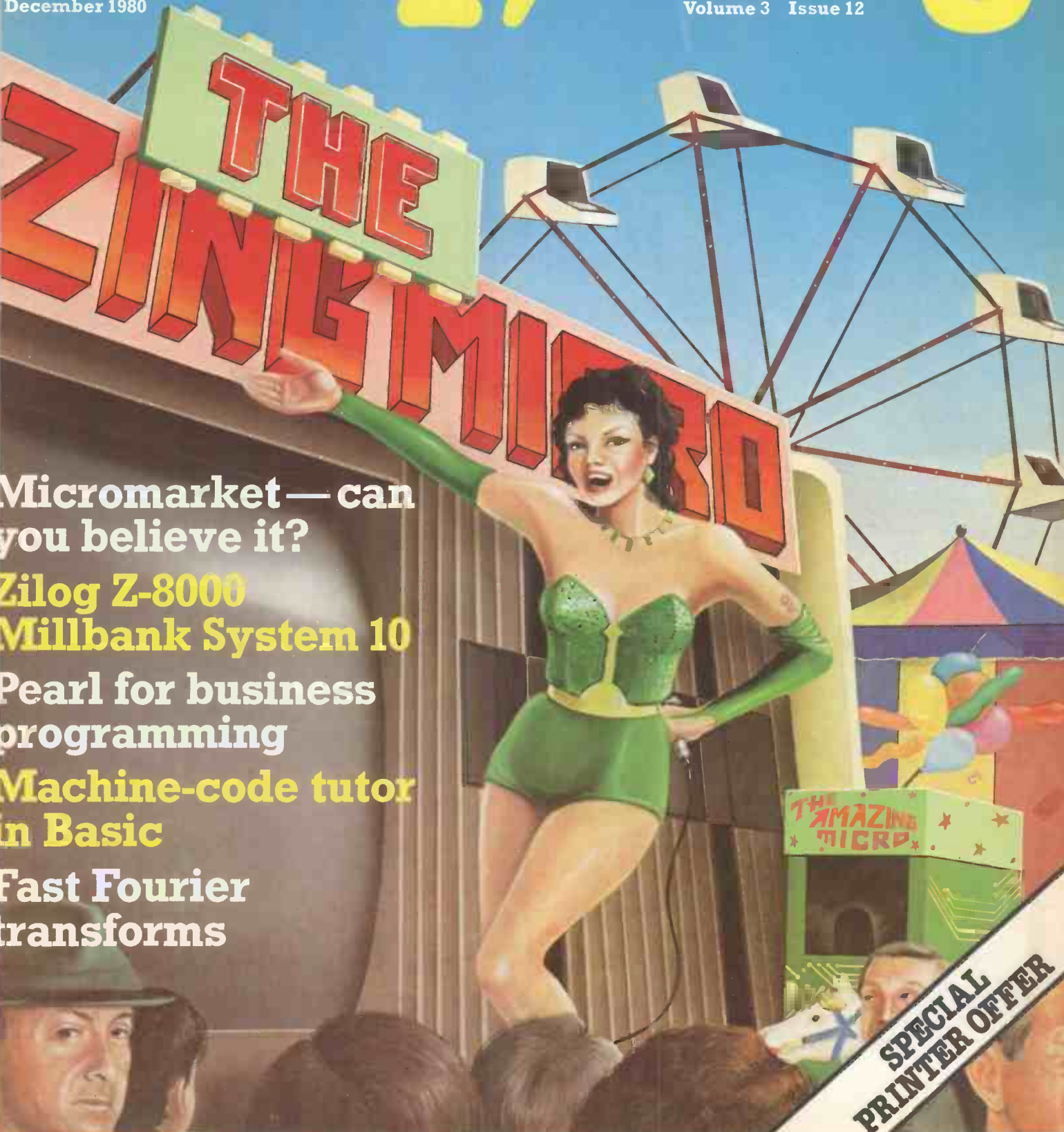


Practical Computing

60p

December 1980

Volume 3 Issue 12



Micromarket — can you believe it?

Zilog Z-8000

Millbank System 10

Pearl for business programming

Machine-code tutor in Basic

Fast Fourier transforms

THE AMAZING MICRO

SPECIAL PRINTER OFFER

The best computers PLUS the best service

At MicroCentre, we're concentrating our resources on what we genuinely believe are the very best computers available today. . . . Cromemco computers, naturally. This way we can offer you the best deal possible.

What we don't do

What we don't do is spread our expertise thinly amongst umpteen different systems, or try to stock every S100 product on the market. We don't claim to offer "impartial" advice on the best buy. And we don't sell from price lists or catalogues.

The MicroCentre approach

Some micro-computer suppliers work like that, but we don't. Because we realise that when you're buying a computer you want more than the "brochures and boxes" of other computer suppliers.



Cromemco Model Z-2H hard disc computer. 10 megabyte hard disc, 2 floppy discs, 7-80 computer and 64K memory. MicroCentre price £5,326.

... STOP PRESS All Cromemco computers supplied by MicroCentre now have double density disks as standard ...

That's why we've specialised in Cromemco systems. Not simply because we think Cromemco systems are the best serious computers available at the price.

So when you visit MicroCentre you will find Cromemco systems on permanent



MicroCentre's Cromemco demonstration room, with the full range of Cromemco computers, peripherals, operating systems and software products on permanent exhibition. Why not pay us a visit? We're only an hour's Shuttle flight from Heathrow!

... demonstration; expect the full range of peripherals; single-user and interactive

documentation, and a collection of Cromemco systems software in the UK.

Expertise

Expect to find in-depth professional expertise at MicroCentre, the kind that is only acquired by installing Cromemco systems all over Britain. Expect a thorough appreciation of how Cromemco systems can be applied . . . in business, scientific research, industrial engineering, medicine and education.

Support

Expect to get frank, accurate answers to your questions at MicroCentre. Above all, once you've bought a Cromemco system from us, expect to get a very high standard of technical support with your hardware enhancements and continuing software needs.

At MicroCentre, simply expect the best.

For  Cromemco... call the experts

NOW IN SPACIOUS
NEW SHOWROOMS

Tel. 031-556 7354

MicroCentre

STILL IN
CENTRAL EDINBURGH

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

● Circle No. 101



The micromarket — page 62.

Editor
Peter Laurie
 Assistant Editor
Duncan Scot
 Production Editor
Toby Wolpe
 Prestel Editor
Martin Hayman
 Consultants
 Technical **Nick Hampshire**
 Software **Mike McDonald**
Editorial: 01-661 3144
 Advertisement Manager
Tom Moloney
 Advertisement Executive
David Lake
Advertising: 01-661 3500
 Midlands office:
David Harvett 021-356 4838
 Northern office:
Ron Southall 061-872 8861
 Advertisement Secretary
Stephanie Hill
 Publisher
Chris Hipwell
 Published by IPC Electrical Electronic Press Ltd, Quadrant House, The Quadrant, Sutton, Surrey, SM25AS. Tel: 01-661 3500. Telex/grams 892084 BIPRESG.
 Typesetting and artwork by Bow-Towning Ltd, London EC1
 Printed by Eden Fisher Ltd, Southend-on-Sea
 Distributed by IPC Sales and Distribution Ltd, 40 Bowling Green Lane, London EC1R 0NE
 Subscriptions: U.K., £8 per annum; Overseas £14 per annum; airmail rates available on application to Subscription Manager, IPC Business Press (S & D) Ltd, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH, tel 0444 59188
 © IPC Business Press Ltd 1980
 ISSN 0141-5433
 Would-be authors are welcome to send articles to the Editor but PC cannot undertake to return them. Payment is at £30 per published page. Programs intended for publication should ideally be justified to 22 or 44 or 66 characters per line.
 Submissions should be typed or computer-printed. Hand-written material is liable to delay and error.
 Every effort is made to check articles and listings but PC cannot guarantee that programs will run and can accept no responsibility for any errors.

CONTENTS

41	Editorial /Microcomputing in the recession
42	Feedback /Fostering pessimism; mis-shapen compiler; list-proofing programs
46	Printout /Nascom's buyer; new Chess Challengers; data-privacy laws
55	Printout Extra /The story of the rise, fall and re-birth of Nascom
56	Pearl /We review the package that can write programs
58	Millbank System 10 /Nick Horgan inspects one of the latest CP/M-based machines
60	Zilog Z-8000 /Our assessment of the development module from Zilog
62	Micromarket /Kerr Borland, Julian Allason and Rodnay Zaks probe the micromarket from different angles and conjecture about its future
72	Micro evaluation for real-time service /Colin Keay on the development of special-purpose data processors
74	Space Intruders /A fast, Basic version of the pub game by Simon Goodwin
78	Education /How to use the micro as an examiner; Rex Tingey offers some example programs
82	The Transam Tuscan design story /The software slant by Brendan Owen in the final part of the chronicle of Tuscan's development
88	Recursion /Recursiveness and non-recursive programming explained by Boris Allan
91	Fast Fourier transforms /What are these mythical beasts? Ben Rogers answers the question
94	Machine-code tutor /How to write machine-code programs in Basic
98	Machine Code /The eighth part of David Peckett's series
105	ZX-80 Line-up
108	Z-80 Zodiac
111	Tandy Forum
113	6502 Special
115	Apple Pie
116	Pet Corner
118	Book Reviews
123	User Groups
126	Peripherals Buyers' Guide
145	The Hexadecimal Kid /Page 3 of the parable in eight virtual pages Prestel page number 45631 /The <i>Practical Computing</i> Prestel pages

megaytor and apple

the perfect couple

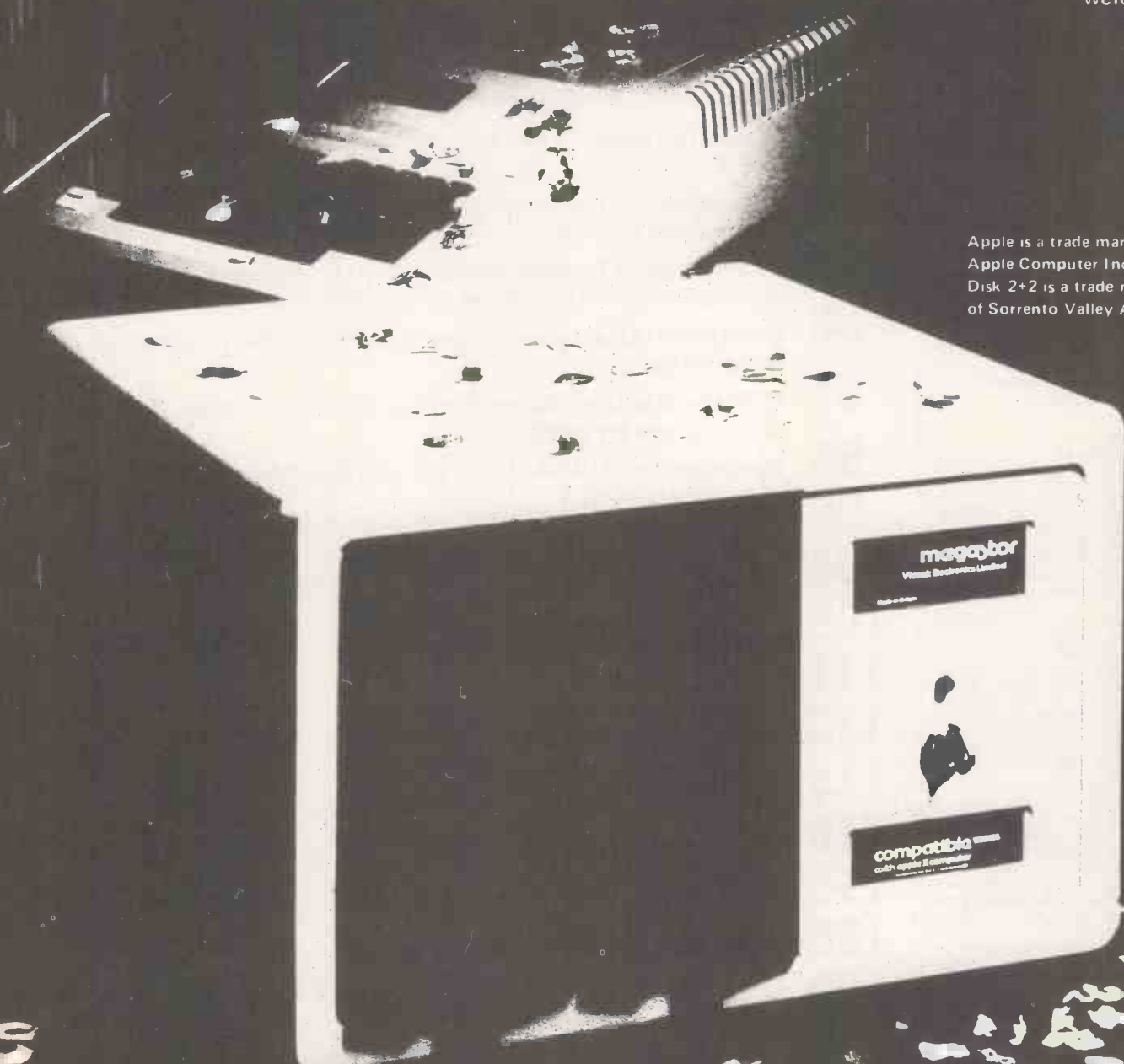
1 Megabyte on  line for £1970

Plug-in compatible with Apple standard 5¼" disk drives.

Runs on Apple DOS. Includes SVA Disk 2+2 Controller Card.

Dealer enquiries
welcomed.

Apple is a trade mark of
Apple Computer Inc.
Disk 2+2 is a trade mark
of Sorrento Valley Associates.



VLASAK ELECTRONICS Ltd, Thames Building, Dedmere Road, Marlow, Bucks, SL7 1PB.

Telephone: Marlow (STD code 06284) 74789. Telex: 847008 Vlasak G

The Cromemco

Z-2H

THE
MARKET
LEADER

Z-2H
Computer System

A

B

Cromemco

**11 Megabytes of hard disc storage in a fast,
new, table-top computer.**

- Fast Z80A 4MHz processor
- 11-megabyte hard disc drive
- Two floppy disc drives
- 64K RAM memory
- RS-232 serial interface
- Printer interface
- Extensive software available

Camberley	Microbits, Camberley, Surrey 0276 34044
Cambridge	Cambridge Computer Store, Cambridge 0223 68155
Dublin	Lendac Data Systems Ltd., Dublin 372052
Ilford	The Byte Shop, Ilford, Essex 01-554 2177 also at Tottenham Court Road, London 01-636 0647
Leeds	Holdene Ltd., Leeds 0532 459459 also at Wilmslow, Cheshire 0625 529486
London	Digitus Ltd., London W1 01-636 0105
Manchester	Computer Workshop, Manchester 061-832 2269 also at West Park, Leeds 0532 788466
Newbury	Newbear Computing Store, Newbury, Berks 0635 30505
Newport	Micromedia Systems, Newport, Gwent 0633 50528
Nottingham	Computerland Ltd., Nottingham 0602 40576 also at Birmingham 021-622 7149; Manchester 061-236 4737; Glasgow 041-332 2468
Sheffield	Hallam Computer Systems, Sheffield 0742 663125
Southampton	Xitan Systems Ltd., Southampton 0703 38740
St. Austell	Benchmark Computer Systems Ltd., St. Austell 0726 61000



comart specialists in microcomputers

Comart Ltd., P.O. Box 2, St. Neots, Huntingdon, Cambs, PE19 4NY. Tel: (0480) 215005 Telex: 32514

• Circle No. 103

Mall Order, Visits,
Trade Enquiries
Welcome, Credit
Card Orders Accepted
by telephone/telex.
Payment must be in
sterling on UK Bank.

ENTERPRISES

Room PC12
8 Cambridge House
Cambridge Road, Barking
Essex IG11 8NT, England.
Telephone: 01-591 6511
Telex: 892395 LPRISE

BOOKS/MAGAZINES/SUBSCRIPTIONS

BY OSBORNE

Introduction to Microcomputers Series

Vol 0: Beginners Book	£ 5.95
Vol 1: BASIC Concepts	£ 6.30
Vol 2: Some Real Microprocessors (without binder)	£ 18.95
Vol 2: Some Real Microprocessors (with binder)	£ 24.70
Vol 2: Updating supplement set Nos. 1-6	£ 18.95
Vol 3: Some Real Support Devices (without binder)	£ 11.95
Vol 3: Some Real Support Devices (with binder)	£ 17.70
Vol 3: Updating supplement set Nos. 1-6	£ 18.95
1 binder (Specify for Vol 2 or 3)	£ 5.75
1 Updating supplement (Specify for Vol 2 or 3)	£ 4.00
PET and the IEEE 488 (GPIB) bus	£ 9.95
6800 Programming for Logic Design	£ 6.30
8080 Programming for Logic Design	£ 6.30
Z80 Programming for Logic Design	£ 6.30
Z80 Assembly Language Programming	£ 8.15
6502 Assembly Language Programming	£ 8.25
8080A/8085 Assembly Language Programming	£ 7.95
6800 Assembly Language Programming	£ 7.95
Accounts Payable and Accounts Receivable (specify Wang or CBASIC)	£ 13.15
Payroll with Cost Accounting (Specify Wang or CBASIC)	£ 13.50
General Ledger (Specify Wang or CBASIC)	£ 12.25
Some Common BASIC Programs	£ 7.95
Running Wild	£ 2.50

GENERAL

See Magazines and Subscriptions!

See Osborne Books!

Microprocessors from Chips to System	£ 7.00
Microprocessor Interfacing Techniques	£ 9.95
Cheap Video Cookbook	£ 4.30
IC OP-AMP Cookbook	£ 8.95
RTL Cookbook	£ 4.25
Ciarcias Circuit Cellar	£ 5.50
Buyers Guide to Microsoftware	£ 2.40
Calculating with BASIC	£ 3.95
Computer Programs that Work (In BASIC)	£ 3.95
Dr Dobbs Journal, Volume 1	£ 13.95
Dr Dobbs Journal, Volume 2	£ 13.95
Dr Dobbs Journal, Volume 3	£ 13.95
Best of BYTE	£ 8.95
Scebi BYTE Primer	£ 8.95
Best of Creative Computing, Vol 1	£ 6.95
Best of Creative Computing, Vol 2	£ 6.95
Program Design	£ 4.25
Programming Techniques: Simulation	£ 4.25
Numbers In Theory and Practice (A BYTE publication)	£ 5.50
PIMS - A Database Management System	£ 5.95
Best of Interface Age - Software	£ 9.95
Programming the Z8000	TBA
Microsoft BASIC University Software Inc., (listings)	
Home and Economics Programs	£ 15.00
Education and Scientific Programs	£ 20.95
Small Business Programs	£ 29.50

CONCERNING LANGUAGE

SCEBAL - BASIC Language Interpreter (Source Code)	£ 15.00
Instant BASIC	£ 6.95
Basic BASIC	£ 6.50
Advanced BASIC	£ 6.00
My Computer likes me... when I speak in BASIC	£ 2.75
Users Guide to North Star BASIC	£ 10.00
A Practical Introduction to PASCAL	£ 3.95
Microsoft BASIC (A guide)	£ 6.50
Secret Guide to Computers	£ 4.00

FOR THE 6800

See Magazines and Subscriptions!

See Osborne Books!

6800 Software Gourmet Guide & Cookbook	£ 7.15
6800 Tracer - An aid to 6800 Program Debugging	£ 3.95
Tiny Assembler	£ 5.75
RA 6800 ML - An M600 Relocatable Macro Assembler	£ 15.95
Link 68 - An M6800 Linking Loader	£ 5.50
MONDEB - An Advanced M6800 Monitor Debugger	£ 3.50

FOR THE 8080

See Osborne Books!

8080 Programmers Pocket Guide	£ 1.95
8080 Hex Code Card	£ 1.95
8080 Octal Code Card	£ 1.95
8080 Software Gourmet Guide & Cookbook	£ 7.15
8080/8085 Software Design	£ 6.75
8080 Standard Monitor	£ 9.95
8080 Standard Assembler	£ 9.95
8080 Standard Editor	£ 9.95
8080 Special Package: Monitor, Editor, Assembler	£ 20.00
BASEX: A Simple Language and Compiler for the 8080	£ 5.50

FOR THE Z80

See Osborne books!

32 BASIC Programs for the TRS-80 (Level II) 16k	£ 10.10
Introduction to the T-bug (TRS-80 Machine Lang. Monitor discussion)	£ 4.50
Z80 Software Gourmet Guide and Cookbook	£ 8.50
Programming the Z80 (ZACS)	£ 9.95
Z80 Instruction Handbook (Wadsworth)	£ 2.95

FOR THE 6502

See Magazines and Subscriptions

See Osborne Books

Best of Micro, Vol 1	£ 5.50
Best of Micro, Vol 2	£ 5.50
Programming the 6502 (Zacs)	£ 7.95
6502 Applications	£ 7.95
6502 Software Gourmet Guide and Cookbook	£ 7.25
32 BASIC Programs for the PET	£ 10.10
First Book of KIM	£ 7.00

FOR FUN

Starship Simulation	£ 4.50
SARGON - A Chess Game (for the Z80)	£ 9.50
BASIC Computer Games	£ 5.00
More BASIC Computer Games	£ 5.50
What to do After you Hit Return	£ 8.95
8080 Galaxy Game	£ 6.95
SUPER-WUMPUS - A game in 6800 Assembler Code & BASIC	£ 4.25
Computer Music Book	£ 6.75
Computer Rage (A board game)	£ 6.95
Artist and Computer	£ 3.95
Games, Tricks and Puzzles for a Hand Calculator	£ 2.49
Introduction to TRS-80 Graphics	£ 5.75
Take My Computer Please... (Fiction)	£ 3.25
Introduction to Low Resolution Graphics for Pet, Apple, TRS80	£ 5.50
Microsoft BASIC University Software Inc., (listings)	
Fun and Games Programs 1	£ 9.50
Fun and Games Programs 2	£ 9.50

FOR THE NOVICE

See Magazines and Subscriptions!

See Osborne Books!

How To Make Money With Your Microcomputer	£ 5.75
From the Counter to the Bottom Line	£ 10.00
Your Home Computer	£ 5.95
Introduction to Personal and Business Computing	£ 5.50
Getting involved with Your Own Computer	£ 5.50
How to Profit from Your Personal Computer	£ 5.50
Microcomputer Potpourri	£ 1.95
Hobby Computers are Here	£ 3.95
New Hobby Computers	£ 3.95
Understanding Microcomputers and Small Computer Systems	£ 6.95
Understanding Microcomputers and Small Computer Systems and Audio Cassette	£ 8.75
Getting Down to Business With Your Microcomputer	£ 5.50

MAGAZINE BACK ISSUES

Micro 6502 Journal	£ 1.75
Personal Computing	£ 1.95
Interface Age	£ 2.95
Dr Dobbs Journal	£ 1.95
Computer Music Journal	£ 3.75
Recreational Computing	£ 1.95
BYTE	£ 2.95
Creative Computing	£ 1.95
Calculators and Computers	£ 1.95
Kilobaud Microcomputers	£ 2.95
Compute - for the 6502	£ 1.95
68' Micro	£ 1.95
80-Microcomputing	£ 2.25
On Computing	£ 1.95
Compute II - for the Single Board	£ 1.95
Magazine Storage Box (Holds 12)	£ 1.50
S-100 Microcomputing (For CP/M Users)	£ 1.75

MAGAZINE SUBSCRIPTIONS (all processed within 3 weeks)

Micro 6502 Journal	(12 issues)	£ 13.50
68 Micro	(12 issues)	£ 17.50
Personal Computing	(12 issues)	£ 17.50
Interface Age	(12 issues)	£ 25.50
Dr. Dobbs Journal	(10 issues)	£ 15.00
Recreational Computing	(6 issues)	£ 10.50
BYTE	(12 issues)	£ 25.00
Creative Computing	(12 issues)	£ 17.00
Kilobaud Microcomputing	(12 issues)	£ 22.00
Compute for the 6502	(6 issues)	£ 10.50
80'-Microcomputing	(12 issues)	£ 21.00
Compute II - for the Single Board	(6 issues)	£ 10.50
S-100 Microcomputing (For CP/M Users)	(6 issues)	£ 9.50

SOFTWARE

Software & Manual/Manual Only	
Byrom Software	BSTAM—Utility to link one microcomputer to another also using BSTAM £70/5
Computer Plus	FMS 80 (File Management System) Demo Pack (includes manual and disc) £35 Complete System £395/25
Computer Services	Bidirectional driver for Diablo Hytype printers for use on CPM & CDOS systems £65/10
CP/M User Library	42 Volumes on 8" disc £4 42 Volumes on 5" disc £8
Creative Computing	For CP/M CS-9001 BASIC Games 1 £12 CS-9002 BASIC Games 2 £12 CS-9000 BASIC Games 1 and 2 £22 CS-9003 ADVENTURE I.O. £12 CS-9004 BILINGUAL Original Adventure £12 CS-9005 BASIC Games 3 £12 CS-9006 BASIC Games 4 £12 CS-9007 BASIC Games 3 and 4 £22 CS-9008 BASIC Games 1, 2, 3 and 4 £40
Digital Research	(Most formats now available) MPM 1.1 £175/18 CP/M 1.4 £65/18 CP/M 2.2 £90/18 SID £45/12 ZSID £55/12 MAC £55/12 TEX £45/12 DESPOOL £30/5 PL/1 £POA/25
Information Unlimited	WHATSIT (Database Management System) on North Star £59 on CP/M £75 on APPLE 2:48k (requires int Basic) £72 On APPLE 2:32k (requires int Basic) £59 on ITT 2020 (see Apple)
KLH Systems	Spooler for CPM systems £65/5
L.P. Enterprises	Diablo driver runs 110 to 9600 baud with autoloader for CP/M or CDOS £30/5 OMNIX—UNIX like multiuser, multitasking operating system for Z80 i.e. IMS, Cromemco, Horizon £250/30 Multiforth £65/20
MICAH Inc.	CP/M for CDOS Users: Program to Expand CP/M system to be compatible with Cromemco CDOS software £59/5 Disc Utilities: Pack one of CDOS users includes: Fast disc copy, Track test, Disc test, Compare files and others £30/5 Pack two for CP/M users includes same as pack one £30/5 Pack three for Cromemco users includes same as pack one and spool and print £65/5
Microsoft Inc.	BASIC-80 £175/17 BASIC Compiler 5.2 £195/17 FORTRAN-80 £220/17 COBOL-80 4.0 £355/17 EDIT-80 £45/11 MACRO-80 £80/11 MICROSEED £TBA/20 MULISP £TBA/20 MUMATH £TBA/20
Michael Shroyer Inc.	Electric Pencil Word Processor £100 SSII for tty etc £100 DSII for Diablo £105 TRS-80 Cassette/disc £50
Microfocus Ltd.	CIS COBOL version 4.2 £425/25 FORMS 2 £100/10
Micropro Inc.	WORD-MASTER 1.7 £70/20 TEX-WRITER 2.6 £35/15 WORD-STAR 2.1 £240/25 SUPER-SORT: Version 1 £120/20 Version 2 £100/20 Version 3 £75/20 WORD-STAR with MAIL-MERGE 2.1 £310/25 MAIL-MERGE 2.1 £70/10 DATASTAR 1.07 £165/20
MT Microsystems	Pascal MT £125/12
Northshare	Multi-user system for Horizon Users 5.1 £40/5

Software & Manual/Manual Only	
Osborne & Associates	Accounts Payable & Accounts Receivable (disc only) £50 General Ledger (disc only) £50 Payroll with Cost Accounting (disc only) £50
Compiler Systems	CBASIC v2.06 £65/15
Structured Systems all Converted to UK Standard	Sales Ledger £275/15 Purchase Ledger £275/15 Nominal Ledger £325/15 Stock Control £275/15 Letterright £95/10 Analyst (File management Reporting System) £115/10 NAD (Name and Address selection system) £50/10 OSORT £50/10
TDL Software (Technical Design Labs)	Business Basic £80 ZTEL (Text Editing Lang.) £35 MACRO II (Z80 Macro Assembler) £35 LINKER £35 DEBUG II (for 8080/Z80) £45
Tiny-C Associates	Tiny-C language for 8080, 8085, Z80 systems £50/35
Supersoft Inc.	DIAGNOSTICS 1 £35/5 TERM £65/5
Software Works	Northstar Format only £50/10 Inventory-1 (Stock Control) £130/15 Inventory-2 with order entry, invoicing £50/15 Mailroom Housekeeper (Utilities, sorts) £35/10 Preventative Maintenance £75/15 Housekeeper-2 (Coming Soon) £TBA

ORDER INFORMATION

Software prices reflect distribution on 8" single density discs. If a format is requested which requires additional discs a surcharge of £4 per additional disc will be added.

