means of allowing changes to the selection methods needed to be found which was both quick and easy. The solution adopted, while appearing very complex, was quite simple to implement; it was a minute part of the total design effort. To define a code, one draws a diagram like a flowchart, showing what sequence of actions must be followed; this diagram is then translated into a language called "ELIC". The source code is then processed by a program to produce a binary version which is loaded into PROM with the rest of the 5602's software. Figure 4 shows a code diagram and the ELIC code produced. It is hoped that the design of ELIC will allow the more intelligent users to design their own methods of selection to optimise their rate of input.

Given the ELIC approach, the processing of the input switches

becomes merely one of interpreting the ELIC code — just as a "BASIC" interpreter does with BASIC. In fact, it takes less than 600 bytes of code.

The text manipulation part of the software is at a fairly primitive level because we are still investigating certain aspects of user's requirements. When the "phrase store" feature was being specified, for example, we initially thought of having about 200 phrases. However, after discussions with teachers, we realised that this would be useless since the average teenager's vocabulary is nearer 4,000 words and to remember 200 codes is an almost impossible task. There is also the problem of displaying the available phrases when a large number of alternatives exist in the store.

A similar situation arises when considering an editor package. It obviously can't be a line-oriented one, because of the different lengths of lines (typewriter and VDU) that will be in use — indeed, in "store" mode there won't be any lines until the text is dumped. A screen-orientated editor presupposes a VDU which, in these days of Government cutbacks, is far from certain to be available to all users. We are considering a context editor which operates on words, sentences and paragraphs, but whether it will be easy to use is, as yet, unknown.

Future developments

Micro Design and Electraid are planning to evolve the 5602 along a wide front. In the short term, a printer is under development which will eventually replace the typewriter as the hard-copy device. Called "MDE-132", this will be able to print text at any size between 1/16" and 2" and will be, like the VDC, particularly valuable for children or the partially sighted. It will use the RS-232 standard and will be available with proportional spacing and graphics capability at a later date.

In the longer term, it's planned to implement a BASIC interpreter on the 5602 and provide a mass-storage system, probably using floppy-discs. When these are available, the 5602 system will span a huge spectrum of needs; from simple to very sophisticated. In addition, thought is being given to "shared logic" systems, in which one 5602 would be shared by a whole class of disabled children — each having his own input switches and VDU. It may also be possible to develop a portable version with speech synthesis.

Why haven't we waited for the day when speech recognition becomes commonplace? Two simple reasons; first, disabled people need help now, and second, some of the users of this system are totally without speech.



New Bear Systems

MICROCOMPUTERS

SHARP MZ - 80K
APPLE II
HORIZON

Plus: Printers & Terminals

NEWBEAR BOOKS

The widest range of MICRO-COMPUTER BOOKS in the U.K.
Visit our MANCHESTER Showroom for a browse, or contact us for our Booklist.

Open Mon-Sat 9.00-5.30 Late opening Thurs 9.00-8.00
callers welcome

NEWBEAR COMPONENTS

ELECTRONIC COMPONENTS	Micro Computer Kits:
VERO PRODUCTS	ACORN
TOOLS	NASCOM
74LS SERIES LOGIC	77-68
BOXES	S100BUS ITHACA AUDIO
KEYBOARDS	DISK DRIVES
DATABOOKS	

Barclaycard & Access welcome.

Mersey House, 220-222 Stockport Road,
Cheadle Heath, Stockport. 061 491 2290.

DO YOU HAVE A NASCOM 1 or a NASCOM 2? SUPERBOARD? COMPUKIT UK101?

Try the SMART series of memory expansion boards.

Updated SMART 1 for the NASCOM's
Kit only £69.95

New SMART 2 for Superboard/UK101
Kit only £99.95

All come with full documentation
Prices do not include p&p
VAT extra (regrettably)

Send your orders or sae for more details to:

**Mike Dennis, Blackberries, Sheriffs Lench,
Evesham, Worcs**

Or ring (0386) 870841 between 6pm and 7pm

*Other SMART boards under development.
Also Apple/ITT software packages*

MICROMART

SURPLUS EQUIPMENT MUST GO

Heath WH14 Printer,
built and tested 360.00
Teletype ASR 33 (with tape read
and punch) recently refurbished £300.00
S.S.M. 104 S100 2 serial/4 parallel
20ma + RS232, built and tested 90.00
S.S.M. S100 Extender Board 8.00
Exidy Sourcerer 32K + S100 850.00
Expansion Box o.n.o
Sinclair Mk14 Boxed with P.S.U
and decent keyboard 30.00
Vero S100 W.W. bare board 8.00
Newbury Labs professional 80 x 21
VDU 110/300 Baud, RS232 180.00
TASA ASCII Touch
Keyboard uc/lc 32.00

Attention Micropolis Mod II owners
Phone for details of Users Club.

Phone 0670 822790/733125

PET EDITOR

Provides full creation and editing of
symbolic text or data files, etc, using

12 POWERFUL COMMANDS
including; CREATE, EDIT, FIND,
REPLACE, INSERT, MOVE, TAB,
etc.
(SAE for full software list.)

On cassette

CIRCLE £20.00
SOFTWARE + VAT

(State old/new ROM + size)

33 Restrop View, Purton, Swindon,
Wilts. SN5 9DG.



SUPERSOFT

STILL SMALL ENOUGH TO CARE !

Our new FREE catalogue lists
38 PET programs from £1-£12

Many of our 17 utility programs are only
available from us, and as for games, AIR
ATTACK at £3 includes a free overlay which
brings colour to your screen ! Blank RACAL
cassettes are £4.50 for ten C.12's.

SUPERSOFT 28 Burwood Avenue, Pinner, Middx

***** STOP PRESS *****
BUSINESS PROGRAMS TO ORDER - PET AND TRS80

Modata

30 ST. JOHNS ROAD
TUNBRIDGE WELLS
KENT

Telephone: Tunbridge Wells (0892) 4155

DIGITAL MICROSYSTEMS
LOW COST BUSINESS COMPUTERS

DSC-2

ONE to 29 MEGABYTES DISK STORAGE
64 Kbytes of Main Memory - STANDARD
Digital Research CP/M operating system -
STANDARD
TEXT PROCESSING BASIC, COBOL,
FORTRAN available

HEX-29

32 to 96 MEGABYTES DISK STORAGE
32 USER & 16 TASK capability - STANDARD
Reentrant ASSEMBLER & BASIC - STANDARD
Floppy disk based development system
available

MODATA still need DEALERS in parts of U.K and IRELAND

```

370 IF C<H THEN F2=1
375 IFF2=0 AND CN=1 AND H<D5 THEN FOR D=1 TO 500 NEXT PRINT "MI NEEDED THAT!" : F2=1
980 PRINT D$ "***** ANOTHER GAME ('Y' OR 'N') : INPUT G$: IF G$="Y" GOTO 240
990 IF G$="N" GOTO 980
995 PRINT D$ "SOUR GRAPES! SO TURN ME OFF!" : END
1010 PRINT " " SPC(17) " "
1020 FOR J=1 TO 3 PRINT SPC(17) " "
1030 FOR K=1 TO 4 PRINT SPC(17) " "
1040 PRINT SPC(17) " "
1050 PRINT SPC(17) " "
1080 IF F3=1 GOTO 1095
1090 IF H<D0 THEN PRINT "***** I HAVE LEARNED
1091 IF H=1 THEN PRINT "***** BAD MOVE.
1092 IF H=2 THEN PRINT "***** ANOTHER ONE!
1093 IF H=3 THEN PRINT "***** BAD MOVES.
1094 IF H=4 THEN PRINT "***** THE HARD WAY!
1095 RETURN
1120 BE$="***** ***** ***** *****
1130 BU$="*****" : H$="*****"
1140 IF TU=H THEN W=XI-XF+2
1150 IF TU=0 THEN BU$=BD$ : H$=C$
1160 PRINT BP$ : FOR YD=3 TO 1 STEP -1 FOR XD=1 TO 3
1165 IF XD<XI OR YD<YI THEN PRINT "*****" : GOTO 1250
1170 PRINT BE$ BU$ MID$(BL$, W, W+XD) : GOTO 1260
1250 NEXT XD : PRINT BD$ BL$ : NEXT YD
1260 RETURN
1310 PRINT "***** HEXAPAWN IS PLAYED WITH CHESS PAWNS ON
1320 PRINT "***** A 3 X 3 BOARD. YOUR PAWNS ARE WHITE.
1330 PRINT "***** TO ENTER A MOVE, TYPE THE NUMBER OF THE
1340 PRINT "***** SQUARE YOU WISH TO MOVE FROM, A COMMA,
1350 PRINT "***** AND THE NUMBER OF THE SQUARE YOU WISH TO
1360 PRINT "***** MOVE TO. FOR EXAMPLE (2,5). THE SQUARES
1370 PRINT "***** ARE NUMBERED LIKE THE KEYBOARD." : PRINT SPC(16) "*****"
1380 PRINT SPC(16) "***** 7 8 9 *****" : PRINT SPC(16) "*****"
1385 PRINT SPC(16) "***** 4 5 6 *****" : PRINT SPC(16) "*****"
1390 PRINT SPC(16) "***** 1 2 3 *****" : PRINT SPC(16) "*****"
1390 PRINT SPC(7) "***** PRESS 'SPACE' TO TURN PAGE." : WAIT 59410.4,4
1400 PRINT "***** TO WIN, MOVE ONE OF YOUR PIECES TO THE
1410 PRINT "***** OPPONENT'S SIDE OF THE BOARD FIRST.
1420 PRINT "***** CAPTURE ALL OF THE OPPONENT'S PIECES, OR
1430 PRINT "***** BLOCK HIM FROM MAKING ANY MOVE.
1440 PRINT "***** THE COMPUTER STARTS A SERIES OF GAMES
1450 PRINT "***** KNOWING ONLY HOW TO MOVE AND HOW TO
1460 PRINT "***** RECOGNIZE A WIN. IT HAS NO INITIAL
1470 PRINT "***** STRATEGY, BUT IT KEEPS A RECORD OF ALL
1480 PRINT "***** BAD MOVES AND IMPROVES ITS STRATEGY
1490 PRINT "***** UNTIL IT BECOMES INVINCIBLE.
1500 PRINT SPC(7) "***** PRESS SPACE TO START GAME." : WAIT 59410.4,4 : PRINT "*****" : GOTO 1050

```

Pascal, cont. from p. 96

```

125: REPEAT
126: READLN(INFILE);
127: I := 1;
128: REPEAT
129: READ(INFILE, BUFFER[I]);
130: I := I + 1;
131: UNTIL EOLN(INFILE)
132: UNTIL EOP(INFILE) OR (LENGTH(BUFFER) > 0);
133: FOR J := 1 TO MAXLINE DO BUFFER[J] := ' ';
134: END; (*FREADLN*)
135:
136: PROCEDURE FWriteln(VAR OUTFILE : TEXT; BUFFER : STRING);
137: (*WRITELN BUFFER TO OUTFILE*)
138: VAR I, J : 1..MAXLINE;
139: BEGIN
140: FOR I := 1 TO LENGTH(BUFFER) DO WRITE(OUTFILE, BUFFER[I]);
141: WRITELN(OUTFILE);
142: END; (*FWriteln*)
143:
144: PROCEDURE FLUSH (VAR BUFFER : STRING);
145: (*OUTPUTS SPACING BLANK LINES, FLUSHES BUFFER AND THEN FILLS WITH SPACES*)
146: VAR I : INTEGER;
147: PROCEDURE LINESPACING;
148: VAR I : 2..10;
149: BEGIN
150: IF USERFORMAT.SPACING > 1
151: THEN
152: FOR I := 2 TO USERFORMAT.SPACING DO
153: BEGIN
154: WRITELN (OUTFILE);
155: CURRENTLINE := CURRENTLINE + 1
156: END
157: END; (*LINESPACING*)
158: BEGIN
159: IF NOT EMPTYOUTBUFFER
160: THEN
161: BEGIN
162: FWriteln (OUTFILE, BUFFER);
163: CURRENTLINE := CURRENTLINE + 1;
164: LINESPACING
165: END;
166: FOR I := 1 TO MAXLINE DO BUFFER [I] := ' ';
167: EMPTYOUTBUFFER := TRUE
168: END; (* FLUSH*)
169:
170: FUNCTION COMMAND : BOOLEAN;
171: (* TRUE IF IN BUFFER IS A COMMAND AND FALSE OTHERWISE *)
172: BEGIN
173: COMMAND := INBUFFER[1] = '.'
174: END; (* COMMAND *)
175:
176: PROCEDURE OBEY (VAR INBUFFER, OUTBUFFER : STRING; VAR EMPTYINBUFFER,
177: EMPTYOUTBUFFER : BOOLEAN; VAR FORN : FORMAT);
178: (* CARRIES OUT FORMATTING COMMANDS *)
179:
180: VAR VALID : SET OF CHAR;
181: I : INTEGER;
182:
183: FUNCTION PARAMETERS (BUFFER : STRING) : BOOLEAN;
184: BEGIN
185: PARAMETERS := LENGTH(BUFFER) > 2
186: END; (* PARAMETERS *)
187:
188: FUNCTION NEXTPARAMETER (START : INTEGER) : INTEGER;
189: VAR I, NUM : INTEGER;
190: BEGIN
191: I := START;
192: WHILE INBUFFER[I] = '.' DO I := I + 1;

```


MICROMART

SOFTWARE FOR THE NEW ROM PETS

COMMAND KEY

A 300 byte machine-code routine that turns the shift key into a command key when used outside quotes. Single key entry of BASIC words. Squeeze complex IF & DEF's onto one line. Logical layout with template provided. Also gives optional repeating keys and a one-key monitor call.

£3.50

LIBRARIAN

Keeps a commented catalogue with fast-forward location of all subsequent programs on a tape. New programs of any length can be added at any time. Not a tutorial - ready to run.

£4.50

PALETTE

Four fast machine-code subroutines in one program to fit in the second cassette buffer. Set or clear a quarter pixel, instant screen reverse, block transfer and screen wash.

£3.50

Mail order only. Send or phone for free list.

MYCROFT

262 Francis Chichester Way, London SW11 5HY,
Tel: 01-720 0991

TRS80 or PET 16K 'THE ANTIQUE GAME'

A realistic instructional business simulation including auctions, realistic pricing from £50 to £5,000. Stolen property. Thousands of different items to buy and sell. Interesting characters to deal with. One to four players.

Price £15 inclusive
(VAT, post and packing.)
from

Island Software
132 Ashleydown Road, Bristol 7.
Telephone enquiries to:
0272 513121

PETS!

Pets - new for old, part exchange your faithful Pet for a new model. We stock Commodore or Computhink discs, PET printers and teletypes etc.

We also buy used Pets and peripherals for cash.

HORIZONS!

32K static memory (the best) 2 double density discs (2 serial and 1 parallel port) from £1999

HIRE!

PET 8K £4.75 per day
PET 32K £6.95 per day
Teletype 43 £6.00 per day
HORIZON P.O.A.

HIGH QUALITY CASSETTES!

C15 41p C30 55p including VAT
Post 20p
Orders over £4.00 free postage
Contact
Richard Mortimore or Chris Phelps
at

MICRO - FACILITIES
01-979 4546/941 1197

EPROM PROGRAMMING POSTAL SERVICE FOR 2708 and 2716

From your Hex listing: £9 + VAT (2708)
£18 + VAT (2716)

From your Master Prom: £2.50 + VAT
Editing at pro-rata rates

(Prices include p/p and assume you supply the device to be programmed, we can supply the device however at reasonable extra cost).

WRITE FOR FURTHER DETAILS TO:
Chromatec Video Products Ltd.,
10 Barley Mow Passage, Chiswick,
LONDON W4

```
193: NUM := 0 ;
194: WHILE INBUFFER[I] <> ' ' DO
195: BEGIN
196:   NUM := 10 * NUM + (ORD(INBUFFER[I]) - ORD('0')) ;
197:   I := I+1
198: END ;
199: NEXTPARAMETER := NUM
200: END ; (* NEXTPARAMETER *)
201:
202: PROCEDURE BLANK (VAR EMPTYOUTBUFFER : BOOLEAN) ;
203: VAR I : INTEGER ;
204: BEGIN
205:   FLUSH (OUTBUFFER) ;
206:   IF PARAMETERS (INBUFFER)
207:   THEN
208:     FOR I := 1 TO NEXTPARAMETER(3) DO
209:     BEGIN
210:       WRITELN (OUTFILE) ;
211:       CURRENTLINE := CURRENTLINE + 1
212:     END
213:   END ; (* BLANK *)
214:
215: PROCEDURE CENTERED (VAR EMPTYOUTBUFFER : BOOLEAN) ;
216: VAR I, START, CENTRE : INTEGER ;
217: BEGIN
218:   FLUSH (OUTBUFFER) ;
219:   FREADLN (INFILE, INBUFFER) ;
220:   CENTRE := (USERFORMAT.RIGHTMARGIN - USERFORMAT.LEFTMARGIN) DIV 2 ;
221:   IF LENGTH (INBUFFER) >= CENTRE*2
222:   THEN START := USERFORMAT.LEFTMARGIN
223:   ELSE START := CENTRE - (LENGTH (INBUFFER) DIV 2) ;
224:   FOR I := 1 TO LENGTH (INBUFFER) DO
225:     OUTBUFFER[START+ I] := INBUFFER[I] ;
226:   EMPTYOUTBUFFER := FALSE ;
227:   FLUSH (OUTBUFFER)
228: END ; (* CENTERED *)
229: PROCEDURE NUM ;
230: BEGIN
231:   USERFORMAT.NUMBER := TRUE ;
232:   IF PARAMETERS (INBUFFER) THEN USERFORMAT.PAGENUMBER := NEXTPARAMETER(3)
233: END ; (* NUM *)
234:
235: PROCEDURE MARGIN ;
236: BEGIN
237:   FLUSH (OUTBUFFER) ;
238:   WITH USERFORMAT DO
239:   BEGIN
240:     LEFTMARGIN := NEXTPARAMETER(3) ;
241:     RIGHTMARGIN := NEXTPARAMETER(6) ;
242:     IF LEFTMARGIN + 20 >= RIGHTMARGIN THEN RIGHTMARGIN := LEFTMARGIN
243:     + 20
244:   END ; (* MARGIN *)
245:
246: PROCEDURE PARAGRAPH (VAR EMPTYOUTBUFFER : BOOLEAN) ;
247: VAR I, SKIPLINES : INTEGER ;
248: BEGIN
249:   FLUSH (OUTBUFFER) ;
250:   IF PARAMETERS (INBUFFER)
251:   THEN
252:     BEGIN
253:       USERFORMAT.INDENT := NEXTPARAMETER(3) ;
254:       SKIPLINES := NEXTPARAMETER(6) ;
255:       FOR I := 1 TO SKIPLINES DO WRITELN (OUTFILE)
256:     END
257:   ELSE
258:     BEGIN
259:       USERFORMAT.INDENT := 5 ;
260:       WRITELN (OUTFILE)
261:     END
262:   END ; (* PARAGRAPH *)
263:
264: PROCEDURE JUST ;
265: BEGIN
266:   USERFORMAT.JUSTIFY := TRUE ;
267:   USERFORMAT.FILL := TRUE
268: END ; (* JUST *)
269: PROCEDURE UNFILL ;
270: BEGIN
271:   USERFORMAT.FILL := FALSE ;
272:   USERFORMAT.JUSTIFY := FALSE
273: END ; (* UNFILL *)
274:
275: BEGIN (* OBEY *)
276:   VALID := ['B', 'C', 'F', 'I', 'J', 'L', 'M', 'N', 'O', 'P', 'R', 'S', 'U'] ;
277:   IF INBUFFER[2] IN VALID
278:   THEN
279:     WITH USERFORMAT DO
280:     CASE INBUFFER[2] OF
281:     'B' : BLANK (EMPTYOUTBUFFER) ;
282:     'C' : CENTERED (EMPTYOUTBUFFER) ;
283:     'F' : FILL := TRUE ;
284:     'I' : INDENT := NEXTPARAMETER(3) ;
285:     'J' : JUST ;
286:     'L' : LINES := NEXTPARAMETER(3) ;
287:     'M' : MARGIN ;
288:     'N' : NUM ;
289:     'O' : NUMBER := FALSE ;
290:     'P' : PARAGRAPH (EMPTYOUTBUFFER) ;
291:     'R' : JUSTIFY := FALSE ;
292:     'S' : SPACING := NEXTPARAMETER(3) ;
293:     'U' : UNFILL
294:     END (* CASE *)
295:   ELSE
296:     BEGIN
297:       STWRITE (INBUFFER) ; WRITELN (' NOT RECOGNIZED')
298:     END ;
299:     FOR I := 1 TO MAXLINE DO INBUFFER[I] := ' ' ;
300:     EMPTYINBUFFER := TRUE
301:   END ; (* OBEY *)
302:
303: PROCEDURE FILLOUT (VAR INBUFFER, OUTBUFFER : STRING ; VAR EMPTYINBUFFER,
304:   EMPTYOUTBUFFER : BOOLEAN) ;
305: (* TRANSFERS WORDS FROM INBUFFER TO OUTBUFFER UNTIL OUTBUFFER IS FULL *)
306: VAR POINTER : INTEGER ;
307: START : 0..MAXLINE ;
308:
309: PROCEDURE STARTINGPOINT ;
310: VAR I : INTEGER ;
311: BEGIN
312:   IF EMPTYOUTBUFFER
313:   THEN
```

MICROMART



COMMODORE PET SPECIALISTS

We stock the Commodore range of equipment and have a large selection of high quality software to go with it. We also have programming facilities and fast reliable maintenance support. In stock is a selection of secondhand and ex. demonstration machines all guaranteed.