Please add VAT and £2.50 for first class postage, packing and insurance.

If required, DATAPOST D service is available for an extra charge of £7.50.

All software on this Advertisement is available from stock and a 24-hour return service is thereby offered on all prepaid orders. When ordering CP/M software please specify the format you require otherwise software will be dispatched on an 8" single density disc.

For more information on any of these items, please phone, write or visit. (We are open during office hours).

All publications are published in the U.S.A. and are stocked in Britain by L.P. Enterprises.

We aim to keep all of these books in stock and as a result of this most mail orders are despatched by return of post.

OEM terms available

MAIL ORDER TELEPHONE ORDER VISIT

Send Cash, Cheque, Credit Card No., Postal Order, IMO to L.P. Enterprises, Room PC12, 8 Cambridge House, Cambridge Road, Barking, Essex IG11 8NT.

All Payment must be in sterling and drawn against a UK bank.

Subscriptions are processed to start with the next current issue, after the date of order.

These details are all current as of August 1980.

Prices are subject to change without notice, due to fluctuation in the dollar rate.

Trade Enquiries welcome.

Bulk Purchasers welcome.

**Would you
interview only
one applicant
for an
important
job?**



CURRY'S MICRO SYSTEMS LTD., A MEMBER OF THE CURRY'S GROUP OF COMPANIES
OUR TERMS AND CONDITIONS OF SALE ARE DIFFERENT FROM THOSE SET OUT IN CURRY'S LTD. STATEMENT OF TRADING STANDARDS BUT THEY EMBODY THE SAME PRINCIPLE.
MORE PROTECTION FOR YOU, OUR CUSTOMER, YOU WILL FIND FULL DETAILS OF TERMS OF BUSINESS ON THE REVERSE SIDE OF OUR INVOICES AND AGREEMENTS.

If you were filling an important job, no doubt you'd make a short list.

Yet, surprisingly, many businessmen will sign on the dotted line for a micro-computer after interviewing only one.

At Micro-C, we've put together a short list for you. Although each is different, they're all value for money. (Since we're part of Currys, that's not a promise we make lightly.)

Here are four brief C.V's:

Commodore Pet

For small businesses, it'll tackle book-keeping, word processing and incomplete records.

ITT 20 20 and Apple II

If your business is slightly more involved, we might talk about the ITT 20 20 or the Apple II. They'll tackle book-keeping, incomplete records, word processing and, through Visicalc, financial planning.

National Panasonic - JD800, JD840 and Micro-C 2000.

For small businesses that want to be big businesses, we'll suggest you look at our more sophisticated hardware. They'll do all the others do but they'll also give you all the financial and management information you need to grow.

However, before we talk about hardware or software, we'll talk about your business. (It's the only way we know to give honest, unbiased advice.)

To Currys Micro-Systems Limited, 653 London Road,
High Wycombe, Bucks HP11 1EZ

- Please send me an information pack on your service and products
 Please telephone to make an appointment

Name _____

Company _____

Address _____

Telephone _____

PCI



COMPUTERS EXPLAINED BY HUMAN BEINGS.

At the same time, we'll offer any number of ways to buy or lease starting from £35 a week.

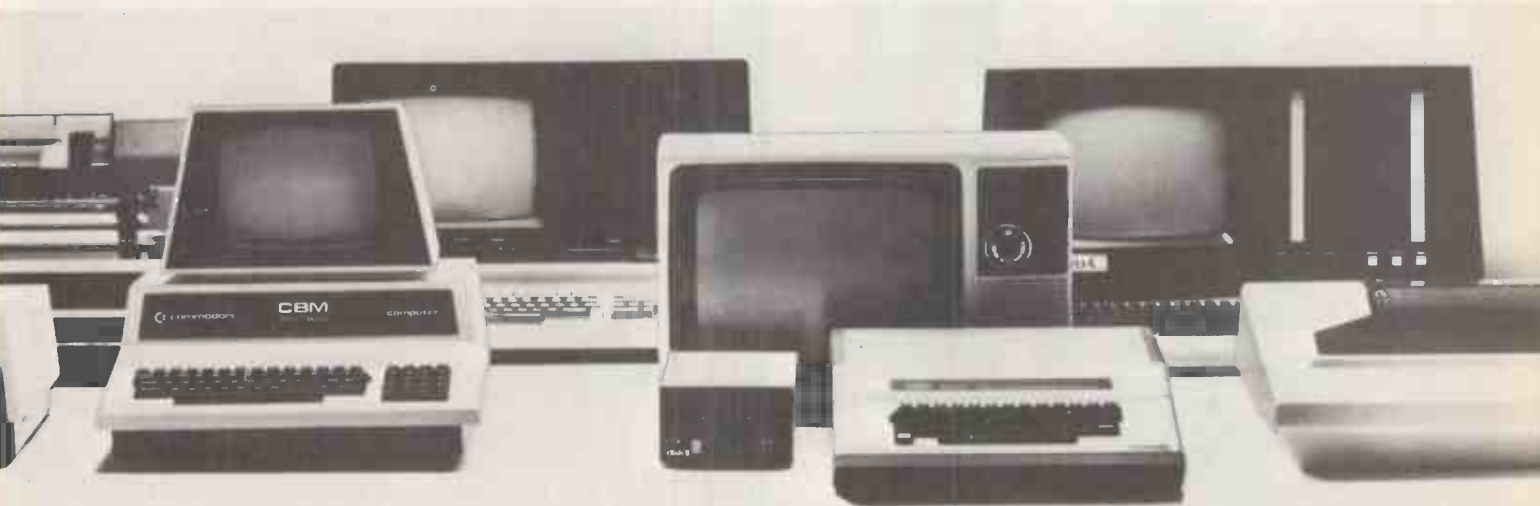
We'll also offer a one year guarantee while others are talking about 90 days.

At a little extra cost, we'll offer to service machines within one working day; and we'll help with staff training.

As for software, we test every package and if they fail to come up to our standards, we won't stock them.

Come and see us for a free demonstration. Or, if you prefer it, an interview with a very hot short list.

Nor would we.



MICRO-C INSIDE CURRYS SHOPS AT: BIRMINGHAM TEL: 2331105 EXETER TEL: 213391 LEEDS ALBION STREET TEL: 446601 LUTON TEL: 0494 40262
NOTTINGHAM TEL: 412455 SOUTHAMPTON BARGATE TEL: 29676 INSIDE BRIDGERS SHOWROOMS AT: BRISTOL TEL: 650501 NEW MALDEN TEL: 01-949 2091

FOR £375* CEN PRINTERS TUR BUSINESS SYS

A microcomputer in the home is fun. But a microcomputer in the office is serious business. The quality of its output reflects your professionalism.

Reports, letters, invoices and other business correspondence need to be presented in a business-like way. At home you wouldn't spoil a good hi-fi system with second-rate speakers—so why accept less than clear, high quality print-out in the office?

Now, you don't have to. Centronics, the world's leading independent printer manufacturer, is making high quality printers available direct to you the user, at a price previously only obtainable within the computer industry for large quantity purchases.

The Centronics 730 and 737 are dot matrix printers which connect to all well-known makes of microcomputer. You'll no doubt recognise the phrase "Centronics compatible" from our competitors' advertising.

A wide choice of speeds and print styles, and the ability to handle single sheet and continuous stationery are provided by both printers.

In addition the 737 offers word processing quality print with proportional spacing. Both machines carry the Centronics manufacturer's warranty, and local maintenance is obviously available from the world's leading supplier of matrix printers.

For sample print-outs and further information send the coupon below.
Centronics Data Computer (UK) Limited, Victoria Way, Burgess Hill, Sussex,
RH15 9NU. Telephone: 04446 45011.

CENTRONICS®

Simply Better

Centronics, please send me a sample print-out and the name of my local stockist.
I am a (delete as appropriate): User/OEM/Shop

Name:..... Position:.....

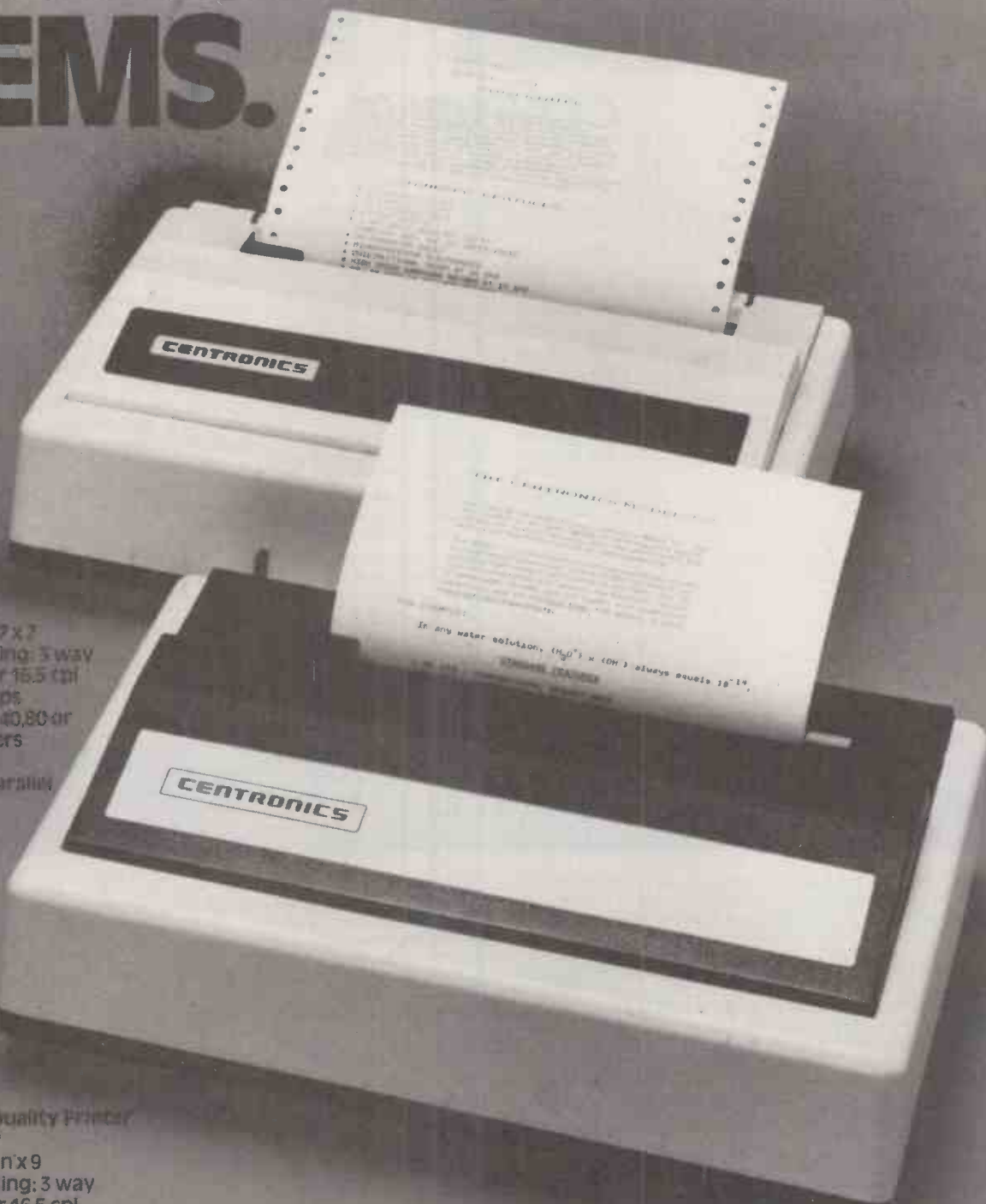
Organisation:..... Tel. No:.....

Address:.....

PC

Centronics Data Computer (UK) Limited, Victoria Way, Burgess Hill, Sussex, RH15 9NU.

TRONICS N MICROS INTO TEMS.



730 Printer
Price: £375*
Dot matrix: 7 x 7
Paper handling: 3 way
Pitch: 5, 10 or 16.5 cpi
Speed: 100 cps
Line length: 40, 80 or
132 characters
Standard
Interface: Parallel

737 Letter Quality Printer
Price: £425*
Dot matrix: n x 9
Paper handling: 3 way
Pitch: 5, 10 or 16.5 cpi
Speed: 80 cps proportional/50 cps monospaced
Line length: 40, 80 or 132 characters
Standard interface: Parallel

*Excluding VAT



SUPERBRAIN™

Intelligent Video Terminal Systems

350K or 700K of Disk Storage

SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL, and APL. Whatever your application . . . General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing, SuperBrain is tops in its class. And the SuperBrain QD boasts the same powerful performance but also features a double-sided drive system to render more than 700K bytes of disk storage and a full 64K of RAM. All standard!



COMPUSTAR™

MULTI-USER TERMINAL SYSTEM

CompuStar user stations can be configured in a countless number of ways. A series of three intelligent-type terminals are offered. Each is a perfect cosmetic and electrical match to the system. The CompuStar 10 — a 32K programmable RAM-based terminal (expandable to 64K) is just right if your requirement is a data entry or inquiry/response application. And, if your terminal needs are more sophisticated, select either our CompuStar 20 or CompuStar 40 as user stations. Both units offer dual disk storage in addition to the desk system in the CompuStar. The Model 20 features 32K of RAM (expandable to 64K) and 350K of disk storage. The Model 40 comes equipped with 64K of RAM and over 700K of disk storage. But, most importantly, no matter what your investment in hardware, the possibility of obsolescence or incompatibility is completely eliminated since user stations can be configured in any fashion you like — whenever you want — at amazingly low cost!

DISK STORAGE

Options for the Superbrain and CompuStar Video Terminal

"Backup" for the 20 megabyte Century Data drive is provided via the dual disk system housed in the CompuStar or the SuperBrain. The Control Data CMD Drive features a removable, front-insertable top loading cartridge of 16 megabyte capacity plus a fixed disk capacity of either 16 or 80 megabytes. Each drive is shipped equipped with an EIA and standard 19" rack mounting system and heavy duty chassis slide mechanisms to permit easy accessibility for fast and efficient servicing.

**** WIDELY USED IN UK AND USE ****
 **** TESTED AND PROVEN ****
 **** POWER AT YOUR FINGERTIPS ****
 **** JUST COMPARE THIS LIST ****

NO OTHER PROGRAM IN THE WORLD COMBINES THESE FEATURES IN ONE. many other programmes, LESS INTEGRATED. DO NOT PROVIDE EVEN SOME OF THOSE FEATURES TO BE FOUND ON OUR 'BUS'.

- 1 = TOTAL INTEGRATION OF SALES/PURCHASE/NOMINAL/STOCK/ADDRESSES/ETC.
- 2 = FULL RANDOM ACCESS ENABLES RETRIEVAL OF ANY RECORD IN A SECOND
- 3 = FLEXIBLE PROMPTS ENABLES WORD CHANGE EVEN TO FOREIGN LANGUAGE
- 4 = FILES MAY BE DEFAULT NAMED AND LOCATED FOR FULL DISK USAGE
- 5 = EASY TO USE, MENU DRIVEN, NO SERIOUS NEED OF MANUAL
- 6 = TESTED AND DEBUGGED IN MANY INSTALLATIONS WORLD-WIDE
- 7 = PRICED LESS THAN THE ACQUISITION OF A LIBRARY OF PROGRAMS
- 8 = THE PROGRAM IS ***TOTALLY*** IN CORE, MAXIMISING DISK SPACE
- 9 = CORE PROGRAM MEANS THAT DISKS MAY BE INTERCHANGED DURING USE
- 10 = CORE PROGRAM MEANS YOU USE THE FIRST SYSTEM DRIVE YOU PAID FOR
- 11 = NUMEROUS REPORTS MAY BE GENERATED (EG: SALE LEDGERS UP TO 30)
- 12 = INVOICE PRODUCES IMMEDIATE STOCK UPDATE + DOUBLE JOURNAL ENTRY
- 13 = REFERENCE ON INVOICES ENABLE COST CENTRE BUILD-UP ON LEDGERS
- 14 = STOCK VALUATIONS AND RE-ORDER REPORTS EASILY GENERATED
- 15 = BANK BALANCE AND REPORTS PLUS STANDARD MAILING FACILITIES
- 16 = CUSTOMER STATEMENTS AND INVOICES PRINTED ON PLAIN PAPER

WE EXPORT TO ALL COUNTRIES

CALLERS ONLY BY APPOINTMENT

IMPORTANT!!! NO COMPUTER HARDWARE IS EVER OF VALUE WITHOUT SOFTWARE; SO WE PROVIDE YOU WITH A STARTING SET OF PROGRAMS ** FREE ****. PURCHASE A SUPERBRAIN AND GET ADDRESS/MAILER (95 POUNDS), STOCK CONTROL (95 POUNDS), DBMS DATABASE MANAGEMENT SYSTEM (195 POUNDS). TOTAL VALUE OF FREE PROGRAMS (385 POUNDS).**

INCLUDES EVERYTHING FROM INVENTORY TO SALES SUMMARY PROMPTS USER AND VALIDATES ENTRIES. MENU DRIVEN

BUS VER 3.00 TO VER 9.00 PET AND CP/M
APPROXIMATELY 60-100 ENTRIES/INPUTS REQUIRE 2-4 HOURS WEEKLY
AND ENTIRE BUSINESS IS UNDER CONTROL

* PROGRAMS ARE INTEGRATED. . SELECT FUNCTION BY NUMBER.

- | | |
|-------------------------------------|--|
| 01 = *ENTER NAMES & ADDRESSES | 13 = *PRINT CUSTOMERS STATEMENTS |
| 02 = *ENTER/PRINT INVOICES | 14 = *PRINT SUPPLIER STATEMENTS |
| 03 = *ENTER PURCHASES | 15 = *PRINT AGENT STATEMENTS |
| 04 = *ENTER A'C RECEIVABLES | 16 = *PRINT TAX STATEMENTS |
| 05 = *ENTER A'C PAYABLES | 17 = GENERAL HELP |
| 06 = *ENTER 'UPDATE INVENTORY | 18 = ALTER VOCABULARIES |
| 07 = ENTER 'UPDATE ORDERS | 19 = PRINT YEAR AUDIT |
| 08 = *ENTER 'UPDATE BANKS | 20 = PRINT PROFIT 'LOSS A'C |
| 09 = *REPORT SALES LEDGER | 21 = ENDMONTH MAINTAINANCE |
| 10 = *REPORT PURCHASE LEDGER | 22 = PRINT CASHFLOW FORECAST |
| 11 = *INCOMPLETE RECORDS | 23 = ENTER PAYROLL (NO RELEASE) |
| 12 = *EXAMINE PRODUCT SALES | 24 = EXIT SYSTEM |

ENTER WHICH ONE?

DATABASE MANAGEMENT INCLUDES

*** FILE CREATE'DELETE'SEARCH. *** RECORD CREATE'DELETE'SEARCH'4 OPTION PRINT.
*** RECORD SORT ANY FIELD ALPHA OR NUMERIC. *** INDEX SEARCH OR GENERAL SCAN'PRINT IN ANY FIELD (EG TOWN OR NAME). *** 4 ARITHMETIC FUNCTIONS TO USE AS CALCULATOR ON LAST 4 FIELDS. *** AUTO CHECK TO PREVENT DOUBLE ENTRY TO FILE MANAGEMENT SYSTEM, DYNAMICALLY ALLOCATING INFORMATION TO MINIMISE DISK SPACE CONSUMPTION.

VERY FLEXIBLE. EASY TO USE

G.W. COMPUTERS U.K. ARE THE PRODUCERS OF THIS BEAUTIFUL PACKAGE

VER 3.00 (EXC PROG 19,20,22,23) = 475.00, VER 4.00 INCLUDES AUTO STOCK-UPDATE = 575.00,
VER 5.00 INCLUDES AUTO BANK UPDATE = 675.00, VER 6.00 IN CORE = 775.00, VER 7.00 (INC 19,20,22,23)
NOT YET RELEASED = 875.00, VER 8.00 RANDOM ACCESS = 900.00, VER 9.00 TRANSLATEABLE = 975.00.

+ + + EACH LEVEL OVERRIDES LOWER ONE

IMPORTANT!!!

WE ALSO SELL THE HARDWARE FOR THE ABOVE TASKS TO ENABLE THE PURCHASE FROM ONE SOURCE.
NOTE THAT A *** COMPLETE *** CBM SYSTEM WITH BUS VER 3 IS 2215 POUNDS AND A *** COMPLETE *** SUPERBRAIN SYSTEM WITH BUS VER 3 AND DEC PRINTER IS 3345 POUNDS.

PET + PET + PET + PET + PET	SOFTWARE +	SOFTWARE	SUPERBRAIN +	SUPERBRAIN
CBM 3032 32K 595.00	BUS VER 3.00 PET 475.00	475.00	SUPERBRAIN 320K 1695.00	
CBM 3040 DISKS 595.00	BUS VER 4.00 PET 575.00	575.00	TWIN Z80 32K + CRT	
CBM 3022 PRINTER 425.00	BUS VER 5.00 PET 675.00	675.00	+ 2 D'D-S'S DRIVE	
CBM 8032 32K 875.00	BUS VER 6.00 CP/M 875.00	875.00	SUPERBRAIN 320K 1795.00	
CBM 8050 1MEG DISKS 875.00	BUS VER 7.00 CP/M 975.00	975.00	TWIN Z80 64K + CRT	
CBM EPSON PRINTER 395.00	BUS VER 8.00 CP/M 1000.00	1000.00	+ 2 D'D-D'S DRIVE	
CBM MULTI USER 650.00	BUS VER 9.00 CP/M 1075.00	1075.00	SUPERBRAIN 800K 2195.00	
CBM 3032 + EPSON +	CBM WORDPRO II 75.00	75.00	TWIN Z80 64K + CRT	
CBM 3040 + BUS V3 2215.00	CBM WORDPRO III 150.00	150.00	+ 2 D'D-D'S DRIVE	
PRINTERS + PRINTERS + PRINTERS	CPM WORD-STAR 195.00	195.00	SUPERBRAIN 2MEG 2795.00	
DIABLO 1650 40CPS 2150.00	CPM MBASIC 80 150.00	150.00	COMPUSTAR 10 1595.00	
DOLPHIN BD80 125CPS 495.00	CPM COBOL 80 320.00	320.00	COMPUSTAR 15 1495.00	
NEC 5510 PRINTER 1695.00	CPM PASCAL MT 150.00	150.00	COMPUSTAR 20 2295.00	
ANADEX 9500 224CPS 975.00	CPM FORTRAN 80 200.00	200.00	COMPUSTAR 30 2495.00	
TELETYPE 43SR 30CPS 875.00	CPM DATASTAR 175.00	175.00	COMPUSTAR 40 2795.00	
DEC-LA34 TRACT 30CP 875.00	CPM PASCAL-M 250.00	250.00	INTERTUBE III 495.00	
NEC-5530PRINTER 1595.00	CPM BYSTAM S'BRAIN 75.00	75.00	EMULATOR 495.00	
QUME DAISY SPRINT5 1950.00	CPM SUPERSORT 120.00	120.00	10 MEG H'DISK 2950.00	
TEXAS 810 150CPS 1390.00	CPM BASIC COMPILER 190.00	190.00	16 MEG (8'8) 3950.00	
SPECIALS + SPECIALS + SPECIALS	CPM DESPOOL 30.00	30.00	96 MEG (4DISK) 7950.00	
N'STAR QUD .7 MEG 1500.00	CPM BYSTAM IMS'N-STAR 75.00	75.00	ADDRESS'MAILER 95.00	
IMS 5000 48K D'D 1500.00	CPM TEXTWRITER 75.00	75.00	STOCK CONTROL. 95.00	
COMPUTHINK * 800K * 795.00	CPM POSTMASTER 75.00	75.00	DBMS DATABASE 195.00	
2 WAY CRDLESS PHONE 135.00	CPM SELECTOR 3 180.00	180.00	IEEE TO PARALLEL 55.00	
TELEPHONE ANSWER 230.00	CPM CBASIC 75.00	75.00	IEEE'RS232 B'DI 195.00	
SHUGART SA400 5" DR 135.00	CPM MACRO 80 75.00	75.00	IEEE TO RS232 100.00	
	CPM W'STAR M'MERGE 310.00	310.00	S'HAND SWTP TERM 100.00	
	BUS MANUAL ***** 9.00	9.00	WARRANTY 6 MONTH FULL REPAIR ***.	

+ + + + + SPECIAL INSTITUTION AND UNIVERSITY DISCOUNTS + + + + +
STOCK AND COMING ROUND. (BARCLAYCARD WELCOME OTHERWISE CHEQUE WITH ORDER)
CONTACT TONY WINTER 01.636.8210
89 BEDFORD CT MANS, BEDFORD AVE W.C.1.

• Circle No. 107

In the microcomputer jungle The Sharp MZ-80 system now with



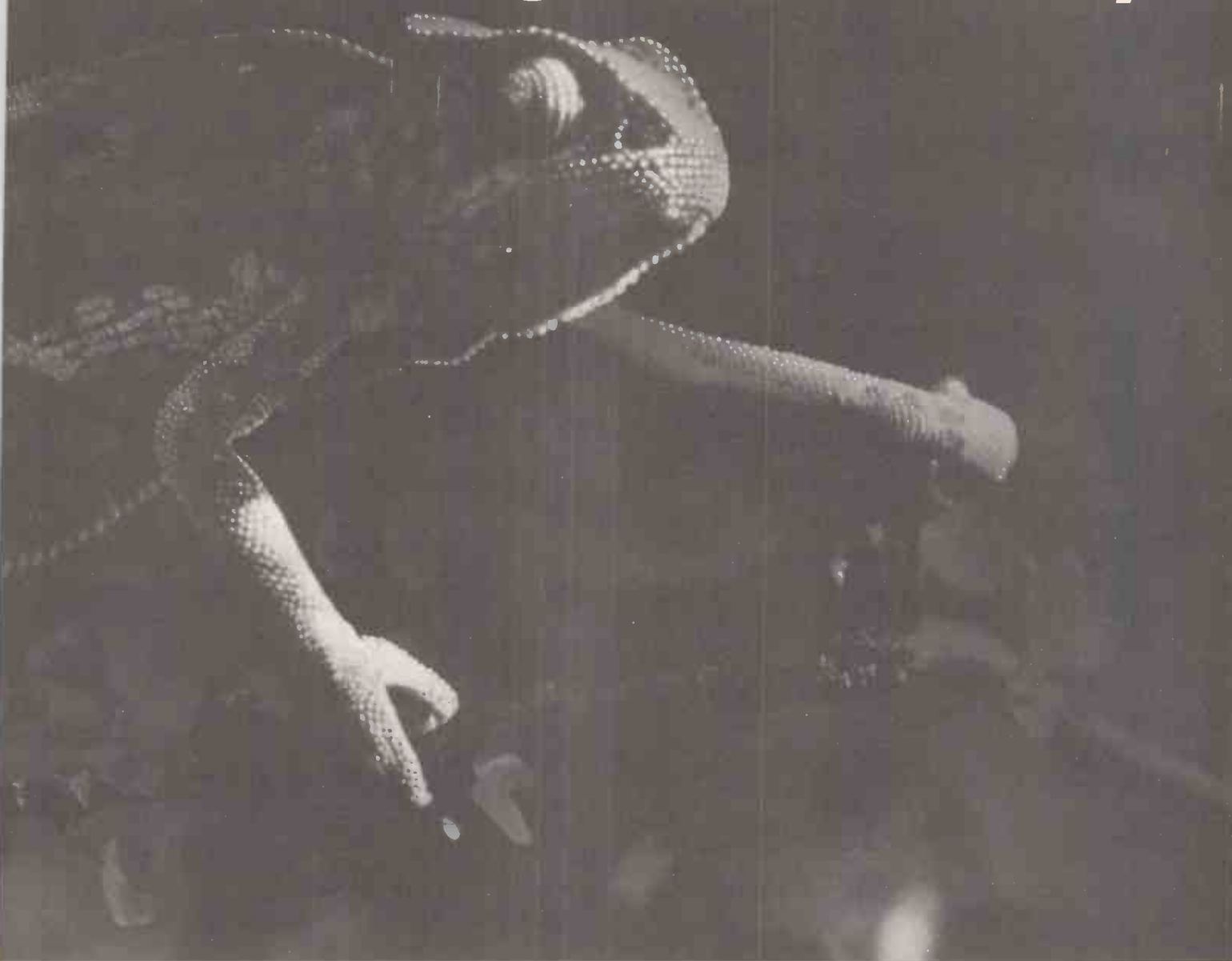
Since its introduction, the Sharp MZ-80 system has proved to be one of the most versatile systems in the micro jungle, for commerce, industry and enthusiasts alike.