Give us a call first to see what we have to offer.

DAVINCI COMPUTERS LTD.
Tel: 01-202 9630
Classic Offices
Rear of Classic Cinema
Hendon Central
London NW4.

RESEARCH MACHINES 380Z SOFTWARE

Startrek	Maze	Pattern
Pontoon	Cubic	generator
Poker	O & X	Type
Roulette	Draughts	Cesil
Mastermind	Bridge	C & G
King	Lgame	Animals
Darts	Weave	Breakout
Moon	Robots	Mini Pilot
Othello	Traverse	Life
Polyfit	Hangman	Forth
Ffit	Gomoko	CHESS
Plot	Patterns	
Newton	Fruit	
Simult. eqn	Drageac	

New programs are constantly being added. Send SAE for more details.
F. Donovan 35 St Julians Road,
St. Albans Herts AL1 2AZ

NORWICH

The computer store that puts you on
the right road

Sales, Service and Software

Professional systems and home
computers by Compucorp,
Commodore and Adler.

Commodore Software, Appointed
stockist. Pet Soft Software

COME AND SEE THE
PROFESSIONALS

SUMLOCK BONDAIN (EAST
ANGLIA) LTD
32 PRINCE OF WALES ROAD
NORWICH

Tel NORWICH (0603) 26259

DATA + =

Business Systems

Supplied and programmed to your
requirements
Buy or Lease

CENTRONICS 730
NOW IN STOCK
£525 +VAT

DATAPLUS, 67 BRIDGE STREET
MANCHESTER. M3 3BQ

Tel: 061-832 3265

A division of
Norman Green (Photo) Ltd

```
314: BEGIN
315: WITH USERFORMAT DO
316: BEGIN
317: FOR I := 1 TO MAXLINE DO OUTBUFFER[I] := ' ';
318: START := LEFTMARGIN + INDENT + 1;
319: INDENT := 0
320: END (*WITH*)
321: END
322: ELSE START := LENGTH(OUTBUFFER) + 2
323: END; (*STARTINGPOINT*)
324:
325: PROCEDURE FINDSTRING;
326: VAR FREELength: INTEGER;
327: SHORTENOUGH, ENDOFLINE, WHOLEWORD: BOOLEAN;
328: BEGIN
329: FREELength := USERFORMAT.RIGHTMARGIN - START + 1;
330: POINTER := LENGTH(INBUFFER);
331: REPEAT
332: POINTER := POINTER - 1;
333: SHORTENOUGH := POINTER < FREELength;
334: ENDOFLINE := LENGTH(INBUFFER) = POINTER + 1;
335: WHOLEWORD := INBUFFER[POINTER + 1] = ' ';
336: UNTIL (SHORTENOUGH AND (ENDOFLINE OR WHOLEWORD)) OR (POINTER = 0)
337: END; (*FINDSTRING*)
338:
339:
340: PROCEDURE MOVESTRING;
341: VAR TEMPBUFFER: STRING;
342: BEGIN
343: COPY(INBUFFER, TEMPBUFFER, 1, POINTER + 1);
344: DELETE(INBUFFER, 1, POINTER + 1);
345: INSERT(TEMPBUFFER, OUTBUFFER, START)
346: END; (*MOVESTRING*)
347:
348: PROCEDURE SETFLAGS;
349: BEGIN
350: EMPTYINBUFFER := (LENGTH(INBUFFER) = 0) OR (EOF(INFILE) AND
351: (LENGTH(INBUFFER) = 1));
352: END; (*SETFLAGS*)
353:
354: BEGIN (*FILLOUT*)
355: STARTINGPOINT;
356: FINDSTRING;
357: IF POINTER > 0 THEN MOVESTRING;
358: SETFLAGS
359: END; (*FILLOUT*)
360:
361:
362: PROCEDURE ADJUST (VAR BUFFER: STRING);
363:
364: VAR POINTER, NEWPOINTER, GAP, START: 0 .. MAXLINE;
365: DIRECTION: -1 .. 1;
366: FUNCTION INRANGE: BOOLEAN;
367: BEGIN
368: INRANGE := (POINTER > START) AND (POINTER < USERFORMAT.RIGHTMARGIN)
369: AND (NEWPOINTER >= START) AND
370: (NEWPOINTER <= USERFORMAT.RIGHTMARGIN)
371: END; (*INRANGE*)
372: PROCEDURE SETUP;
373: VAR ONEWORD: BOOLEAN;
374: I: 0 .. MAXLINE;
375: BEGIN
376: GAP := USERFORMAT.RIGHTMARGIN - LENGTH(BUFFER);
377: POINTER := LENGTH(BUFFER);
378: DIRECTION := 1;
379: NEWPOINTER := POINTER + DIRECTION * GAP;
380: START := 0;
381: REPEAT
382: START := START + 1
383: UNTIL BUFFER[START] <> ' ';
384: ONEWORD := TRUE;
385: FOR I := START TO LENGTH(BUFFER) DO
386: IF BUFFER[I] = ' '
387: THEN ONEWORD := FALSE;
388: IF ONEWORD THEN GAP := 0
389: END; (*SETUP*)
390: PROCEDURE MOVECHARACTER;
391: BEGIN
392: BUFFER[NEWPOINTER] := BUFFER[POINTER];
393: BUFFER[POINTER] := ' ';
394: END; (*MOVECHARACTER*)
395: PROCEDURE PADIFSPACE;
396: BEGIN
397: IF INRANGE AND (BUFFER[NEWPOINTER] = ' ')
398: THEN IF BUFFER[NEWPOINTER + DIRECTION] <> ' '
399: THEN
400: BEGIN
401: BUFFER[NEWPOINTER - DIRECTION] := ' ';
402: GAP := GAP - 1
403: END
404: END; (*PADIFSPACE*)
405: PROCEDURE MOVEPOINTERS;
406: BEGIN
407: IF INRANGE
408: THEN POINTER := POINTER - DIRECTION
409: ELSE
410: BEGIN
411: POINTER := NEWPOINTER;
412: DIRECTION := -1 * DIRECTION
413: END;
414: NEWPOINTER := POINTER + DIRECTION * GAP
415: END; (*MOVEPOINTERS*)
416: BEGIN (*ADJUST*)
417: SETUP;
418: WHILE GAP > 0 DO
419: BEGIN
420: MOVECHARACTER;
421: PADIFSPACE;
422: MOVEPOINTERS
423: END
424: END; (*ADJUST*)
425:
426:
427: PROCEDURE CLEAR (VAR OUTFILE: TEXT; VAR OUTBUFFER: STRING;
428: VAR EMPTYOUTBUFFER: BOOLEAN);
429: VAR I, LINESLEFT: INTEGER;
430: PROCEDURE NEWPAGE (VAR CURRENTLINE: INTEGER);
431: VAR I: INTEGER;
432: BEGIN
```


MICROMART

TANDY SOFTWARE

Our best seller at the
Personal Computer World Show

STAR TREK

Now vastly improved with many
extra facilities - it's the best!

£12 post free

Full catalogue of guaranteed quality
Level II 4K 16K software on request

Kansas

Unit 3, Sutton Springs Wood,
Chesterfield. Tel: (0246) 850357

Phone anytime - Return post service.

EXIDY SORCERER

in the
MIDLANDS

contact

Midland Microcomputers
Nottingham (0602) 298281
for all your hardware and
software requirements.

Vets for Pets

Anita Electronic Services (London) Ltd.
are specialists in the repair and service of
Commodore Pets.

We offer a fast on-site service, or alternatively repairs can be carried out at our workshops should you wish to bring in your Pet.

Pet maintenance contracts are available at very competitive prices. Trade inquiries welcomed.

For further information, tel or write to:

John Meade
Anita Electronic Services
15 Clerkenwell Close, London EC1
01-253 2444

We also specialise in the repair of all makes of office equipment.

A COMPILER FOR TRS-80® BASIC

Southern Software ACCELERATOR
speeds execution of BASIC programs
by compiling the common statements
to Z80 machine-code.

- Develop and debug normally.
- Compile for production work.

Properly - structured, error-free
level 2 programs only. £19.95

SOUTHERN SOFTWARE, PO Box 39
Eastleigh Hants. SO5 5WQ

```
433: WITH USERFORMAT DO
434: BEGIN
435:   FOR I := 1 TO 3 DO
436:     WRITELN (OUTFILE) ;
437:   IF NUMBER
438:     THEN
439:     BEGIN
440:       FOR I := 1 TO RIGHTMARGIN - 7 DO
441:         WRITE (OUTFILE, " ");
442:         WRITELN (OUTFILE, "PAGE ", PAGENUMBER) ;
443:         PAGENUMBER := PAGENUMBER + 1
444:       END
445:     ELSE WRITELN (OUTFILE) ;
446:     WRITELN (OUTFILE) ; WRITELN (OUTFILE) ;
447:     CURRENTLINE := 3
448:   END (* WITH*)
449: END ; (* NEWPAGE *)
450: BEGIN (* CLEAR *)
451:   WITH USERFORMAT DO
452:   BEGIN
453:     IF (CURRENTLINE + SPACING) >= (LINES - 2)
454:       THEN
455:       BEGIN
456:         LINESLEFT := LINES - CURRENTLINE ;
457:         FOR I := 1 TO LINESLEFT DO WRITELN (OUTFILE) ;
458:         NEWPAGE (CURRENTLINE)
459:       END ;
460:     FLUSH (OUTBUFFER)
461:   END (*WITH*)
462: END ; (* CLEAR *)
463:
464: BEGIN (* TEXTFORMAT *)
465:
466:   USERFORMAT := STANDARD ;
467:   WITH USERFORMAT DO
468:   BEGIN
469:     CURRENTLINE := 1 ;
470:     EMPTYINBUFFER := TRUE ;
471:     EMPTYOUTBUFFER := TRUE ;
472:     WHILE NOT EOF (INFILE) DO
473:     BEGIN
474:       FREADLN (INFILE, INBUFFER) ;
475:       EMPTYINBUFFER := LENGTH(INBUFFER)=0 ;
476:       IF COMMAND
477:       THEN OBEY (INBUFFER, OUTBUFFER, EMPTYINBUFFER, EMPTYOUTBUFFER,
478:         USERFORMAT) ;
479:       WHILE NOT EMPTYINBUFFER DO
480:       BEGIN
481:         IF FILL OR EMPTYOUTBUFFER
482:         THEN FILL (INBUFFER, OUTBUFFER, EMPTYINBUFFER,
483:           EMPTYOUTBUFFER) ;
484:         IF NOT EMPTYOUTBUFFER AND ((NOT EMPTYINBUFFER)
485:           OR EOF(INFILE) OR NOT FILL)
486:         THEN
487:         BEGIN
488:           IF EOF(INFILE) AND EMPTYINBUFFER THEN JUSTIFY:=FALSE;
489:           IF JUSTIFY THEN ADJUST (OUTBUFFER) ;
490:           CLEAR (OUTFILE, OUTBUFFER, EMPTYOUTBUFFER)
491:         END
492:       END
493:     END (* WITH *)
494:   END ; (* TEXTFORMAT *)
495:
496:
497: BEGIN (* MAIN PROGRAM *)
498:   STANFORMAT (STANDARD) ;
499:   REPEAT
500:     WRITE ("FILENAME OR E TO EXIT -> ") ;
501:     READLN (INFILENAME) ;
502:     IF INFILENAME <> "E"
503:     THEN
504:     BEGIN
505:       RESET (INFILE, INFILENAME) ;
506:       WRITE ("NEW FILE NAME -> ") ;
507:       READLN (OUTFILENAME) ;
508:       REWRITE (OUTFILE, OUTFILENAME) ;
509:       TEXTFORMAT ;
510:       CLOSE (INFILE, LOCK) ; (* UCSD ONLY *)
511:       CLOSE (OUTFILE, LOCK) ; (* UCSD ONLY *)
512:     END
513:   UNTIL INFILENAME = "E"
514: END.
```

Systems, cont. from p. 86

provided as Hartford Software don't feel the package is complex enough to warrant it.

Should user corruption of a tape occur, Hartford Software will provide a replacement at nominal charge. Bugs will be fixed on a priority basis and users who have paid a user registration fee of £4 will be given preference and advised of any fault. Should a user corrupt his files, assistance will be given, although without any guarantees; also a fee would be charged.

CONNECTICUT MICROCOMPUTER WORD PROCESSOR PROGRAM

Petsoft (0635 201131) market this program designed for an 8K PET. The package costs £25 and is available both on disc and tape. The cost for the minimum hardware consisting of 8K PET disc drive/cassette and printer is £1250 for cassette based and £1990 for

disc based.

A very basic manual is included in the price which would appear to be adequate for this simple system. Petsoft will correct any bugs free of charge.

MAGIC WAND

This package is also supplied by London Computer Store (01-388 5721) as part of a complete system. It consists of a 64K Superbrain computer, dual floppy disc drives, daisywheel printer and Magic Wand software for the price of £4300.

The system is supplied with an owner's manual which covers the use of the package in great detail. It has step by step instructions which are very clear and although the tasks covered by the software are quite complex, with the use of the graduated lessons contained in the manual, they shouldn't take too long to learn.

London Computer Store offer a

MICROMART

50 HZ
SUPER BOARD
NOW FROM ONLY

£150

Plus P&P & VAT

Includes 8K BASIC, 4K RAM
KEYBOARD etc
FITTED MODULATOR EXTRA

CTS 1 Higher Calderbrook,
Littleborough, Lancs, OL15 9NL
Tel: Littleborough (0706) 79332
anytime

APPLE and PET SYSTEMS in DUBLIN

* Come and try these fine computers
in our showrooms

Sensible Software for Apple

* Sales, Creditors Ledgers; Financial
Modelling

* Educational systems in Maths,
Physics, Geography, Commerce.

S O F T E C H

SOFTECH Ltd., 51 Lr Camden St.,
Dublin 2, Ireland. Phone Dublin 784739

APPLE & ITT 2020 BUSINESS SOFTWARE

Professionally written packages now available with comprehensive manuals, built-in validity checks, interactive enquiry facilities, user options, satisfying accountancy, Inland Revenue and Customs & Excise requirements. On diskette under DOS 3.2 in Applesoft with SPACE utility. Not adaptations. Written for Apple System. Support all printer interfaces. Sales, Purchases and General Ledgers £295.00 each. Manual only £3. Payroll £375. Manual only £4. General Ledger supports Incomplete Records, Job Costing, Branch and Consolidated Accounts, etc. General Ledger Applications Manual £10. Prices exclusive of V.A.T. From our shop or your nearest stockist.

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

SUPERBRAIN

Available now. Demonstrations on
your premises. The best value
available on the market in small
business systems.

64K RAM
320K Dual Floppy
CP/M

£1950 plus VAT.

1st five orders £200 discount

ENCOTEL SYSTEMS LTD
Tel: Upper Waringham 5701
Telex: 896559

hardware maintenance contract at 12%
of the initial outlay and will replace any
disc which corrupts.

Other systems known but not evaluated:

Memec Systems Ltd. 084 421 5471
Intereurope Software Design Ltd
0734 786644
Commodore 01-388 5702
Databank Software Services
0509 217671
A. J. Harding 0424 220391

T. & V. Johnson Microcomputers
0276 62506
Optronics 01-892 8455
Stage One Computers 0202 23570
H. B. Computers Ltd. 0536 83922
Algobel Computers Ltd. 021 233 2407
Interface Software Ltd. 0276 25247
Micromedia (Systems) Ltd. 0633 63310
Katanna Management Services Ltd.
0245 76127
Sail 01-359 2818
Liveport (Exidy Sorcerer Firmware)
0736 798157

PROGRAMS

Submitting programs to PCW

Our thanks to all the readers who
responded to our recent plea for
programs. It seems that, after PET, the
next most popular machine is Comp
Shop's UK101 — we've been inundated

with programs for this. Keep sending
them in, especially if you want to prove
that *your* machine is in fact the most
popular.

Addition of sine waves on the MZ80K

by A. Tiplady

At school I was taught that all complex
waves can be built up by the addition
of simple sine waves. It takes quite an
act of faith for a schoolboy to believe
that a square wave is built up of multiple
sine waves. My scepticism was rewarded
with a homework of constructing a
sine wave and adding odd numbered
harmonics to show how it is squared
off.

I recently bought a Sharp MZ-80K
and started to learn BASIC programming.
Surprise, surprise — the first
program I have written from scratch is
to illustrate the effect of addition of
sine waves.

Up to six frequencies F1 to F6 can
be input. Their sines are generated in
lines 80, 90 and 100. Line 110 combines
these values at amplitudes decreasing

in a harmonic series. The added constant
shifts the curve to fit on the screen
with the odd 0.5 to ensure that the INT
function inherent in the SET statement
does not offset the harmonics by one
unit.

A fundamental frequency of 5 shows
just over one complete wave across the
screen. Unwanted harmonics can be discarded
by input 0.