Now the MZ-80 Computer system has even more versatility thanks to CP/M[™] giving greater adaptability to face the future. After all look what happened to the Dinosaur.



The MZ-80 system is made up of the MZ-80K computer with the powerful Z-80 microprocessor. MZ-80FD Floppy Disc storage unit, now with CP/M[™] for even greater versatility. MZ-80P3 dot printer producing ultra Sharp print out copy.

Survival depends on adaptability. CP/M has even greater versatility.



Your Sharp Microcomputer Dealers

AVON
BCG SHOP EQUIPMENT LTD · BRISTOL ·
TEL: 0272 425338
DECIMAL BUSINESS M/CS LTD · BRISTOL ·
TEL: 0272 294591
BEDFORDSHIRE
SHERWOODS (H.B. COMPUTERS) LTD ·
LUTON · TEL: 0582 416202

BERKSHIRE
BCG SHOP EQUIPMENT LTD · READING · TEL: 0734 54015
NEWBEAR COMPUTING STORE LTD · NEWBURY ·
TEL: 0635 30505
BUCKINGHAMSHIRE
INTERFACE COMPONENTS LTD · AMERSHAM ·
TEL: 02403 22307

CHESHIRE
CASH REGISTER SERVICES · CHESTER · TEL: 0244 317549
FLETCHER WORTHINGTON LTD · HALE · TEL: 061-928 8928
NEWBEAR COMPUTING STORE LTD · CHEADLE HEATH,
STOCKPORT · TEL: 061-491 2290

DEVON
BCG SHOP EQUIPMENT LTD · PAIGNTON · TEL: 0803 557711
CRYSTAL ELECTRONICS LTD · TORQUAY · TEL: 0803 226999
PETER SCOTT (EXETER) LTD · EXETER · TEL: EXETER 73309

DORSET
SOUTH COAST BUSINESS M/CS · FERNDOWN, DORSET ·
TEL: 0202 893040

ESSEX
PROROLE LTD · WESTCLIFFE ON SEA · TEL: 0702 335298

LANCASHIRE
MICRODIGITAL LTD · LIVERPOOL · TEL: 051-227 2535
SUMITA ELECTRONICS LTD · PRESTON · TEL: 0772 55065
SUMLOCK SOFTWARE LTD · MANCHESTER ·
TEL: 061-228 3502
SOUND SERVICES · BURNLEY · TEL: 0282 38481

LEICESTERSHIRE
ARDEN DATA PROCESSING · LEICESTER · TEL: 0533 22255
GILBERT COMPUTERS · LUBENHAM · TEL: 0858 65894

LINCOLNSHIRE
HOWES ELECT. & AUTOM. SERVS. WASHINGTON ·
TEL: LINCOLN 32379

LONDON
C.S.S. BUSINESS EQUIPT LTD · LONDON · E8 ·
TEL: 01-836 1176
CENTRAL CALCULATORS LTD · LONDON · EC2 ·
TEL: 01-729 5588

DIGITAL DESIGN & DEVELOPMENT · LONDON · W1 ·

TEL: 01-387 7388
EURO-CALC LTD · LONDON E.C.2 · TEL: 01-729 4555
EURO-CALC LTD · LONDON W.1 · TEL: 01-636 5560
EURO-CALC LTD · LONDON W.C.1 · TEL: 01-405 3113
JAXREST LTD · LONDON EC1 · TEL: 01-403 1801
L'ION COMPUTER SHOPS LTD · LONDON W.1 ·

TEL: 01-637 1601
PERSONAL COMPUTERS LTD · LONDON · TEL: 01-626 8121
SCOPE · LONDON EC2M 4HX · TEL: 01-247 8506
SUMLOCK BONDAIN LTD · LONDON EC1R 0AA ·

TEL: 01-253 2447
VIDEO SERVICES (BROMLEY) · TEL: 01-460 8833
CREAM COMPUTER SHOP · HARROW · TEL: 01-380 0833

NORFOLK
SUMLOCK BONDAIN (EAST ANGLIA) LTD · NORWICH ·
TEL: 0603 26259

NORTHAMPTONSHIRE
HB COMPUTERS LTD · KETTERING · TEL: 0536 83922

NOTTINGHAMSHIRE
KEEN COMPUTERS · NOTTINGHAM · TEL: 0602 583254
MANSFIELD BUSINESS M/CS LTD · MANSFIELD ·
TEL: 0623 26610

SALOP
COMPUTER CORNER · SHREWSBURY · TEL: 0743 55166

SOMERSET
NORSETT OFFICE SUPPLIES LTD · CHEDDAR ·
TEL: 0934 742184

SUFFOLK
MICROTEK · IPSWICH · TEL: 0473 50152

SURREY
PETALECT ELECTRONIC SERVICES
WOKING · TEL: 04862 69032
R.B.M. DATA SERVICES ·
CROYDON · TEL: 01-684 1134

SUSSEX
M & H OFFICE EQUIPMENT ·
BRIGHTON · TEL: 0273 697231

TYNE & WEAR
P.M.S. LTD · SUNDERLAND · TEL: 0783 480009

WALES
CITY RADIO · CARDIFF · TEL: 0222 28169
SIGMA SYSTEMS LTD · CARDIFF · TEL: 0222 21515

WARWICKSHIRE
CAMDEN ELECTRONICS · SMALL HEATH (BIRMINGHAM) ·
TEL: 021-773 8240

E.B.S. LTD · BIRMINGHAM · TEL: 021-233 3045
JAXREST LTD · BIRMINGHAM · TEL: 021-328 4908
NEWBEAR COMPUTING STORE LTD · BIRMINGHAM ·
TEL: 021-707 7170

POINTCRAFT · BIRMINGHAM · TEL: 021-233 2325

YORKSHIRE
DATRON INTERFORM LTD · SHEFFIELD · TEL: 0742 585490
BITS & P.C.S. · WETHERSBY, W YORKSHIRE · TEL: 0937 63744

SCOTLAND
A & G KNIGHT · ABERDEEN · TEL: 0224 630526
BUSINESS & ELECTRONIC M/CS · EDINGURGH ·
TEL: 031-226 5454

FORTRONIC LTD · DUNFERMLINE · TEL: 0383 823121
STRATHAND LTD · GLASGOW · TEL: 041-552 6731

NORTHERN IRELAND
O & M SYSTEMS · BELFAST 49440

EIRE
TOMORROWS WORLD LTD · DUBLIN 2 ·
TEL: 00001 776861

ISLE OF MAN
DELTA SYSTEMS LTD · DOUGLAS · TEL: 0624 4586



COMPUTER APPLICATIONS

Find out today what a Sharp Microcomputer will do for you.

Price-bombing is fun...

...especially if you're the buyer!

We've bombed the prices of peripherals again...about £120 off the price of a popular terminal and printer, and a really low price on a brand-new heavy-duty printer for the commercial market.



TVI 912C/920C terminal

- ◁ A fully intelligent terminal at an intelligent price. A very complete specification includes 24x80 display with dual intensity, blinking, reversed, underline and protected fields; 96 ASCII upper and lower case character set; separate numeric keypad; auto-repeat on all keys; full tabbing facilities and addressable cursor for forms work; single key edit-functions (on 920C version only); serial printer port.

Runs in full- or half-duplex from 75 to 9600 baud.

TVI 920C (as shown here) £550

TVI 912C £475

Anacom 150 printer

A fast and practical printer for commercial use — printing up to four copies as well as the original. 150 characters per second, bidirectional printing, full upper and lower case character set with true descenders on a 9x9 matrix, and programmable double-width characters. Adjustable tractor feed, for up to 15" wide paper; 6 or 8 lines per inch, 10 columns per inch character spacing. Programmable top-of-form and skip controls, 11" standard form length. Parallel or serial (RS232) interfaces.

Anacom 150 £699



Microline 80 matrix printer

- ◁ Lightweight but heavy-duty, the now well-known Microline at our unbeatable price of **£369**. Full upper and lower case ASCII character set, plus 64 pixel-type graphics characters. Standard, double-width and condensed character sizes; six- and eight-lines-per-inch line-spacing. 80 characters per second print speed. New-style print head is lighter, quieter and more reliable than conventional counterparts. Pin-feed and friction feed for up to 9" paper as standard; adjustable tractor feed option. Roll-holder for paper roll as standard. Parallel interface as standard; serial interface (RS232 or 20ma) option.

Midlands and South West:

**Mutek
Quarry Hill
Box, Wilts.
Tel: Bath (0225) 743289**

London and South East:

**Northamber Ltd
Albany Close
Esher, Surrey.
Tel: 0372 62071**

All prices quoted exclude VAT.

...British S100 BOARDS.....

(MANUFACTURED IN THE U.K. TO IEEE BY

INTERACTIVE DATA SYSTEMS)

IDS SBMC	Single Board Micro-computer, Z80A CPU, 4MHz operation (can be jumpered to operate at 2MHz if required), 1K RAM, sockets for up to 32K EPROM, TWO SERIAL PORTS.	KIT £178 A&T £235
IDS 16K SRAM	4MHz Static RAM using low power 2114 chips.	KIT £174 A&T £198
IDS 8K SRAM	4MHz Static RAM using low power 2114 chips	KIT £ 98 A&T £114
IDS DFDC	Double/single density, double/single sided Floppy Disc Controller, up to 4 drives.	KIT £177 A&T £198
IDS SFDC	As DFDC but single density only	KIT £109 A&T £140
IDS PCI 10	Parallel Control Interface with:- 8 channels relay-isolated output, 8 channels opto-isolated input, four 8 bit D/A converters, Eight 8 bit analogue inputs, 8 bits input, 8 bits output at TTL	KIT £195 A&T £223
IDS Z80 CPU	Z80A CPU board, 4 MHz operation	KIT £ 84 A&T £105
IDS TERM 40	Active Termination Board	KIT £ 25 A&T £32.50
IDS 7M.BD	7 slot Mother Board, including power connector. (Excludes S100 connectors)	Each £16
IDS 15M.BD	As 7M.BD but 15 slot.	Each £ 24
S100 CONN	S100 edge connectors	Each £2.90
DP 8000	Anadex dot matrix printer, RS232 interface.	Each £495
CATALOGUE	More details of the above products and others.	FREE

Please add 15% VAT to all prices.

MAIL ORDER ONLY

.....Mendip Computers..

57 BATH ROAD, WELLS, SOMERSET, BA5 3HS. TEL: WELLS (0749) 75249

• Circle No. 110

Almarc would like you to meet their new VIP

HAND HELD GAMES

Supersonic Mastermind	£21.00
Galaxy Invaders	£22.95
Mattel Soccer	£21.50
ENTERPRISE 4 in 1	£24.95
3 Games and calculator in one	
*Electronic Mastermind	£12.90
U.F.O. Master Blaster	£24.95
Amaze-A-Tron maze game	£18.95
Touch Me by ATARI (like Simon)	£26.95
Football (two players)	£24.95
ZAP missile game	£11.95
*DIGITS (like Mastermind)	£14.95

ALL GAMES HAVE SOUND EFFECTS EXCEPT *

The latest from the U.S.A. PINBALL WIZARD

* Still available *
Featured in Nov. issue of E T I
Home TV Game — B/W Kit
Basic Kit **£28.90**
Contains everything except box and controls
Box & Controls — **£5.50**. Mains Adaptor — **£3.90**
Play 7 games with 4 options on each game
4-Pinball games 2-Basket. 1-Breakout
Versatile car alarm kit **£18.90**
See review in Hobby Electronics November
CHROMA CHIME 24 tune door chimes kit **£10.75** Built **£15.95**
C.B. Aerials and Accessories

ATARI video computer

Sargon 2.5 Chess	£278.00
Super System 3 Chess	£149.95
SPACE INVADERS CART	£29.95
STAR CHESS T.V. Game	£63.35
DATABASE Prog. T.V. Game	NEW £59.95
CHESSMATE 8 Level	NEW £59.95
CHESS CHALLENGER 7	£84.00
CHESS CHALLENGER 10	£158.00
VOICE CHALLENGER	£219.00
CHECKER CHALLENGER 2	£54.00
CHECKER CHALLENGER 4	£90.00
ZODIAC Astrol Computer	NEW £29.95
Snooze Alarm	£14.90
EL-MAC 5MHz Scope	£139.90
EL-MAC 3" 5MHz Scope	£115.00
RADAT 1DMHz Scope	£169.00
PDM35	£36.50
PFM	£52.30

COMPUTERS — Home, Business etc.

PET 8K	£458.85
PET 16K	£573.85
SORCERER 16K	£861.36
SORCERER 32K	£918.85
SUPERBOARD II 4K	£180.00
UK 101 Kit 4K	£226.85
Built 4K	£286.35
TRS80 Level 2 16K	£409.40
5 1/4" Floppy Drive	£271.40
Dual Drive	£506.00
NASCOM 2 Kit	£339.25
HEATH WH89	£1,805.00
HEATH WH14 Printer	£586.50
Softy Kit	£115.00
Softy Built	£138.00
Intelligent EPROM Programmer	
Sharp Software	
PRINTERS . FLOPPY DISCS : BOOKS	

S.A.S. Enquiries. Please allow up to 21 days for delivery. All prices inc. of VAT.



N.I.C

61 BROAD LANE, LONDON N.15 4DJ
Day 01-808 0377; Eve 01-889 9736



• Circle No. 111

P.T.O.

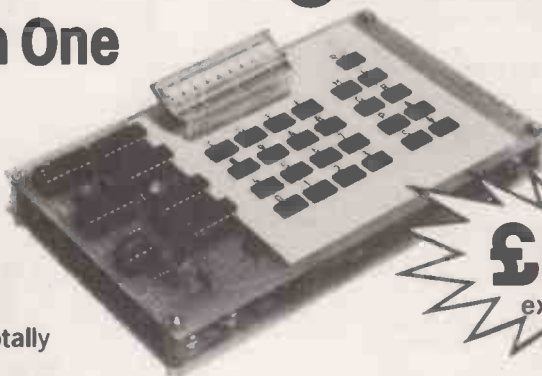
The Acorn modular system

A range and price unmatched by any other manufacturer in the world.
Designed and produced in Britain.

For the absolute beginner...

System One

A compact stand-alone microcomputer based on standard Eurocard modules, and employing the highly popular 6502 MPU (as used in APPLE, PET, KIM, etc). Throughout, the design philosophy has been to provide full expandability, versatility and economy. Many thousands have already been sold throughout the world.



£65 in kit form
excluding VAT

System One is complemented by a range of totally compatible eurocards including:

● 8K+8K Static RAM and EPROM	£95	● Laboratory Interface (isolated inputs, high current outputs)	£122
● Colour Prestel Compatible VDU Interface	£88	● 6809 CPU Card	£98
● Versatile (serial, parallel, RS232 etc) Interface	£69	● Professional Keyboard (parallel ASCII encoded)	£96
● Dual Mini-floppy Controller	£120	● AIM 65 Bus Interface adaptor	£33
● PROM/EPROM Programmer (Bipolar and UV erasable)	£55	● PAL Encoder	£22.50
● A to D, and D to A Interface (12 bit, high speed)	£132		
● Printer Interface (for 12 data 3 strobe)	£60		

All prices exclude VAT

Available soon:

- 80 x 24 character VDU Interface
- 32K Dynamic RAM Card
- 5V/12V Switched mode power supply (1" deep)
- In circuit emulator (block relocating)

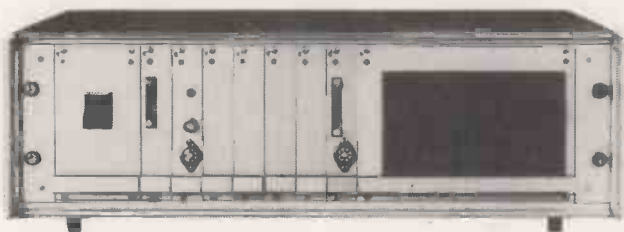
- IEEE Bus Interface (Full implementation)
- Real time clock with CMOS RAM

All these cards utilise 'state of the art' devices and represent an elegant and long lasting solution to today's requirements.

• Circle No. 112

...and the absolute professional

System Three



System 3, contains the 6502 CPU, 16K RAM with DOS and BASIC, VDU Interface, Disc controller and 5" drive, Printer Interface, backplane and power supplies. The entire unit costs about £1,000 and can be added to or reformatted as required.

If you need the facilities of the 6809 processor this can be substituted for the 6502 CPU (all other hardware remains unchanged.)

Acorn's fast BASIC combined with what is probably the most efficient disc operating system available may be linked with a control oriented ONLI BASIC addition for laboratory control, or an accounts/stock control package for small businesses.

A twin disc System Four is available if two drives and several peripheral interfaces are required in one case. Full service and software facilities available.

For more information and order form ring or write to



**ACORN
COMPUTER**
Acorn Computer Limited,
4a Market Hill,
Cambridge, CB2 3NJ
Cambridge (0223) 312772

Please send me further information of Acorn products.

My application concerns _____

Name _____

Address _____

Telephone _____

Acorn Computer Limited, 4a Market Hill, Cambridge, Cambs. Cambridge (0233) 312772

PC/12/80

• Circle No. 113

computerkit

a new concept in
computer control

built on peripheral highway

apple and other interfaces
from £120

digital controller analog controller
from £150

relays from £10

digital sensors analog sensors
from £10

all you need for control application
in the laboratory, home, and industry

dealer enquiries welcome

BUSINESS COMPUTER SERVICES
POLLARDS FARMHOUSE, CLANVILLE
NR. ANDOVER, HAMPSHIRE
TELEPHONE 026470300

• Circle No. 114

micrologic

for Business Systems
based on the apple II
Microcomputer

Complete systems from
£2,500*. Agents for
Appleware. All
standard programs
available. Seminars arranged. Write
or 'phone for list of dates & venues.
Software to your own specification.



Visicalc
Performs many tasks:
Estimating; Costing;
Cash Flow Analysis
and many others on
your Apple.
No programming
knowledge
required. **£95***

Database
Allows you to create
your own filing system.
Search Routines,
Print Routines.
No Programming
knowledge
required. **£120***

* all prices ex. VAT

micrologic apple
Sales and Service
TEMPLE HOUSE, 43-48 NEW STREET, BIRMINGHAM
021-643 0253

• Circle No. 115

Almarc would like you to meet the Vector Graphic VIP



High performance at an astonishingly low price.
Compare this specification:

- *The Vector 3 terminal, with 6 slot industry standard S100 bus.
 - *Z80 Processor.
 - *56K of user RAM.
 - *1 serial RS232 port, 3 8-bit parallel ports.
 - *80 x 24 characters video display with 8 x 10 character matrix.
 - *Typewriter style keyboard with a separate numeric key pad and capacitance keys.
 - *Unistor disc drive module giving 315 Kbytes of storage capacity.
- PLUS** CP/M2, Microsoft BASIC 80, SCOPE (text editor) and RAID (simulator debugger).
PLUS Almarc's 12 month warranty.

Almarc are Specialists in Vector Graphic equipment which includes Micro-Computers for research, laboratory work, word processing, business systems, schools, colleges, universities and industry. Plus an ever growing list of compatible software including Pascal, Fortran, Cobol, APL, Algol, Basic Compiler and others.

We will be pleased to demonstrate how Almarc + Vector Graphic Systems equates to The Complete Partnership in Micro-Computers.

ALMARC
DATA SYSTEMS LTD
906 Woodborough Road, Nottingham NG3 5QS.
Telephone: (0602) 625035

• Circle No. 116

Wego Computers Ltd



CBM approved
£75.00 + VAT

Wego Sequential Switching Unit

Allows up to 5 devices to be connected to the mains, and with one switching operation power up and down all the devices, in the correct sequence.



£89.50 + VAT

Numeric Key Pad for the Apple.

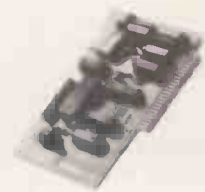
A 13 digit Key pad (0-9, -, ., ENTER) to run in parallel with the numeric section of the APPLE Keyboard. Supplied with connecting cable, plugs and sockets.



CBM approved
Prices from £620 + VAT

Mark Sense Card Reader

"A pencil, a card, and this low-cost reader. . . it's the new, fast way to enter data into your microcomputer." Versions available able to communicate with PET, APPLE, TRS-80, or any S100 or RS232 bus. Ideal for business and education applications.



Sole UK Distributors

California Computer Systems Cards for the Apple

Synch Serial Card	£119.97 + VAT
Asynch Serial Card	£106.37 + VAT
Parallel Card	£ 79.97 + VAT
Arithmetic Proc. Unit	£265.97 + VAT
Programmable Timer	£106.37 + VAT
IEEE GPIB	£199.50 + VAT
A/D Converter	£ 99.72 + VAT
ROM/PROM Module	£ 70.89 + VAT
Clock Card	£ 83.33 + VAT
Centronics Card	£ 79.97 + VAT

Available from your local dealers, or direct from Wego Computers Ltd., 22A, High Street, Caterham, Surrey CR3 5UA. Tel: (0883) 49235 Telex: 933660

Authorised COMMODORE and APPLE Dealers

• Circle No. 117

ELECTRONIC BROKERS LTD VDU PRICES

SHATTERED

£199



HAZELTINE 1000
The low, low priced teletypewriter — compatible video display terminal with 12" screen (12 x 80) 64 ASCII alphanumeric and symbols. Full/Half Duplex. RS-232

ALL EQUIPMENT RECONDITIONED
UNLESS OTHERWISE STATED

£299



HAZELTINE 2000
The world's largest-selling teletypewriter — compatible video display terminal. Features include: 12" screen (74 x 27) 64 alphanumeric and symbols. 32 ASCII control codes. Switch-selectable transmission rates to 9600 baud. Three switch-selectable operating modes full-duplex, half-duplex or batch. Direct cursor addressability. Dual-intensity video. Tabulation. Powerful editing capability. Remote keyboard. Selective or automatic roll-up. RS-232

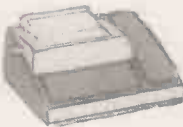
£399



MODULAR ONE BASIC Now with Upper & Lower Case 12" screen (24 x 80). XY cursor addressing, 64 ASCII alphanumeric & symbols. Dual intensity detachable keyboard. Choice of 8 transmission rates up to 9600 baud. RS232. Range of options available including Printer Port (£70.00).
MODULAR ONE EDIT
All the above plus full edit capability, tabulation, 8 special function keys + many other features. £695.00.
POLLING MODELS also available — P.O.A.

SPECIAL LOW COST PRINTER OFFER

The famous Teletype 33 printer mechanism including case but no keyboard or electronics. 64 upper case ASCII. Print Speed 10cps. Pinfeed platen.
ONLY £85.00 + VAT (personal callers) or £115.00 (mail order total)



NEW LOW-COST ASCII KEYBOARDS

TTL compatible, ROM-encoded Full 128 ASCII character set Range of spares and accessories Prices from £45.00 Send for full leaflet/price list.
Also available — attractive keyboard enclosures in heavy-duty moulded plastic — manufacturer's surplus Dimensions 17 1/2" wide, 8" deep, 1 3/4" — 4" high.
ONLY £6.00 (mail order total £8.63).



DIGITRONICS 35CPS PAPER TAPE PUNCH
Solenoid — actuated unit capable of punching 5 to 8 channel tapes asynchronously. Basic punch contains 8 data, 1 sprocket and 2 transport solenoids plus end of tape switch. Pulse amplitude 27VDC. Very compact unit measuring only 6 1/2" x 5 1/2", weight 9 1/2 lbs. Price £95.00 (mail order total £115.00).

WE HAVE MOVED TO EXTENSIVE NEW PREMISES

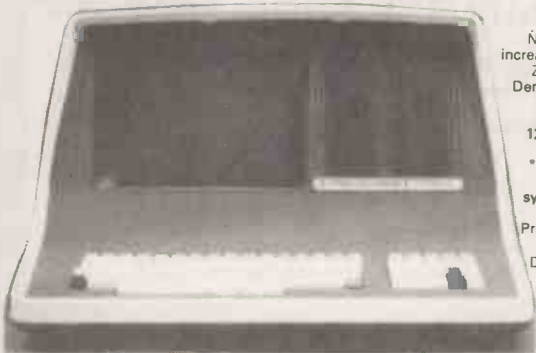


Electronic Brokers Ltd., 61/65 Kings Cross Road, London WC1X 9LN. Tel: 01-278 3461. Telex 298694

• Circle No. 118

COMPLETE SYSTEMS

NEW SUPERBRAIN DOUBLE DENSITY £1595 QUAD DENSITY £1995



Now with CP/M2.2, and increased disc storage. Twin Z80-A 4MHz. *2 Double Density Disc Drives, giving 350/700K storage *64K RAM. *High resolution 12 inch crt. 80 x 24 lines upper/lower case * 2 RS-232 printer ports. * CPM 2.2 operating system. *MBasic, Cobol, Fortran, Pascal, Word Processing and Accounts packages available. Dealer Enquiries invited.

TRS-80 MODEL II £1999

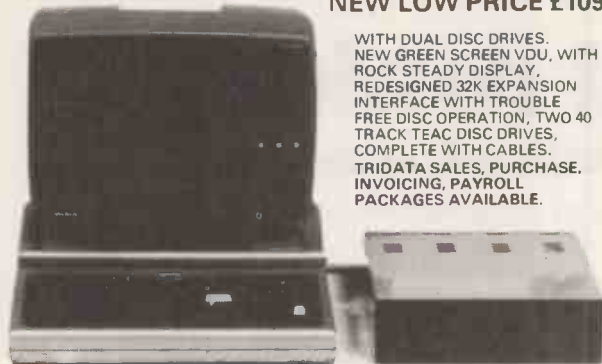


NOW WITH CP/M 2.24 EXTENDED DENSITY

State of The Art Second Generation Computer. Over 10,000 already sold in USA. 8 slot bus ensures expansion of hard discs and other peripherals. 76 Key professional keyboard, self test on power up. TRSDOS and Level III Basic Standard. CP/M available as option, making a wide range of accounting, educational, scientific and word processing packages instantly usable. Nationwide service through 180 Tandy Stores and Computer Centres.

NEW TRS-80 MODEL 1 48K SYSTEM

NEW LOW PRICE £1095



WITH DUAL DISC DRIVES. NEW GREEN SCREEN VDU. WITH ROCK STEADY DISPLAY. REDESIGNED 32K EXPANSION INTERFACE WITH TROUBLE FREE DISC OPERATION. TWO 40 TRACK TEAC DISC DRIVES. COMPLETE WITH CABLES. TRIDATA SALES, PURCHASE. INVOICING, PAYROLL PACKAGES AVAILABLE.

LOW COST WORD PROCESSOR I

BASED ON TRS-80 LEVEL 2 16K, CASSETTE RECORDER, ELECTRIC PENCIL SOFTWARE, UPPER/LOWER CASE MOD, PRINTER INTERFACE AND OKI DOT MATRIX PRINTER. COMPLETE READY TO GO £895 FREE MAILING LIST PROGRAM.

WORD PROCESSOR II

SAME AS ABOVE BUT WITH 48K, 2 DISC DRIVES AND RICOH DAISY WHEEL PRINTER. £2195

WORD PROCESSOR III

BASED ON SUPERBRAIN COMPUTER SHOWN ABOVE. WITH RICOH PRINTER AND "MAGIC WAND" THE ULTIMATE IN WORD PROCESSING. LETTERS AUTOMATICALLY FORMATTED WITH ADDRESSES FETCHED FROM SEPARATE FILE. COMPLETE SYSTEM. £2950.

INVOICING, STOCK CONTROL, 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.

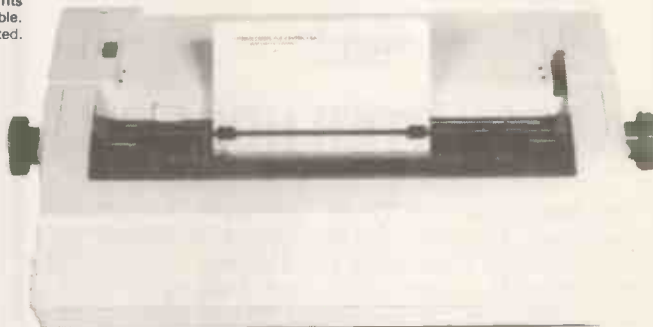
PRICES QUOTED ABOVE DO NOT INCLUDE VAT. PHONE OR CALL FOR FURTHER DETAILS OR DEMONSTRATIONS.

PRINTERS

60 CHARACTERS PER SECOND NEW LOW PRICE £1095

RICOH RP-1600 THE FASTEST DAISY WHEEL PRINTER. FAST, heavy duty commercial DAISY WHEEL printer, with high quality printout, coupled with low noise necessary for office environment. Nationwide service by NEXOS. 90 day warranty provided at your premises.

124 char: upper/lower case. * 10/12 chars: per inch giving 136 or 163 columns. * 15 inch wide friction platen. * Top of the form, BOLDING, underline, and host of other features. * Centronics type parallel interface as standard. Options: serial interface £60 * PET interface £65 * APPLE interface £75.



ANADEX DP-8000 NEW LOW PRICE £449.

Fast 112 Characters per second. * Both RS-232, and Centronics Parallel interfaces built in * Upper/lower case £ sign.



NOW WITH £ SIGN NEW LOW PRICE £399

OKI MICROLINE 80/132. The quiet printer you can live with. The quietest Dot Matrix available. 40,80, or 132 cols per line. * excellent print quality * 3-way paper handling: Letterheads, Fan-fold, or Paper Rolls * Graphics * Ideal for software written for large 132 col printers * Continuous rating printing day in and day out * Centronics parallel standard. Options: RS-232, PET, APPLE. Dealer Enquiries invited.

NEW MAXI ANADEX WITH GRAPHICS £895

Takes up to 13.5 inch wide paper * Upper/lower case with decenders * £ sign * 132 or 175 chrs/line with double width printing * Fast 150 CPS bi-directional logic seeking printing * Heavy duty print head giving 650 million chrs print life * serial, Parallel and Current Loop interfaces built in * Host of other features found on printers costing twice as much.



LONDON COMPUTER CENTRE LIMITED

43, GRAFTON WAY, OFF TOTTENHAM COURT ROAD, LONDON W1

TEL: 01-388 5721 OPENING HRS: 11-7 MON-FRI, 12-4 SATS.

MICRO SYS LTD
58 HIGH STREET
PRESCOTT
MERSEYSIDE

TEL: 051 426 7271

NOTHERN DEALERS

HORIZON SOFTWARE LTD
REGENT HOUSE
16 WEST WALK
LEICESTER LE1 7NG

TEL: 0533 556550

• Circle No. 119

MICROTEK COMPUTER SERVICES

for
IMS 5000, 8000

and
NORTH STAR HORIZON

We have many software packages for these machines, including Stock Control, Accounting, Payroll, Word Processing and Mailing. However, if you are fed-up with looking at standard packages then why not let us design and write a system specially for YOU! If you are interested, contact:

John Rothwell
on
Orpington 26803 or write
to 50 CHISLEHURST ROAD,
ORPINGTON, KENT

• Circle No. 120

THE ONE STOP COMPUTER SHOP

**BUSS
STOP**

We Supply Systems for Business, Education and Industry —
And We Support Them With Service and Software!

Commodore					
2001-8	£379.00	8032	£895.00	KIM1	£93.00
3008	£398.00	8050	£895.00	KIM3B	£96.95
3016	£495.00	8024	£1160.00	KIM4	£65.00
3032	£625.00	8010	£220.00	Toolkit, SuperChip,	
3022	£383.00	Pet Lead	p18.75	Soundbox, Parallel	
3023	£337.00	IEEE Lead	£23.44	and Serial Interfuses	
3340	£625.00	C2N Cass	£49.50	All Ex-Stock.	

Now on demonstration — The NEW PET MODEM, with Supporting Software.

VIDEO GENIE — EG3003 16K RAM, 12K LEVEL II BASIC IN ROM.
TRS80 Compatible £289.50

NASCOM — Phone for latest Details/Prices.
Dolphin Printers — The Superb BD80P now 80/132, chrs/line.
Down to £450.00 While Stocks Last.
The New BD136, The Ultimate Intelligent Matrix Printer — Prints
at 240 Chrs/Sec. £1200.00

RICOH, QUME, NEC Spinwriter etc, Also Available, Please phone
for Prices.

CONSUMABLES C15's Only £4.00 for 10. 10 Verbatim 5¼" Disks
— 35 Track £19.95 — for CBM 3040. 10 Verbatim 5¼" Disks —
77 Track £36.50 — for CBM 8050.
Wide range of Continuous Stationary in stock — Paper, Labels etc.

SOFTWARE — We Sell Only The Best — Wordpro, Wordcraft,
OZZ, Communicator, Medicom — and much more! Plus — A Wide
Range of Books and Manuals for all Machines.

Please phone for carriage charges, all prices + VAT
Photo Acoustics Ltd, BUSS STOP Computer Division
255a St. Albans Road, Watford, Herts. (entrance in Judge Street)
Phone: Watford 40698 or Newport Pagnell 610625

• Circle No. 121

mikro and makro

— TWO GREAT BRITISH ASSEMBLERS FOR THE CBM PET

Whether you are an experienced 6502 programmer or just getting to grips with machine language, one of these assemblers is right for you!

MIKRO ASSEMBLER makes full use of PET's Basic editor to pack a full-featured assembler into a single 4k chip which plugs into one of the 3 spare sockets. When you power up you will be just a SYS command away from being able to program in Assembler, Basic, or even both at once! There are just three new commands to learn because source code is written just like a Basic program — and if the Programmer's Toolkit is fitted you can use functions like FIND, DELETE, RENUMBER, APPEND and HELP to edit and debug your code. For any PET, tape or disk, MIKRO costs £50 plus VAT.

MAKRO ASSEMBLER really needs a 32k machine, though a 16k version is available. You can define macros with up to 9 parameters, and they may be nested to a depth of five! As source files can be appended you could build up a library of useful macro definitions — then bring them into your programs at will. MAKRO has all the standard assembler features plus a user-friendly editor — all for £50 plus VAT.

THE PETMASTER SUPERCHIP (£45 + VAT) gives owners of standard 40 column PETs many of the features of the new 8032 SuperPet — and much more besides. Single key entry of Basic and an auto-repeat facility are popular features, but the advanced programmer will find the User Definable Function Keys innovative and invaluable! Fully compatible with the PROGRAMMER'S TOOLKIT (??? + VAT).

80 PET programs in our
FREE catalogue!

TOOLKIT NOW £29

SUPERSOFT

28 Burwood Avenue, Eastcote, Pinner, Middlesex
Telephone: 01-866 3326

• Circle No. 122

MULTI-USER BUSINESS COMPUTER SYSTEM FOR £395/MONTH*

SALES LEDGER, BOUGHT LEDGER, NOMINAL LEDGER, CREDIT CONTROL, STOCK CONTROL, ORDER PROCESSING.



COMPUTER HARDWARE

Consists of a 16-Bit ALPHA MICRO central processor unit, 128 KB of dynamic random access memory, 6 terminal input/output ports, 10 Megabyte of disk storage of which 5Mb is fixed and 5Mb on a removable cartridge for security and backup purposes, all rack mounted in a universal cabinet. In addition there are 3 PERICOM visual display units with green phosphor screens, a LEAR SIEGLER 180 character/second printer on stand.
TOTAL PRICE FOR THIS HARDWARE DELIVERED, TESTED AND INSTALLED £14,685

This system gives a new meaning to the words "Cost Effective." It combines a powerful 16 bit processor with a proven timesharing disk operating system to give you data handling and software sophistication parallel to that of high performance mini-computers. It can be field upgraded from a simple single terminal system up to a 20 terminal, multi-printer, system with 400 Megabytes of disk storage and 768 Kilobytes of random access memory without any hardware redundancy. Ask us about any application you have in mind.

An integrated business accounting system is available virtually "off the shelf" and consists of 4 individual subsystems. Each subsystem can be individually implemented which allows you to

start with the sales ledger only and gradually introduce and integrate the others. If required, the individual subsystems can be tailored to match your specific business.

ORDER PROCESSING STOCK CONTROL

A truly professional piece of software. Complete inventory file maintenance. Order and back-order processing with credit control. Automatic salesman commission processing. Automatic stock allocation and update. Category and product sales analysis. Low stock reporting. Stock valuation and much, much more.
TOTAL 75 PROGRAMS. PRICE £1600.
MANUAL ONLY £25.

SALES LEDGER

Complete customer file maintenance. Open item and/or balance brought forward ledgers. Instant account enquiry. Statements, aged debt analysis with or without detail, sales journal, cash journal, VAT analysis, customer or area sales analysis and much, much more.
TOTAL 70 PROGRAMS. PRICE £800.
MANUAL ONLY £15.

BOUGHT LEDGER

Complete supplier file maintenance. Open item ledger with invoice, payment, discount and due-date details. Payment by date or selection. Automatic Cheque writing. Purchase register, cash requirement report, aged debt analysis and much, much more.
TOTAL 50 PROGRAMS. PRICE £800

NOMINAL LEDGER

Complete account file maintenance. Open item ledger. Instant account enquiry. Trial balance, source cross reference, user defined balance sheet and profit and loss accounts. Supports multiple profit centres or operating divisions. Journals, supporting schedules and much, much more.
TOTAL 40 PROGRAMS. PRICE £800.

There is really only one way to find out more. Come to our office and showroom. As we have implemented all our systems in our own business we can even demonstrate in a live environment. Phone us for a demonstration or send us the coupon and we will phone you.

MULTI-USER BUSINESS COMPUTER SYSTEM		PC.1
REQUEST FOR A DEMONSTRATION		
Name _____		
Title _____		
Company _____		
Address _____		
Postcode _____		
Tel: _____		
ORDERS FOR MANUALS MUST BE PREPAID.		
NEWTONS		
LABORATORIES		
111-113 Wandsworth High Street,		
London SW18 4JB.		
Tel: 01-874 6511. Telex: 21768 (NEWTON G)		

*£395/Month is based on a total system price of £18,750 leased over 5 years with zero residual value. Other terms available.

• Circle No. 123

INTELLIGENT ARTEFACTS LTD.



AMAZING VALUE AND 1 YEAR'S GUARANTEE

DISCOUNT PETS	£
8K	425
16K	480
32K	580
DUAL DRIVE FLOPPY	590
SUPER PET	799
SUPER FLOPPY	825
CASSETTE	50
TOOLKIT	40
DISCOUNT PRINTERS	
EPSON (WITH INTERFACE)	350
BASE 2	375
SOFTWARE	
BLAKE 7 + GAMEPACK	20
PAYROLL	52
ACCOUNTS (NORTH STAR)	520

TEXAS	£
TI99/4 + 14" SKANTIC	
COLOUR TV/MONITOR	499
NORTH STAR HORIZON	
WITH 2 SERIAL + PARALLEL I/O,	
4 MHz Z-80 DOS + BASIC	1450
32K QUAD DENSITY	1690
48K DOUBLE DENSITY	1690
48K QUAD DENSITY	1950
SUPER BRAIN	
(INTEGRAL DISKDRIVE AND VDU)	
32K RAM 320K DISK	1499
64K RAM 320K DISK	1650
64K RAM 788K DISK	1895
(PRICES EX VAT)	

INTELLIGENT ARTEFACTS LIMITED

DISCOUNT HARDWARE AND SOFTWARE

Cambridge Road, Orwell, Royston, Herts.
Telephone: ARRINGTON (022 020) 689

• Circle No. 124

CAPITAL COMPUTER FACTORS

85 CARNWATH ROAD FULHAM LONDON SW6 3HZ

Tel: 01-731 3510

Telex: Methq 917792

Member Company of The National Computing Centre

In Association with NIBMAIN Ltd. (Software House)



New and Refurbished Hardware
PERIPHERALS TO TURN KEY SYSTEMS
IF WE CAN'T SUPPORT IT WE DON'T SUPPLY IT

We do supply:

The TOPAZ 80 Micro Computer supporting the OASIS operating system. TOPAZ + OASIS A Micro system to match the Minis.

Contact us for details of your nearest dealer.

This system is 'Multi user' not just Multi Terminal. Turnkey systems start at £8000.

Word Processing — Magic Wand System available.

We also supply

The Point 4 Mini — For Big applications

The Durango Micro — Really Compact Computing

New and Refurbished MAEL Mini Power Systems.

Peripherals:

New and Refurbished LOGABAX Matrix Printers.

The NEW LOGABAX LX 213 £1550 — 180 c.p.s.

Maintenance Contracts available on all LOGABAX Printer (Air Call Paging for Fast Response!!)

Visual 200 V.D.U. Emulates most makes of V.D.U.

Price on application.

Whatever Your Application We Can Supply The SYSTEM AND SUPPORT IT.

IF YOU HAVE IN HOUSE EXPERTISE

OPERATING SYSTEMS

LANGUAGES

CPM

BASIC

OASIS

COBOL

IRIS

PASCAL

IF YOU ARE A FIRST TIME USER WE CAN FULLY SUPPORT YOUR APPLICATION

• Circle No. 125

Wilkes Computing

**Exclusive Suppliers of G.R.[®]
DEC PDP 11 Computer Systems
comprising:**

- * 1.25 M Byte CDC Floppy Drives
- * 8 inch 10 M Byte Winchester Disks
- * 96 MB CDC Disk Drives
- * TSX Multi Tasking, Time Sharing
- * Word Processing
- * DBL Commercial language/RSX 11-M
- * All DEC Terminals

[®] General Robotics Inc.

For further details contact:

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU. Tel: (0272) 25921. Telex 449205.

• Circle No. 126

THE
PAPER
SHACK

SUPPORTS PAPER USERS

With sensible prices..

RULED
14 1/2" x 11" = £6.00
INC. P & P

PLAIN
9 1/2" x 11" = £6.00
INC. P & P

For sensible minimums..
of 500 sheets continuous stationery.
Details of other sizes, self adhesive
labels etc:-



01-642 8971

Prices include VAT

THE
PAPER
SHACK

• Circle No. 127

SPECIAL OFFER PERKIN-ELMER

MODEL 550
BANTAM VISUAL DISPLAY UNIT



£470-00

Westrex Company Limited
Bilton Fairway Estate
Long Drive Greenford Middlesex
Telephone: 01 578 0950 & 578 0957/8/9



• Circle No. 128

BRITISH 
is BEST and now

Costs Less !



ddg Data
Dynamics
Group

DATA DYNAMICS LTD.,
DATA HOUSE,
SPRINGFIELD ROAD,
HAYES, MIDDX.
TEL: 01-848 9781.

The ZIP KSR built for
industrial use with a
strong metal case.

Now Price Competitive
with inferior
plastic - cased printers

Key Points

- ★ 10/30 Characters/sec.
- ★ Lower case, 20 mA, RS 232
- ★ Supplied with interface leads
- ★ 5 x 7 Dot matrix
- ★ 6 Months warranty

• Circle No. 129

NewBear Computing Store Ltd



PLEASE ADD V.A.T. TO ALL PRICES.

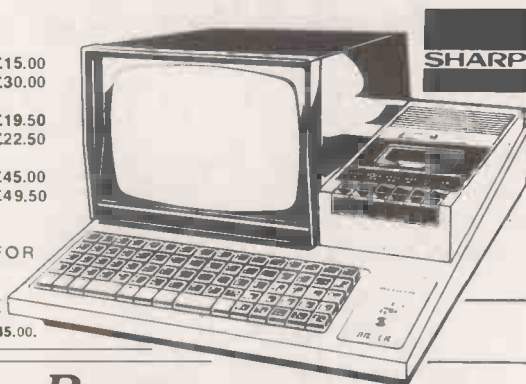
MICROCOMPUTING I.C.'S

MC6800	£6.75
MC6802	£10.50
MC6809	£17.75
MC6810AP	£3.61
MC6821	£4.63
MC6840	£10.50
MC6850	£4.99
MC6852	£4.75
Z80 CPU 2.5 Mhz	£8.99
Z80 CTC 2.5 Mhz	£7.99
Z80 P10 2.5 Mhz	£7.99
Z80-S10/0	£25.57
Z80A CPU 4 Mhz	£10.50
Z80A P10 4 Mhz	£10.00
Z80A CTC 4 Mhz	£10.00
SC/MP 11 (INS8060N)	£11.30
INS8154N	£8.18
6502	£8.99
6522 VIA	£8.14
6532	£9.75
6545 CRT CONTROLLER	£18.50
6551 ACIA	£9.99
8080A	£5.50

MZ-80K

NBMZ80K MONITOR LISTING	£15.00
NBMZ80K BASIC LISTING	£30.00
NBMZ80K ZEN EDITOR/ASSEMBLER TAPE & MANUAL	£19.50
MZ80K MACHINE CODE TAPE & MANUAL	£22.50
MZ80K ASSEMBLY LANGUAGE TAPE & MANUAL	£45.00
NBMZ80K V24/RS232 PRINTER INTERFACE	£49.50

DISKS & PRINTER NOW AVAILABLE
A COMPLETE BUSINESS SYSTEM FOR
LESS THAN £2000.



SPECTRONICS U.V. EPROM — ERASING LAMPS FROM £45.00.

NEW LOW PRICES!

NewBear

for the widest selection of computing books
NEW BOOK LIST

proper 816

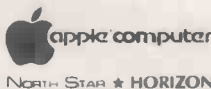
C.I.T.O.H. 8300 R.M. PRINTER

PROFESSIONAL PROM PROGRAMMER

FOR 2708/2716/2532

PRICES FROM £565.00

SEND FOR FULL SPECIFICATION.



MEMORIES

4116 (16K DYNAMIC)	£4.50
2716 (INTEL + 5V TYPE)	£12.50
2708	£4.50

NEWBEAR COMPUTING STORE LTD, (HEAD OFFICE) 40 BARTHOLOMEW STREET, NEWBURY, BERKS

TELEX 848507 NCS

MAIL ORDER

TEL. (0635) 30505

FIRST FLOOR OFFICES, TIVOLI CENTRE, COVENTRY ROAD, BIRMINGHAM.

TEL. 021 707 7170

220-222 STOCKPORT ROAD, CHEADLE HEATH, STOCKPORT.

TEL. 061-4912290

GET A SHARP DEAL FROM NEWBEAR
SEND FOR OUR FREE CATALOGUE

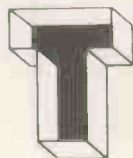
• Circle No. 131

SOFTWARE FOR CP/M®

HIGH QUALITY SOFTWARE — WITH HIGH QUALITY SERVICE

WORDSTAR - Professional word processing software. On-screen formatting, wordwrap, pagination, line and character count on view. Micro-justification on daisy-wheel printer. Search and replace. Block/paragraph manipulation. External file read/write. Background printing during editing etc.	£250	IBM - CP/M COMPATIBILITY - Powerful utility giving micro's the ability to act as IBM Data Preparation system with added benefit of micro processed data being available to IBM computer and vice versa.	£110
MAIL-MERGE - Wordstar enhancement for personalising documents.	£80	CIS - COBOL - ANSI '74 implementation to full level 1 standard. Supports random, indexed and sequential files, features for conversational working, screen control, interactive debugging, program segmentation etc.	£425
CONFIGURABLE BUSINESS SYSTEM (CBS) - Unique information management system with user definable files, powerful report generator, menu-driven for ease of use. No programming experience necessary!	£175	FORMS-2 - Automatic COBOL code generator for screen formats	£100
SELECTOR III - C2 - Information management system written in CBASIC-2. Maintains multi-key data base files and produces sorted formatted reports. Package includes simple application programs.	£185	CBASIC-2 - Extended Disk Basic pseudo compiler and run-time interpreter. Widely used for commercial packages	£75
SELECTOR IV - Upward compatible enhanced version of Selector. Includes file format conversion, field computation, global search and replace, enhanced report formatter etc.	£300	MICROSOFT BASIC INTERPRETER	£195
GLECTOR - Superior General Ledger application utilising the power of Selector	£200	MICROSOFT BASIC COMPILER	£215
MAGSAM - Keyed file management system for use with CBASIC-2. An extended version of ISAM includes secondary indexing and deleted space reclamation.	£130	MICROSOFT FORTRAN COMPILER	£270
ACCOUNTING PACKAGES by Median - Tec: PAYROLL, SALES, PURCHASE, NOMINAL. Specially developed by UK software house to exacting specifications. each Written in Microsoft Basic each package may be customised by end user, all are widely used. Ledgers are open item. Payroll caters for weekly and monthly pay.	£500	STRUCTURED BASIC - Relocatable compiler combining the flexibility of Basic with the power of advanced structured techniques	£140
PROJECT COST CONTROL - A comprehensive set of programs to monitor budgets, account for expenditure and project completion etc. Ideally suited for contractors. Written in CBASIC-2.	£150	SUPERSORT - Sort, merge and selection program	£140
DATASTAR - Data preparation facility with screen form design, field validation, duplication etc. Menu driven. Compatible with CP/M and Wordstar files.	£175	WORDMASTER - Full screen text editor	£85
		TEXTWRITER III - Text formatter with many features	£80
		STATISTICAL & MATHS ROUTINES - Over 40 useful routines easily used.	£150
		BSTAM - Telecomms facility for exchanging files between CP/M computers. Error detection and automatic retry with console messages.	£75

Please contact us for availability of other products
All orders must be PREPAID. Add 50p per item P & P (Minimum £1) and VAT
*CP/M is trade mark of Digital Research



TELESYSTEMS LTD

P.O. Box 12, GREAT MISSENDEN, BUCKS, HP16 9DD

Telephone (02406) 5314



• Circle No. 132

INNOVATIVE

TRS-80 SOFTWARE

FROM THE PROFESSIONALS



**Animation
Animation
Animation**

Animate is a machine language program representing an entirely new breakthrough in the use of graphics on the TRS-80 or Video Genie microcomputers. As Walt Disney and others found to their profit some years ago, if you draw a number of separate pictures slightly different to each other, and then display them consecutively sufficiently fast, a moving picture is produced. This is precisely what Animate does. Pictures are built up as a sequence of frames, each one being as small or as large as you wish and composed using an easily used graphics cursor. The entire graphics content of a frame can be shifted in any direction so as to move objects without the need to redraw them in each new position. As each new frame is completed it is automatically stored in memory and given a number, so that it may be recalled and edited at will. The timing of the projection of each frame is definable up to a maximum of 100 seconds. When the picture is completed it may be viewed and edited as you wish. When the final picture is complete it may be stored on cassette as a SYSTEM program. Thereafter it may be loaded and accessed either by Animate or by any Basic program. Thus the same picture may be used in any number of different Basic programs, if you wish. Animate is available at present only on cassette for Level II or Genie machines of 16K and up. A disk version will be available shortly. A comprehensive manual is included.

£ 14.95

Plus VAT and 75p P & P = £17.94.

Send large SAE (38p) for our current Catalogue of TRS-80 software. Add £1.85 for a binder.



A.J.HARDING (MOLIMERX)

MOLIMERX LTD.

28 COLLINGTON AVENUE, BEXHILL-ON-SEA, E.SUSSEX.

TEL: (0424) 220391

TELEX 86736 SOTEX G



• Circle No. 133

Karadawn Ltd.

Micro Computer Systems & Software

2 Forrest Way, Gatewath Industrial Estate, Warrington, Cheshire.
Tel: 0925-572668. Telex: 628269

Business Systems

- THE INCREDIBLE ROSTRONICS Z PLUS**
- 2 MEGABYTE CAPACITY • Z80 CPU • 64K RAM
 - ELBIT 1920-x TERMINAL WITH 15" SCREEN
 - FULLY HOUSED IN CUSTOM BUILT WORKSTATION
 - DELIVERED + INSTALLED AT ONLY **£4500.00**

Printers for the above from £925 — £2,500 by Teletype, Diablo, Qume, Centronics, Texas Instruments.
10 Megabyte Hard Disk system £7,950.

THE ULTIMATE PERSONAL/SMALL BUSINESS MICRO

Superbrain by Intertec

- 320K Dual Double Density Floppies • CP/m Op System
- 64K • TWIN Z80 A MICROPROCESSORS

DELIVERED + INSTALLED AT ONLY **£1,950.00**

N.B. This is NOT a model CPI SUPERBRAIN

Word Processor Systems

- 2 MEG Z Plus system • Diablo Heavy Duty Daisywheel
- "Wordstar" Word Processor Pack •

DELIVERED + INSTALLED FROM **£6,950.00**

For the Personal Computer

PRINTERS Centronics 730 80/132 Character Mode,
Roll/Sheet/Sprocket £425 Paper Feed,
110 C.P.S. 6 INTERNATIONAL CHR Sets.

TEAC Disc Drives. Smooth as silk
Single Drives £250 Inc Cable. Double Drives
£450 Inc. Cable.

Floppies FREE plastic library case with every
10 disks 5 1/4" verbatim £30 inc vat.
8 1/4" Double sided, double density £45 Inc VAT

ALL SYSTEMS CAN BE SUPPLIED WITH INDIVIDUALLY WRITTEN SOFTWARE
TAILORED TO YOUR EXACT SPECIFICATIONS BY OUR OWN PROGRAMMERS.
ALL OUR SOFTWARE IS FULLY SUPPORTED.

• Circle No. 134

New from Millbank!



SYSTEM 10

List every important feature you would like to see on a small business computer — then add "compact, reliable, portable, easy to use and guaranteed for one year"

SYSTEM 10 a real Giantkiller at **£2995.00** (excl. VAT)

Ring or write for details and don't forget to ask about our amazing new prices for:—

Qume Sprint 5 Printers.

high quality 45/55 KSR and RO Daisywheel Printers.

MILLBANK COMPUTERS LIMITED

98 Lower Richmond Road, London SW15 1LN.
Telephone: 01-788 1083

• Circle No. 135

MICRO SPEECH 2 DOES YOUR COMPUTER SPEAK TO YOU?

MICROSPEECH 2 is a stand alone speech synthesizing unit. It converts phonetic code or any ASCII text into a speech output. MICROSPEECH 2 may be interfaced to any computer system because all the computation necessary to synthesize speech is performed by its own dedicated microprocessor. Up to one thousand phonetic characters, representing about one minute of speech, may be assembled in the units internal buffer before it is commanded to speak.