5,0,0,0,0,0, produces a simple sine wave.
5,0,15,0,25,0 shows the odd harmonics
starting to square off the wave.

5,15,25,35,45,55 produces a credible, if
slightly "noisy" square wave as the
higher frequencies are added.

5,10,10,10,10,10 shows the cross over
distortion dreaded by all hi-fi amplifier
designers.

```
5 REM ** Sine Waves - By A.Tiplady **
10 PRINT"0":
20 PRINT"F1,F2,F3,F4,F5,F6"
30 INPUT F1,F2,F3,F4,F5,F6
40 FOR Y=0 TO 20:PRINT" ":NEXT
50 PRINT"0"
60 PRINT"*****"
70 FOR J=0 TO 79
80 A=SIN(J+F1*PI/180):B=SIN(J+F2*PI/180)
90 C=SIN(J+F3*PI/180):D=SIN(J+F4*PI/180)
100 E=SIN(J+F5*PI/180):F=SIN(J+F6*PI/180)
110 SET J,10*(A+B/3+C/5+D/7+E/9+F/11)+22.5
120 NEXT J
130 PRINT"*****"
140 A$="":GET A$:IF A$="" GOTO140
150 GOTO 10
```

Listing courtesy of Sharp Electronics (UK) Ltd

FUN & GAMES

Dodgems for UK101

by N. E. Berry

This is a micro version of the pub game,
and is ridiculously simple to play (but
very difficult to win). For those who've
never played it before, the idea is that
you drive your little man around the
course, mowing down dots and jumping
from one lane to the other at the gaps
in the walls, dodging the robot car driv-

ing the other way. You gain ten points
for each pair of dots you obliterate and
200 points for each beacon (these
appear randomly around the board).
You need 3000 points to win and there
is a time limit after which the robot gets
you and the game ends.

The controls are key 1 to move the

MICROMART

A SUPERCASE FOR YOUR SUPERBOARD!

Precision formed in super quality ABS - supports a TV Complete with all screws & holes for instant fitting
Exciting Flame Red (black base) or Ivory (brown base)

COMPUKIT model too!

Instant refund guarantee - or send for leaflet and Superboard software list

MICROCASE

15 Havelock Road
Brighton Sussex

£26 plus VAT post free
"TURNS A BOARD INTO A REAL COMPUTER"

COMPUKIT UK101 GAMES

STARTREK - LUNAR
LANDER - LIFE -
BIO-RHYTHMS

Available on cassette
£2.50 each

£4.00 for any pair

Each program will run within 4K of memory.

Dr J.B. Simpson,
18 Southdean Drive,
Hemlington, Middlesbrough,
Cleveland.

Programming in BASIC

An Intensive Weekend Course
Learn BASIC

Learn to use a variety of microcomputers. Discuss the factors involved in selecting a computer system.

DATES

* 12th-13th April 1980

* 28th-29th June 1980

* 19th-20th July 1980

at

THE HALLAM TOWER HOTEL
SHEFFIELD

FEE

Inclusive of meals and accommodation

£125

Contact:

Dean Consultancy Limited

45 Canterbury Avenue,

Sheffield S10 3RU.

Telephone (0742) 303054

Horizon Business Systems

Incomplete Records, Sales, Purchase, Nominal Ledger, Letter Writers, Stock Control, etc.

We write packaged or bespoke software for

North Star Horizon
MICOSYS LIMITED
58 High Street, Prescott,
Merseyside L34 6HQ.
Tel: 015 426 7271

PROGRAMS

```

1065 NN=NN+1: IFNN=20THENV=0
• 1070 GOTO1005
1090 IFE=53774DRE=53778DRE=53782THEN800
• 1091 IFE=53752DRE=53748DRE=53744THEN800
• 1092 IFE=53924DRE=54052DRE=54180THEN900
1093 IFE=53348DRE=53476DRE=53604THEN900
• 1095 D1=PEEK(E): POKEH, D: POKEH+1, D: POKEE, 4: POKEE+1, 4
1096 Q=01
• 1100 POKE57088, 253: IFPEEK(57088)(>)239ANDNTHENN=0: GOTO1005
1110 N=1: J=I
• 1120 IFM=1ANDPEEK(I+2)(>)187THENI=I+2: GOTO1150
1130 IFM=2ANDPEEK(I-64)(>)187THENI=I-64: GOTO1150
• 1140 IFM=3ANDPEEK(I-2)(>)187THENI=I-2: GOTO1150
1145 IFM=4ANDPEEK(I+64)(>)187THENI=I+64: GOTO1150
• 1146 M=M+1: IFM=5THENM=1: SC=SC+10
1147 GOTO1110
• 1150 IFPEEK(I-1)=4DRPEEK(I)=4DRPEEK(I+3)=4THEN2000
1151 IFPEEK(I+64)=4DRPEEK(I-64)=4THEN2000
• 1152 POKE57088, 127: IFPEEK(57088)=127THEN3000
• 1153 IFPEEK(57088)=191THEN3500
1154 IFPEEK(I)=213THENS=SC+10
• 1155 IFPEEK(I)=9THENS=SC+200: FORLL=1TO2000: NEXT
1156 POKEJ, 32: POKEJ+1, 32: POKEI, 3: POKEI+1, 3
• 1160 IFRND(8), .95THEN500
1170 GOTO1005
• 1999 REM POKE SCORE ETC.
2000 POKEI, 42: POKEI+1, 42
• 2005 SC=SC-100
• 2025 GOTO2060
2029 S=53732
• 2030 SC%=RIGHT$(STR$(SC), LEN(STR$(SC))-1)
2040 FORA=1TOLEN(SC%): POKES+A, ASC(MID$(SC%, A, 1))
• 2050 NEXT: S=53788
• 2055 RETURN
2060 IFVTHEN10
• 2065 S=53788
2070 IFSC)3000THEN2200
• 2080 POKES, 71: POKES+1, 65: POKES+2, 77: POKES+3, 69
2090 POKES+5, 76: POKES+6, 79: POKES+7, 83: POKES+8, 84
• 2099 REM IF LOSE, END. IF NOT OFFER ANOTHER GO
2100 FORLL=1TO10000: NEXT: FORLL=1TO16: PRINT: NEXT: END
• 2200 POKES, 89: POKES+1, 79: POKES+2, 85: POKES+4, 87
2210 POKES+5, 73: POKES+6, 78
• 2220 FORLL=1TO10000: NEXT: INPUT"ANOTHER GO "; A$
• 2230 ILEFT$(A$, 1)="Y"THENRUN
2240 POKES30, 0: END
• 2999 REM ROUTINE TO DETERMINE WHICH TRACK YOU'RE ON
3000 IFI=53348ORI=53476ORI=53924ORI=54052THENI=I+128
• 3010 IFI=53778ORI=53782ORI=53752ORI=53748THENI=I-4
3020 IFI=53774ORI=54180THENY=1
• 3030 IFI=53778ORI=54052ORI=53748ORI=53476THENY=2
3040 IFI=53604ORI=53744THENY=3
• 3050 GOTO1155
3500 IFI=53476ORI=53604ORI=54052ORI=54180THENI=I-128
• 3510 IFI=53774ORI=53778ORI=53744ORI=53748THENI=I+4
3520 IFI=53348ORI=53752THENY=1
• 3530 IFI=53778ORI=54052ORI=53748ORI=53476THENY=2
3540 IFI=53782ORI=53924THENY=3
• 3550 GOTO1155

```

Listing courtesy of Comp Shop.

Fox and Hounds for TRS80

L. J. Aston

This program generates a very nice draught board, upon which are placed four hounds and one fox. The object is to corner the fox. Full instructions are contained in the listing. It is fairly

easy to corner the fox with four hounds, difficult with three and, I think, impossible with two. The program requires 6K of memory and runs on a TRS80 level II.

```

• 10 CLS:PRINT:PRINT:PRINT:PRINTCHR$(23)
20 PRINT" FOX AND HOUNDS
• 30 PRINT:PRINT" LIKE INSTRUCTIONS (Y/N)";GOTO 40
40 A$=INKEY$:IF A$=""THEN 40 ELSEIFA$="Y"
• 60SUB 880
50 DIML(9,9)
• 80 Z=0:CLS:PRINTCHR$(23)
70 FORC=1TO8STEP2
80 L(1,C)=1:L(1,C+1)=2:NEXTC
• 90 FORC=1TO8STEP2
100 L(2,C)=4:L(2,C+1)=1
• 110 L(3,C+1)=4:L(3,C)=1
120 L(4,C)=4:L(4,C+1)=1

```


PROGRAMS

```
130 L(5,C)=1:L(5,C+1)=4
140 L(6,C)=4:L(6,C+1)=1
150 L(7,C)=1:L(7,C+1)=4
160 L(8,C)=4:L(8,C+1)=1:NEXTC
170 L(8,5)=3:X=8:Y=5:A=X:B=Y
180 GOSUB 820
190 PRINT@14,"C O L U M N
200 PRINT" 1 2 3 4 5 6 7 8"
210 PRINT" "+STRING$(16,176)
220 FORL=1TO8:PRINT"R"L;+CHR$(170);
230 FORC=1TO8
240 IFL(L,C)=1PRINTCHR$(191)+CHR$(191);
250 IFL(L,C)=2PRINT" H ";
260 IFL(L,C)=3PRINT" F ";
270 IFL(L,C)=4PRINT" ";
280 NEXTC
290 PRINTCHR$(149)+" R";L:NEXTL
300 PRINT" "+STRING$(16,131)
310 PRINT" 1 2 3 4 5 6 7 8
320 IFX=1THEN 790
330 IFZ=1THEN 770
340 PRINT@832," YOUR MOVE - ROW? COLUMN?
";
350 GOSUB 1110 :FORI=1TO300:NEXT
360 PRINT" - TO ?";:GOSUB 1150 :FORI=1T
0300:NEXT
370 IFT<FPRINT"YOU CANNOT MOVE BACKWA
RD";
380 IFT<FGOTO 340
390 IFT<F<>160TO 420
400 IFL(F,F1)<>2GOTO 420
410 IFL(T,T1)=4ANDL(F,F1)=2GOTO 440
420 PRINT"INVALID MOVE"+CHR$(31);
430 GOTO 340
440 L(T,T1)=2:L(F,F1)=4:O=0
450 K=INT(RND(8)*2)
460 IFK>2THEN 450
470 IFK=1THEN 490
480 IFK=0THEN 550
490 O=O+1:X=A-1:Y=B-1
500 IFL(X,Y)=4THENL(X,Y)=3
510 IFL(X,Y)<>3ANDO<>2THEN 550
520 IFL(X,Y)<>3ANDO=2GOTO 610
530 IFL(X,Y)=3THENL(X+1,Y+1)=4
540 IFL(X,Y)=3THEN 180
550 X=A-1:Y=B+1:O=O+1
560 IFL(X,Y)=4THENL(X,Y)=3
570 IFL(X,Y)<>3ANDO<2THEN 490
580 IFL(X,Y)<>3ANDO=2THEN 610
590 IFL(X,Y)=3THENL(X+1,Y-1)=4
600 IFL(X,Y)=3THEN 180
610 IFK=0THEN 670
620 IFK=1THEN 700
630 O=O+1:X=A+1:Y=B+1
640 IFL(X,Y)=4THENL(X,Y)=3
650 IFL(X,Y)<>3ANDO<4THEN 700
660 IFL(X,Y)=3THENL(X-1,Y-1)=4
670 IFL(X,Y)=3THEN 180
680 IFL(X,Y)<>3THENZ=1
690 GOTO 180
700 Y=B-1:X=A+1:O=O+1
710 IFL(X,Y)=4THENL(X,Y)=3
720 IFL(X,Y)<>3ANDO<4THEN 630
730 IFL(X,Y)=3THENL(X-1,Y+1)=4
740 IFL(X,Y)=3THEN 180
750 IFL(X,Y)<>3THENZ=1
760 GOTO 180
770 PRINT"YOU WIN -LIKE ANOTHER GAME (V/
H)";
780 GOTO 800
790 PRINT"I WIN - LIKE TO TRY AGAIN (V/H
)";GOTO 800
800 A$=INKEY$:IFA$=""THEN 800 ELSEIFA$="
Y"THEN 60
810 END
820 IFA=XTHEN 870
830 IFZ=1CLS:PRINTCHR$(23):PRINT" I
CAN'T MOVE
840 IFZ=1THEN 870
850 CLS:PRINTCHR$(23):PRINT@960,"I MOVED
FROM ";A;" ";B;" TO ";X;" ";Y;
860 A=X:B=Y:FORI=1TO900:NEXT
870 RETURN
880 CLS:PRINTCHR$(23):PRINT:PRINT"YOU AR
E THE HOUNDS
890 PRINT"YOU HAVE FOUR PLAYERS (4)
900 PRINT"YOU MAY ONLY MOVE FORWARD.
910 PRINT:PRINT"THE COMPUTER IS THE FOX
(F)
920 PRINT"AND MOVES FORWARD OR BACKWARD.
930 PRINT:PRINT"IF YOU TRAP THE FOX, YOU
WIN
940 PRINT"IF THE FOX GETS TO ROW 1,
950 PRINT"THE COMPUTER WINS":PRINT
```

MICROMART

WANTED

Freelance Micro Programmers

Can you program in either
Cobol, Basic, Pascal,
machine code?

Do you have a microcomputer?

Would you like to be payed
for programming?

Do you have a programming
requirement?

Send for information to:

NDP Ltd,
MICROSYSTEMS DIV,
69 Northampton Road,
Rushden, Northants.

CARDIFF MICRO CENTRE

PETs

+

SHARP MZ-80s

+

HEWLETT PACKARD

+

COMPUTER BOOKS

SIGMA SYSTEMS

54 Park Place
Cardiff 21515/34869

TOPMARK Computers

dedicated to

APPLE II



Simply the best!

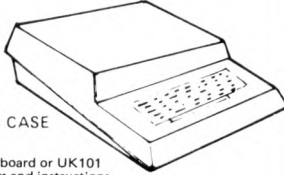
Full details from Tom Piercy on
Huntingdon (0480) 212563

To advertise in
MICROMART
Please ring Jacquie Hancock
on 01-631 1682

MICROMART

NEW

MICROTYPE
SERIES 80
MICROCOMPUTER CASE



Ready Cut for Superboard or UK101
Complete with screws and instructions
Also available with uncut keyboard for homebrew
enthusiasts. Produced in strong, black ABS plastic

Please state type when ordering.
Only £17.50 + VAT. Post and packing inclusive.
Send Cheque or Postal Orders to:
Microtype, PO Box 104,
Hemel Hempstead, Herts HP2 7QZ
SAE for details

PLUS
C12 BRANDED DIGITAL QUALITY CASSETTES
With library box and index card 10 for 38p each + VAT
Send £5.40 includes p&p + VAT.

*****Exciting Opportunity*****

**Small Turnkey Systems
need a
Consultant/Programmer**

for financial and commercial projects and
bespoke systems using Micro com-
puters and BASIC — client contact to
implementation.

Enthusiastic graduate with 2+ years
commercial/computing experience —
accounting/financial background an
advantage.

Location N. London. Part-time con-
sidered. Good salary, flexible hours, profit
sharing and partnership possibilities.

Call Alan Perry 272-3530 or 263-1951

MINE OF INFORMATION LTD

1 FRANCIS AVENUE,
ST ALBANS AL3 6BL
ENGLAND

Phone: 0727 52801
Telex: 925 859

**MICROCOMPUTER
CONSULTANCY &
BOOK SELLERS**

OSI?

CALL MUTEK

* Good Service
* Best Prices

C2 4P £349
C1 P £220

We stock the entire
OSI Range

Mutek
Quarry Hill, Box,
Wiltshire SN14 9HT.
Tel: Bath (0225) 743289

PROGRAMS

```

960 INPUT"PRESS ENTER TO CONTINUE";A$
970 CLS:PRINTCHR$(23)
980 PRINT"WHEN IT IS YOUR TURN,
990 PRINT"TYPE IN THE ROW NUMBER
1000 PRINT"AND COLUMN NUMBER OF
1010 PRINT"THE MAN TO BE MOVED
1020 PRINT:PRINT"THEN WHEN ASKED - TO ?
1030 PRINT"TYPE IN ROW NUMBER AND
1040 PRINT"COLUMN NUMBER TO WHICH
1050 PRINT"YOU ARE MOVING.
1060 PRINT"ONLY THE BLACK SQUARES
1070 PRINT"MAY BE USED.
1080 PRINT" GOOD LUCK !!!
1090 PRINT:INPUT"PRESS ENTER TO CONTINUE
";A$
1100 CLS:PRINTCHR$(23):RETURN
1110 A$=INKEY$:IFA$=""THEN 1110
1120 F=VAL(A$):PRINTF;" ";
1130 B$=INKEY$:IFB$=""THEN 1130
1140 F1=VAL(B$):PRINTF1:RETURN
1150 A$=INKEY$:IFA$=""THEN 1150
1160 T=VAL(A$):PRINTT;" ";
1170 B$=INKEY$:IFB$=""THEN 1170
1180 T1=VAL(B$):PRINTT1:RETURN
    
```

LEISURE LINES

With J. J. Clessa

The problem set in February Leisure Lines was to find the smallest square that is also the average of two other perfect squares. Despite being rather easy, more than 20 of the 70-odd entries received turned out to be incorrect.

Clearly there is an infinite number of squares which satisfy the conditions, but the smallest of these is 25, which is the average of 1 and 49. So, this month's prize of a folding umbrella goes to the first correct entry selected — which was from Mr Phil Ogden of Halifax, Yorks. Congratulations Mr Ogden, although in such a sunny part of the country, you'll probably never have need for it; still, you can always use it as a parasol.

Many thanks, by the way, to those of you who have sent in ideas for future puzzles. They're always welcome and I'll undoubtedly be using some of them in future issues.

QUICKIE

This one shouldn't cause too many brain ruptures! As usual, no prizes and no answers.

A girl has as many sisters as she has brothers. But each brother has twice as many sisters as brothers. How many brothers and sisters in the family?

PRIZE PUZZLE

A nice variation on the "truth/lie situation"!

There is a famous island in the

Pacific (whose name I forget) on which there live three tribes:

- the Whites, who always tell the truth
- the Blacks, who always tell lies
- the Greys, who lie and tell the truth alternately. . .

(although their first answer may be either truth or lie).

These natives always gather in groups of three, with one representative from each tribe in the group. A visitor to the island approached such a group of three natives and had the following conversation with the first native.

"Are you the White, the Black, or the Grey?"

"I am the Grey."

"And what about your first friend here?"

"He is a Black."

"So your other friend is the White?"

"Of course."

Was the "other friend" a White — and if not, what was he?

Answers please on a postcard to Puzzle No. 8, Personal Computer World, 14 Rathbone, Place, London W1P 1DE. All solutions must arrive by April 14th latest.

PRIZE OF THE MONTH

For connoisseur drunks only, this month I'm giving away a bottle of Remy Martin champagne cognac (which I may be bringing around to deliver personally). As usual, good luck (hic!).

BLUDNERS

A bumper crop this month — see editorial.

January 1980. Correct the Z80 Homebrew circuit diagram as follows:

IC13 — IC20: "pin 11" should read "pin 12" and vice versa. IC 11: Labels A0 - A7 should read Y0 - Y7 and vice versa.
March 1980. Correct Macroia as follows:

Equations box

Line 6: remove one of the "+.35"s.
Line 3: replace (E(t)/2 with (E(t-1)/2.
Line 13: replace the first / with a -.
Last line: replace 1460 with 7740 and

add xP1(t) at the end.

Program listing

Line 420: change the GOTO to 400.
Line 430: renumber as 435.
Line 465: renumber to 430.
Line 860: add :K8=Y(J).
Lines 900 & 910: transpose them.
Line 1270: remove the second equation.
Line 1680: remove the /100 at the end.
Line 1810: remove.
Line 1895: Replace with INPUT "TYPE Y OR N";A\$

Buy here at discount prices!

Save money.

☆ Full after-sales service in our own workshops

☆ One year guarantee on all machines

Leasing available to companies

Up to 1.6Mb for PET!

and 'on-line' with the Computhink Disc System

* Allows powerful business programmes using 16 Extra BASIC commands. * Easy to connect and use - plugs directly into 16/32K PETs, detailed manual supplied. * Simple startup (no difficult procedures to remember) as Disc Op. System in ROM. * Ready to run - useful programmes supplied free; full set of professionally written business packages available - Sales and Purchase Ledger, Stock Control, Payroll etc., * Real-Time processing, Engineering and Commercial boundaries overcome with full language support - Business BASIC, Assembler, FORTRAN, COBOL, PASCAL, FORTH, FIFTH, PLM, PILOT & CESIL.

24K Memory expansion with dual disc for old ROM 8K PET £275 for new ROM 8K PET £320

Basic 400K dual disc system

only

£840

800K £1,095
1.6 Mb £2,190

Credit terms available

The only 16k complete computer for under £400

Keyboard computer, power supply, UHF modulator and all cables to plug into your own TV set and cassette recorder and go!! 16K of user RAM for decent size programmes and data, sophisticated level II Microsoft BASIC. Complete with level I and level II programming manuals. What more could you ask?

TRS-80

£381⁷⁴

Expansion interface £199.09
4K level I computer £251.30

Now! Numeric keypad included

This must be today's best buy!

Get into print this easy way!

Fast!

Immaculate!

Silent!



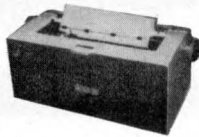
Anadex DP 8000 dot-matrix printer

* Speedy 112 ch/s bidir. * Fits A4 page - up to 80 cols. * Up to 4 copies. * Precision form-filling with sprocket feed. * Special headings using double-width chars. * Modern paper format to match A4 filing systems. * Other paper sizes with adj. sprocket. * Full punctuation, U/L case. * E sign, 96-ch. set. * Reliable - strongly built, 100 M.ch. head.

Knock down price!

£499

Interfaces -
Pet £45 Ohios £10
TRS-80 £40 Sorcerer £8
Apple £45



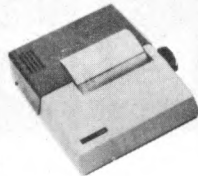
IBM golfball printer ideal for word-processing

* Forget expensive Spin-Wheel printers - the Golfball produces equal quality at up to 15 ch. per sec. * Match various typewriter styles with IBM interchangeable heads. * Completely reliable - each machine rebuilt by IBM trained engineers and fully guaranteed. * Precision form-filling possible with 15 in. pin-feed platen.

Limited supply!

£595

Interfaces -
Pet £45 Ohios £10
TRS-80 £35 Sorcerer £8
Apple £45



TCM 100 Thermal Printer

* Stop disturbing others with noisy printout! * Neat, clear, 96-ch. set, U/L case & symbols. * Matches Pet/Apple line lengths. * Fast, 40 ch/s bidir. * Reliable - robust - only two driven parts. * Plug in and go, built in PSU, detailed manual. * Thermal paper 4 1/2 in wide x 80 ft, less expensive than electro-sensitive paper.

A snip!

£249

Interfaces -
Pet £45 Ohios £10
TRS-80 £40 Sorcerer £8
Apple £45

While stocks last



PET 2001-8N (8K RAM New large keyboard)

£469

2001 - 16N (16K RAM and new large keyboard) £590
2001 - 32N (32K RAM and new large keyboard) £690
External cassette deck, suitable for all Pets £53
CBM dual drive mini floppy £745
Tractor feed printer with Pet graphics £499
Pet high-res. graphics 200 x 320 £259

You can afford to start computing now! - with the Ohio CI-P

As imported, fully tested, complete with 4K RAM, but unconverted to UK std. (conversion instructions supplied).

£199

Add £24 for converted model, Extra 4K RAM £39.

* Powerful programming possible - 6502 processor, fast 8K Microsoft floating-point BASIC (easy to learn). Superior utilities, 53 key key-board, giving upper and lower case, user-definable keys, gaming and graphics chs. Ultra-fast and powerful machine code from keyboard.

* No intricate soldering or metal work. Computer supplied assembled in ready-made case. * Reasonable sized programmes in 4K RAM. * Expandable to 24K RAM in case, drives discs, printer; available items include Assembler/Editor and Extended Monitor. * Programme interchangeability/reliability - Kansas City tape interface. * Save programmes on own cassette recorder - all cables supplied.

- at a lower price than equivalent kits!

COMPUTERAMA

Please add £10 Securicor delivery on computers etc plus 15% VAT on all prices

Your dealer for Bath, Bristol and S.W.

Tel: Bath (0225) 28819

We stock components, test instruments, tools etc.

LTD.

Computerama Ltd.
Harpers Kensington
Showrooms
London Rd. Bath, Avon

TANDY DEALER

AMERICAN EXPRESS

TRUSTCARD VISA

AMERICAN EXPRESS

BARCLAYCARD VISA

Credit card orders accepted by telephone for immediate despatch.

Loads of software - ask for list!

IF

..... you want the best service
you need professional advice
years of experience impress you
you are trying to find the best computer equipment
as well as the finest software

MICROSOLVE

is the Company to contact

MICROSOLVE COMPUTER SERVICES LTD

3rd Floor (rear),
MIDDLESEX HOUSE,
29-45 High Street,
EDGWARE,
Middlesex.
(exit 4 M1/20 mins. West End).
(prices ex. VAT)

01-951 0218/9/0

We cover a full range of equipment including
the **APPLE II** (from £695/16K); the
MICROSTAR multi-user system (from £4,950)
and the powerful **ALPHA MICRO** which will
run 1 to 22 terminals – the most cost
effective system available today.

WE OFFER A COMPLETE SERVICE which
encompasses advice, systems design, sale
and installation of computer and peripherals, as
well as tailor-made software, where necessary.
There are fully documented **ACCOUNTING**
and **WORD PROCESSING PACKAGES** etc., for
Accountants, Solicitors, Manufacturers,
Retailers, Medical Practitioners in fact all
business applications.

ALSO in stock are **PRINTERS**, **VDUs**,
CONTINUOUS STATIONERY, **DISKETTES**,
DISK BOXES, all from the best names
in the computer world – **TEXAS**, **LEAR**
SEIGLER, **TALLY**, **QUME**, **PAPER TIGER** etc.

So if you either wish to buy a computer to
program yourself or take advantage of our service
TELEPHONE NOW FOR AN APPOINTMENT.

MICROSOLVE MICROSOLVE

Possibly the most cost effective word processors in the world.



The Vector Graphic MZ

- *4MHZ Z80A CPU
- *48K ram
- *630K Bytes disk storage
- *Serial port and two parallel ports
- *Prom/ram Board with monitor
- *MDOS Operating system
- *Z80 Assembler
- *Basic Interpreter

Plus a large range of CP/M compatible software
including Fortran, Cobol, Macro assemblers etc.

The Vector Graphic System B

- Complete Vector MZ system plus: *
- *Vector Mindless terminal *
- Flashwriter 2 video board (24 x 80) *
- *Software driver on prom *
- MZOS North Star compatible DOS *
- *CP/M configured by Almarc *

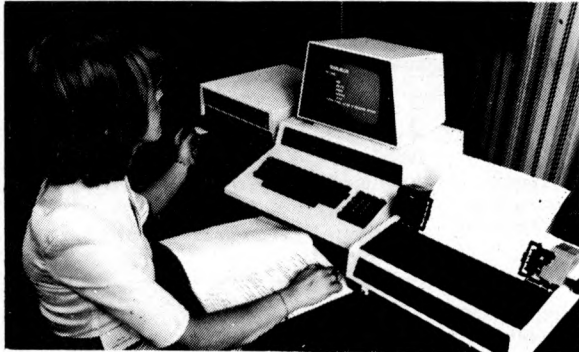
DATA SYSTEMS LTD

906 Woodborough Road, Nottingham. Telephone: (0602) 625035

PET, COMPUTHINK & ANADEx IN THE HOME COUNTIES

SALE OF THE CENTURY

With every order received in the next week for 16K or 32K Pet, a Petsoft Programmers Toolkit (RRP £55) yours for only £5.00.

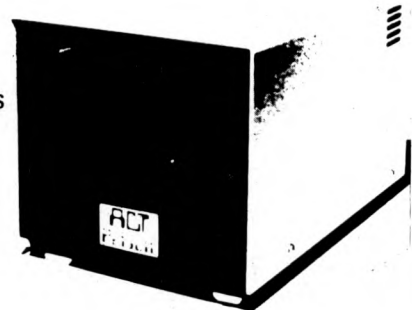


New Keyboard Pets & Peripherals



Anadex Printers
(Dealer enquiries welcome)

Computhink Disc Drives



Orchard Electronics Ltd (Ask for Dave or Barry)
21 St Martins Street
Wallingford
Oxon OX10 0DE
Tel: (0491) 35529

Comprehensive demonstration facilities available (by appointment)

*Also call us for your component requirements *

Z-Plus Microcomputer System

Over One Megabyte Disk Storage

4 MHz Z-80 Processor

Two Serial and Two Parallel I/O Ports

64k Memory

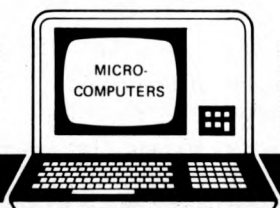
An alphanumeric keyboard

Including System Desk



Price **£3950** plus VAT

THE Z PLUS SYSTEM IS MARKeted
THROUGHOUT THE UK & EUROPE
AND IS AVAILABLE THROUGH A
NUMBER OF SELECTED DEALERS



ROSTRONICS

LIMITED

115-117 WANDSWORTH HIGH STREET, LONDON SW18 4HY
Telephone: 01-874 1172 Telex: 8813089 INTPRM G

Scottish Office: 8 ROYAL CRESCENT, GLASGOW
Telephone: 041 332 7642

hi-tech electronics

1 Richmond Gardens, Highfield Southampton SO2 1RY
Telephone (0703)555072

OUR S 100 **COLOUR** VDU BOARD

WILL MAKE YOUR FRIENDS GREEN WITH ENVY AND OUR COMPETITORS SEE RED AND ANY OTHER OF OUR SPLENDID RANGE OF COLOURS

- HIGH DEFINITION, FULLY INTERLACED 625 LINE PAL COLOUR VDU BOARD
- 20 COLOURS AND GREY-SCALE TONES, INCLUDING RED, GREEN, BLUE, YELLOW, MAGENTA, CYAN, BROWN, PURPLE, ETC.
- 24 LINES OF 40 CHARACTERS, MIXED GRAPHIC AND ALPHANUMERIC
- COLOUR GRAPHICS RESOLUTION OF 80 x 72
- UPPER AND LOWER-CASE, DEFINITION OF 10 x 14
- ALL CHARACTERS CAN FLASH AND HAVE ANY HUE
- SEPARATE BACKGROUND AND FOREGROUND COLOURS
- 256 DIFFERENT GRAPHIC CHARACTERS
- SELECTABLE DOUBLE-HEIGHT CHARACTERS AND TWO PAGE MEMORY
- 1K MEMORY, MAPPED TO ANY 2K BOUNDARY
- 64 PORT - PROGRAMMABLE INSTRUCTIONS
- MONITOR, OR UHF OUTPUTS, RGB TO ORDER
- TELETEXT AND PRESTEL COMPATIBLE CHARACTER SET
- BRITISH DESIGNED AND MADE

NOW AVAILABLE

- PROGRAMMABLE 13A MAINS DISTRIBUTION BOX, FULLY ISOLATED, FITS TTL 8 BIT LATCHED PARALLEL OUTPUT PORT FROM YOUR COMPUTER, AND CONTROLS 3 ON/OFF AND 1 32-LEVEL DIMMER SOCKETS £69.00
- S100 COLOUR VDU BOARD, UHF OUTPUT £215.05
- S100 COLOUR VDU BOARD, MONITOR OUTPUT £215.05
- S100 16K MEMORY BOARD, 250 nS £210.95

PRICES INCLUDE P&P - BUT NOT 15% VAT

COMING SOON:

- S100 TELETEXT TUNER/DECODER, S100 MUSIC SYNTHESISER, ETC.

WE'RE IN THE NORTH WEST! ARE YOU?

BUSINESS SYSTEMS FOR PROFESSIONAL PEOPLE

All our systems cover the major problem areas encountered in running your business, i.e. Ledgers, Payroll, Stock Control, Word Processing, Personnel Records etc.

1. For the smaller business.
Commodore Pet based system from **£2,500**

2. For the more ambitious enterprise.
Rostronics Z-Plus from **£3,950**

3. For the more demanding user.
ACT 800 from **£3,950**

We are available for consultation, feasibility studies and general overviews, etc. We also provide sensible, user orientated service contracts.

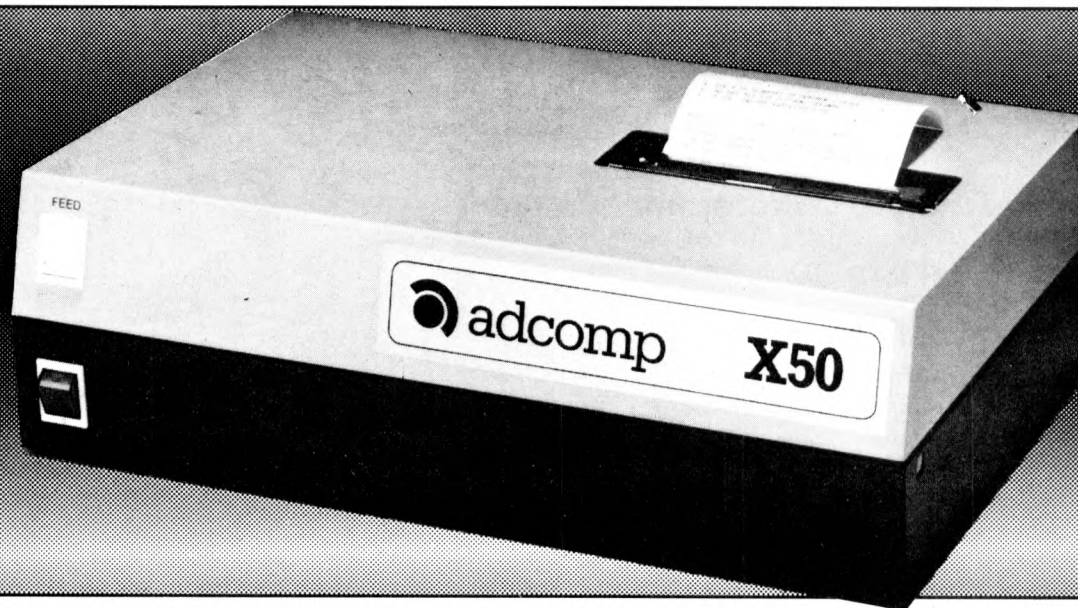
For more extensive details of our services and many more products not listed—write to or telephone

IAN KENDRICK on 051-236 5778.

We are approved ACT and STAGE ONE Dealers.

MWS
Microcomputers Limited

North Western Systems (Microcomputers) Limited
6a Lombard Chambers, Ormond Street, Liverpool 3.



NEW EUROPEAN PRINTER

- * Versatile matrix printer with no hidden extras.
- * Fully compatible with all main computers - no additional hardware needed; PET handshake routine, RS232 and V24 all standard features.
- * Has primary and secondary addressing capability allowing not only single and double width characters but also full PET graphics.
- * Uses plain paper

- * Choice of blue or black ribbon

80 column bi-directional £590 + VAT
52 column bi-directional £490 + VAT

Journal printers etc. also available. For further details write to UK distributors:

Barnes Consultants, 36 Eaton Court, Boxgrove Ave., Guildford, Surrey
Tel: Guildford 60982

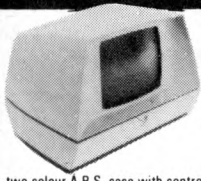


COMPUTER WAREHOUSE

NOW OPEN
MONDAY-SATURDAY
9.30-5.30

In stock now test equipment, microprocessors, teletypes, transformers, power supplies, scopes, sig. gen's, motors, peripheral equipment, I.C.'s, tools, components, variacs, keyboards, transistors, microswitches, V.D.U.'s sub-assemblies + thousands of other stock lines. Just a mere fraction of our vast range, is displayed below: 100's of bargains for callers.

HIGH DEFINITION 9" VIDEO MONITOR



This superb ex computer video monitor was originally used as an information display on large computer systems. It features all silicon electronics, attractive style, housed in shatterproof two colour A.B.S. case with controls under flap. 240v operation, 625 lines, 75 or 50 ohm composite video input 50 Hz - 20 mhz frequency response. Supplied complete in good condition but untested and unguaranteed.

Connect direct to your M.P.U. at only **£47.50** p.p. £6.00
Supplied complete with circuit.

DATA STORAGE MEDIUMS

RACAL C10 "Supergrade" cassettes complete with library cases 66p each 10 for **£5.45**
VERBATIM 5 1/4" soft sectored mini disks **£3.45** each 10 for **£31.63**

OPTO SMASH!

TIL 302/MAN 7 7 segment LED readout common anode direct drive (via resistors) from 7447 £1.10 each
TIL 119/OC72 Darlington opto isolator 3 for £1.00.
TIL305 0.3" 7 x 5 matrix LED alphanumeric readouts £3.75 each.
PHOTO TRANSISTOR Fairchild FPT-100 NPN silicon 30v, 25ma. 4 for £1.00.

4k x 12 RAM static Memory card

Complete 4K x 12 bit memory system on one PCB. This ex computer memory card contains all relevant decoding, read write and control logic for coupling to your M.P.U. or mini computer system. TTL in and out make interfacing a "cinch". We understand that by reading the outputs correctly, the memory can be organised as a 6K x 8! Features include fast 250ns max. access time. Standard +12v, -12v+5v power rails compact construction, non-volatile memory, data remains even when power switched off!
Original cost over £800 each, supplied complete with full data and circuit manual, at an unbelievable price of **£39.95** P.P. £1.75
Note: Memories are removed from working equipment but supplied untested, unguaranteed.

HOW TO GET HERE

Victoria, London Bridge or Holborn Viaduct to Thornton Heath. 1 minute from Thornton Heath Station.

STOP PRESS

WORD PROCESSOR VDU TERMINALS

Just arrived a VDU with a green screen! As yet no time to obtain full details but we'll make a start. Made by the famous Ventek Co. They have the following spec. 12" monitor, 24 lines x 80 characters, upper and lower case with descenders, 85 plus keyboard, numeric keypad ASCII, RS232 serial interface, adjustable baud rate, full cursor control, edit function, character(s) flash function, etc. etc. latest technology used, mostly 74LS with plug in dynamic rams, supplied in 3 grades.