FEATURES

- Runs from phonetic code, giving unlimited vocabulary and simple operating software.
- Optional English to phonetics translator allows operation directly from ordinary text.
- Uses standard RS232/V24 interface.
- Totally self contained with internal loudspeaker and power supply.
- No need to worry about complex interfacing or support software.

PRICE

Phonetic model **£875.00 + VAT**

Phonetic model plus English to phonetics translator
..... **£950.00 + VAT**

Available from:

COSTRONICS ELECTRONICS 13 Field Heath Avenue,
Hillingdon, Middlesex Uxbridge (89) 38791
TIM ORR DESIGN CONSULTANT
55 Drive Mansions, Fulham Rd, London SW6
(01) 7312077



• Circle No. 136

THE EAST MIDLANDS

SUPERBRAIN

CENTRE

£1450
+ VAT FOR
SUPERBRAIN
'SD'
(320k bytes)



£1800
+ VAT FOR
SUPERBRAIN
'QD'
(700k bytes)

THE 'TERMINAL' WITH A DIFFERENCE

A CPM COMPUTER IDEAL FOR REMOTE DATA PROCESSING

CONNECTION TO DEC COMPUTERS WITH SPECIAL COMMS SOFTWARE NOW AVAILABLE

EX STOCK

- DUAL 4 MHZ Z80 CPUs
- 64K RAM ● 12" CRT
- DUAL DD/DS FLOPPY DISKS
- 25 LINES X 80 COLS SCREEN SIZE
- FULL ASCII KEYBOARD
- S 100 BUS CAPABILITY
- DUAL SYNCHRONOUS/ASYNCRS232 PORTS
- TABLE TOP

MOST CPM LANGUAGES, UTILITIES, AND APPLICATION PACKAGES AVAILABLE
including ACCOUNTS, PAYROLL, WORD PROCESSING

ALSO
AVAILABLE
EX STOCK

- DEC LSI11/2 SYSTEMS WITH FLOPPY (1MB/2MB) AND HARD DISK CONFIGURATIONS (10MB, 20MB)
- ALL DEC LSI11 PERIPHERALS, /OPTIONS LA34, LA120, VT100, TU58/AAV11, ADV11 DRV11 IBV11 etc.
- DEC SOFTWARE RT11 and TSX/DBL, SINGLE/MULTI-USER
- DEC COMPATIBLE PERIPHERALS/OPTIONS INCLUDING TVI 912/920 ANADEx 9500 PRINTER, QUME (RO) LQP, DIABLO 630 LQP, MICROLINE 80
- DEC LSI11 BASED ACCOUNTS/PAYROLL/WORD PROCESSING PACKAGES

SPECIAL
OFFER

32k PET +
PET DISK DRIVE,
AND COMPUTHINK
EX DEMOS (VGC)
(800k) SPECIAL
LOW PRICES



Office Computer
Techniques Ltd.

Call or write for further details.
Kimberley House, Vaughan Way,
Leicester LE1 4SG.
Telephone Leicester (0533) 28631

• Circle No. 137



apple® computer

Sales and Service

**16K Apple £695
+ VAT and carriage**



We also supply • Lear Siegler ADM3A — **£515** for one.
£500 each for two or more.

• Verbatim
Single-sided minidiskette — **£23** per box of 10.

— **£21** for two boxes or more.

Double-sided 8m. diskettes — **£40** per box of 10

— **£38** for two boxes or more.

Carriage inclusive, VAT extra.

We are also a Cromemco dealer supplying turnkey packages for Estate Agents, Solicitors and Wholesalers.

Total Concept Systems Ltd

373 High Road Leyton, London E10. 01-539 7194 (day) 01-554 1152 (eve)

• Circle No. 138

Intex DATALOG LTD COMPUTERS

MICROPAY-200 £195.00 + VAT

Micropay-200 is a complete payroll System designed to run on a COMMODORE 32K PET microcomputer, interfaced to dual floppy disk drives and a printer.

The System provides:

1. Weekly/monthly payslips
2. Summary page of all payments and deductions that month
3. Summary page of all payments and deductions for the tax year to date
4. Weekly/monthly cash analysis slip for all cash payments made
5. Monthly summary of all payments and deductions
6. Year end summary of all payments and deductions

STOCK CONTROL 3750

Stock Control 3750 is a complete stock control system designed and written to meet the needs of a small business.

It will accommodate up to 3747 stock items and runs on a COMMODORE PET microcomputer interfaced to a printer and COMPU/THINK disk drives.

The System incorporates programs to:

1. Set up a Supplier file.
2. Set up Stock files.
3. Copy Data files.
4. Insert/delete stock records.
5. Insert/delete supplier records.
6. Update/display stock file.
7. Update/display supplier file.
8. Print stock list.
9. Print supplier list.
10. Print reorder report.
11. Print stock movement report.
12. Print stock valuation report.

And perform other useful routines.

Stock Control 3750 is fully protected from misuse and can easily be used by someone with no knowledge of computers or their operation.

The System costs £195.00 + V.A.T. and this price includes a full back-up and advisory service from INTEX DATALOG.

FOR FULL SPECIFICATION WRITE TO:
INTEX DATALOG LTD, DEPT PC1280
EAGLESCLIFFE IND. EST., EAGLESCLIFFE
CLEVELAND TS16 0PW. TEL: 0642 781193

MAIL ORDER SERVICE

BARCLAYCARD — MAIL ORDER — ACCESS

ITEM	PRICE	TOT. INC. VAT
*** DUSTCOVERS		
PET — ALL MODELS	5.75	6.90
T1743 PRINTER	5.75	6.90
ANADEX DP8000	3.50	4.35
CBM 3040 DISK	3.50	4.35
CBM 3022 PRINTER	3.99	4.80
COMPU/THINK DISK	3.00	3.75
ACOUSTIC COVER FOR CBM 3022 PRINTER	49.00	62.00
*** D/D DISKETTES IN FREE CASE		
BASF	35.00	40.83
ACCUTRACK	30.00	35.08
LIBRARY CASE	3.50	4.60
*** BLANK CASSETTES		
C15 (PER 10)	4.00	5.75
C60 (PER 10)	6.00	8.05
*** CONNECTORS		
USER/IEEE PORT	1.30	1.78
CASSETTE PORT	.89	1.43
USERPORT COVER	2.50	3.16
MALE 'D' PLUGS	2.50	3.16
FEMALE 'D' SOCKETS	3.50	4.31
'D' CONNECTOR COVERS	2.50	3.16
*** RIBBONS		
TELETYPE 43	7.72	9.17
ANADEX DP8000	2.75	3.45
ANADEX DP9500/1	15.00	18.40
CBM 3022	2.75	3.45
QUME (FABRIC)	4.25	5.18
QUME (CARBON M/S)	4.50	5.46
QUME (CARBON S/S)	5.00	6.04
DAISY WHEELS		
QUME SPRINT 5	6.50	7.76
*** PROGRAMMERS TOOLKIT		
*** SPECIAL OFFER		
OLD ROMS BK	65.00	75.90
NEW ROMS BK	55.00	75.90
NEW ROMS B/16/32K	45.00	52.90

PROKIT 1

PROKIT 1 — PROGRAMMERS AID.
ADDS THAT TOUCH OF PROFESSIONALISM TO EVERY PROGRAM YOU WRITE.
NUMERIC INPUT ROUTINES: — AUTOMATICALLY ADD LEADING AND TRAILING ZERO'S AND RESPOND ONLY TO NUMERIC KEYS AND DECIMAL POINT.
GENERAL INPUT ROUTINES: — SET THE LENGTH OF FIELD REQUIRED, SPECIFY WHICH CHARACTERS YOU WANT PET TO RESPOND TO AND ALL OTHERS WILL BE IGNORED.
DATE INPUT ROUTINE: — THE PROGRAM WILL NOT CONTINUE UNTIL YOU HAVE ENTERED A VALID DATE.
STRING SEARCH ROUTINE: — FINDS A MATCHING SUBSTRING WITHIN A STRING ENABLING YOU TO USE ON . . . GOTO WITH ANY CHARACTERS, NOT JUST NUMBERS.
SCREEN ROUTINES: — CAN STORE SCREEN DISPLAYS IN MEMORY AND RETRIEVE THEM IN A FLASH: — SUPER FOR MENUS AND GAMES!
PROKIT 1: DEFINITELY THE BEST THING FOR PROGRAMMERS SINCE THAT OTHER KIT AVAILABLE ON DISK OR TAPE. READY TO INCORPORATE IN YOUR OWN PROGRAMS.
PRICE £40 25 INC. VAT AND POSTAGE



• Circle No. 139



©Apple is a trade mark of Apple Computer Inc., Cupertino, CA, USA.

PLUS
16K RAM



£485

Send cheque or money order for
£565 (including VAT & Delivery
in the U.K.) to:

Trade Enquiries
Welcome

QUESTEL

Refuge House, 2-4 Henry Street, Bath, BA1 1JT
Telephone: 0225 65379

Please allow 28 days for delivery

• Circle No. 140



Pete & Pam Computers

Microcomputer hardware & software
Specialists in Applefare
Peter & Pam Fisher

Products for APPLE (A) PET (P) and TRS-80 (T) at a
FAIR PRICE!

MICROSOFT

Z 80 SOFTCARD (A) £175.00
A true Z-80 microprocessor including CP/M and Micro-
soft BASIC.
ASSEMBLY LANGUAGE
(A + Softcard) £162.95, (T) £49.95

BASIC COMPILER
(A + Softcard) £192.95, (T) £99.95

COBOL (A + Softcard) £359.95

EDITOR/ASSEMBLER PLUS (T) £15.95

FORTTRAN (gen. true mach. code)
(A + Softcard) £99.95, (T) £49.95

LEVEL III BASIC (T) £26.95

ADVENTURE (A + T) (disk int or fp) £14.95

TYPING TUTOR (int. tape) (A) £7.95, (T) £ 8.95

OLYMPIC DECATHLON (A + T) £14.95

Test your reflexes in 10 events — uses High Res graphics!

PERSONAL SOFTWARE

VISICALC (P) £96.95, (A) £75.00

CCA DATA BASE MANAGEMENT
(T) £37.95, (A) £49.95
(P) £12.95

6502 BASIC ASSEMBLER

GAMES — all on tape (int or ft)

CHECKER KING (A, P + T) £10.95

BRIDGE PARTNER (P + T) £ 8.95

GRAPHICS PACKAGE (P) £ 8.95

ELECTRONIC PAINTBRUSH (T) £ 8.95

PERIPHERALS PLUS

VERSAWRITER (A 32K) £124.95

Drawing tablet — allows colour, hi-resolution graphics
to be drawn free-hand or traced. Enlarge, shrink, rotate
images. Includes applications software — calculate
distances, add electronics symbols, 5 sizes of U & L case
text, and much more!

HIGH TECHNOLOGY

INFORMATION MASTER (A) £73.95

The most flexible and reliable data manager available,
written by the authors of "The Cashier" and "DBMS".
Performs mathematical calculations. Powerful, but easy
to use.

DATA BASE MANAGEMENT SYSTEM (A) £49.95

Design your own system for manipulation of large
amounts of data, and print formatted reports arranged
as you choose.

DATA MASTER (A) £49.95

NEW! A powerful accessory to use with either "Informa-
tion Master" or "DBMS", adds immense versatility
to both. Re-define files, merge data, enter new calcula-
tions, and more!

ORDER SCHEDULER (A) £73.95

Helps you to maintain records and schedule shipment of
orders from your stock. Makes sales accounting easy.
Written by the author of "The Cashier", optional inter-
action with "The Cashier" produces reports of projected
sales and demand. Remarkable!

MOUNTAIN HARDWARE

EXPANSION CHASSIS (A) £319.95

8 more slots for your APPLE with separate power supply
to allow optimum use. This long-awaited product is
made to Mountain Hardware's high standards. Compati-
ble with all peripherals.

MUSIC SYSTEM (A) £259.95

Generates the sound of any musical instrument — real
or imagined! Digital synthesizer with sixteen voices —
sophistication previously only available on mainframe.
Graphical input using light pen (provided) paddles or
keyboard. Includes membership of User's Club.

M & R ENTERPRISES

SUP-R-TERMINAL (A + video monitor) £195.00

The best of 80 x 24 video cards! Shift/lock mod. 128
U & L case 5 x 8 dot matrix ASCII characters and User
definable char. sets.

UTILITIES

MACRO SCREEN EDITOR (A Int or FP disk) £19.95

PASCAL PAPER TIGER GRAPHICS (A) £22.95

ENHANCED TIGER GRAPHICS
(PAGE 1 OR 2) (A disk) £22.95

VISILIST (A) (formula/grid location of
Visicalc files) £10.95

APPLE-DOC (A) (change any listed element) £12.95

PROGRAM LINE EDITOR (A disk Int or FP) £18.95

HIGHER TEXT (A disk Int or FP)
(def. own colour text) £16.95

**PLEASE ADD 15% V.A.T. TO YOUR ORDER —
POSTAGE IS FREE**

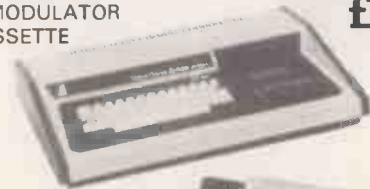
**ASK US FOR OUR FULL CATALOGUE
BUSINESS — GAMES — UTILITIES — FIRMWARE
WE WANT TO BE YOUR MAILORDER SUPPLIER.
IF YOU KNOW WHAT YOU WANT — AND DON'T
WANT TO PAY AN INFLATED PRICE —
GIVE US A CALL. WE'LL TRY OUR BEST!
TEL. 01-677-2052 (24 hours) 7 days a week.
98 MOYSER ROAD, LONDON SW16 6SH.
POST OFFICE GIRO A/C NO. 585 6450**

• Circle No. 141

Enter the Computer Age video genie system

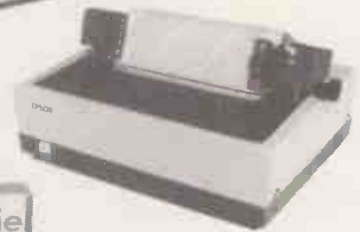
12K MICROSOFT BASIC
16K RAM, TV MODULATOR
INTERNAL CASSETTE

£330
+ VAT



£395
+ VAT

80 Columns
70 Lines per minute
Graphics Characters
Interfaces to most machines
Tractor or friction feed



100's of programs available
TRS-80 level II software
compatible

Dealer List

3 Line Computing
ABC Supplies
Advance TV Services
Allen TV Services
Amateur Radio Shop
Arden Data Processing

Beaver Computers
Blandford Computers
Briers Bookshop
Buss Stop

Cambridge Microcomputers
Catronics
Cavern Electronics
Computer Business Systems
Computer and Chips
Computerama

Computopia
D B Microcomputers
Derwent Radio
Eiron Computers
Eley Electronics
East Midlands Computer Services
Emprise Ltd
G B Organs & TV
Gemsoft
Kansas City Systems
Kays Electronics
Leisurronics
Marton Microcomputer Services

Matrix Computer Systems
Midland Microcomputers
Microdigital

Mighty Micro
Mighty Micro Ltd
MRS Communications
Optelco

C Owens
Q Tek Systems
Radio Shack Ltd
Rebvalle Computers
SMG Microcomputers

Tryfan Computers
University Radio Stores
Ward Electronics
Watford Electronics

STOP PRESS
Anglia Computer Centre
Morrison Computer Centre

Hull 445496
Levenshulme 061-431-9265
Shipley 585333
Stoke on Trent 616929
Huddersfield 20774
Peterboro' 49577
Leicester 222 55

Littlehampton 22461
Blandford 53737
Middlesbrough 242017
Watford 40698
Newport Pagnell 610625
Cambridge 314666
Wallington 01-669-6700/1
Milton Keynes 314925
Lytham 730033
St Andrews 72569
Bath 333232
Leighton Buzzard 376600
Limerick 42733
Scarborough 65996
Dublin 808575/805045
Leicester 871522
Nottingham 267079
Colchester 865773
St Saviour Jersey 26788
Woking 22881
Chesterfield 850357
Chesterfield 31696
Blackpool 27091
Northampton 890661
Melton Mowbray 812888
Stock on Trent 541743
Beckenham 01-658 7508/7551
Nottingham 298281
Liverpool 227-2535
Basingstoke 56417
Burnley 32209/53629
Cardiff 616936/7
Rayleigh 774089
Peterlee 865871
Stevenage 653858
London NW6 01-624-7174
Garboldisham 316
Gravesend 55813
Bangor 52042
Nottingham 45466
Birmingham 021-554-0708
Watford 40588
37774

Norwich 29652
Swansea 795817

LOWE ELECTRONICS

Bentley Bridge, Chesterfield Road,
Matlock, Derbyshire. DE4 5LE.

TRADE ENQUIRIES WELCOME



• Circle No. 142

DOLPHIN PRINTERS

From WALTERS MICROSYSTEMS — Britain's leading manufacturer.

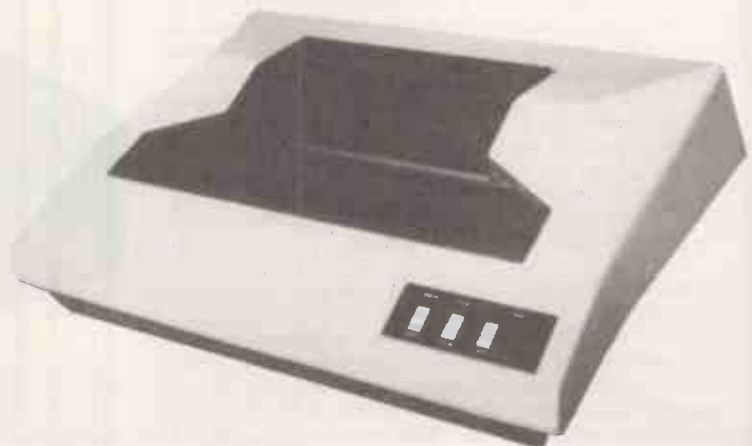
Introducing the advanced BD 136 printing at 240 characters per second



- large 100 line buffer
- centre & right justification
- decimal tab alignment
- enhanced characters
- 32 user definable characters
- £1200.00 end user

& also the BD 80P

- 125 characters per second
- 80/132 characters per line
- 64 graphic characters
- 10 user definable characters
- 750 character buffer standard
- complete with RS 232C, IEEE or parallel interfaces
- £500.00 end user



For further information contact the Sales Office
Walters Microsystems,
1, Blenheim Road, Cressex,
High Wycombe,
Buckinghamshire.
Tel (0494) 445172 Telex 837600

• Circle No. 143

HAVE FUN AND GAMES THIS CHRISTMASTIDE — WITH KANSAS!

Games for the TRS-80 and Video Genie:

SWORDS AND SORCERY

An 'Adventure' type program, with much, much, more — and graphics!
Meet the great oracle, nymph, trolls, maidens, verb, fable warfer, slave girls, rats, snakes, spiders, dragons, goblins and the necromancer in the right to save the princess — then get out quick!
A full 16K of superb entertainment needing skill, strategy and cunning. Only available from Kansas. £9.50

INFINITE STAR TREK

Upgraded yet again to give fast Warp and Impulse. It really is by far the best, requiring no little skill and awareness to destroy the Klingons before they destroy you. £9.50

PLAY THE MICRO

CHESSE Seven levels of skill and plays to correct rules. Far ahead of Microchess in speed and play.

BRIDGE Four hand and dummy contract bridge, with all the facilities to give a hard game.

PONTOON The micro plays a clever hand and you'll need your wits about you here.

BACKGAMMON Try to beat this one, you'll need all your skill.

DOMINOES It's not just luck as this program plays a clever game indeed.

Any of these at a remarkable £8.50 each

DOUBLE GAMES PACKS

Maze Runner and Shatter. Pot Black and Breakthrough. Pin Ball Bounce and Robots. Build High and Knights Tour. Amazing Maze and Touchdown. Suicide Plane and Fire One.

All entertaining full graphic games at two for the price of one. £6.50 per pack.

Prices are VAT paid post free. First class return post service. Telephone your Barclaycard or Trustcard number for same day despatch. (You can order after 6pm using our answering machine with programs sent the following morning). Despatch world-wide but add the postage in this case. Full catalogue sent free upon request.

Kansas

Kansas City Systems, Unit 3, Sutton Springs Wood,
Chesterfield, Derbys. Tel 0246 850357

• Circle No. 144

aculab

floppy tape,

The tape that behaves like a disc,
For TRS-80 LEVEL II and Video Genie.

Connects directly to TRS-80 Level 2 Keyboard. Operating and file handling software in ROM. 8 commands add 12 powerful functions to Level 2 BASIC. No buttons, switches or volume controls. Full control of all functions from Keyboard or program. Daisy chain multiple drives. Certified digital tape in endless loop cartridges. Reads and writes in FM format at 9000 Baud. Soft sectored with parity and checksum error detection for highly reliable operation—just like discs. Maintains directory with up to 32 files on each tape, tapes may be write-protected. Supports Basic and machine-language program files, memory image and random access data files. 12 character filespecs—: "FILENAME/EXT:d" (d is drive no. 0-7). Automatic keyboard debounce. Full manual with programming examples and useful file-handling routines.

COMMANDS (usually followed with a filespec and possible parameter list).

@SAVE, @LOAD, @RUN —for BASIC programs, machine language programs and memory image files. @GET, @PUT

—moves a 256-byte record between a random access file and BASIC's data buffer. @KILL —removes a file from the

directory and releases tape sectors for immediate re-use. @LIST —displays file directory along with sector allocation and free sectors. @NEW —formats tape and creates a blank directory.

Master drive with PSU, Manual and a selection of tapes.

For TRS-80 £169-00, for Video Genie £174-00.

Slave drives £125-00. (add £2-00 p.p. + vat).

(Export orders pp charged at cost)

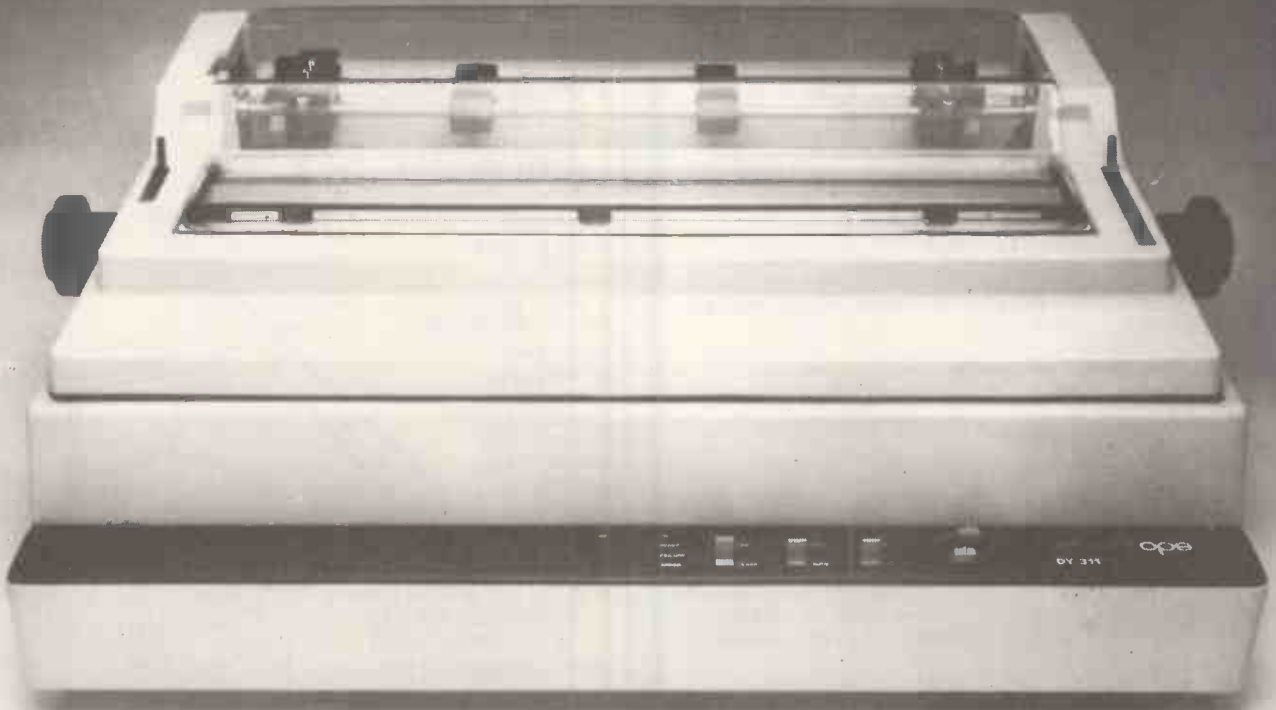


For further
information,
Telephone
0525 371393

aculab Ltd.
24 Heath Road,
Leighton Buzzard,
Beds. LU7 8AB

• Circle No. 145

The next best thing to printing money...



The Olivetti DY 311 is a brand new Daisywheel Printer which will bring a whole new concept of quality and value-for-money to word-processing.

Backed by Olivetti's vast technological and manufacturing experience, the DY 311 is efficient and reliable — easy and inexpensive to maintain and service.

With end-user prices around **£1250.00** it is a very attractive alternative to other available Daisywheel printers.

Add a System 10—

for word-processing, accounting, stock control and payroll with readily available software. Total system price well under **£4500.00**— including basic software!

Key Facts

- Intelligent Daisywheel Printer
- 32 cps average printing speed (1/10" Shannon text)
- Four selectable spacings — three constant, one proportional
- Microprocessor controlled
- Automatic bidirectional printing
- High speed horizontal tabulation
- RS 232 C Serial interface up to 9600 baud
- Forms widths up to 17½"
- 150 to 300 characters on line
- Long life 100 char. Daisywheel (min. 10 million imp.)
- Range of interchangeable print wheels and ribbons



Millbank Computers are proud to announce their appointment as an official UK distributor of the Olivetti DY 311 Daisywheel Printer and also the Olivetti TH 240 high-speed Thermal printer. We are also the sole UK distributor of System 10.

Visit our new showroom — the only place in the country where you can see these exceptional new products together.



Millbank Computers Limited
98 Lower Richmond Road · London SW15 1LN
Telephone: 01-788 1083

Please send more information about: PC12

System 10 Olivetti DY 311 Olivetti TH 240

Name _____

Company _____

Address _____

Telephone No: _____



• Circle No. 146

MICRO-FACILITIES

127 HIGH STREET
HAMPTON HILL
MIDDLESEX **01-979 4546**
01-941 1197

MIDDLESEX & S.W.LONDON

Approved Business Dealers for:

Commodore Computers & Business Packages
Apple II
North Star Horizon
IMS 5000/8000 Series

As fully authorised Dealers for the above equipment, and as experienced data processing professionals, we are the best people to help you.

Our complete package offers you:

Free initial discussion & advice
Systems Design & Programming
Software Packages
Supply & Installation of equipment
Leasing & Financing terms
Full Maintenance Contracts
Genuine After Sales Service

Contact us to discuss your problems and requirements, we offer you a lot more, but only charge the same. Our ability will give you peace of mind and confidence that the job will be done properly.

• Circle No. 147

ANGLIA COMPUTER CENTRE

MICROCOMPUTERS FOR BUSINESS,
EDUCATION AND HOME

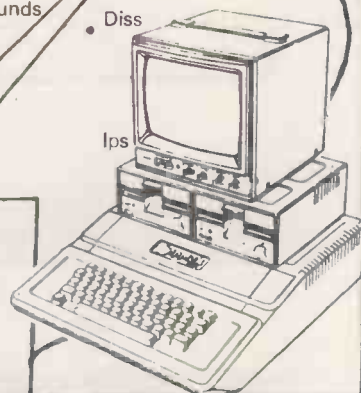
FOR ALL YOUR BUSINESS, EDUCATION
& LEISURE COMPUTER REQUIREMENTS!!!