Grade 1 complete tested and working **£275.00+VAT**
Grade 2 complete less some keytops **£250.00+VAT**
Grade 3 condition as seen or described **£175.00+VAT**

Although grade 1 sold working no guarantee is offered. Carriage extra. New rams available 95p each. P.S. Anyone with circuits or manuals please contact us.

DISPLAY I.C. AND TRANSISTOR BARGAINS NEVER CHEAPER

All I.C.'s and Transistors by well known manufacturers and fully guaranteed. No fall outs. Comprehensive data on I.C.'s 15p per type.
2N4351 N channel MOS FET.
2N4352 P channel MOS FET.
60p each £1.00 per pair.
HIGH VOLTAGE NPN POWER SWITCHING transistors BVcbo 600v BVcvo 500v BVebo 15v 1c 5 amps P.C. 125 watts HFE 60 typ 1c 2.5 mhz ideal invertors, etc. TO3 £1.60 each 4 for £5.40.
BF258 NPN 250v @ 200ma 45p each 3 for £1.08.
I.R. BSB01 2.5 amp 100v bridge rec.
P.C. mount long leads 35p each 4 for £1.08.
IN4998 4 amp 100v P.C. mount diodes long leads 14p each 10 for £1.10.
LM309K +5v 1.2 amp regulator £1.10 each 6 for £5.35.
2N1671B unijunction 450mw 30v 48p each 3 for £1.00.
IN4004 SD4 1 amp 400v diodes 7p each 18 for £1.00.
I.R. 12 amp BRIDGE RECS. 400 volt £1.25 each.

S.C.R.'s
2N3001 30v 350 ma TO18 22p each 6 for £1.00
2N4441 50v 8 amps TO220 45p each 10 for £4.00
C106D1 400v 5 amps TO202 55p each 10 for £5.00

TRIACS
G.E. 12 amp 600v TO220AB 95p each 10 for £8.75
E.C.C. 1.8 amp 400v TO5 38p each 3 for £1.00
A.E.I. 10 amp 400v ready mounted on 2 1/2" x 2 1/2" heatsink £1.00 each 4 for £3.75

LOW PROFILE I.C. SOCKETS
14 D.I.L. 14p each 8 for £1.00
16 D.I.L. Gold Plated mil. grade 22p each 6 for £1.00
22 D.I.L. 27p each 5 for £1.00
24 D.I.L. 35p each 3 for £1.00

OTHER GOODIES
AF279 low noise P.N.P. germanium up to 780MHZ 32p each 4 for £1.10
2N4304.WN720 F.E.T. transistor 37p each 3 for £1.00
LM380N/SL6051 14 D.I.L. 2 watt A.F. amp 80p each 8 for £6.00
CA3028B IC. 120 MHZ differential/cascode amp £1.00 each 3 for £2.50
CA3011 20 MHZ wideband amp TO99 case 65p each 2 for £1.00
TMS3114 DUAL MOS 128 bit static shift reg. DC. 2.5 MHZ £1.50 each 4 for £4.25
NE555 10 for £2.55
GE424 zero voltage switch, triac SCR relay driver TO5 can £1.10 each 7 for £6.50
FSA2719 8 independent diodes IN4148, IN914 type in 16 D.I.L. pack 38p each 3 for £1.00
FPO3725 4 NPN 50v 500ma transistors in 14 D.I.L. pack 70p each 2 for £1.00

POWER DARLINGTON SCOOP!
MJ1000 NPN 60v 90w 8 amps TO3 95p each
2N6385 PNP 80v 100w 10 amps TO3 £1.25 each
MJ4030 NPN 60v 150w 16 amps TO3 £2.25 each

PLESSEY EDGE STACKABLE DECADE THUMBWHEEL SWITCHES. Gold plated contacts dimensions 2" x 2" x 1/8" 85p each 8 for £5.35.
28 way 0.156" double sided edge connector, easily cut £1.25 each.
AMPHENOL 50Ω BNC plug 50p. 50Ω BNC plug right angled 60p.

C90 Audio Cassettes screw type construction 45p each 3 for £1.00.
Bulbs 24v 14 watt white frosted S.B.C. 8 for £1.00.
Bulbs 12v 100 watt clear, base similar S.B.C. 45p each.
S.B.C. Bulb Holders All steel cad. plated panel mount easily fixed via nut and round hole, ideal disco displays, scoreboards, etc. 4 for £1.10.
Xtal filters S.E. 1 QC1121/B miniature low insertion loss P.C. mount. C.F. 10.7mhz with B.W. of 7.5khz 2000Ω imp in-out. Brand new @ £7.99.
Heavy Duty Flat Insulated Earth Braid 100-200 amp braided tinned copper in heavy clear PVC sheath 50p per metre. £6 for 15 metres + PP £1 per 15 metres.
BULGIN miniature 6 way male chassis mount socket and matching free plug 60p each, 2 for £1.10.
Red L.E.D.'s full spec. 0.2" 14p each. 10 for £1.25.
Dynamic Stick Mics 6000Ω with built in on/off switch complete with lead and min. jack plug £1.15 each. 10 for £10.00.
TO5 HEATSINKS "Thermaloy" black anodised press on aluminium finned type 18p each. 8 for £1.00.

HARDWARE PACK Don't be stuck for the right nut and bolt for the job. Pack contains B.A. Metric, Unified, Self Tap, etc. Nuts, Bolts, Screws, Washers, etc. in Brass Bronze and Steel. All steel items plated. Average contents 400-600 pieces.
Sold by weight, **£2.65** 2lb bag.

MANY HUNDREDS OF TRANSFORMERS IN STOCK - SEND SAE FOR LIST
80 column EXTEL 7 x 5 matrix printers. All TTL. RS232 TTL interface. Baudot code, easily converted by software. £165.00 + carriage & VAT.

CRYSTALS
FREQUENCY CASE PRICE
19.20 KHZ B7G £2.50
1.00 MHZ HC6/U £2.75
2.00 MHZ HC6/U £2.35
2.50 MHZ B7G £2.25
5.00 MHZ HC18/U £2.25
8.00 MHZ HC18/U £2.25
10.25 MHZ HC18/U £2.25
11.20 MHZ HC18/U £2.50
20.00 MHZ HC18/U £1.75
33.339 MHZ HC18/U £2.80
UART Xtal 3B 40 KHZ*
SAE for latest XTAL stock list.

TELETYPES
KSR33 20ma loop from **£150.00**
ASR33 20ma loop from **£275.00**

SCOOP OF THE YEAR HAZELTINE H1200 V.D.U. TERMINAL

Due to a fantastic bulk purchase, we are now able to offer this superb terminal at a price almost below the cost of manufacture! Features include: 12" screen, 55 key TTY keyboard, full ASCII, RS232 interface, adjustable baud rate 75 to 9600, 12 lines x 80 characters (upgradable to 24 x 80), cursor control, lower case option, plus many other features.

Brand new at only **£250** + VAT.
FULL Technical Manual available

POWER SUPPLY UNITS

5 VOLT 2.5 AMP T.T.L. P.S.U.
Made for T.T.L. this compact ex computer systems unit features a 10 amp transformer with D.C. outputs of 5 volts @ 2.5 amps and 7.5 volts @ 5 amps. The 5 volt output is fully regulated and smoothed and has electronic current limiting. May be easily modded for 5 volts @ 7.8 amps, believed working but untested. 240v A.C. input
Complete with circuit **£8.25** P.P. £1.60

KEYBOARD



A special bulk purchase enables us to offer the above keyboard at a lowest ever price. 49 coded keys encoded into a direct TTL compatible 7 bit output. Features such as delayed strobe, 5 volt D.C. single rail operation and rollover protection make this an absolute must for the MPU constructor! Supplied complete with connection diagram and edge connector, at a secondhand "no time to test" price of only **£20.00** + P.P. £1.60
SUPER CASED VERSION Same as above spec. but housed in attractive two tone moulded, free standing case. Unit also includes an all TTL parallel to serial converter (no details) etc.
£27.50 + P.P. £1.85
Note, super cased version matches 9" video monitor

VMOS POWER FETS
LATEST TECHNOLOGY BRINGS YOU THE SILICONIX VMOS POWER FET! Capable of switching 2 amps up to 60V D.C. to 200 MHZ and may be driven direct from CMOS etc. £1.50 each 10 for £12.50. Full application data 25p.

OLIVETTI TELETYPES

KEYBOARD, PRINTER, PAPER TAPE PUNCH AND PAPER TAPE READER ALL IN ONE UNIT, THE CHEAPEST WAY FOR 1/0 IS WITH OUR TE300 TELETYPES, ASCII, RS232, SERIAL INTERFACE, 110 BAUD, 240v AC OPERATION, WHAT MORE COULD YOU WANT! WE'VE JUST BOUGHT ANOTHER LOAD AND WE NEED THE SPACE SO 1/0'S DOWN AGAIN TO A SNIP PRICE OF ONLY **£125.00** + Carriage + VAT
Supplied as seen, untested, unguaranteed.

EX EQUIPMENT RESOLVABLE CANNON "D" TYPE 25 WAY PLUG OR SOCKET COMPLETE WITH COVERS £1.15 each.

HY GRADE SMOOTHING CAPS
MULLARD - PLESSEY - MALLORY - SPRAGUE
1500mf 100v 60p* 3300mf 40v 50p
3300mf 63v 70p* 1mf 600v MYLAR 28p
10,000mf 15v 11† 22,000mf 16v £1.10†
100mf 250v 45p 2100mf 200v £2.50†
*Ex equipment tested †P.P. 40p

SEMICONDUCTOR 'GRAB BAGS'

Amazing value mixed semiconductors, include transistors, digital, linear I.C.'s, triacs, diodes, bridge recs. etc. etc. All devices guaranteed brand new, full spec. with manufacturers markings, fully guaranteed.
50 + BAG **£2.95** 100 + BAGS **£5.15**

MUFFIN FANS

KEEP YOUR EQUIPMENT COOL AND RELIABLE WITH OUR TESTED EX-EQUIPMENT MUFFIN FANS AS USED IN MOST PROFESSIONAL SYSTEMS, COMPACT AND QUIET. DIMENSIONS 48" x 48" x 1 1/2"
240v AC **£6.25** + pp 75p 110v AC **£4.99** + pp 75p

ELECTRONIC COMPONENTS & EQUIPMENT **66%** DISCOUNT

Due to our massive bulk purchasing programme which enables us to bring you the best possible bargains, we have thousands of I.C.'s Transistors, Relays, Cap's., P.C.B.'s, Sub-assemblies, Switches, etc. etc. surplus to our requirements. Because we don't have sufficient stocks of any one item to include in our ads., we are packing all these items into the "BARGAIN PARCEL OF A LIFETIME" Thousands of components at giveaway prices! Guaranteed to be worth at least 3 times what you pay plus we always include something from our ads. for unbeatable value!! Sold by weight
7lb **£ 5.25** 14lb **£ 7.95**
28lb **£13.75** 56lb **£22.00**
PLEASE ADD P + P £1.25

ISOLATED 240v 4 AMP & 10 AMP SOLID STATE RELAYS

Interface your MPU etc, with the outside world made by the famous "Astralux" Co. They consist of a miniature plastic module with mounting holes containing a reed relay for isolation, choke and triac. 12-20 volts D.C. at a few milliamps enable on/off control of A.C. loads up to 10 amp! The 10 amp version should be mounted on a heatsink. 100's of uses including power control, lighting, etc., etc.
Dimensions: 4 amp, 1 1/2" x 1" x 3/4". 10 amp, 1 1/2" x 1 1/2" x 1".
4 amp **£1.45** 10 amp **£2.10** complete with circuit

ELECTRONICS

Dept. P.C.W., 64-66 Melfort Road, Thornton Heath, Surrey
Telephone: 01-689 7702
Unless otherwise stated all prices inclusive of VAT. Cash with order. Minimum order value £2.00. Prices and Postage quoted for UK only. Where post and packing not indicated please add 40p per order. Bona Fide account orders minimum £10.00. Export and trade enquiries welcome. Orders despatched same day where possible. Access and Barclaycard Visa welcome.



Scotland's Complete Microcomputer Service

now supply and support:

HARDWARE:

Apple II Systems and Peripherals
Commodore Business Systems
A wide range of VDUs, printers, etc.

SOFTWARE:

Incomplete Records Accounting
Sales Ledger
Purchase Ledger
Nominal Ledger
Stock Control
Payroll
Word Processing
Database

Software can be tailored to your requirements or written completely to your specifications.

Our service is comprehensive, ranging from advice on system selection through installation and implementation, to operator training and comprehensive Hardware and Software maintenance.

You don't have to take our word for it.

Call us and arrange a demonstration.

GATE MICROSYSTEMS LTD.,
THE NETHERGATE CENTRE,
66 NETHERGATE,
DUNDEE.
TEL: (0382) 28194.

Philips Mini-Digital Cassette Recorder.

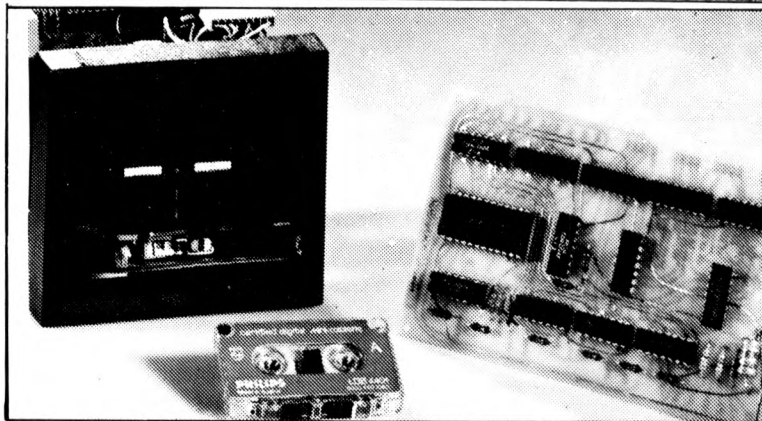
CASSETTE RECORDER

The Mini-Digital Cassette Recorder (Mini-DCR) can operate in the following modes: Idle, Read, Write, Backspace and Rewind. Complementing the quality and reliability of the Mini-Digital Cassette Recorder are Philips mini-cassettes certified for digital data recording applications. These mini-cassettes use tape which is certified for freedom from drop-outs. Mini-cassettes have been widely used for program loading in Philips office computers during the last four years, and over half a million are already in service.

Low cost, low power consumption and compact size of the Mini-Digital Cassette Recorders mean they are ideal for program loading and updating applications as well as providing a highly convenient data capture facility.

Ample capacity for program loading and data interchange is provided by the 128 k byte capacity, and the high data transfer rate of 6000 bits/sec allows quick reading and writing of programs and data.

PRICES INCLUDING MANUAL
MINI D.C.R. £95 ea. + VAT
INTERFACE £37.50 ea. + VAT
INCLUDE £2.25 FOR CARRIAGE ETC.



INTERFACE BOARD

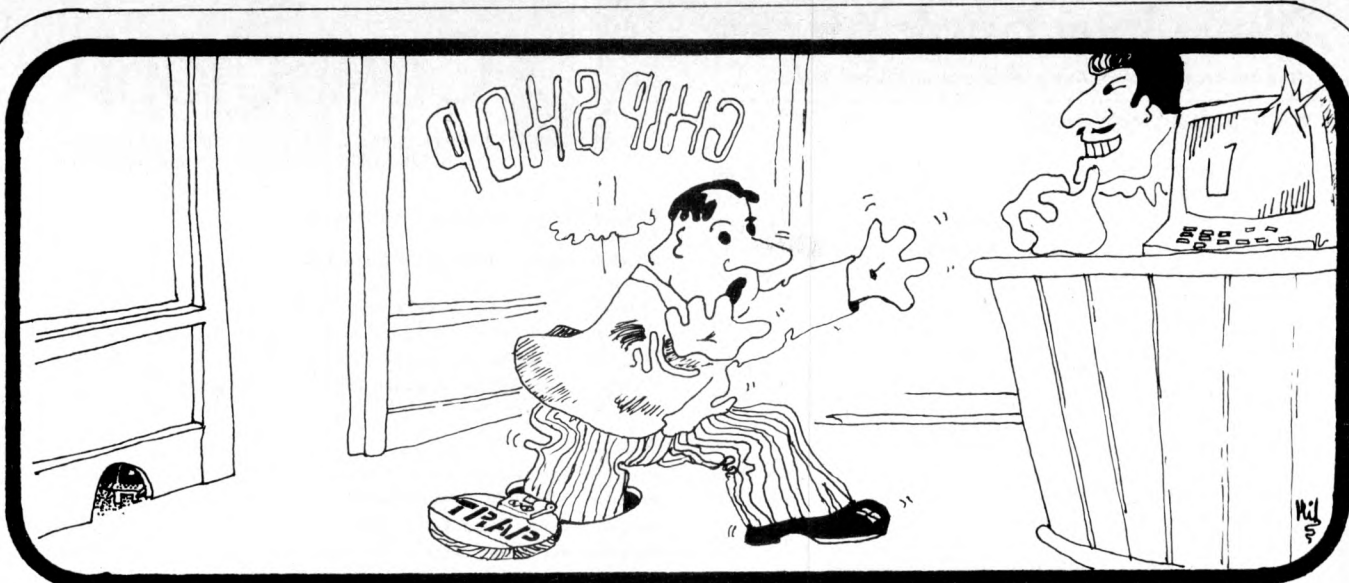
This compact interface board was designed specifically for the purpose of interfacing the Philips Mini DCR to a Micro-computer. Power consumption is very low, enabling it to be powered from the micro-computer that it is serving. Flexibility of the system was held as paramount, address decoding can be changed simply by moving links.

By using subroutines held in the micro-computer to control the system the user can make his controlling program to suit his own particular needs and can be as simple or as complicated as necessary.

CURRAH

COMPUTER
COMPONENTS

79 Crowland Rd. Hartlepool Cleveland.
TS 24 2JN. Phone 0429 / 871900



SOMEBODY'S PUT HIS FOOT IN IT

Your business is not exactly the same as any other and neither are its problems. Any solutions are probably unique and must be tailored exactly for you.

You know your business better than anyone else and any system designed should use your knowledge. The micro-computer specialist should show you how to use the computer to meet your business requirements.

You should be able to get the micro-computer which best suits your business. It should be chosen after your requirements are specified.

You and your staff have a right to know all about YOUR system, including helping to program it if you want to. Training is your right – not an additional service.

If microcomputers cannot satisfy your business needs, you want to know – you don't want false promises.

67 Nova Road, Croydon, Surrey CR0 2TN.

Telephone: 01-688 6013



New low book prices

Also dealers for Acorn, Apple, Microstar and Alpha Micro.



CompUtopia LIMITED

30 Lake Street, Leighton Buzzard, Bedfordshire
Tel: (0525) 376600 24 hour Answering Service

BASIC & BASIC PROGRAMS

Microsoft Basic: Kenneth Knecht	£ 5.80
The Mighty Micro Chris Evans	£ 5.50
General Ledger Basic: Poole/Borchers	£10.50
Accounts Payable and Accounts Receivable Lon Poole	£11.50
Mind Appliance T G Lewis	£ 5.00
Introduction to Microcomputers	
Vol 0 - The Beginner's Book Adam Osborne	£ 5.40
Introduction to Microcomputers	
Volume 1 - Basic Concepts Adam Osborne	£ 5.90
Your Home Computer James White	£ 6.20
Peanut Butter & Jelly Guide to Computers Jerry Willis	£ 6.30
C201 Microprocessors: from Chips to Systems	
Rodnay Zaks	£ 6.90
Illustrating BASIC Donald Alcock	£ 2.50
Microcomputers in the Three R's: A Teacher's Guide	
Christine Doerr	£ 4.90
Little Book of BASIC Style: How to write a program	
you can read John Nevison	£ 5.40
Programming in BASIC for Business Bosworth/Nagel	£ 6.90
Basic Handbook David Lien	£11.00
BASIC and the Personal Computer Dwyer/Critchfield .	£11.90
Computer Programs that Work! Lee/Beech/Lee	£ 3.00
Basic Computer Games David Ahl (Ed)	£ 5.50
More Computer Games David Ahl (Ed)	£ 5.50
Some Common BASIC Programs Poole/Borchers	£ 7.50
6502/6800/8080/Z80	
8080A/8085 Assembly Language Programming	
Lance Leventhal	£ 7.50
Z80 Assembly Language Programming Lance Leventhal	£ 7.50
Z80 Microcomputer Handbook William Barden	£ 6.90
Sargon: A Computer Chess Program	
Dan & Kathe Spracklen	£ 9.50

6800 Assembly Language Programming	
Lance Leventhal	£ 7.50
6502 Assembly Language Programming	
Lance Leventhal	£ 7.50
C202 Programming the 6502 Rodnay Zaks	£ 6.90
32 Basic Programs for the Pet Computer Rugg/Feldman	£9.50
D302 6502 Applications Book Rodnay Zaks	£ 7.90
Programming a Microcomputer: 6502 Microprogram-	
ming MOS' KIM-1 Caxton C Foster	£ 7.90

PASCAL

Practical Introduction to Pascal Wilson/Addyman	£ 4.00
Pascal User Manual & Report Jensen/Wirth	£ 5.90
Introduction to Pascal Welsh/Elder	£ 7.00
Programming in Pascal Peter Grogono	£ 7.80
Microcomputer Problem Solving using Pascal	
Kenneth Bowles	£ 7.90

OTHER READING

The Pet Revealed Nick Harpshire	£10.00
C207 Microprocessors' Interfacing Techniques	
Lesea/Zaks	£ 7.90
Computerisation: Layman's Guide for Directors &	
Senior Management E G Cluff	£ 4.90
How to Profit from your Personal Computer T G Lewis	£ 5.50
Vol 1 Fundamental Algorithms Donald Knuth	£10.50

Books will be despatched within 24 hours or our acknowledgment giving precise delivery date. All prices include p&p within the UK. Outside the UK please add 10%. For details please contact 30 Lake Street, Leighton Buzzard. Tel: (0525) 376600. When ordering please state your Barclaycard number. Or send cheque/P.O.

WE'RE THE NEWEST AND MOST UP-TO-DATE COMPUTER CONSULTANTS AND SUPPLIERS. WE'RE SPECIALISTS IN HARDWARE, SOFTWARE AND CONSULTANCY.

JUST LOOK AT THESE PRICES !!

SOFTWARE	} £350 EACH INCLUDING TRAINING COURSE
SALES LEDGER	
PURCHASE LEDGER	
INVOICING (FOR COMPUTHINK)	
STOCK CONTROL	} PRICES ON REQUEST
WORD PROCESSOR	
ASSORTED GAMES AND	
INSTRUCTION COURSES	

AND AVAILABLE ALMOST IMMEDIATELY:

77 TRACK 5 1/4" DISC DRIVE	INCLUDING
8" " "	DOS

TRAINING COURSES FOR ITT, TRS 80, COMMODORE - BOOK NOW!

MEDIA 5 1/4" from £22 for 10
8" from £37 for 10

MAIL ORDER:
PLEASE ALLOW 21/28
DAYS FOR DELIVERY.
P&P EXTRA AT COST

HARDWARE	
TRS80 16K II	£546
ITT 2020 (APPLE)	£750
DISC DRIVE	£370
COMMODORE PET 32K	£795
COMMODORE DISC DRIVE	£795
3022 PRINTER	£700
COMPUTHINK DRIVE 400K	£955
800K	£1245
VIDOGENIE 16K	£395
TEAC DISKDRIVES SINGLE	£275
DUAL	£499
ANADIX DP8000	£499

ALL OUR PRICES INCLUDE VAT AND THE BEST SERVICE BACK-UP AVAILABLE

NAME _____ ADDRESS _____
TEL: _____

PLEASE SUPPLY: _____

I ENCLOSE PO/CHEQUE £ _____
COMPUTER CONSULTANTS,
64 Parkfield Road., Rugby,
Warwickshire
Tel: (0788) 72596



NewBear
—Components—



MICROCOMPUTING I.C.'s

Z8001	£142.50
MC6800	£ 6.75
MC6802	£ 8.50
MC6821	£ 4.63
MC6850	£ 4.99
MC6810AP	£ 3.61
MC6840	£ 12.72
MC8602P	£ 2.88
MC14536P	£ 3.69
MC3459	£ 2.43
Z80 CPU 2.5MHz	£ 8.99
Z80 P10 2.5MHz	£ 7.99
Z80 CTC 2.5MHz	£ 7.99
Z80 SIO	£ 25.57
Z80A CPU 4MHz	£ 13.99
Z80A P10 4MHz	£ 10.00
Z80A CTC 4MHz	£ 10.00
SC/MP 11	£ 8.88
(INS 8060N)	
INS 8154N	£ 8.18
8080A	£ 5.50
6502	£ 9.90
6522	£ 7.30
6532	£ 12.76
6545	£ 16.66
6551	£ 10.79

77-68 Prices Slashed!

Bearbag 1	77-68 CPU KIT	£35.00
Bearbag 5	77-68 4K RAM KIT	£55.00
Bearbag 6	77-68 MON 1 KIT	£37.50
Bearbag 12	77-68 V.D.U. KIT	£42.50
Bearbag 13	77-68 MON 2 KIT	£47.50
Bearbag 16	77-68 EPROM BOARD KIT	£21.50
Bearbag 17	77-68 PIO BOARD KIT	£40.00
Bearbag 23	77-68 32K DYNARAM KIT	£75.50
Bearbag 18	CASSETTE INTERFACE	£12.50

STOP PRESS! ☆☆

6809 & FLOPPY DISC CONTROLLER BOARDS
NOW AVAILABLE — SEND/PHONE FOR DETAILS.

★ SUPERBOARD II	£188
★ 610 EXTENSION BOARD	£188
★ FLOPPY DISC DRIVE	£312
(includes DOS, 12K Basic, Case & PSU)	

MEMORIES

2708	£ 6.99
4116 (16K Dynamic)	£ 6.99
2716 (INTEL)	£21.50

NASCOM II £295.00

☆ 2K GRAPHICS ROM	£15.00
☆ POWER SUPPLY	£29.50

**SHARP
MZ 80K
at NEWBEAR**

VISIT OUR NEW BOOKSHOP ☆☆☆☆☆
1st FLOOR OFFICES, TIVOLI CENTRE,
COVENTRY ROAD, BIRMINGHAM. Tel: 021 707 7170

ACORN

6502 BASED MICRO KIT	£65.00
8K RAM KIT	£95.00
MAINS ADAPTOR	£ 5.00
V.D.U. KIT	£88.00

NEW LOW PRICES!

S-100 bus (Ithaca Intersystems)

		★★★★★★	
		Assembled & Tested	Bare
IA1160	Front Panel	£225.00	N/A
IA1010	Z-80 CPU 2MHz	£105.00	£21.00
IA1010	Z-80 CPU 4MHz	£123.00	£21.00
IA1100	Video 50/60 Hz	£ 99.00	£15.00
IA1050	2708/2716 EPROM	£ 57.00	£15.00
IA1110	8K Static RAM 250nS	£117.00	£15.00
IA1110	8K Static RAM 450nS	£ 99.00	£15.00
IA1030	Prototype	N/A	£15.00
IA2010	16K Static RAM 250nS	£295.00	N/A
IA2010	16K Static RAM 450nS	£275.00	N/A
IA1120	Single Board Computer	£895.00	N/A
IA1190	4P2S I/O w. interrupts	£210.00	N/A
IA1190	4P2S I/O wo. interrupts	£180.00	N/A
IA2030	64K Dynamic RAM 250nS	£615.00	N/A
IA1170	A/D, D/A — 8 Channel, 8-bit	£295.00	N/A

All boards come with manuals.

**NEWBEAR SYSTEMS FOR APPLE II,
HORIZON AND SHARP.**

TERMS: Official Orders (minimum £10.00)
Barclaycard & Access Welcome. Please add 15% V.A.T.
SEND FOR OUR BOOK LIST
AND NEW FULL CATALOGUE

CALLERS AND MAIL ORDER: 40 Bartholomew Street, Newbury, Berks. Tel: 0635 30505

CALLERS ONLY: 220-222 Stockport Road, Cheadle Heath, Stockport. Tel: 061 491 2290

a division of Newbear Computing Store Ltd.

FARMLAN COMPUTER SYSTEMS

HARDWARE

16k I.T.T. 2020 Microcomputer	£650
16k R.A.M. Upgrade kit	£60
Disk Drive and controller	£350
Parallel Printer Interface card	£95
Anadex Printer	£525
Numeric Key Pad	£75
Music Composer	£120

STATIONERY

5¼ Verbatim Disks	£2.50 each
Box Printer Paper	£13.60 per box
Other stationery available upon request	

SOFTWARE

Agricultural Package	£2565
Desk Top Management (Financial analysis)	£125
Visi-Calc (Problem Solving)	£95
Rent Master	£250
Word Processor	£125
Payroll	£200
Data Base	£125
Quotation System	£350
Games & Utility Disks Vols.1-6	£20 each
Documentation Utility Disk	£50

ALL MACHINERY EXCEPT PRINTER (3 MONTHS) GUARANTEED FOR 12 MONTHS

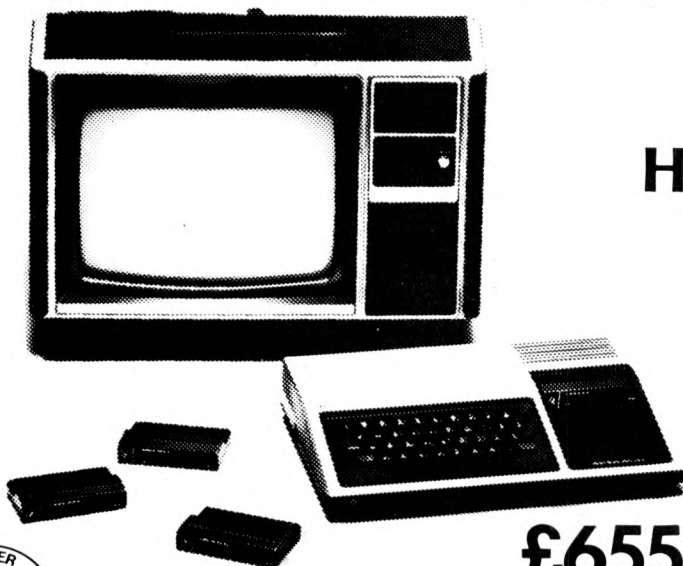
IMPORTANT We now have available – controller cards for 8" Drives
I.B.M. compatible, suitable for Apple/I.T.T.
Price on application

ORDERING INFORMATION:

Delivery/Insurance extra. All prices exclude V.A.T. @ 15%
Price list correct at time of publishing, subject to change without notice.
FARMLAN, NETHERTON, ROSS-ON-WYE, HEREFORDSHIRE:
Tel: Ross 4321

Offices also at Melton Mowbray, Northallerton, Aberdeen

DATRON of SHEFFIELD



TEXAS

Home Computer TI-99/4.

See it in operation
and buy it at DATRON

Demonstrations.
9am - 5pm Monday - Saturday.

Call anytime - no obligation -
or by mail order.

HP/Leasing Available

Delivery free anywhere in the U.K.



£655 plus VAT
Excl. TV & Cassette

DATRON MICRO CENTRE
DATRON INTERFORM LTD

Latham House, 243 London Road, Sheffield S2 4NF.
Telephone 0742 - 585490. Telex 547151.



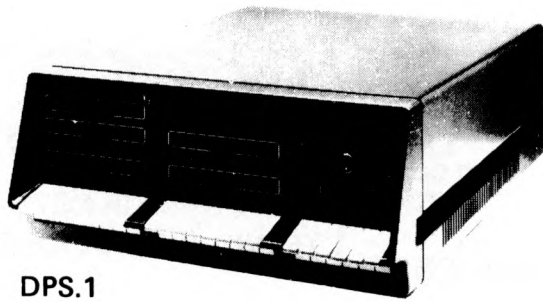
SIRTON PRODUCTS

76 Godstone Road, Kenley, Surrey (nr. Croydon).
Tel: (01) 688 0761.

Professional versatile computer system with comprehensive front panel facilities and 20-slot motherboard. Units have substantial power supply etc. and come with 2 or 4 MHz Z80 CPU. BUS conforms to the IEEE S100 standard.

DPS.1 from £695

Available with K2 operating systems & PASCAL/Z. Companion Disc Drive Enclosure for on-line storage for 250K Bytes to 2 M Bytes.



DPS.1

MIDAS

MIDAS S.100 SYSTEMS

Substantial Mainframe to house your S100 system, with optional 5" or 8" disc drives. Special systems built to your requirements from Z80 CPU and other S100 boards held in stock

Mainframes from £228

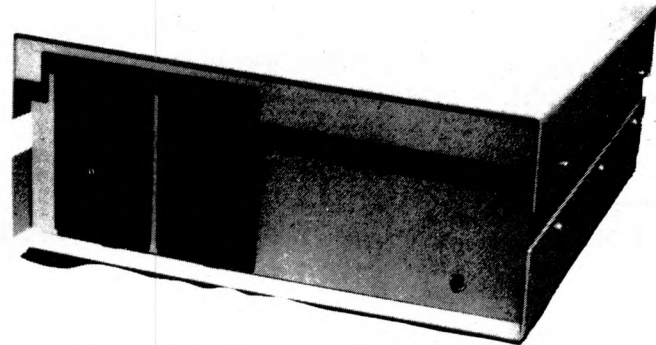
MIDAS 1 : Z80 System from £625

MIDAS 2 : Z80 Disc System from £1100

MIDAS 3 : Z80 Disc System 8" from £1350

DOUBLE DENSITY recording available on MIDAS giving up to 2M BYTES of on-line storage.

Software for MIDAS includes CP/M, FORTRAN, COBOL, PASCAL and several BASICS including XYBASIC for control applications.



Board Kits — All available as built & tested boards

Z80 Starter kit, featuring on-board Keyboard, 2K Monitor, 1K RAM, 2x8 bit I/O Ports, Prom Programmer etc. etc.	£188.00
Z80 CPU, 2MHz, 1K RAM, up to 8K EPROM, S/P I/O Port, four-channel counter timer — SBC100	£159.00
Z80 CPU, as above but 4MHz	£177.00
SBC200	£116.00
Z80 CPU Board, 4 MHz, jump-on-Reset	£92.00
8080 CPU Board, jump-on-reset	£79.00
8K RAM Board, low power 450 n Sec (21L02)	£195.00
16K RAM Board, low power 250 n Sec Static A/T	£343.00
32K RAM Board, extended addressing, Static	£39.00
Memory Manager, allows memory expansion addressing to 16M Bytes — IEEE spec	£129.00
Dynamic RAM Board, 2 MHz, 16-64K	from £167.00
Dynamic RAM Board, 4 MHz, 16-64k, A/T	£60.00
2708 EPROM (16k) Board	£90.00
2708/2716 EPROM Prog Board,	£110.00
2 Textool Sockets	£100.00
PROM 100 Programmer Board	£135.00
I/O Board, 2S/2P, with DIP switch selection	£210.00
I/O Board, 2S/4P, provision 4K RAM/4K ROM	£295.00
I/O Board, 2S/4P, with interrupts A/T	£287.00
Analogue I/O Board, 8 ch 8/10 Bit A/T	£93.00
Analogue I/O Board, 2 ch 12 bit A/D, 2 ch D/A	£99.00
Video Interface, 16 lines, 32 or 64 ch/line (60 frames)	
Video Interface, 16 lines, 64 ch/line (I/O Port driven)	

Video Interface, IEEE spec, 80 ch by 24 1, memory mapped up to 256 ch, 50Hz,	£230.00
Video Display, 24 1, 80 ch/1, keyboard interface, 2K RAM, special characters available etc	£198.00
Video Interface, 16 lines, 64 characters (50 frames)	£104.00
High Density Graphics from Vector, inc	£333.00
8K RAM Board A/T	£140.00
Real Time Clock Board from Mountain Hardware A/T	£35.00
Motherboard (9 slot with 4 edge connectors)	£43.00
Motherboard (13 slot with 4 edge connectors)	£29.00
Extender Board with logic probe for voltage level impulses	

FLOPPY DISCS	
Disc Controller, 5" or 8"	£139.00

Software	
CP/M on 8" or 5"	£75.00
CP/M 2	£106.00
C-BASIC 2	£75.00
Microsoft BASIC V.5	£155.00
XYBASIC Extended	£215.00
Microsoft FORTRAN 80	£205.00
Microsoft COBOL 80	£325.00
PASCAL/Z CP/M Version	£165.00
PASCAL (UCSD)	£150.00
MAC Macro-Assembler 8080 with Z80 Library	£55.00
Z80 Ass, Linker & Editor	£56.00
ZS1D Trace & Debug Tool	£50.00
Diszillog Disassembler	£35.00
Wordstar Text Editor	£255.00
Supersort	£125.00

Mainframes from	£239
MIDAS 1: Z80 System from	£680
MIDAS 2: Z80 Disk System 5" from	£1259
MIDAS 3: Z80 Disc System 8" from	£1535

WRITE OR PHONE FOR CATALOGUE

**dale
dams**
OFFICE EQUIPMENT LTD.,
30-36, Dale Street,
Liverpool

**WE CAN HELP
YOU WITH:**

PETS: PRINTERS: DISKS

2001(32K) £715	CBM 3022	£675 inc cable	CBM 3040	£880
2001(16K) £607	ANADIX	£650	COMPU	{400K £875
2001(8K) £495	TELETYPE 43	from £889	THINK	{800K £1095

SOFTWARE

PETAID: From Stage One Computers, disk based file handling in hours, not weeks – possibly the most useful piece of software available for PET. CBM or COMPU-THINK £140

PETACT: Well written business systems covering Sales & Purchase Ledger, Invoicing, and Stock Control: from £270

Many more items in stock

For details of these and many more products and services; telephone:-

051-227-3301

A SOUND INVESTMENT.

**MP 12 and MP 15
Microprocessor
Cassettes**

When you record on cheap cassettes you run a high risk of program failure, dropout errors and excessive headwear.