APPLE II
TRS-80
SHARP
NORTH STAR
HORIZON
TANGERINE
U.K. 101
NASCOM

+ PRINTERS &
OTHER PERIPHERALS.

BOOKS**
SOFTWARE*
MAGAZINES**
STATIONERY***
BUSINESS &
INDUSTRIAL
CONTROL

• Cromer
• King's Lynn
• Dereham
• Thetford
• Bury St. Edmunds
• Diss
• Great Yarmouth
• NORWICH
• Lowestoft



WE ARE HERE!!!
88 St. Benedict's Street
NORWICH NR2 4AB
Tel. (0603) 29652
24hr. Answering Service.

• Circle No. 148

KRAM ELECTRONICS

30 Hazlehead Road, Anstey, Leicester
053-721 3575

CENTRONICS PRINTERS FROM £390
PROPORTIONAL SPACING FROM £490

UK101 4K RAM £30

PET-RS232 INTERFACE
£80 (DECODED)

DECODED PET-CENTRONICS INTERFACE £50

DECODED AUDIO
INTERFACE FOR
PET £50

UK101 NUMERIC PAD
£12

CASE FOR UK101 £24

ADDITIONAL
EDUCATIONAL
DISCOUNTS

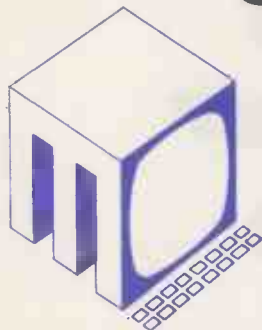
DECODED TRS80 TO
CENTRONICS INTERFACE
£50

SORRY ALL PRICES SUBJECT TO 15% VAT

• Circle No. 149

CP/M SOFTWARE

from



METROTECH

* SPECIAL OFFER FOR ORDERS IN 1980 * WORD PROCESSING

WORD-STAR^{tm1} is the most complete integrated word processing software system ever seen on a microcomputer. In less than six months more than four thousand people have proudly purchased WORD-STAR.

WORD-STAR 2.0 £205
WORD-STAR 2.0 with MAILMERGE £265

INTEGRATED BUSINESS SYSTEMS

Written specially for the U.K. market, Version 2.0 of GRAFFCOM'S Integrated Small Business Software is now available for both floppy (ISBS-F) and hard (ISBS-H) disk systems. Prices for the floppy disk systems are:—

Payroll	£475
Company Sales	£425
Company Purchases	£425
General Accounting	£375
Stock Control	£325
Order Entry and Invoicing	£325
Name & Address	£225
Time Recording	£375
Lease, Rental & HP	£375

Discount prices are quoted for bundles of the above systems.

Prices for the hard disk systems are available on request.

LANGUAGES/UTILITIES

CBASIC II Commercial Disk Extended Basic	£ 75
SBASIC Compiler Structured Basic	£175
SUPERSORT I	£125
WORD-MASTER Superior Text Editor	£ 75
MET/UTIL advanced CP/M utilities to Backup & Initialise disks and Configure your machine environment	£ 35
MET/TWAM Index sequential file Access in CBASIC II	£ 55

COMMUNICATIONS

BISYNC-80/3780 and **BISYNC-80/3270** are full function IBM 2780/3780 and 3270 emulators for microcomputers. **BISYNC-80/3780** gives you a Remote Job Entry terminal for the price of a micro!

BISYNC-80/3270 combines the local processing power of a micro with a sophisticated screen capability. Make your dumb terminal smart!

I/O Master is a superb S100 buffered I/O board which supports 3780 and teletype communications, plus serial and parallel peripherals.

MET/TTY will connect your micro to a timesharing service in simple teletype emulation.

BISYNC-80/3780	£275
BISYNC-80/3270	£275
MET/TTY	£ 95
I/O Master Board	£225

DATA MANAGEMENT

SELECTOR III-C2

An easy to use Information Management System; requires CBASIC II £185

SELECTOR IV

An advanced Information Management System; requires CBASIC II £275

DATASTAR

Powerful data entry, retrieval and update system £195

Micro Data Base Systems

MDBS is a full network database with many additional features.

Prices available on request.

NEW * FINANCIAL REPORTING * NEW

Have you seen and liked VISICALC^{tm2}?

Did you know that similar facilities are now available under CP/M^{tm3}?

REPORT WRITER will carry out all your calculations and produce reports with your headings, totals and summaries. Ideal for financial planning, budgeting and management reporting. Requires Microsoft Basic.

REPORT WRITER £150

All software is Ex-stock and available on standard 8" disks or 5" disks for Cromemco Z2H, North Star Horizon, Vector MZ & Superbrain.

- * Add 15%
- * Postage and Packing £2 per order
- * State which disk type and size

- * All orders prepaid
- * Manuals available at £15 each

Telephone orders welcome for Access, Barclaycard, American Express or Diners Card
CALL 0895 58111 Ext. 247 or 269 or Write to

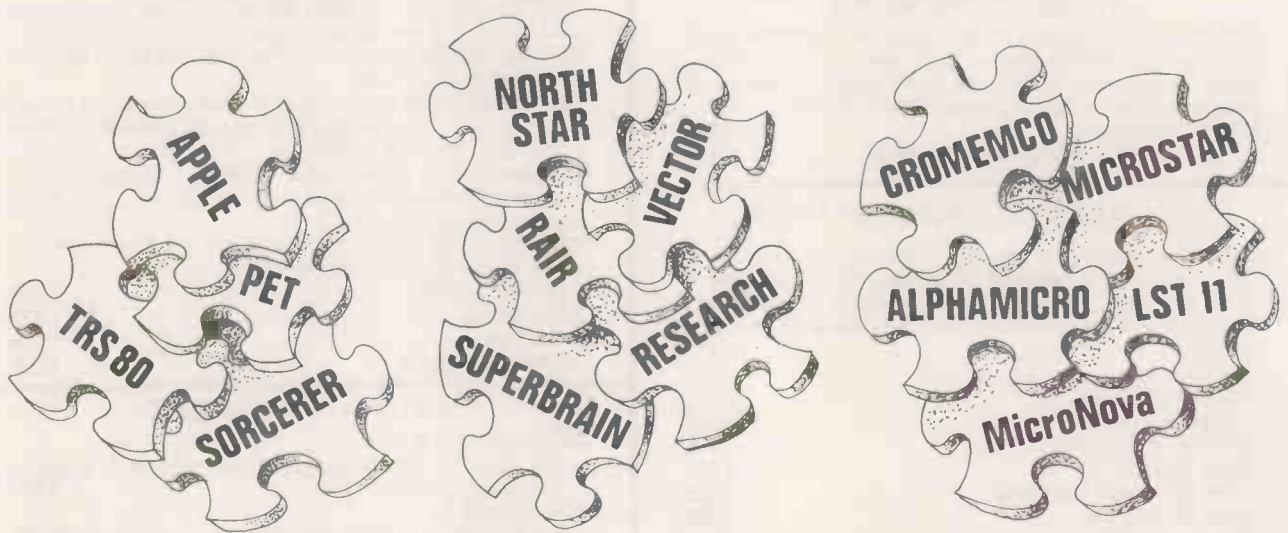
tm1 WORD-STAR is a trademark of Micropro
tm2 VISICALC is a trademark of Personal Software, Inc
tm3 CP/M is a trademark of Digital Research

METROTECH MAIL ORDER
WATERLOO ROAD
UXBRIDGE
MIDDLESEX UB8 2YW

enclosing cheque, PO's payable to METROTECH

• Circle No. 150

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

• Circle No. 151

Microcomputing in the recession

ALL AROUND us, industrial giants are wallowing and bellowing in the slime; their bones sinking down to be unearthed by future generations of industrial archaeologists. Big closures are announced in chemicals and consumer electronics and thousands of people lose jobs they probably assumed were recession-proof — solid, high-technology jobs which could not go wrong before the year 3000.

Is this the steepening of the descent into the final chasm of capitalism's total collapse, or is it just the winnowing of ante-deluvian businesses which would have gone under one way or another? After all, when you think about it, the businesses which are going bust are the ones which seemed most threatening to a civilised way of life. Cars, nylon carpets, television sets — precisely the things whose very profusion seemed likely to make life unbearable.

More economical

In fact, economics seems to be forcing us to do what the conservationists have long been pleading. Since we cannot afford deluges of things, we must perforce save the materials which would have gone to make them. Since we cannot afford energy to waste in our homes or our cars we must make do with less; we must insulate, be more economical, use the train, walk — all very good things whether we are poor or rich. Yet all that has a special importance for us in microcomputing. We are, for the moment, insulated from the slide. Microcomputing has grown from nothing to a £20 million industry in two years flat. Without a penny of Government money, support, comprehension or even awareness of our existence.

The darker side

There is a darker side to the micro story. The business started by satisfying the passion in some 20,000 breasts for computing. The announcement, two years ago, of kitchen-table computers for a few £100 caused a stampede. Now, the micro industry looks for its future to small businesses. There are, after all, more than one million of them in the U.K., and an enormous number abroad to which we may well sell our hardware and software.

Yet what, as they say in the advertising business, is our unique selling proposition? Very roughly it is this; a small business which spends £4,000 or less on a suitable micro and software can either fire an employee who costs £4,000 a year, or increase its productivity without taking on more staff.

Enormous flaw

The emergence of the micro is beginning to expose a great flaw in the public presentation of computers. They have, up to now, been such expensive, complicated machines which even their owners, the managers of big companies, never touched. They never learned the truth about computers — that they are work-hungry morons. Instead they were sold the myth that these machines are super-brains. They are not.

They are very good at doing very simple boring jobs. They are good at doing jobs which people in a civilised country ought

not to have to do. The penetration of micros into the business world can only mean that less people have to copy-type contracts, type envelopes, look for flawed parts on the production line, tap out messages on Morse keys, sit gazing over a bank of TV monitors for lonely eight-hour shifts.

That is all very well, says the shop steward, "but my members would just as soon have a boring job as no job at all". One cannot fault him; but do they have to have no job at all?

Negative aspects

We should not be too alarmed if a set of jobs perishes which devoured natural resources. We can replace them with other jobs which deal in materials less burdensome to poor Mother Earth — which deal in information and ideas, in pleasures and emotions. That is our business in microcomputing. If, at the moment, our contribution is eliminating the negative aspects of industrial employment rather than improving the positive aspects that too, is not all bad — there is plenty of leeway to make up.

Providing, that is, that we can persuade ourselves, and later the world, that we are creating jobs. Any activity whose main contribution is job destruction is going to find itself, before long, in deep trouble. What can we say about job creation? If we believe that the micro business turns over £17 million, that implies 3,400 jobs of some kind or another, somewhere or another, that did not exist two years ago. That may not sound much, but we have hardly started.

Small businesses

If we reckon that small businesses employ eight million people, and that in the next five years, each five of them are to buy a micro, worth, say, £3,000, we ought to produce 960,000 jobs in our industry alone, let alone new jobs in businesses which would not have existed without computers to do the dirty work.

Another bonus is that many jobs in microcomputing will go to the young simply because they have the energy and adaptability to cope. We should also soon start to find substantial numbers of young people leaving school who have at least overcome humanity's first natural fright of VDU and keyboard. Many of them will be expert programmers already since it seems that nature intends 16 year olds to be machine-code programmers — later, they wake-up to the possibilities real life has to offer.

Job creation

We may also create some new jobs which would not have happened without computers to do the dirty work. The nearest analogy which springs to mind is the massive pop music industry which developed rapidly on the back of cheap, powerful semiconductor audio amplifiers. Just what those new jobs may be is not so easy to predict. We would very much like to hear from anyone who has created a genuine new job — not in the micro industry itself. □

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it is your chance to keep in touch.

Creativity exists

YOUR SEPTEMBER editorial paints a depressing picture. No creativity — nonsense. I believe that you were being deliberately controversial. I work as a consultant outside the commercial field and I know that the micro has made it possible to extend computing power to every industrial enterprise. We can do things now that were either commercially or technically impossible a few years ago.

I give you a few examples of graphics-orientated software packages which are the fruits of the great surge you deny exists. Those programs are of interest to the process designer or operator.

Mimic Diagram Generation — a program which, using a joystick to move high-resolution shapes and text, positions the shapes, e.g., valves, vessels, etc., and joins them. The resulting diagram may be stored as a text file on disc and may be dumped to a suitable printer.

Multi-vessel heating/cooling system simulation — a program which models the dynamic temperature status of up to 12 stirred vessels. Interactive process control of batch processes. A combination of all three which gives a visual representation in real time of the progress of a batch process.

Any of those programs may be run on a system costing about £2,000 with which any number of users can communicate over the international telephone network, miles away if necessary. Although the programs are rather technical, they have a general interest within a specific field. The creativity is being practiced but not published perhaps, or advertised.

Colin Grace,
Saffron Walden,
Essex.

Communication barriers

I AM an engineer myself and write in response to your editorial in the September issue. In the last few years, we have seen the cost of personal computing power fall as no other commodity since the German mark in the years of hyperinflation.

In relative terms, the cost of a sophisticated programmable calculator has fallen to a level where almost every university student, even sixth-form schoolboy can afford one. The advent of the mass-produced MPU has caused the same thing to happen to the microcomputer. The mini-computer has, however, not taken such a dramatic fall in price.

The control which the big computer manufacturers exercise in that field is enormous and they have prevented any of the fierce competition which has been

instrumental in bringing down prices in the other fields of computing. Herein lies one of the factors which have prevented the real imaginative innovation in today's software market.

That lack of imagination was more than adequately demonstrated in the August *Practical Computing* software guide. A total absence of anything but commercial applications, word processors, stock-control programs and the like is a far cry from the expectations expressed by the pundits 12 months ago.

The hopes of the past have not come to fruition, lost or mislaid along the line, pushed out by the novelty of Space Invaders and chess games. It is a sad fact that the microcomputer market will die or dry-up unless new applications can be developed. The market cannot be sustained solely on inadequate stock control programs or the novelty of Star Trek and battleship games.

The scope for future development is almost endless. There is one application which one might have expected to have surfaced already and it is in the field of engineering. The lack of commercially-available software in that market is probably due to a language barrier. The language of the software designer has been for the most part commercial, both in terms of the computer language and the language used by the people involved, that between the designer and the end-user.

The engineer talks only of engineering, if he talks at all of computers or programming, 10 times out of 10 it will be in Fortran. In some respects, that has not been a bad thing, the limited exchange of engineering programs has not been hampered by any language barrier, unlike that in education where everybody speaks a different form of Basic.

If he talks of the hardware involved with computing, it will be a mainframe or at least a mini and that will probably be PDP-11. He still believes the micro has nothing to offer him, believing that they still work in either machine code or a very simple form of integer Basic. Neither of which would be of any use to him.

The engineer wants to use the computer as a tool, he is not interested in the computer itself and the intricacies of the program are probably meaningless to him. It is the end result which matters, a computer is just a means to that end. For the development of the market both in volume and quality the range and complexity of the user must be expanded.

To sell to the engineering market, the engineer needs to be convinced that the new developments in microcomputer

hardware can provide him with a worthwhile and useful tool. The software to go with the hardware must also be developed. It must be dedicated to engineering applications, reliable and preferably in Fortran.

If the younger engineers are to be enticed into the home-computer market, the software must also be cheap. £75 for CP/M and a further £200 for a Fortran or Pascal compiler cannot really be justified with the number of systems in use today.

Communication between the software designer and the end-user is the only route to a better environment for us all.

R J Campbell,
Northallerton,
North Yorkshire.

Fostering pessimism

I READ with interest your depressing editorial in the September edition and the article on the financial failure of several firms by Martin Hayman.

I must say that as a commercial user of both micro and minicomputers, I am not at all surprised by the current pessimistic outlook. To some extent, it is fostered by publications such as yours. The following points may illustrate why that is so:

- Your constant presentation of machines such as ZX-80s, Pets, Apples, Tandys, etc., obscures the point that those installations are not suitable for more than the simplest of operations.
- You seem to ignore the mini market such as Digico Micro 16 although that type of equipment is not much more expensive in real terms and is certainly much more reliable and usable than the small equipment.
- Very many people are quite frustrated by the type and quality of the programs advertised and discussed in your magazine. Most of them are unusable and irrelevant in the average office.
- Your apparent insistence that programming is now a skill all can develop is quite incorrect and offputting. Proper programs need specialist skills just like any other profession. There are many disillusioned amateurs who have discovered that fact.
- The type of peripheral equipment pushed by the micromarket is virtually useless to the commercial user. It is generally unreliable, floppy discs, or too slow — the daisywheel printer.
- I do not think you are really interested in the one-off system.
- A serious approach to successful applications is needed if your publication and others like it are not simply to serve the

(continued on page 44)

SIX OF THE BEST

Pet Programs from Petsoft

76 BASIC PROGRAMS

76 COMMON BASIC PROGRAMS

A collection of 76 useful programs on one cassette from Adam Osborne's best selling book. These include personal finance, maths, statistics and general interest topics. Excellent value for stand alone or incorporated use.

£15 on cassette.

STOCK CONTROL

STOCK CONTROL Powerful and flexible stock system with full facilities for recording and control of stock information. An audit listing is automatically printed which itemises all transactions including the entry amendment and deletion of master stock information, issues receipts, allocations, purchase orders. Printed reports include Full Stock Control, Stock Valuation, Reordering Report, Audit Listing, The system is highly flexible.

£50 on CompuThink or Commodore Disk.

WORDCRAFT

WORDCRAFT A true Word Processor for the 32K PET. Wordcraft is a genuine word processing system, easy to understand and use, but containing all the facilities normally found only on more expensive dedicated Word Processors. Features include scrolling in both vertical and horizontal directions (to overcome small screen size), up to 117 characters wide and 98 lines deep for a full page of text. Written entirely in machine code for speed and compactness. Truly the Rolls-Royce of PET Word Processors.

£325 on CompuThink or Commodore Disk.

PAYROLL 200

PAYROLL 200 Comprehensive, easy-to-use package for small businesses with up to 200 employees. Facilities provided include Holiday Pay, Sick Pay, Bonus Payments and two rates of overtime, as well as allowing a 'Standard week' to be specified for each employee. Weekly and monthly summaries are provided and amendments necessary because of a Budget are made very easy. Prints wage slip and coin/note analysis. Tax & NI are computed automatically from knowledge of employees codes. Update service available. Full manual provided. £50 on Commodore or CompuThink Disk. Cassette system also available at £25

PETPLAN BUSINESS SIMULATION

PETPLAN BUSINESS SIMULATION

PETPLAN BUSINESS SIMULATION Petplan is a general management business simulation game which is exciting to play. Already it is widely used by colleges and Industrial Trainers to teach the skills needed to run a business. The program creates the model of a manufacturing company; you take the decisions. You will need to hire workers, invest in plant and premises, set advertising budgets and prices. At each stage screen reports (which may be printed out) show the results of decisions as they take effect. 50 page manual and voice guide on cassette. For 32K PETs. £60 on Cassette.

PET BASIC TUTORIAL

PET BASIC TUTORIAL 2 A revised version of our best selling course on programming the PET in Basic. Let PET take you through its commands and functions at your own speed. Over 50K of lessons including working examples of the programming techniques that are described. Suitable for novices and those with some programming experience, from literacy age 10 on.

£15 on cassette.

PROGRAMMERS TOOLKIT £44

Plug-in ROM Chip adds nine useful commands to PET BASIC including RENUMBER, TRACE, DUMP, FIND and APPEND.

You will find Petsoft programs on sale in more than 200 computer shops throughout the country, and in many more all over the world. We invite you to try them.

If you can't find the program you need, contact us directly. We offer over 200 titles and can supply you directly. We will even take credit card orders over the telephone. Since we normally carry all programs in stock, you won't have long to wait.

PET is the trademark of Commodore.

Petsoft

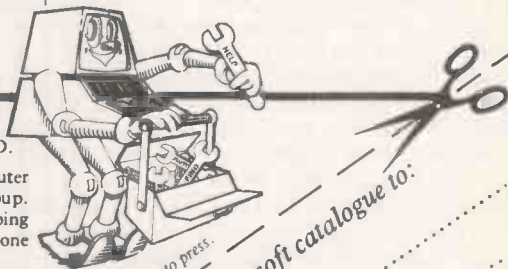
part of the **ACT**
Computer Group



Radcliffe House, 66/68 Hagley Road, Birmingham B16 8PF

Telephone 021 455 8585

Telex 339396



Prices exclude VAT and where correct at time of going to press.

Please rush a FREE copy of the latest Petsoft catalogue to:

Name:

Address:

Postcode:

I have an

- 8K PET
- 16K PET
- 32K PET
- No PET yet

• Circle No. 152

(continued from page 42)

fun market. Perhaps that is, however, where you see your future.

To sum up, I think the sooner a more responsible and realistic attitude is adopted by the computer industry to actual applications, the better it will be for the expansion of computer usage. Perhaps your magazine could be re-named, Impractical Computing.

**Martin Hawkins,
London WC1.**

Mis-shapen compiler

I AM annoyed about an article in the September issue. Frankly, I feel that I have been misled by you, and I think that you have been misled by the author of the two-page article, *The shape of things to come*.

The article was not the only reason for my having bought your magazine, yet an important one, because I own and use an Apple Plus and a good shape-table compiler would have been very valuable.

Admittedly, the presentation of the article was good, but there are obvious mistakes in the program listing, e.g., line number 2000 instead of 1000. There are omissions, like a goto 200 after line 290, which are less obvious. That annoys me.

After spending a good deal of time debugging, it becomes clear that the program cannot do what is said it could do, because there are serious omissions in the algorithm.

For example, after, in one shape-table byte, one plot and one move, one again goes into plotting mode; the program tries to store that action into the same byte, which, in fact, is impossible. Also, a move-up, as the third action in one shape-table byte, cannot be used, a situation not covered in the program.

If the third action after starting a new byte is a plot, it does not fit in that byte and must become the first action in the next byte, leaving the seventh and eighth bit in the current byte at zero. That the program does, but, when the second action in that byte has been moved-up, leaving also the fourth, fifth and sixth bit to zero, the plotting routines will ignore those bits, so that this move-up should be repeated in the next byte, before other moves or plots. Again, the program fails.

Those situations, which will arise in every shape which contains moves as well as plots, are fully and clearly described in the Applesoft reference manual, and omitting them means that the shapes produced by the program are not the shapes you try to compile. It is my guess, that the author of the program never really tested it, or even worse, knew it does not work properly. I take it, that *Practical Computing* has not tested the program.

Yet the point I want to make is this. Thousands of people spend money on your magazine. Again, hundreds of people will sit down at their computers and try to make the program work for them.

It is not acceptable in that situation,

that *Practical Computing* builds a two-page article, very attractively, from an untested and as shown, very incapable program. So, please take more care in the future; the rest of your magazine is worthy of it.

**Dirk Rietveld,
Amsterdam, The Netherlands.**

Re-compiled shape table

AFTER spending a few days working through the manuals supplied with my new Apple, I decided to implement Malcolm Banthorpe's shape table compiler — September issue — to design a lower-case character set.

Apart from the obvious typing errors, which I corrected while inputting the program — the first line 2000 should be 1000, > is missing from line 380 — I found a number of errors when I tried to run it: the high-resolution shape was not displayed long enough to see it;

When a shape was cancelled, the space it occupied was not released for re-use; the compiled shape was too large and rather distorted; even after correcting those errors, there was still something wrong, which became noticeable when I tried to draw the letter "f". Dry-checking a shape through the program showed that, under certain circumstances, the plot/move marker was being applied to the wrong vector.

I, therefore, re-designed the part of the program which creates the shape table, here are the amendments. Apart from the fact that, barring typing errors, this version works correctly, I believe that the use of a three-word array to construct the three vectors per byte makes it simpler to understand. That is just as well, since the line numbers are so closely spaced that I did not have room for REMs.

Incidentally, although Banthorpe recommends plotting small shapes and using the SCALE facility, that should be done only where space is at a premium or the shape consists solely of horizontal and vertical lines. That is because SCALE uses the vector associated with a plotted point to determine in which direction to expand. Try plotting an x on a five by five grid and displaying it with a scaling factor of 10. These amendments cure all the errors found and cancel the shape automatically if an illegal sequence is input — three consecutive upward moves or two upward moves followed by a plot.

```

101 DIM A(2)
290 A(J) = F*4 + C : J = J + 1
292 IF J < 3 GOTO 200
294 IF A(2) < 4 AND A(2) > 0 GOTO 300
295 Q = A(2) : A(2) = 0 : KEEP = 1
296 IF A(1) > 0 GOTO 300
297 KEEP = 2
298 IF A(0) = 0 THEN AS = "X" : KEEP = 0 : J = 0 : GOTO 355
300 POKE I, A(0) + A(1)*8 + A(2)*64 : I = I + 1
310 A(0) = 0 : A(1) = 0 : A(2) = 0 : J = KEEP : KEEP = 0
312 IF J > 0 THEN A(J-1) = Q
315 GOTO 200
320 POKE I, A(0) + A(1)*8 + A(2)*64 : POKE I + 1, 0 : I = I + 2
    
```

```

325 A(0) = 0 : A(1) = 0 : A(2) = 0 : J = 0
330 HGR
335 HOME : INPUT "SCALE?"; AS
355 IF AS = "X" THEN N = N - 1 : S = S - 2 : I = TI : GOTO 130
410 GOTO 335
    
```

Apple owners with a disc drive may delete lines 2000 to 2080 and replace lines 419 to 510 with a simple display of the start address and size, which is all that is required to BSAVE the table.

**Neil Lomas,
Crewe, Cheshire.**

List-proofing Pet

I WOULD like to add some information to the note about list-proofing programs in your September issue Pet Corner. The note gives a technique of making programs list-proof by changing the line link in memory location 401. It is said that the line links are not used when the program is run, so that method of list-proofing will not affect program operation.

However, that seems to be true only if the program does not contain any GOTO or GOSUB instructions. For example, the following program, when made unlistable by the technique given, will not run. In fact, it will crash the Pet.

```

0 REM
10 GOTO 100
100 PRINT "HELLO"
    
```

The note is also incorrect in claiming that the changed line links will be maintained when the program is saved and reloaded.

**Glenn Kleiman,
Toronto, Ontario, Canada.**

Microline 80 outlined

CONCERNING the Microline 80 printer made by Oki, on the hard-wired board in the printer are four movable jumpers, S1, S2, S3 and S4. Some of them are obliquely mentioned in the operators' instructions.

Without going into immense detail, the four jumpers, each having two positions in addition to being unconnected, give 36 possible combinations. What they provide as printed output is:

Eight combinations: English upper- and lower-case and numerals.

Four combinations: Japanese Kana script, with numerals.

Six combinations: Japanese Kana script, with other symbols.

Five combinations: overwritten script. 13 combinations: auto-test. In that mode, the printer prints continuously, not under software control. Output is either English characters, numerals, and graphic characters; or Kana characters and graphic characters; or English characters, Kana characters and graphic characters, depending on the combination of jumpers.

I should be happy to provide anyone with tedious detail on the combinations should they wish it; but I should be most interested to hear from anyone running a Microline 80 in a Z-80 system and who has managed to run the graphics characters under software control.

**Robert Tasher,
Caersws, Powys. ☐**

BUTEL-ATHENA

The Ideal Small Business System

The ATHENA is just what your growing business needs. The high performance ATHENA can deal with all your accounting, stock control, word processing and other requirements. It is simple to use, has only a single power lead and can be expanded with multiple terminals and more storage.

Prices start at £5694. Write or call for details.



ATHENA Dealerships Available.

BUTEL
Technology for business

Butel-Comco Limited
50 Oxford Street,
Southampton,
England SO1 1DL
Telephone 0703 39890
Telex 47523

• Circle No. 153

Nascom's buyer brings cash and new projects

NASCOM has at last found a buyer — and the good news is that the buyer is prepared to inject more cash into the company to keep the existing machines going, and to develop and market new ones.

The buyer is Allteck Technology Initiatives which deals with "new products for industry generally" — among them, a Prestel adaptor which has now been transferred to the Nascom side of the business as part of a big drive to develop the company, restore confidence in the industry and among users, and to broaden its marketing base, particularly overseas.

Head of Allteck is Peter Mathews, who recently outlined his plans for the company and previewed some of the machines the new company is developing. Nascom will in future be known as Nascom International, which will probably be headed by Martin Tomlins, partner in Microprocessor Developments who has skills both as an accountant and as a software development engineer and would hence bring an unusual blend of talent to Nascom. In particular, Allteck will be looking for "financial discipline".

Nascom International will be a holding company; the U.K. side of the operation will be known as Nascomputers Ltd and a software house, Nasoft, is likely to follow soon.

Micro industry watchers had been expecting that a buyer would probably want Nascom only for its assets, which it would break-up and sell in small lots. Estimates of the value of Nascom at the time it was declared bankrupt — in March of this year — varied widely.

On the basis of the receiver's, Cork, Gully, figures, some put its value as low as £40-50,000. One of the criticisms was that there was an extremely unbalanced stock inventory, and that is confirmed to *Practical Computing* by Peter Mathews.

Mathews denies emphatically that he had gone by the receiver's figures in assessing his

bid. Mathews reveals that he had raised his original bid of May in August, but will not say how much he finally paid to acquire the company, though informed sources believe the figure to be around £100,000.

Enthusiasts of the Nascom — and, as John Margetts' Users' Club effort to raise finance to buy the company



The Nascom System 80.

showed, there are many — will be pleased to learn that Allteck is to continue with its kit models, even though it is to build a new low-cost machine with 64K RAM and standard ½MB memory to crack the business market, and a Post Office-approved Prestel interface.

It is also proposing to set the

talents of the many hobbyists to use, and is inviting anyone who has bright ideas, either for hardware modifications or for complete software packages, to contact it. Peter Mathews says this is in an attempt to broaden the base of the Nascom applications and to involve users. Areas of particular interest are medical, commercial — cash registers — robotics, artificial intelligence, and automotive and other process-control applications.

In the medium term, says Mathews, Allteck would be able to finance much of its ambitious programme of development, which included a big thrust into Europe and the Middle East, and possibly the U.S. It is searching for European partners and is expecting to announce the identity of an overall sales manager shortly.

The level of operation which Mathews envisages is going to be costly and he has already talked with four other potential backers, including a government agency. Backing might well take the form of management expertise as well as cash.

Two of the top priorities, he says, were to establish a comprehensive library of software — he invites anyone who had converted packages for other machines to run on the Nascom to submit them — under the company name of Nasoft Ltd; and to improve the quality control at the assembly

stage. He was aware, he says, of quality criticisms of recent Nascom products but was unable to confirm whether the Scottish assembly plant would continue. The Chesham office and plant would continue "for the foreseeable future".

Just how long the foreseeable future is, only time will tell. At the time of the announcement, Mathews and his team had been in charge for only a few days and had not yet even costed the existing products. There seems little likelihood, though, that there will be a reduction in any prices; the Nascom 2, as priced at the beginning of the year, is reputed to have had an extremely slender profit margin.

The Nascom International proposed range of products in detail:

- A disc-controller board which is Nas-Bus-compatible and capable of driving four Siemens double-density, double-sided 5¼in. mini-floppy disc drives.
- A write-protected dynamic RAM card, also Nas-Bus-compatible, with up to three banks of 16Kbytes.
- A programmable character-generator board with 2Kbytes of static RAM.
- Visiontel 1000, which converts a standard TV into a Prestel receiver with automatic dialling and the option of connecting either a cassette recorder to a small plain paper printer.
- A light pen.
- A programmable stereo sound generator.

Those products, as well as the Nascom 1 and 2, will progressively become available through the 23 Nascom dealers. □

'New information technology department should be formed'

INFORMATION technology in all its aspects should be brought under one head within one Government department, the Cabinet has been told by a committee of high-ranking advisers. Computing, telecommunications and information processing are handled by various Government departments and should now be properly coordinated, the Government Advisory Committee for Applied Research and Develop-

ment has told Prime Minister Margaret Thatcher.

The Government has accepted the conclusions of the report and is re-organising the Industry Department to form a new information technology department under a deputy secretary, Roy Croft. The committee had urged, though, that the head of the department should have full ministerial status, and points out that the world market for inform-

ation technology is £500 million a year and rising by 10 percent every year.

Among its potentially contentious recommendations are that the British Telecom should be able to borrow sufficient money to make it world-competitive if the tax payer cannot afford it; and that legislation — which would presumably also mean data-privacy legislation — should be handled by the new department. □

U.S. chips to dominate

THE States will still be the dominant world manufacturer of chips in 1985, though its share of the world market, worth \$38 billion, will decline slightly from 71 to 67 percent, predicts a report from a microelectronics consultancy.

World consumption of microchips will rise on average by 27 percent a year, and firms in Japan, the Far East and the Caribbean will take much of the business.

The report, from Mackintosh consultants, does not hold high hopes for European manufacturers. During the five-year forecast period, chip demand will rise by only 15 percent, while production as expressed as a percentage of the world market will fall from its present six percent to four percent.



A new graphics input tablet, suitable for drawing on a CRT, tracing graphics documents, or selecting from a menu, has been introduced by Hewlett-Packard. Interfaced through HP-IB — the Hewlett-Packard implementation of IEEE standard 488-1978 — the tablet is compatible with most Hewlett-Packard computers including the HP-85 personal computer. In the interactive-graphics mode, the tablet can be used as a CRT cursor mover to create or locate graphics data on a display, as in the case of an engineer using a computer to design electronics schematics or mechanical structures. In the graphics entry mode, line-drawings and charts can be traced on the tablet and then stored for future use. The tablet costs £1,071. Details from Wokingham (0734) 784774.

Two new Chess Challenger models released for Christmas period

THE NUMBER of computer chess games on the market grows apace with two new versions of the Chess Challenger being released in time for the Christmas rush. The Sensory 8 Chess Challenger and the Voice Sensory Chess Challenger feature a touch-sensitive playing surface instead of the familiar built-in keyboard and display window. The new games see each move and record it automatically. A tiny light on each square of the

chess board lights up according to which piece is being moved, showing the from-and-to position for each piece as it is played.

The Sensory 8 Chess Challenger features eight levels of play from beginners' to experts' and can be switched to any level at any time — even mid-move.

The Voice Sensory version Chess Challenger is similar but has nine levels of play and can speak all its own moves. Fort-

unately its Dalek-like tones can be switched off at any time.

It has a repertoire of 64 book opening variations, each averaging 15 moves into the game. It can also duplicate 64 of the world's greatest chessgames by players such as Morphy, Capablanca, Spassky and Fischer, or tell you each time you make a move which differs from that played by the master.

Both the games can operate from batteries or the mains supply and there is an optional printer unit to provide a hard-copy printout of every move made for later study. The Sensory 8 will sell for £129.95 and the Voice Sensory for £279.95.

The voice sensory Chess Challenger.



APL versions available for Black Box and Superbrain

A VERSION of APL is now available for the Rair Black Box, priced at £150. Most of the primitives are implemented including innerproduct, monadic and dyadic format, and the ability to subscript arrays with arrays. Files are handled by the standard method of Shared Variables. It is capable of accessing memory by systems functions. Existing users of

ZX-80 ROM withdrawn

THE ZX-80 8K Basic ROM promised by Clive Sinclair for the end of October has been withdrawn and orders for the chip are not being accepted. Clive Sinclair has denied that bugs in the new software are responsible and claims that he wants to incorporate some extra functions into the chip such as a printer drive. He says that he wanted to avoid ZX-80 owners the bother of having to buy yet another new chip next year.

The 8K Basic ROM was launched originally as a plug-in replacement for the 4K ROM Basic and was going to incorporate many extra functions such as full floating-point arithmetic with nine digits. The ROM will now be re-launched some time in the early spring in 1981.

Micro threat to future of TV

SATELLITE broadcasting of English-language television programs, video tape recorders and the BBC are not the only things with which the independent television channels in the U.K. have to contend. According to a worried document just published by Granada television, entitled "Who'll be watching Coronation Street in 1984", droves of television addicts will start using their televisions for more productive entertainment such as playing with their home computers, Prestel and teletext channels.

Granada believes that by 1984 there will be 1.7 million television, Prestel or computer units in Britain and that the loss to the television channels will be around 300,000 of their audience.

Softtronics APL can purchase the upgrade for £12.

APL can also be bought for the Superbrains with 64K of memory, with a conversion kit available for £475. Prospective users of the Superbrain who will need APL can buy a Superbrain complete with APL for £1,995 from Alan Pearman Ltd, Maple House, Mortlake Crescent, Chester CH3 5UR.

IMAGINE A SYSTEM...



- * 64K RAM, 12K ROM (Bank switched when needed).
- * Twin processors Z-80 with CP/M, MBASIC and 6502 running 10K extended BASIC, UCSD Pascal. Switchable under program control! Special memory mapping to avoid addressing conflicts.
- * 80x24 memory-mapped Upper and lower case video display with 12" screen. All 128 ASCII characters user definable. Rock steady clear. 50Hz display.
- * Separate video output to a paralleled monitor for high-resolution graphics. Colour graphics and interface to RGB monitor or domestic colour TV 120.00 extra.
- * Minifloppy disk with 143K formatted capacity.
- * UCSD Pascal, 6502 macro-assembler, 6K Integer BASIC, 10K extended BASIC, Microsoft MBASIC 5.0 and GBASIC (MBASIC with high resolution graphics extensions), CP/M 2.2 (with ASM, ED, PIP, etc.), full set of software utilities, graphics demonstrations, games all supplied as standard.
- * UCSD FORTRAN, Microsoft FORTRAN, COBOL, Assembly language development system, BASIC compiler (source-code compatible with MBASIC), CP/M software available as options.
- * Four free slots for expansion.
- * Interfaces with almost all available printers via optional serial or parallel interfaces.
- * Wide range of control, A/D, D/A interfaces available now.
- * Full one year warranty, parts and labour.
- * Supplied as a complete, working system with all necessary plugs, cables.
- * Ex-stock, prices include Securicor delivery.

UNDER 2000.00 pounds! £1995 (plus 299.85 VAT) for a total of £2298.85.

It's an Apple-II with, 12" Monitor, Language system, Disk subsystem, Sub-r-terminal and Z-80 Softcard, Specially configured and available exclusively from STACK-APPLE.




Please add our name to your mailing list

PC12

to
**STACK-APPLE, 290-298 Derby Road, Bootle,
 Liverpool. Telephone 051-933 5511.**

Surprised ??
Please phone Paul
Fullwood or Carl Phillips for
more details. Its an
unbeatable system for
software development,
education and the technical
or scientific user.

• Circle No. 154

Government takes decision on data-privacy laws

THE Government seems to have reached a decision on the issue of data protection — but there is confusion as to which department will be responsible for framing suitable laws and enforcing them.

The U.K. representative on the Council of Europe's Committee of Ministers has undertaken to sign the European convention on data protection on January 28. It commits the U.K. to pass laws which enshrine a set of general principles, which include the right of a subject to look at files which may be held on him, to correct any mistakes in such files and — most importantly — to know if such a file exists.

Though the convention will be signed by Donald Cape of the Foreign Office, it is William Whitelaw's Home Office which will draw up U.K. laws on data protection. So far, there is no indication of what form such a law would take.

The EEC Committee of Ministers is relying on voluntary co-operation on the part of signatories to the convention, and admits that there may be disagreement as to whether the general principles

are adhered to by a particular country.

Yet the issue has gained in importance with the Cabinet since a report by its own technical advisers, chaired by Sir Robert Clayton of GEC, urged the U.K. to introduce data-privacy laws without delay.

Since Sir Robert's committee includes high-ranking members of British industry, it is thought that the report will have more influence on speeding such laws than the Lindop Committee, which reported on the subject more than two years ago.

Industrialists are concerned that the lack of data privacy in the U.K. has earned the coun-

try the reputation of being a "dirty data" haven. Our European partners are prohibited by law from trading with U.K. firms which are thereby losing business.

The Lindop Committee, on the other hand, addressed itself more to the civil rights aspect of data protection, and the National Council for Civic Liberties has adopted the case by drafting what it believes would be suitable legislation.

The Cabinet advisers also recommended that all aspects of information technology be centralised under one head. At present, responsibility is shared among several Government departments and other public

bodies. The Government is thought to incline towards appointing a Junior Minister within the Department of Industry who would, presumably, relieve the Home Office of its responsibility for data-protection laws, though the Home Office is not likely to relinquish its control of such a sensitive area of public security without a struggle.

Certain information already held on individuals by Home Office and police computers is thought to contravene the general principles of the EEC Council of Ministers convention. The final outcome is likely to be a compromise. New laws will be made to comply with EEC requirements, though the Lindop Committee's recommendation of a separate Data-Protection Authority is unlikely to be implemented for the moment. □

More State involvement in micros urged by Labour report

A LABOUR report has urged greater Government involvement in the U.K. microelectronics industry and suggests that the biggest U.K. electronics group, GEC, could well be ripe for nationalisation.

The discussion document, published by a working party

of the Labour National Executive Committee, and chaired by Dame Judith Hart, severely criticises the U.K. microelectronics industry, past governments' lack of foresight in grasping the initiative in the field, and urges much more Government intervention in the design, development and marketing of microelectronics — as well as a thorough programme of public education.

The report in particular criticises the "malign influence" of U.K. giant GEC and blames much of the decline of investment in development on the closure by GEC of Elliott Automation in 1971, "effectively ending the U.K. stake in the mass market from that day to this".

It contrasts other countries' policies with our own and concludes that the key to U.K. success in the rapidly-expanding world market must be increased Government backing, particularly for our own chip production.

Without our own production capability, it says, we shall be in an increasingly precarious supply position, and our manufacturers will not have available the kind of chips needed to build products that will succeed in the world market.

It strongly recommends that Inmos should receive more money if needed, and casts doubt on the ability of the traditional financial institutions — the City and the U.K. companies — to provide the backing or the planning to make a viable semiconductor industry: "Where private industry does not or cannot spend, Government must — a point accepted by the governments of every advanced economy but our own", it claims.

The document goes on to illustrate how a Labour policy would frame its objectives, in particular emphasising the need for planning agreements which take union needs into account and stressing that microelectronics technology should be directed towards "uses which have a social value" rather than those which have a military value. At present a great deal of British chip production and research and development funds are channelled towards defence needs.

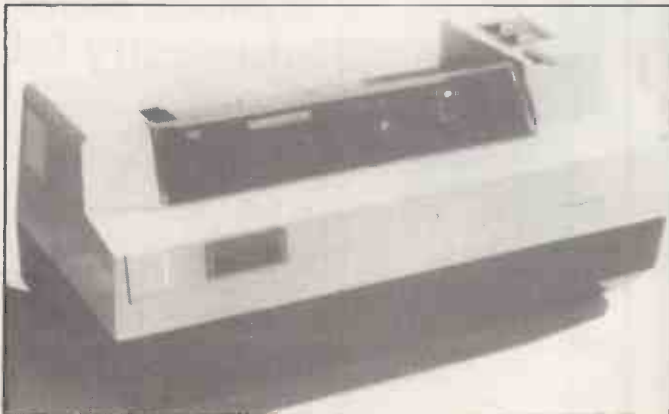
Such planning control would go hand in hand with a widespread programme to improve public awareness.

Microelectronics, a Labour Party discussion document, published by the Labour Party, 150, Walworth Road, London SE17, price 80p. □

Unihammer single-needle has full graphics capability

A SINGLE-needle matrix printer, the Unihammer, manufactured by Seiko, is now being sold in the U.K. for £199. The Unihammer speed is only 30cps, and it has a 128-character set, prints 80 character per line and has full graphics capability. It prints on ordinary listing paper and can produce up to three

copies. It is only 32cm. long and weighs about 2.5kg. The price includes a Centronics interface, cable connector and manual and other interfaces including IEEE488 and RS232 are available. Details from Mitrecrest, 61 New Market Square, Basingstoke, Hampshire RG21 1HW. □



Accurate high-speed drawing with latest package for Apple II

A GRAPHICS package for the Apple II microcomputer has been developed and launched by Personal Computers Ltd of Bishopsgate in London. The system enables a user to generate at high-speed a finished and accurate drawing, chart map or plan. The package is priced at £3,250 for a 48K Apple II microcomputer, CRT, disc pack, graphics tablet, an A3 personal plotter and the software.

Designs drawn on to the graphics tablet can be dumped into the system and altered via the screen or reproduced immediately via the personal computer plotter. To speed the procedure, the user has a choice of 16 predetermined shapes and a further selection of at least five user-definable or purpose-designed shapes which may be stored by the system.

They are generated merely by pointing to the appropriate

symbol on the graphics tablet with the electric pen. The shapes vary from circles to triangles or more complex forms and can be used in combination with freehand drawing. All the details created can be retained on disc.

For a further £300 the package can be used as a remote-transmission unit by

means of a modem linked to a conventional line through which the system can communicate with a plotter at a different site. That facility is expected to prove useful to surveyors and architects working on location. Details are available from Personal Computers, 194-200 Bishopsgate, London EC2M 4NR. □

Junk market in computers

THERE is no need to wait 100 years to start trading in the antique market for computers as the business has started already with the opening of the Computer Junk Shop, in Widnes, Cheshire. The items on sales will be mainly unused surplus stock bought from electronic manufacturers and second-hand items. You can find the junk at 10 Waterloo Road, Halton, Cheshire. □

It's vive la micro différence at France's Sicob exhibition

THE characteristic differences between the managers in the mainframe game and the personal micro enthusiasts are obvious, and Sicob, the major French computing exhibition, went to considerable effort to emphasise those differences.

It sectionalised its personal computer and micro exhibits into a show tent, or boutique, outside the main five exhibi-

tion floors. Apart from being innately tinnier than the rest of the show, the annex was free, and therefore drew an altogether more informal and relaxed crowd to its stands.

Sicob — *Salon International Informatique, Télématique Communication, Organisation du Bureau et Bureautique* — is the second of two elephantine European shows dedicated to computing and to office equipment, and running annually. The first is Cebit which is held at Hanover in the spring, and is followed by the Sicob, which appears in the autumn.

This year, there were 736 stands at Sicob varying from modest orange-box structures to ostentatious multi-storey stands like the Olivetti one. Approximately 2,240 products were shown, from around 30 countries, the exhibits varying

from the latest in nasty furniture from Pierre Cardin to new personal computer systems developed and built in France. Indeed, despite its international tag, Sicob remains quite emphatically a French show.

A number of exhibits at the boutique drew large crowds, most conspicuously the Sharp stand, which was busy demonstrating the MZ-80, and the PC-1211, and also LogAbax with its latest LX-500 personal computer system.

While Apples prevail Tandy and Pet equipment were equally in evidence, and some new pioneering small French companies had also ventured into the small-business equipment systems market.

Mercure Informatique of Strasbourg has built its own small system, the Mercure 2000 which it claims to be an entirely French product, or there is intentionally no mention of the origin of the components apart from the Z-80 microprocessor. The system supports Micro-Cobol, Basic and Cobol. □

Survey-analysis program helps process gathered data

COMPILING questionnaires and conducting interviews for market research and other surveys is child's play compared to the problems of analysing the information gathered. A Bristol-based management consultancy, Mercator, is now selling a survey-analysis program which will help devise and then analyse survey data.

The user can form individual questionnaires in the program, specify the questions and valid ranges of the answers. Production of tables is carried-out interactively with the survey data held in memory. Facilities are available for filtering, hole-count analysis, cross-tabulations, totals, row and column percentages.

It is claimed to be suitable for the analysis of all survey data irrespective of the method of collection although ideally a survey should be based on about 1,000 interviews. The program could be used by market research companies, advertising agencies or by schools.

Written in Microsoft Basic, the program requires a mini-

mum of 27K of user memory and 90K of disc space. A printer is an optional extra since all the tabulations are prepared on the VDU before any printing is required. Details from Mercator, 6 Vyvyan Terrace, Clifton, Bristol. (0272) 33636. □

A new range of specialised cleaning products for computers has been launched by the U.K. company, Automation Facilities Ltd. The products will clean anything from discs, disc heads, tape drives and tape-head drives. For details contact AFL, Blakes Road, Wargrave, Berkshire. Telephone (073522) 3012. □

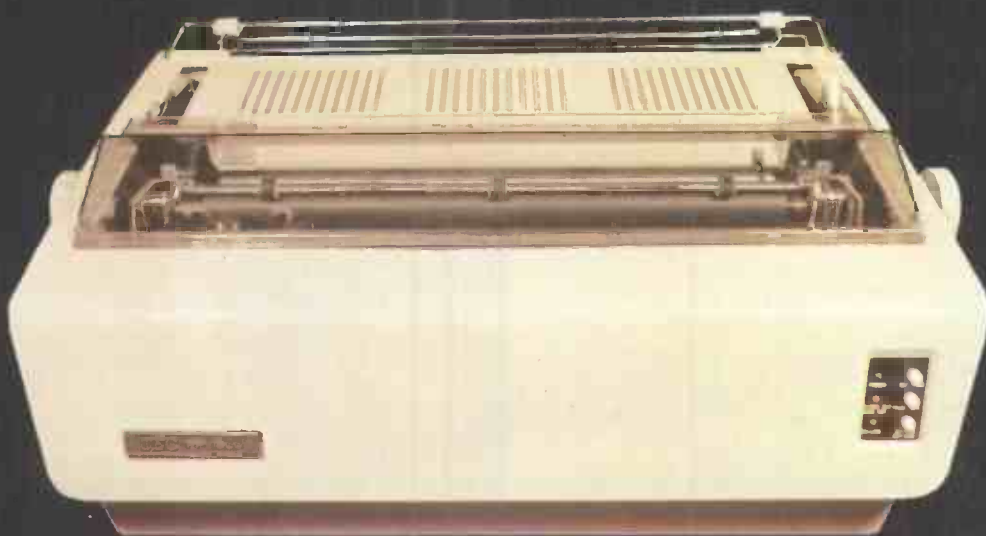


System Bs for university lab

ESSEX University has opened a new microcomputer teaching laboratory with the installation of 17 Vector Graphics System B units. They will operate under UCSD Pascal, especially implemented by the University. The new laboratory will handle up to 300 students per year and will concentrate on the initial teaching of programming to undergraduate students. □

... put it in writing!

Use your TANDY, APPLE or SORCERER with our Daisy Wheel Printer for typewriter quality printout.



The STARWRITER daisy wheel printer gives top quality printout for any computer with a Parallel or Centronics interface.

Features include

- ★ Standard Diablo Hytype II Print Mechanism
- ★ Proportional Spacing capability
- ★ Bi-directional printing (with suitable drivers)
- ★ Up to 15 inch paper width
- ★ Uses standard Diablo wheels and ribbons
- ★ Die-cast alloy case

Please send me further details of THE STARWRITER

Name _____
Address _____
Tel No. _____
P.C.A _____

Only £1,200 Ex. VAT

Contact Geoff Wilkinson
for further information.
Telephone: (0736) 798157

LIVEPORT
DATA PRODUCTS

The Ivory Works, St. Ives, Cornwall TR26 2HF
Telephone: (0736) 798157

SUPERBRAIN™

FROM **SUN** THE GROUP WITH A WEALTH
OF HARDWARE & SOFTWARE EXPERIENCE
IN THE COMPUTER INDUSTRY.

NOW
WITH HARD
DISK



NOW PLUG IN UP TO 116 MBYTE WINCHESTER DISK TO YOUR SUPERBRAIN

PRICES START FROM £2995.00 FOR 14.5 MBYTE AND ALLOWS
CONNECTION OF 8 INCH FLOPPIES, CARTRIDGE BACK UP AND CAN
BE SHARED BY UP TO 4 SUPERBRAINS
PARALLEL PORT & REAL TIME CLOCK ALSO AVAILABLE

FOR FURTHER INFORMATION CONTACT YOUR NEAREST DEALER

CAMBRIDGE MICRO COMPUTERS LTD, Cambridge Science Park, Milton Rd., CAMBRIDGE, (0223) 314666.
COVERHILLS LTD, 1 Greenwich Drive, Lytham St. ANNES, Lancs, 0253 737459/739868.
COMPUTER SALES & SOFTWARE CENTRE LTD., 190-192 Cranbrook Rd., ILFORD, Essex, 01-554 3344.
DEACON HOARE & CO LTD., 27 Regent St, CLIFTON, Bristol BS8 4HR (0272) 312374.
GEMSOFT COMPUTER SERVICES, 27 Cobham Rd, WOKING, Surrey GU21 JID, (04862) 22881.
HARTLEY COMPUTING, 16 Park Rd., COVENTRY, CV1 2LD, (0203) 27851.
JAGOR TECHNICAL SYSTEMS LTD., 81 Atherley Rd., SOUTHAMPTON, SO1 5DT, (0703) 20579.
KARADAWN LTD., 2 Forrest Way, Gatewarth Industrial Estate, Great Sankey, WARRINGTON, (0925) 572668.
MERCATOR MANAGEMENT CONSULTANTS LTD., 6 Vyvyan Terrace, CLIFTON, Bristol, BS8 4HR, (0272) 33636.
MICRO AUTOMATION COMPUTING LTD, 207 Putney Bridge Rd., Putney, LONDON SW15 2NY, 01-874 2535.
PENNY RENTALS, 15 MAIN AVENUE, Peterston-Super-Ely, SOUTH GLAMORGAN, CF5 6LQ, (0446) 760681.
ROGER SALISBURY SMITH, COMMERCIAL SERVICES, Moonrakers, Wheatsheaf Enclosure, LIPHOOK, Hants, GU30 7EJ, (0428) 722563.
STARWEST COMPUTER SERVICES LTD., 3 Grove Place, BEDFORD, (0253) 57135.
SYSTEMATIKA LTD, 36 Monpelier Grove, LONDON NW5, 01-586 4585.
TURNKEY COMPUTER TECHNOLOGY LTD., 23 Calderglen Rd., ST. LEONARDS, East Kilbride, (03552) 39466.
ZETA DYNAMICS LTD, Riverway, NEWPORT, ISLE OF WIGHT, (0983) 527725.

SUN COMPUTING SERVICES LTD
138 CHALMERS WAY, NORTH FELTHAM TRADING ESTATE
FELTHAM, MIDDX. TEL: 01-751 5044
TELEX: 8954428 SUNCOMG

DEALER ENQUIRIES WELCOME

SUPERBRAIN™ is the registered trademark of Intertec Data Systems.

• Circle No. 156

• Circle No. 157 ▶

We are now entering our fourth financial year of dealing solely in the personal computer market — in fact, we started it! Over this period, Personal Computers Limited have formed a group of graduate specialists who will help you in the fields of word processing, financial planning, statistics, economic modelling, forecasting, accounting systems, foreign exchange, banking and oil exploration.

We also do rather well with computer graphics and highly recommend the graphics tablets and our plotter for Apple.

We can also offer two excellent items of software — **Format 40** and **Visicalc** — at a combined price of **ONLY £189**, and the **Super Sound Generator** for only **£90!** (excl. V.A.T.)



8" Disk Drive (above left)

Our 8" disks are still as popular as ever — 2 drives give you 1.2MB with all the reliable security of Shugart Technology. Easily interfaced to Apple, uses the same D.O.S.

A.I.O. Serial and Parallel Card (above centre)

Three hand-shake lines (R.T.S., C.T.S. and D.C.D.). Firmware for serial interfaces on-board, software for parallel printer available, 2 bi-directional 8 bit parallel ports, plus 4 additional interrupt and hand-shaking lines.

Light Pen (above right)

A much sought after product which we introduced to the U.K.