Saving pennies on an unsuitable cassette could turn out to be very costly. To make a long life, high quality microprocessor cassette needs both tape and cassette mechanism to operate together in harmony.

Backing up the microprocessor cassette technology is a background of more than 10 years of experience within the Group on the manufacture of computer tape, memory discs and cartridges. Pyral is one of Europe's foremost manufacturers of magnetic digital recording media.



**The perfect match of
cassette body
and tape.**

For further information on the Microprocessor cassette and other Pyral products, send to:

Sales office: PYRAL MAGNETICS LTD, COURTLANDS ROAD, EASTBOURNE, SUSSEX. Tel: (0323) 638965 Telex: 877123

THE SATELLITE VIDEO KEYBOARD TERMINAL



**GIVES YOU
MORE ON
YOUR SCREEN**

(INCLUDING 128 GRAPHICS CHARACTERS).

The Satellite is based on the KTM Keyboards made by Synertek. The on-board microprocessor gives full control over the display allowing not only the full ASC11 character set to be displayed, but also 64 graphics characters which, with reverse video becomes 128.

An auxiliary serial port allows onward transmission to or from a remote peripheral such as a printer, or modem, and may be switched on and off under software control.

The Satellite comes built and tested. All you need is a monitor (a television and modulator may be used with the Satellite 1) and a 5V 1.25A power supply. If RS232 is to be used, then +12 at 100mA is also required.

SATELLITE 1 24 rows of 40 characters £215 + VAT.

SATELLITE 2 24 rows of 80 characters £250 + VAT.

(Dealer Enquiries Welcome).

SPECIFICATION.

- * 24 rows of 40 or 80 characters.
- * Full 128 ASC11 Character Set.
- * PLUS 128 graphics characters.
- * Full RS232 or TTL Serial Interface with RS232 handshaking.

- * Auxiliary RS232/TTL Serial Port for printer, modem, etc.
- * Interlace/non-interlace.
- * Line truncate/non-truncate.
- * Direct cursor addressing.
- * Switch selectable European/USA standard.

**INTERACTIVE DATA SYSTEMS 14, BUCKMAN CLOSE,
GREENLEYS—MILTON KEYNES. Telephone: (0908) 313997.**

PETALECT

**ELECTRONIC
SERVICING LTD.**



Petact authorised distributors for central Southern England for the full range of Computhink disc systems (dealer enquiries welcome)

Computhink Old ROM 400K	£795.00
" New ROM 400K	£795.00
" New ROM 800K	£995.00

All + VAT

Large Keyboard PETS in stock 32K PET £795 + VAT 16K PET Ask for delivery on 16 2040 Disc System and C.B.M Printers. Large Extension Keyboard for the PET £89.50 + VAT.

Stockists for Petact Business Systems (Sales accounting, purchase invoicing, payroll, Stock Control, Nominal Ledger and management information.

A wide range of Printers available i.e. Teletype 43, Anadex C.B.M, Printerm

COMPUTER BOOKS — for professionals, hobbyists, businessmen and newcomers.

ACCESS, BARCLAYCARD

If you require any more information or demonstration regarding the PET 2001/8 or any associated equipment, programs, etc., please contact:

Mr. P.J.A. Watts or Mr. D.W. Randall at:

PETALECT ELECTRONIC SERVICES LTD

33/35 Portugal Road
Woking
Surrey

Tel: Woking 69032/68497

Shop at:
PETALECT
Chertsey Road
Woking
Surrey

Tel: Woking 21776/23637



Micro-Computer Centre for the MIDLANDS

Nascom and Commodore Specialists

A full range of micro computers and peripherals are available, whether buying or browsing we can give helpful and friendly advice.

Commodore Business Systems are suitable for the professional office, the small business or the sole trader. We will be pleased to give advice and a demonstration.

Nascom 2 systems can be fully built and tested to order. We are sole distributors for the **Micro Type case** for Nascom 1 and 2, also stockists of the **William Stuart colour graphics** and full range of 'add-ons'.



Business & Leisure Micro Computers

16 The Square, Kenilworth, Warwickshire CV8 1EB.

Tel: (0926) 512127



NewBear Books



NEW BOOKS

The S100 and other Micro-buses	Poe	£ 5.05
Software development	Jones	£13.95
Computers and Commonsense	Hunt	£ 3.95
Architecture of Small Computer Systems	Lippiatt	£ 4.50
Principles of Data Base Management	Martin	£12.50
Cobol for Beginners	Worth	£ 7.75
16-bit Microprocessor Architecture	Dolhoff	£16.20
6502 Assembly Lang. Programming	Osbourne	£ 6.95
Introductory Experiments with Digital Electronics and 8080A Book 1	Rony	£ 8.40
Book 2	Rony	£ 8.40
Microcomputers for Business Applications Handbook of Microprocessors, Microcomputers and Minicomputers	Barden	£ 5.80
Introduction to Microprocessors	Lenk	£11.65
The VNR Concise Encyclopedia of Mathematics	Levanthal	£ 8.95
	Gellert	£15.35

COOKBOOKS

Active Filter Cookbook	Lancaster	£10.45
CMOS Cookbook	Lancaster	£ 6.95
IC OP AMP Cookbook	Jung	£ 9.50
IC Timer Cookbook	Jung	£ 7.50
T.V. Typewriter Cookbook	Lancaster	£ 7.50
TTL Cookbook	Lancaster	£ 6.95
The Cheap Video Cookbook	Lancaster	£ 4.30
IC Converter Cookbook	Jung	£ 8.40

INTRODUCTORY BOOKS

The Mighty Micromite	Evans	£ 5.75
Intro. to Personal & Business Computing	Zaks	£ 4.95
A Dictionary of Microcomputing	Burton	£10.00

Z80 BOOKS

Z80 Programming for Logic Design	Osbourne	£ 5.95
Z80 Technical Manual	Zilog	£ 4.00
Z80 P10 Technical Manual	Zilog	£ 3.25
Z80 Programming Manual	Zilog	£ 4.50
Z80 Microcomputer Handbook	Barden	£ 6.95
Practical Microcomputer Programming Z80	Weller	£19.55
Z80 Instruction Handbook	Scelbi	£ 3.25
Z80 Assembly Language Programming	Osbourne	£ 6.95
Introduction to TRS 80 Graphics	Inman	£ 5.75
Z8001/Z8002 Product Specification	Zilog	£ 3.75
Z8000 CPU Instruction Set	Zilog	£11.50
Z80 Instant Programs (book) for Nascom	Hopton	£ 7.50
Z80 Instant Programs (cassette) for Nascom	Hopton	£10.00
Z80 Microprocessor Programming and Interfacing Book 1		£ 7.75
Book 2		£ 8.50
Z80 Assembly Language Programming	Osbourne	£ 6.95

BASIC

The Basic Primer	Waite	£ 5.80
The Basic Handbook	Lien	£11.00

SOFTWARE TAPES FOR PET & TRS 80

Applications Program	Educational Program
Game Program	Mathematics Program
Graphics Display & Misc. Program	

All at £6.65 each.

Terms: OFFICIAL ORDERS (min. £10.00). ACCESS & BARCLAYCARD WELCOME. SEND FOR COMPLETE BOOK LIST. ALL PRICES INCLUDE POSTAGE & PACKING.

MAIL ORDER: 40 Bartholomew Street, Newbury, Berks. Tel: 0635 30505

MANCHESTER: 220-222 Stockport Road, Cheadle Heath, Stockport. Tel: 061 491 2290

BIRMINGHAM: 1st Floor Offices, Tivoli Centre, Coventry Road, Birmingham. Tel: 021 707 7170

FIRST NAME IN

MICROHIRE

CCS MICROHIRE

NEW MONTHLY RATES * (1 MONTH PLUS)

8K PET £ 7.99 /Month

16K PETS/APPLES/ETC. One
DOUBLE DISK DRIVE Rate
PRINTER £ 8.99 /Month

32K and 48K COMPUTERS £ 9.99 /Month

These are C.W.O. rates on our Standard Terms.
If you want something different to these terms, please call Letchworth (04626) 73301
C.C.S. MICROHIRE
7 The Arcade, Letchworth, Herts SG6 3ET

Software for CP/M

QUALITY PACKAGES DIRECT FROM U.S.A.

CBASIC-2	£75
Extended Disk Basic for Commercial work	
WORDSTAR	£250
Ultimate in micro Word Processing Software	
SELECTOR III-C2	£185
Best selling DBMS	
SUPERSORT I (relocatable & executable)	£140
SUPERSORT II (executable only)	£115
SUPERSORT III (as II but without Select/Exclude)	£85
Sort/merge and select/exclude	
WORDMASTER	£85
Superior full screen text editor	
TEX-WRITER	£50
Output formatter	
IBM-CP/M COMPATIBILITY	£110
3740 data exchange with CP/M	

CASH WITH ORDER
ADD 50p/Item P&P (Min £1) and VAT (15%)
STATE Computer and Disk size/format
Due to Dollar fluctuations, Prices subject to change without notice.

Telesystems Ltd

P.O. BOX 12, GT. MISSENDEN BUCKS HP16 9DD
02406 5314



BOOKS
MAGAZINES
SOFTWARE

L.P. ENTERPRISES

ROOM PW
8/11 CAMBRIDGE HOUSE
CAMBRIDGE ROAD
BARKING
ESSEX IG11 8NT
01-591 6511



Z80 Users

Have you a Z80, or access to one?

Have you seen, read and digested

Leventhals	Z80	Assembly Language Programming	£6.45
Osbornes	Z80	Programming for Logic Design	£6.30
Bardens	Z80	Microcomputer Handbook	£7.50
Wadsworths	Z80	Instruction Handbook	£2.95
and	Z80	Software Gourmet Guide & Cookbook	£7.95

No? Why not?

Here's the chance to fill this gap in your life!

HOW TO ORDER

Send cash, cheque, P.O. or credit card no. to

L.P. ENTERPRISES

ROOM PW 8/11 Cambridge House, Cambridge Road

Barking, Essex IG11 8NT

All payment must be in sterling and drawn against a UK bank

Telephone orders and enquiries welcome 01-591 6511

TRADE ENQUIRIES WELCOME

Some NEW Items

Compute — A super new magazine for the 6502 User. This magazine is at present divided into four sections. These are 1) 6502 section, covering areas of general interest. 2) Business and Industrial, for both learners and 'doers' 3) Education — intended as a resource guide for teachers. 4) The 'Gazettes' — including articles covering specific machines. i.e. the PET, the ATARI, the APPLE and single board computers.

'68 Micro — Features articles of interest to the 6800 User: - ranging from software updates to hardware developments, covering such areas as SCOPE (SSB DOS Backspace), LIFE (a 6809 Program), INTEG MOD (Flex Utility), 6809 Adaptor for the 6800 and Data Files.

Compute	Sub £17.50 s.i. £1.95
68'Micro	Sub £17.50 s.i. £1.95
Introduction to LOW RESOLUTION GRAPHICS	£5.50
6502 Assembly Language Programming	£6.45
Business With Your Microcomputer	T.B.A.
Running Wild	£2.95
More BASIC Computer Games	£5.50

Tridata + MICROS = SOFTWARE

Business systems available now for the TRS 80

Sales Ledger	(OPEN ITEM/DEBTORS ANALYSIS/STATEMENTS/INVOICES/VAT/DAYBOOKS etc.)	£ 225
Purchase Ledger	(OPEN ITEM/CREDITORS ANALYSIS/REMITTANCE ADVICE/VAT/DAYBOOK etc.)	£ 225
Invoicing	(UPDATES SALES LEDGER/DOWNDATES STOCK/MAINTAINS BACK ORDERS)	£ 75
Stock Control	(ISSUES/RECEIPTS/MOVEMENT, USAGE, VALUATION, RE-ORDER REPORTS etc.)	£ 200
Payroll	(WEEKLY, MONTHLY, CASUAL STAFF/BONUS SCHEMES/COIN ANALYSIS/PAYSLIPS etc.)	£ 218
Nominal Ledger		from £225

12 MONTH WARRANTY ON ALL PACKAGES - TAILORED SYSTEMS TO YOUR REQUIREMENTS

FOR THE BEST IN PROFESSIONAL MICRO BUSINESS SOFTWARE CONTACT US DIRECT OR CALL YOUR NEAREST TRIDATA DEALER FOR A DEMONSTRATION.

CAMBRIDGE COMPUTER STORE (CAMBRIDGE)	0223 68155
COMPUTER DEVELOPMENT SERVICES (SWANSEA)	0792 26085
ELECTRON SYSTEMS (SANDY, BEDS.)	0767 81195
A. J. HARDING (BEXHILL, E. SUSSEX)	0424 220391
KATANNA MANAGEMENT SERVICES (CHELMSFORD)	0245 76127
OPTRONICS (TWICKENHAM)	01 892 8455
GPW ELECTRONICS LTD (PORTSMOUTH)	0705 693341



Tridata Micros Ltd.
Smithfield House
Digbeth
Birmingham B5 6BS
Tel: 021 622 6085/6

**Introducing
MAIL ORDER
from Intex**

**A NEW
SERVICE
FOR YOU!**

**MAIL ORDER DEPARTMENT
CASH WITH ORDER ONLY**

PET		DEMAGNETISERS	
2001-8	£ 495.00	Curved Head (Mains)	4.00
3016	675.00	Cassette (Battery)	12.00
3032	795.00		
C2N Cassette Deck	55.00	WORKBOOKS	
IEEE to IEEE Lead	25.00	TIS WORKBOOKS (NO VAT)	
PET to IEEE Lead	20.00	Set of 6	18.00
3040 Disk	795.00		
Computhink 400K for		CONNECTORS	
8K via exp/PET	825.00	PET USER/IEEE PORT	1.25
For 16/32K	895.00	PET 2nd CASS PORT	.95
800K Unit	1145.00	Covers for USER/IEEE	
24K Expandapet	320.00	PORT Connector	2.50
		D52 RS232 Connectors	
INTERFACES		Male/Female	3.25
Small sys, Serial C	120.00	Covers	2.50
Serial B Bi-Dir	175.00		
TNW2000 Bi-Dir	165.00	KIM	
All IEEE/RS232		KIM 1	99.95
PETSET 1 A/D	166.00	KIM 3B	99.95
Stockists of PETSOFT & COMMODORE SOFTWARE		KIM 4	69.95
		NASCOM	
PAPER		Nascom 1 (kit)	125.00
TCM100 Roll	2.50	Nascom 1 (Built)	140.00
Anadex/PET 80 Col	15.00	Nascom 2 (Kit)	295.00
Teletype 132 Col	25.00	Power Supply (kit)	29.50
PR-40 Roll	1.00		
		SEND FOR OUR FULL SOFTWARE & MAIL ORDER PRICE LIST -	
CASSETTES		DUST COVERS	
C12 Cass Highgrade Per 10 in library cases	4.00	PET (All models)	£5.75
		PET 3040	£3.50
DISKETTES		COMPUTHINK DISK	3.00
PET 3040 per 10	25.00	T/T 43 PRINTER	5.75
APPLE " "	25.00	Anadex DP8000 Printer	3.50
C/THINK D/D Per 10	35.00		

**ALL PRICES ARE EX. VAT.
PLEASE ADD 50p p&p ON SMALL ITEMS £2.50
ON LARGER ITEMS**

**ALL GOODS DESPATCHED BY RETURN OF
POST OR YOU WILL BE NOTIFIED OF ANY
DELAY & OFFERED AN ALTERNATIVE OR THE
RETURN OF YOUR MONEY**

**Don't delay
SEND
NOW!**



Name

Address Phone

.....

Item No.

INTEX DATALOG LIMITED EAGLESCLIFFE INDUSTRIAL ESTATE, EAGLESCLIFFE, STOCKTON ON
TEES, CLEVELAND TS 16 0PN, ENGLAND. TELEPHONE: EAGLESCLIFFE 781193 (STD Code 0642).
CABLES INTEXRAD. STOCKTON ON TEES. TELEX 58252.

Intex

AERCO GEMSOFT

Specialists in Business Computers and Software

Appointed dealers for:

APPLE, SUPERBRAIN, SWTP, VIDEO GENIE

Whatever your needs in Micro-Computers,
we have one to suit you or your business.

From the Video Genie at £369
Apple 2 at £695
Intertec Superbrain at £1995
And the SWTP 6809 from £2312

Software for all machines available:
Sales/Purchase Ledgers, Stock Control, Payroll,
Word Processing, Production Control,
Mailing List etc. etc. etc.

If it doesn't exist, we'll write it for you. Systems
tailored to exact customer requirements.
All Apple peripherals in stock, Qume printers
from £1950, Anadex £570, Paper Tiger £585,
Microhush £266, Word Processing programs
from £42, Games from £4, and much more
besides.

We're in business to help your Business.

If you can't come and see us, phone for details,
or send a SAE for catalogue.

All prices exclusive of VAT.

Call, write or phone:-
GEMSOFT, 27 CHOBHAM ROAD,
WOKING, SURREY
Telephone (04862) 22881
Open 6 days a week, 9.30am to 5.30pm

L&J COMPUTERS

**OFFICIALLY APPROVED
COMMODORE DEALER**

KEEN & COMPETITIVE!

**WE ARE SPECIALISTS.
'PET' SPECIALISTS.
HARDWARE & SOFTWARE.**

**WE HAVE EXCELLENT
STOCKS OF BOTH**



*Inc. a full range of Commodores and Petsoft; and,
of course, our own, such as:*

Stock Control & Invoicing	£ 60
Random Entry & Analysis	£ 40
Delivery Services	£220
Work Study	£150
Monthly Planner	£ 7

etc. etc. (SAE for descriptive leaflet)

*We will also write programs for you that you are
unable to do or get written.*

**YOU ARE WELCOME TO TRY, BROWSE & PUR-
CHASE AT OUR PREMISES... TRY US!**

**ORDERS TAKEN BY POST OR PHONE: ACCESS-
BARCLAYCARD-VISA**

**3 CRUNDALE AVENUE, KINGSBURY
LONDON NW9 9PJ 01-204 7525**

ADVERTISERS INDEX

Access Data		Communications	14	Little Genius	18	Mike Rose Micros	129
Communications	28	GW Computers	2	Liveport Data Products	21	Nascom	8
ACT Microsystems	44,45	Happy Memories	67	L & J Computers	138	Newbear	112,131,136
Aculab	67	A J Harding (Molimerx)	25	Logitek	58	NW Computer Systems	126
Adda Computers	22	HB Computers	26	London Computer Store	14	Orchard Electronics	125
Almarc Data Systems	22,124	Henry's	20	Lowe Electronics	23	On-line Conferences	88
Barnes Consultants	126	Hitech	126	LP Enterprises	137	Personal Computers	OBC
BFI	4	Intelligent Artefacts	20	Masterpack	99	Petalect	135
Bits and PC's	20	Interactive Data Systems	135	Microcentre	IFC	Petsoft	82
BNR & ES	26	Interface Components	17	Microdata	20	PIPS	10
Business & Leisure		Intex Datalog	138	Microdigital	5	Pyral Magnetics	134
Microcomputers	135	Keen Computers	110	Microsolve	124	Q-Com	26
Camden Electronics	4	Lifeboat Associates	102	Microtrend	87,89,91	Rair	3
Carter Keyboards	28	Lion Microcomputers	29	Mighty Micro	78	Research Machines	100
Cassette Duplicating						Research Resources	19
Services	92					Rohan Computing	18
CCS	136					Rostronics	125
Comart	38,54					Science of Cambridge	30,31
Commodore	37					Sharp Electronics	62
Comp Shop	140,IBC					Sirton Products	133
Computerama	123					Small Systems	
Computer Consultancy	130					Engineering	7,28
Computopia	130					Stack Computer Services	9,27
CRA	18					Strumech (SEED)	53,84
Crystal Electronics	16					Tandy	11
Currah Computer						Tangerine	15
Components	128					TECS	16
DAMS	134					Telesystems	136
Datron Micro Centre	132					Terminal Displays	92
DDP	107					Terodec Systems	80
Mike Dennis	112					Theydon Computer	
Digital Data Electronics	10					Services	108
Digitus 70,71	70/71					Transam	74
Display Electronics	127					Tridata	137
Ensign	97					TVJ Microcomputers	12,13
Equinox	48,139					Wego Computers	16
Farmplan	132					Xitan Systems	24
Gate Microsystems	128					Zenith Data	46
Gemsoft	138						
Goregrange	6						

THE 3rd Personal Computer World SHOW

will be held at the Cunard International Hotel
in Hammersmith, London on
4,5 & 6 SEPTEMBER 1980
Organizations interested in exhibiting should contact
TIMOTHY COLLINS
of Montbuild Ltd on
01-486 1951

MULTI-USER, MULTI-TASKING MICRO SYSTEMS FROM £5000

For business, education and scientific use.

- Cartridge storage 10MB to 1200MB.
- Comprehensive utilities.
- Word processing.
- Multi-language (languages supported include Basic, Cobol, Fortran, APL, Pascal etc.

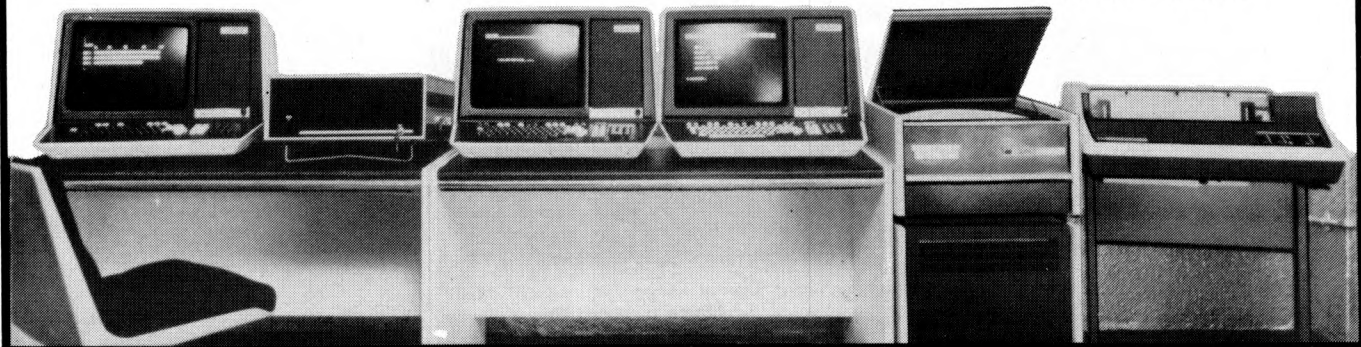
OEM and Dealer enquiries invited.

EQUINOX

COMPUTER SYSTEMS LIMITED

Kleman House, 16 Anning Street,
New Inn Yard, London EC2A 3HB.

Tel: 01-739 2387 & 01-729 4460



8MHz Super Quality Modulators	£4.90
6MHz Standard Modulators	£2.90
C12 Computer Grade Cassettes 10 for	£4.00
Super Multi-rail P.S.U. +5 -5 +12v	£29.50
ETI Breakout Game - Chip and PCB	£9.90
S100 Expansion Motherboard for Nascom I	£39.00
Anadex Printer Paper - 2000 sheets	£25.00
Floppy Disks 5 1/4" Hard & Soft (Sector)ed	£3.50
Floppy Disk Library Case 5 1/4"	£3.50
Eprom Boards	£63.00
8K Static Ram Boards - S100	£110.00
Cartridges for Grandstand	£11.99
George Risk Ascii Keyboard	£39.00
Cartridges for Atari - Full Range in Stock	£13.90
Interface PET IEEE - Centronics Parallel Not decoded	£49.00
Decoded	£77.00
Interface to Centronics parallel for TRS80	£75.00
Verocases for Nascom 1 & 2 etc.	£22.50
Keyboard Cases	£9.90
Electric Pencil for TRS80	£29.00

RRP £690 only **£590** + VAT



IBM SELECTRIC GOLFBALL

Refurbished IBM Golfball Printers to new specs. Accepts Centronics parallel data. Friction feed. Prints at 15 cps.

Attaches either directly or through interfaces to Pet, Apple TRS80, Sorcerer, Nascom, CompuKit etc.





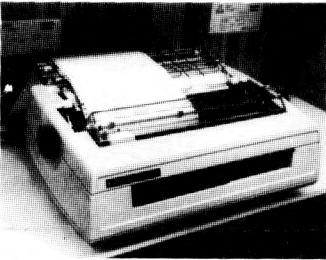
HITACHI PROFESSIONAL MONITORS

9" - **£129**
12" - **£199**

- **Reliability** Solid state circuitry using an IC and silicon transistors ensures high reliability.
- **500 lines horizontal resolution** Horizontal resolution in excess of 500 lines is achieved in picture center.
- **Stable picture** Even played back pictures of VTR can be displayed without jittering.
- **Looping video input** Video input can be looped through with built-in termination switch.
- **External sync operation** (available as option for U and C types)
- **Compact construction** Two monitors are mountable side by side in a standard 19-inch rack.

A PROFESSIONAL WORD PROCESSING SYSTEM AND IT'S A COMPUTER AS WELL.

FOR ONLY **£3250** + VAT

PET 32K - This is the standard 32K Pet from Commodore. Reverse video and graphics allow the WordPro Package to give simple clear and easy to read displays.

2040 Disk Drives Twin disk drives allow large high speed storage for your letters, or paragraphs. Plugs in the back of the PET.

NEC Spinwriter NEC's high quality printer uses a print "thimble" that has less diameter and inertia than a daisy wheel, giving a quieter, faster, more reliable printer that can cope with plotting and printing (128 ASCII characters) with up to five copies, friction or tractor feed. The ribbon and thimble can be changed in seconds.

55 characters per second bidirectional printing - with red/black, bold, subscript, superscript, proportional spacing, tabbing, and much, much more.

WordPro II The heart of the system - consists of a ROM and diskette. The ROM is inserted into a space socket inside the Pet. One of the most versatile Word Processing Packages around.

All items sold separately.

only **£356** + VAT



TRS80 LEVEL 2 16K


Fully converted to UK T.V. Standard. Comes complete with easy to follow manuals. UK Power Supply - Cassette Leads - Sample tapes. Special box to enable you to plug into your own TV. Recommended for first time-buyers. Just plug in and go. Full Range of Software Available

Model with numeric key pad £389 + VAT
4K Level I - machine only £261 + VAT

NEW REDUCED PRICES

8K **£449**
16K **£549**
32K **£649**

+ VAT



RRP £795 for 32K **The PEDIGREE PETS**

Very popular for home & business use. 8K Microsoft Basic in ROM. 8K Pet 32K & 16K with new improved keyboard. All with green screen.

Extra cassette deck **£55** Full range of software available.

32K **£690** + VAT
48K **£790** + VAT



EXIDY SORCERER

RRP £859 for 32K


For Personal or Business Use.

32K or 48K memory. 8K Microsoft Basic in ROM. Dual Cassette I/O, RS232 I/O. Parallel I/O (Centronics). Expansion available through optional extra S100 Motherboard. 69 Key keyboard including 16 key numeric pad.

S100 EXPANSION - **£199**

NASCOM IMP PLAIN PAPER PRINTER

325 NEW



Fully built and housed in a stylish enclosure for just **£325** plus VAT. Interfaces with all micro computers.

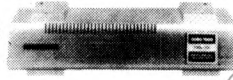
The Nascom IMP (Impact Matrix Printer) features are listed below:

- 60 lines per minute.
- 80 characters per line.
- Bi-directional printing.
- 10 line print buffer.
- Automatic CR/LF.
- 96 character ASCII set (including upper/lower case, #, \$, %).
- Accepts 8 1/2" paper (pressure feed).
- Accepts 9 1/2" paper (tractor feed).
- Tractor/pressure feed.
- Baud rate from 110 to 9600.
- External signal for optional synchronisation of baud rate.
- Serial RS232 interface with parallel option available soon.

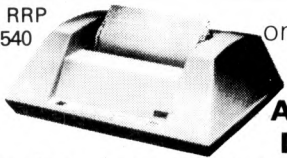
only **£295** + VAT

Expand your TRS80 by 32K. 32K Memory on board. Centronics parallel port. Disk controller card. Real time clock. Requires Level II Basic. Interface for 2 cassette decks. complete with power supply.

TRS80 EXPANSION INTERFACE



RRP £540 only **£499** + VAT



ANADEX DP8000

Super Quality - Low cost printer. Tractor Feed with full 96 ASCII character set. Accepts RS232C at band rates between 100 and 9600 and Parallel Bit data.

Attaches either directly or through interfaces to Pet, Apple, TRS80, Sorcerer, Nascom, CompuKit etc.

video 100

12" BLACK & WHITE LOW COST VIDEO MONITOR

RRP £79 only **£69** + VAT

- Ideal for home, personal and business computer systems
- 12" diagonal video monitor
- Composite video input
- Composite video input
- Compatible with many computer systems
- Solid-state circuitry for a stable & sharp picture
- Video bandwidth - 12MHz + 3dB
- Input impedance -75 Ohms
- Resolution - 650 lines Minimum In Central 80% of CRT; 550 Lines Minimum beyond central 80%.

NASCOM-2 MICRO-COMPUTER

only **£295** + VAT



Your choice of freebies with every Nascom 2 purchased from us

either FREE POWER SUPPLY OR FREE GRAPHICS ROM OR FREE VERO CASE TO TAKE NASCOM 2

Microprocessors Z80A. 8 bit CPU. This will run at 4MHz but is selectable between 1/2/4 MHz. This CPU has now been generally accepted as the most powerful, 8 bit processor on the market.

INTERFACE

Keyboard New expanded 57 key Licon solid state keyboard especially built for Nascom. Uses standard Nascom, monitor controlled, decoding.

T.V. The lv peak to peak video signal can drive a monitor directly and is also fed to the on-board modulator to drive the domestic T.V.

I.O. On-board UART (Int.6402) which provides serial handling for the on-board cassette interface or the RS232/20mA teletype interface.

The cassette interface is Kansas City standard at either 300 or 1200 baud. This is a link option on the NASCOM-2. The RS232 and 20mA loop connector will interface directly into any standard teletype.

The input and output sides of the UART are independently switchable between any of the options - i.e. it is possible to house input on the cassette and output on the printer.

PIO There is also a totally uncommitted Parallel I/O (MK3881) giving 16, programmable, I/O lines. These are addressable as 2 x 8 bit ports with complete handshake controls.

Documentation Full construction article is provided for those who buy a kit and an extensive software manual is provided for the monitor and Basic.

Basic The Nascom 2 contains a full 8K Microsoft Basic in one ROM chip with additional features like DEEK, DOKE, SET, RESET for simple programming.

With free 16K RAM board.

COMPUKIT UK101

EUROPE'S FASTEST SELLING ONE BOARD COMPUTER



Simple Soldering due to clear and concise instructions compiled by **Dr. A.A. Berk, BSc. PhD.**

- ★ 6502 based system — best value for money on the market.
- ★ Powerful 8K Basic — Fastest around
- ★ Full Qwerty Keyboard
- ★ 4K RAM Expandable to 8K on board.
- ★ Power supply and RF Modulator on board.
- ★ No Extras needed — Plug-in and go.
- ★ Kansas City Tape Interface on board.
- ★ Free Sampler Tape including powerful Dissassembler and Monitor with each Kit.
- ★ If you want to learn about Micros, but didn't know which machine to buy then **this is the machine for you.**

Build, Understand and Program your own Computer for only a small outlay.

KIT ONLY **£199** + VAT
NO EXTRAS NEEDED

AVAILABLE READY ASSEMBLED & TESTED
READY TO GO FOR **£249** + VAT

Specially designed case for CompuKit in orange/black. With room for accessories. **£29.50** + VAT

6502 Assembler/Editor for CompuKit **£14.90** + VAT

The **CompuKit UK101** comes in kit form with all the parts necessary to be up and working, supplied. No extras are needed. After plugging in just press the reset keys and the whole world of computing is at your fingertips. Should you wish to work in the machine code of the 6502 then just press the M key and the machine will be ready to execute your commands and programs. By pressing the C key the world of Basic is open to you.

This machine is ideal to the computing student or Maths student, ideal to teach your children arithmetic, and is also great fun to use.

Because of the enormous volume of users of this kit we are able to offer a **new reduced price of £199** + VAT

THE NEW TRS80 SURPRISE — MODEL II

Fast and expandable!

Model II operates at twice TRS-80's high speed.



In addition to either 32 or 64 thousand characters (bytes) of internal Random Access Memory, one built-in 8" floppy disk stores an additional one-half million bytes, including the Disk Operating System. And you can easily expand up to a four-disk system for up to two-million bytes of storage.

Model II features upper and lower case letters. Its built-in 12" high-resolution video monitor displays 24 lines of 80 normal characters. The professional 76-key keyboard (with "calculator" keypad) includes advanced functions such as Control, Escape, Caps, Hold, Repeat. The keyboard is detachable and moveable for convenient data entry.

You get the enhanced Level III version of TRS-80's already-famous Level II BASIC language and "TRSDOS" operating system, automatically loaded in memory when you "power up." (About 24K of RAM is used by this software.)

Each time you power up, Model II thoroughly tests itself to insure proper operation. Your chosen program can appear immediately, without any intermediate steps or questions to answer.

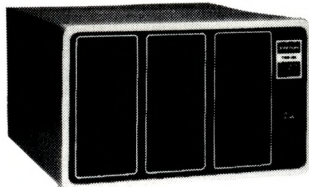
Versatility ... plug-in expandability

Built-in input/output capabilities include two RS-232C channels, and one Centronics parallel port. Future expansion is provided for through four plug-in slots for optional PC boards.

64K 1-Disk Model II **£2250.00** + VAT

1 DISK EXPANSION Room for 3

500K per Drive gives total of 1.5M Byte — 1 Drive plus Cabinet **£799** + VAT



Just Plug In

WE ARE NOW EX-STOCK

EXTENDED WARRANTY BY COMPCARE

Why do people buy more from COMPSHOP than anywhere else?

- ★ **LARGER STOCKS** — we hardly ever run out
- ★ **GOOD SERVICE** — we give extended warranties on all our products.
- ★ **EXCELLENT REPAIR SERVICE** — Through CompuCare we repair and maintain most makes of personal computers.

LAST YEAR WE SUPPLIED TO THE PUBLIC — LARGE & SMALL
16,000 Television Games & 7,000 Computer Systems

COMPCARE

CompuCare is a company that has been set up to provide servicing and maintenance for the popular makes of micro-computers i.e. Sorcerer, Pet, Apple, TRS80, Nascom, CompuKit. Our charges are £7 per hour plus parts.

Because of the extensive range of spare parts stocked you can usually expect your micro to be repaired within 10 days for an average charge of £14 labour.

Emergency 24 hour repairs can be handled for a £10 surcharge where possible. CompuKits and Nascoms unsuccessfully constructed will be charged a standard £25.



THE ATARI VIDEO COMPUTER SYSTEM

£99 + VAT

Atari's Video Computer System now offers more than 1300 different game variations and options in twenty great Game Program™ cartridges!

Have fun while you sharpen your mental and physical coordination. You can play rousing, challenging, sophisticated video games, the games that made Atari famous.

You'll have thrill after thrill, whether you're in the thick of a dogfight, screeching around a racetrack, or dodging asteroids in an alien galaxy. With crisp bright colour (on colour TV) and incredible, true-to-life sound effects. With special circuits to protect your TV.

Cartridges now available All at **£13.90** each + VAT
Basic Maths, Airsea Battle, Black Jack, Breakout, Surround, Spacewar, Video Olympics, Outlaw, Basketball, Hunt & Score*, Space War, Sky Diver, Air Sea Battle Codebreaker*, Miniature Golf.

Extra Paddle Controllers — **£14.90** + VAT

*Keyboard Controllers — **£16.90** + VAT



"Europe's Largest Discount Personal Computer Store"

Please add VAT to all prices — Delivery at cost, will be advised at time of purchase. Please make cheques and postal orders payable to COMPSHOP LTD., or phone your order quoting BARCLAYCARD, ACCESS, DINERS CLUB or AMERICAN EXPRESS number.

CREDIT FACILITIES ARRANGED — send S.A.E. for application form.

14 Station Road, New Barnet, Hertfordshire, EN5 1QW Telex: 298755 TELCOM G

Telephone: 01-441 2922 (Sales) 01-449 6596

OPEN - 10 am - 7 pm — Monday to Saturday

Close to New Barnet BR Station — Moorgate Line.

★ **NOW in IRELAND** at: 80 Marlborough St., Dublin 1. Tel: Dublin 749933



COMP COMPUTER COMPONENTS

(Part of the CompuShop Ltd. Group)



"My best Apple programs are on long-term deposit in the City... it pays rather well!"

We brought the first five Apples into the U.K. in November '77, with every penny we had. In November '79, we find several thousand throughout the country.

THANK YOU Apple owners.

Now we'd like to help you re-coup your investment by cataloguing and supporting the best Apple programs in the U.K. The Apple Software Bank is more like an old penny bank than a major clearing bank, but we know you'll help it grow. Telephone Stephen Derrick on 01-626-8121 to discuss your investment.

ATTENTION ALL Estate Agents, Employment Agencies, Yacht Brokers, Antique Dealers and Motor Traders.

Find out about *FINDER SOFTWARE!*

SOME BLUE CHIPS

TESKIM. This ROM will simulate the Tektronix 4010 family of graphics terminals. It's rather good!

UPPER LOWER CASE ADAPTOR A chip for the chap considering word processing.

NEW ISSUES

We are continually trying to bring the latest add-ons for your Apples. Please phone for the latest product information and data sheets.

NEW PRODUCTS

8" SHUGART DISKS giving 1.2 Megabytes A twin drive (with room for a third.) disk system with controller and software, give tremendous commercial possibilities. £2350 Excl. V.A.T.

WORD PROCESSOR. Ask about our Apple II Plus word processor package. Complete System with Diablo 1650 Daisy-Wheel Printer. £4250 Excl. V.A.T.

PERSONAL COMPUTER PRINTERS. Sensational 40 & 80 Character printer (graphics options) from £243 Excl. V.A.T. Interfaces for Apple, Pet & TRS 80. High quality silent printers. It's your choice!

A/D BOARD At last we have either an 8 bit or 12 bit A/D card for Apple. Excellent spec from £125 Excl. V.A.T.

APPLE PASCAL £296



Personal Computers Limited

194-200 Bishopsgate, London EC2M 4NR.

Let us advise you about *COLOUR DISPLAY* on your Apple. Contact Technical Services.