80 Character Card (below left)

... opens up the real commercial world for all Apple owners.

Paper Tiger (Below centre)

132 character line, plus graphics, 8 character sizes, ordinary paper, multiple copy, upper and lower case 96 character, parallel/serial, form control.

Centronics 730 (Below right)

A substantial, robust printer from a major manufacturer. 3 way paper handling system, 100 character per second. Special low-cost including interface. 96 characters.



Items pictured

Sharp MZ — 80K

A new generation of personal computer, self contained, versatile and starting at only £570 (excl. VAT). Explore the Zilog Z80 now the easy way. Disks and printer available shortly.

Numeric Keypad

... with 8 function keys is a must in all financial applications.

TCM 100 & TCM 200

... both now have graphics as well as their own power supply, essential with this type of printer.

Qume Sprint 5

The quality word processing printer. Clean, clear executive reports the way you want them. Can print up to 5760 points per square inch — or even print in 2 colours.

This is what we do..
and we do
it rather well!



Personal Computers Limited

194-200 Bishopsgate, London EC2M 4NR. Tel. 01 626 8121

For further information, please complete this coupon and post to:-
 Personal Computers Limited, 194-200 Bishopsgate, London EC2M 4NR.
 NAME _____
 ADDRESS _____
 PC12

*** Now here details for**
APPLE III

RAIR BLACK BOX
MICROCOMPUTER

POWER

LOAD

RESET

POWER

RAIR BLACK BOX
MICROCOMPUTER

*Discover the secrets of
the RAIR Black Box*

Nascom—rise, demise and future

A NUMBER of City analysts who looked at Nascom while it was on offer, reached the conclusion that they could not see, under the policies of the then management, any prospect that it would ever show a reasonable return on investment injected into it.

That view may be a considerable surprise to the many who saw the sales of the Nascom 1 rise easily to become — at the end of 1979, at least — the most popular single-board computer in the country as well as those who had seen the Nascom 2 and the plans for the associated System 2 peripherals and had decided that they were spot-on for market requirements.

Nevertheless, the fact is that of the many groups, large and small, which went to Chesham in Buckinghamshire to put substance to the rather vague offer-for-sale-as-a-going-concern package assembled by the receivers, Cork, Gully, very few stayed to make a firm offer.

To understand Nascom, you must remember that its genesis was in the buying and selling of components. Managing director John Marshall belongs to the same family which owns Marshalls of London's Cricklewood, Edgware Road and other places. In fact, his main activity now appears to be Interface Components. His long-term associate Kerr Borland had been 10 years in the components business before Nascom Microcomputers started.

Definitively suitable

Nascom 1 was invented not by a dedicated hardware freak but by Marshall and Borland. The finished design was the responsibility of Chris Shelton. It was launched officially in January 1978. By the end of the day of the launch, 300 units had been ordered and paid for — and all without having a working board to demonstrate. Almost immediately there were 7,000 enquiries.

It is easy to see now that this is where the troubles started. Nascom 1 was superbly — even definitively — suitable for market conditions at the time.

Up to and beyond the £550 and £600 mark were the three stalwart finished-and-cased personal micros — the Pet, Apple and TRS-80. The Nascom 1 mixture of not-too-difficult construction, full alphanumeric address, the possibility of VDU hook-up, the upgradability — and the price, less than £200 — was intoxicating. No wonder the money flowed in, but the results were devastating.

Unlike most start-up operations, Nascom never really had to worry about raising finance or cashflow. As a result, insufficient attention may have been paid to fundamental costing. Nascom 1 was sold to dealers at around £105; material costs, including documentation, were about £83. The margin seems inadequate — from that had to come salaries, office

overheads, research and development — essential for any company in the field — and profit. Most new companies would also have had to add a hefty extra simply to repay loans. Nascom, though, seems to have been awash with cash in the latter half of 1978 and the first half of 1979.

The second effect was that it may have been insulated from the need to market properly. All a salesman had to do was to explain to retailers why they could not have as many units as they had ordered — Kerr Borland talking to Kay Floyd, *Practical Computing* July, 1979. Others had seen Nascom's success and, whether they had already had similar ideas in development before Nascom 1 was launched or simply climbed hastily on the bandwagon, during 1979 the single-board market suddenly became very competitive.

At the same time, the retail prices of the finished personal micros were falling. When they were first launched, the Apple, Pet, and TRS-80 were almost twice the U.S. price, the result of decisions by the U.K. distributors that this was the way to optimise profits. Towards the end of 1979, however, competition forced a price war — one which is by no means over.

Nascom apparently failed to see beyond the initial bonanza. Once the rivals had appeared, once the finished products started dropping in price, once the original generation of enthusiasts had learned all they wanted to — what should Nascom have attempted? Finally, it seems that like many other businessmen suddenly and unexpectedly successful, the directors of the Nascom may have convinced themselves they did not have to bother about planning in an essentially unplanned market.

One of the great puzzles of the Nascom trading account for the year to the end of June 1979 is the purpose of a management charge of £154,030. In the previous financial year, the comparable figure was only £25,000. The management charge was in addition to research and development costs of £23,255 and consultancy fees of £17,571. Sales in this period were £894,955 and the company ended with a loss of £183,948. At the same time Nasco, an associated components company which had sales of £184,438 received management charges of £147,040.

At the time of Nascom's collapse the stock of the company was grossly unbalanced — certain vital components were in short supply and, indeed, obtainable only against cash as Nascom was already in debt to the manufacturers — while others were stocked in large quantities.

Nascom 2 is an attractive machine and at its launch, interest was high. Critics now say that perhaps it is a little over-engineered, going for a 40-pin solution where 24 might do, but many are pleased

with it. For a company which had far smaller reserves than it perhaps realised and had borrowed heavily to make Nascom 2 happen, mistakes were made.

Firstly, the micromarket had moved on. The Nascom 2 was merely a good buy among the Superboards, UK101s, Tangerines, Titans, and Acorns. Evaluation of its good features now became a sophisticated exercise. Nascom 2 entered a buoyant enthusiastic market, but it was no longer the only seller there.

In a sense, Nascom knew that and priced down without being absolutely certain it could afford to do so. Replicating the experience with Nascom 1, it advertised far ahead of availability, hoping for a good inflow of cash. Now, however, the customers had other micros to consider, many of them available ex-stock. The design of the board required a certain type of memory chip and, as the launch of the Nascom 2 approached they were not available.

Add-on board

An add-on board, capable of handling more common memory chips was hastily readied, but for three months hardly any Nascom 2s could be sold. When they finally appeared with their free memory board, it was at the cost of the already very slim margins. The Nascom directors may not have known it, but they were losing money. The costs of Nascom 2 — materials, documentation, packing — was £142. Its main dealers bought it from them at £157.50.

This time, in addition to overheads, the company had to support interest charges — or at least make provision for them even if payment was not instantly required — and research and development.

Again, as Nascom pondered whether to try to sell wired-and-tested versions, it had allowed the development of more than eight separate Basics, all of them more or less incompatible. To be successful beyond the hobbyist market, a micro needs a good deal of software, preferably published by a variety of outside houses.

Towards the end, Marshall started shedding personnel rapidly and by the time Cork, Gully arrived, only a skeleton staff remained. For the immediate future no new micro is ever likely to have the same deceptive and destructive runaway success of Nascom 1 so perhaps there will never be another spectacular crash.

In the meantime, Nascom 2 is a good product and the new peripherals seem well conceived — the receiver allowed development to continue. If the new Nascom owner — Allteck Technology Initiatives — can avoid price rises which lose customers, and if it makes sensible plans beyond Nascom 2, the company has a chance of survival. □

We review Pearl, a package which could help cut programmers' fees by writing bug-free business programs for the experienced and simple systems for the beginner.

```
PEARL LEVEL 2 (PEARL) VERSION N.00
MAIN SELECTION MENU-01/01/80
MINIMUM FREE SPACE=(20064)

0. RETURN TO CP/M
1. SYSTEM INITIALIZATION
2. EDIT SYSTEM DEFINITION DATA
3. FILE DEFINITION
4. DATA ELEMENT DEFINITION
5. DATA ELEMENT ARRAY VALIDATION MAINTENANCE
6. REPORT PROCESSING
7. SYSTEM GENERATION
8. CHANGE SYSTEM DATE

ENTER DESIRED FUNCTION BY NUMBER:
```

Initial system design by Pearl, program-writing package

SINCE THE invention of the tabulator, people have been striving to invent computers which are self-programming and can communicate with the end-user without the intervention of programmers.

At the very start of the history of true computers, all programming was done in machine code and mostly by engineers, giving rise to the early image of the white-coated programmer/scientist. Machine code seems now to have been relegated to use by designers of the computer hardware or to situations where speed and compaction of code is essential.

The next step was to provide an assembler language for each machine. That type of programming language provided the programmer with short cuts to machine-code programs. The essential functions of an assembler were to provide the programmer with chunks of regularly-used machine code and group them together under an easily-remembered key word.

Code libraries

That process was carried on as programmers realised that there were groups of assembler instructions which were also used time and time again. Initially, individual programmers would build-up libraries of code which they could use

several times when the situation arose.

High-level language development has taken two diverse paths: firstly, there has been the ever-increasing sophistication of the existing languages, coupled with the introduction of completely new types such as APL. Secondly, there has been the growth of the non-procedural type of system.

Relationship emphasis

They, and I include both databases and systems such as RPG, tend to place the emphasis on the relationships of data. They are results of a philosophy different to the one behind procedural languages but have such an advantage in terms of writing speed, debugging, etc., that they are gaining considerable ground in the large installations.

However, in the world of the micro we are still, by and large, using Basic or in some cases Cobol or Pascal. There have been some attempts to write general information storage and retrieval systems, but while acceptable in some applications, they are not suitable in complex systems.

The problem of obtaining accurate and fast programs has been tackled in a different way by Computer Pathways Unlimited Inc with its package, Pearl.

Pearl is a program which writes programs, in this case in CBasic. CBasic is a Basic which runs under CP/M on any micro that can support the operating system. As most micros can be used to run CP/M, it is reasonable to say that CBasic is used in a large number of installations.

The main reason that CBasic is popular is that until recently it was the only Basic on micros which could be compiled. Compiled Basic has two advantages; they are that it is fast to run and that it is difficult for people to pirate the code with any hope of being able to maintain it.

As more and more people are able to buy micros, the need for an easy-to-use programming system has become more and more acute. With the average cost of a programmer in the region of £400 per week, a large number of businessmen, inexperienced in programming have been tempted to try and write their own systems.

Pearl attempts to solve the problem by providing a package which can be used by the experienced programmer to produce bug-free programs, and at the same time, can be used by the inexperienced person to create a simple system with the minimum of knowledge about CBasic.

Powerful technique

In writing a system of the type used on a micro, there are five steps:

1. Systems analysis
2. File design
3. Processing requirements
4. Reporting needs
5. Testing the system

Pearl is not much help in the analysis phase, which is a pity as however well the system is written, if the analysis is incorrect, the resultant system will not perform in an acceptable way.

It is arguable that the design of files within a system will make the whole project stand or fall. Pearl helps the user in

```
LOADING SELECTED PROGRAM: UPDATE CUSTOMER CONTACT
CUSTOMER CONTACT FILE (CF100) VERSION 1.0
CUSTOMER CONTACT UPDATE MAINTENANCE-01/01/80
MINIMUM FREE SPACE=(NNNNN)

0 TO RETURN TO MAIN MENU
1 TO ADD RECORDS TO FILE
2 TO EDIT OR DISPLAY EXISTING RECORDS
3 TO DELETE RECORDS
?
```


two ways: firstly, Pearl provides a very powerful file-indexing technique of use both to the first-time user and to the more experienced programmer, and secondly, it provides an easy question-and-answer session for the newcomer to programming.

Definition of the file itself consists of telling Pearl the name of the file as it will be known to Pearl, the external name, the access method and where you want the file to reside. Obviously, you should ensure that each file has its own name.

Within the file, you then have to describe the fields of data you want to be able to store. An extra complication which arises at this stage of the development is the need to describe not only how the data is held on the file but also how it is to be input from the screen and what, if any, validation is required.

There are four default methods of automatic input validation:

1. Yes or no
2. Numeric range
3. Via the contents of an array
4. Date validation

The user can also specify that certain fields are not to be displayed on the screen, or that they should be displayed but the user cannot alter the contents. The two file organisations that Pearl adds to the normal Basic functions are direct and indexed.

Indexed organisation

In particular, the indexed organisation gives the user the ability to access his files by, for example, customer name. The indexing system will support duplicate keys provided the user writes a routine to determine which of the records with the selected key is required. If the file is very active, e.g., an invoice file, it will require routine re-organisation from time to time. The required program to do that is included in the Pearl system and can be included as part of a program.

The Pearl system is menu-driven as are the systems it generates for the individual projects. Having defined the files you

require, it is then necessary to tell Pearl how you want those files included into your programs and the type of structure the whole system is to have. That again is done via a question-and-answer session involving such information as user name, system name, terminal type, message levels, etc.

There is no processing in the Pearl-generated program with the exception of data-input validation and some simple report writing. If your system requires extra input validation, conditional processing, complex file relationships or complex report lay-outs, it is up to you to code, in CBasic, your own modules.

Pre-coded modules

Pearl helps in two ways: firstly, you can insert any code you require into the generated program, and secondly, there are a large number of pre-coded modules which may be called by your program.

Some examples of the functions that can be called are:

1. Prompt the user on the screen and return the input
2. Centre a string within a variable
3. Allocate keys in an index file

The ability to obtain and add to the generated program provides the experienced user with a framework on which to build, and the first-time user with an example of how to code and structure a program.

The reporting ability of Pearl is limited to simple lists of the file contents. Routines are provided for page counts and paging, the report headings are taken from the file definition and column spacing is automatic.

One of the problems of general-purpose software is in the region of screen handling. Although CP/M allows the program to run on any system which supports CP/M, most VDUs have totally different screen-format characters. For that reason, almost all packages running under CP/M stick to simple scrolling formats and screen clear. Pearl can be

configured to run on the following screens:

Sol
HazelTne
Beehive
Soroc
Intertec

If your screen is not one of those, you must supply the sequence that clears the screen for your particular VDU.

The documentation is extensive at more than 150 pages. It is divided into two parts, the first for non-programmers and the second for more experienced users.

Conclusions

- I tested version two of Pearl, but there are two further versions available — one a subset aimed at small projects and the other at programmers.

- The system is well presented and planned and has one big advantage to all users in that it will force an ordered approach to the writing of programs and the documentation of, say, file lay-outs.

- I can see it being of use to the first-time user as a practical way of seeing how to write and control his system.

- For the existing user, it will provide a structured format to assist in the writing of large integrated systems, particularly where there is more than one programmer.

- Add that to the ability of the system to create error-free code and generate indexed files, and you can see that Pearl can be an enormous help in most types of system design.

- Unless you are prepared to write a certain amount of CBasic for your project, the system is really of any use only in very simple, e.g., lists, applications. For the person who does not want to learn to program but wants to create a simple system, there is a number of database and information retrieval systems available under CP/M that are far simpler to use.

- However, for the first-time user who wants to create an initial system and to have it up and running in a short time, and is then prepared to learn CBasic and gradually add the bells and whistles, Pearl could well be the best package to buy. □

XYZ COMPANY
CUSTOMER CONTACT MASTER LIST
PEARL CONTACT FILE
01/01/80

PAGE 1

CUSTOMER NAME PHONE	CONTACT DATE	BUSINESS	CUSTOMER ADDRESS	LOCATION
ADAMS, MARIE 392-8793	04/07/80	OTHER	7899 EAST STATE	SALEM, OR 97303
DOE, JOHN 392-6299	04/05/80	EDUCATIO	1099 THIRD STREET	SALEM, OR 97301
JOHNSON, RICHARD 988-2780	04/07/80	WHOLESALE	6540 EAST PEARL STREET	SALEM, OR 97304
JONES, SAMUEL 399-8923	04/28/80	RETAIL S	3369 OVERTON DR.	SALEM, OR 97302
MILLER, DANIEL 992-2034	04/14/80	WHOLESALE	2333 CONOVER DRIVE, NE	PORTLAND, OR 97222
SMITH, MARY 322-6390	04/14/80	GOVERNME	4329 WESTHAVEN RD	SALEM, OR 97302
THOMAS, MICHAEL 872-2300	04/21/80	FARMING	3250 97TH AVE., SE	ALBANY, OR 97322



Millbank System 10

THE FIRST thing you notice about the Millbank System 10 microcomputer is the anti-glare screen across the front of the VDU. Made from a kind of silk material, it is stretched over the front of the screen making it one of the most relaxing machines to work with I have experienced.

The whole machine is very well engineered; from the number of sockets at the back to the keyboard and general appearance of the front panel it has a solid businesslike feel. The lay-out of the computer is, what has now become, the

almost industry standard of screen to the left, integral discs on the right-hand and a fixed QWERTY keyboard. I wish more manufacturers would build detachable keyboards — when you work in an office

by Nick Horgan

with a crowded desk it is a great benefit to be able to relegate the screen to some remote corner and have the keyboard on your knee.

However apart from that minor niggle,

Summary specifications

CPU: Zilog Z-80
 Memory: 65K read/write RAM, 2K PROM with disc boot and diagnostics.
 Discs: dual double-sided, double-density 5¼in. with 700K capacity
 Keyboard: normal QWERTY keyboard plus four cursor control keys, 16-key numeric pad and 10 user-definable function keys
 Display: 12in. screen with separate 8085 processor; selectable baud rate to 48,000 baud; 24 datalines of 80 columns
 Interfaces: two RS232, one RS449, high-speed parallel interface to X comp controller, optional IEEE 48 parallel interface.



I liked the general appearance of the Millbank System 10 as much, if not more, than any other micro I have used. After a day working on a normal screen, the System 10 anti-glare screen was the nearest thing to heaven, and still a computer, that I can imagine.

The fundamental system uses the Z-80 processor, a well-tried and familiar CPU to anyone in microcomputers. The screen is a standard 80-column VDU with good resolution. The only disadvantage of the anti-glare screen is that from a side view the screen becomes very hazed.

To the right of the screen are two mini-floppy drives. They are 5.25in. double-sided, double-density, soft-sectored discs giving 700K of on-line storage.

Two neat features are that the software will turn off both the screen and the disc drives if they are not used for a length of

time. The screen is turned back on either by a display from a program or by the operator touching any key on the keyboard, the drives re-start as soon as an access is requested.

The machine may be powered-on or off with the discs *in situ*, although I could not bring myself to do it.

Both the screen and the keyboard have their own CPUs, allowing the user on the keyboard to allocate his requirements to the function keys, and on the screen, full cursor control and functions such as erase to end of line. Using the keyboard and the screen functions allows the programmer to write very neat and fast input routines.

The system is supplied with CP/M as standard, Wordmaster and CBasic as options. CP/M is an operating system in use on the majority of medium-size micros. It allows software to be machine-independent, and, means, therefore, that there is a large amount of software available which can be bought over the counter. If you do not have the time or expertise to generate your own systems, CP/M-based machines can be of great benefit.

There are many 64K-based CP/M supporting machines on the market, and to rise above the general standard, your machine has to offer a new approach. Millbank System 10 has, as they would say in California, hung its flag on communications. At the back of the machine is a neat row of output connectors, they can include:

- Two RS232 ports
- One parallel interface
- One IEEE port
- One RS449 port for networking

The software supports the following protocols:

- Async
- Bsync
- HDLC
- SDLC

From that combination, you can see where the Millbank System 10 is aimed. From mainframes to laboratory instru-



Background

The Millbank System 10 is based on a micro manufactured by a small independent company, based in San Diego, California, called Gnat. Millbank Computers is run by two men, Alan Miller and Tim Mott. Alan Miller used to run an office stationery business and became involved with the micro when he tried to do his stock control on a Nascom kit; he found it insufficiently flexible or powerful. The militating factors were the lack of disc drives and expansion boards. As a newcomer to computing, he found trying to write in machine code a harrowing experience. That was not necessarily a disadvantage from the personal point of view: "It was like going back to school, getting the old grey matter going again".

After a visit to the States, he decided he could market the Ohio Challenger 3, since to him it seemed to represent an ideal solution at the right price for the small business. That was negotiated through the main U.S. distributor, American Data of Washington.

In November 1979, he was introduced to Tim Mott, a market consultant who was looking for a buyer and — entirely with his own cash made from the office stationery business — established Millbank Computers — changing the name of Mott's operation from Millbank Computing.

One of their first profitable moves was to start distributing the Qume printer. Millbank had co-operation from Qume, and it was also, it says, selling only to the trade and giving dealers a respectable margin. It now sells about 30 a month and provides service back-up.

It is on the System 10, that Millbank's principal hope rests. The System 10 is built by a small independent in San Diego with which Miller seems to have a good understanding, so much so that in the event of the Millbank needing more than 200 units a year, it has secured Gnat's permission to assemble in the U.K. Millbank could even build the machine from the original Gnat blueprints. Liaison also extends to technical co-operation and Mott is already talking about replacing the drives with Corvus 5¼in. hard discs though that is so far only an idea.

Millbank found Gnat through a dealer in the States who still acts as a shipper, collecting the units from the factory gate and delivering them to the expediter. It says it has been assessing the machine for four months before it started to market it and say that it is now reliable. Since the machine runs on CP/M, there should be little problem with software portability.

Alan Miller feels that his new baby offers the same kind of performance as the Sord or the Superbrain; only time will tell whether the reliability is better. Price, all-in, is £2,995 plus VAT, complete with manuals, CP/M, C Basic or Pascal, and Wordmaster, the professional word processing package by Wordpro.

ments, the user can interface with it, giving a flexibility unknown outside minis or do-it-yourself micros.

The attitude to communications is echoed in the resident monitor which, apart from the normal memory display, also allows you to monitor the output ports.

There are some very useful utilities provided over and above the normal CP/M ones. Both the serial and parallel ports can be tested with T SERIAL and


TPIO. For the port to be tested, the user must insert a loop-back plug; the wiring requirements are included in the manual.

With other routines the user can check the following:

- The VDU screen, PROM and RAM
- The disc drives
- The direct memory addressing, DMA
- Interrupt generation

As an option the user may specify the inclusion of an arithmetic processor board. That allows the system to do 32-bit arithmetic and is particularly of use in Fortran or other scientific situations.

Conclusions

- All in all, a very well-assembled microcomputer priced at £2,995, with one year's warranty.
- As the system runs under CP/M, there is an enormous range of commercial software available for it — so much it would be difficult to know where to start to describe it.
- Although, of course, the system could run as a stand-alone commercial micro, and do very well, it would seem a pity to waste all the effort that has been put into the design of the interfaces which are standard.
- I suspect that this machine is going to sell very well to the scientific and engineering users who will be prepared to dig into all the options offered on this well-designed micro. 

The Zilog Z-8000 development module

THE ZILOG Z-8000 non-segmented, 40-pin version, the Z-8002, is configured as a single-board computer and marketed by Zilog as the Z-8000 development module. Zilog recommends the use of the Z-8000 development module in conjunction with a host system, e.g., ZDS or MCZ systems. We test the module only in the stand-alone role.

The Z-8000 development module is a single printed circuit board measuring approximately 37 x 28 cm. — 14½ in. x 11 in., slightly smaller than an opened *Practical Computing*. On first sight, the board is unremarkable other than the 48-pin socket which is for use with the full Z-8001 — the segmented version of the Z-8000.

On closer examination, the board supplied by Zilog U.K. had 16K words of RAM on-board. Although 16K may not seem much in today's terms, they are 16K words which make 32K bytes. In fact, the

by Vincent Tseng

board is laid out with sockets to accept a total of 32K words or 64K bytes.

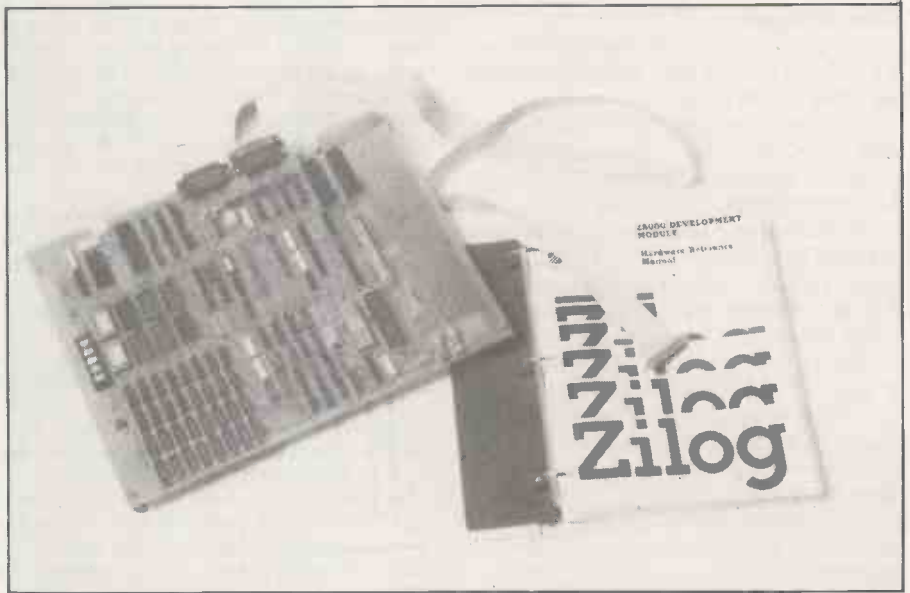
A power supply was attached to the module giving the +5V, +12V and -12V required by the board — the current ratings as stated in the manual are 3A, 1A and 200mA respectively. There are two 25-pin D-type connectors providing two serial interfaces via a Z-80 serial I/O, and there is a small area of board to allow for the addition of components by the user.

As the development module is supplied ready-built, all that is required is the attachment of a power supply — already connected — and that of a suitable terminal, which may be a normal RS232/V-24 VDU or a Teletype. There is, however, a slight problem, especially if the VDU can be set for various transmission/receive standards in terms of the number of bits, parity, stop bits and baud rate.

The baud rate is set easily enough since the selector switch positions are listed in the manual, but what about the remainder? One can discover them by trial and error, but that is not really satisfactory. I found them by looking up the monitor listings — it needs 8-bit characters, no parity and two stop bits which is the normal way a Teletype communicates.

The documentation was not clear which of the two connectors was the required one referred to as channel B. It required reference to the lay-out diagram to confirm which it was.

The Z-8000 development module communicates with the user only via the serial interface and there is no built-in keyboard/



pad and display. On powering-on, provided a VDU terminal is connected correctly to the module, and the re-set button is pressed, the VDU displays a prompt character of “<” to show that it is in monitor mode.

There was no consistent power-on re-set, sometimes the prompt character would be displayed on switch-on, sometimes the re-set switch was required. On examination of the documentation and circuit diagrams, there seemed to be no power-on re-set.

Using the monitor via the VDU showed that this was, in fact, a very simple and primitive program, despite the fact that the board featured a microprocessor which is claimed to be one of the most powerful available. There are 15 commands available under the monitor:

- Break — for setting of break point
- Compare — for comparing memory blocks
- Display — for displaying and altering memory

Summary Specifications

Z-8000 Development Module

CPU — Z-8002 40-pin, non-segmented version of Z-8000, socket provided for the Z-8001 48-pin segmented version. Clock rate at 2 to 5 MHz selectable for 3 to 9 MHz.

Memory — Sockets for 32K words, 64Kbytes, of 4116-type dynamic RAM with 16K words installed.

Monitor — in 2K words, 4Kbytes, two 2716-type EPROMs, 15 command types including communications with ZDS or MCZ microcomputer systems.

I/O — two serial I/O via Z-80 serial I/O parallel I/O provided via multi-pinned connector.

Display/keyboard — not built-in, provided for via serial I/O to RS232/V-24 or Teletype standard.

The MPU — Z-8002

16-bit word operations with instructions for single-bit, byte and long-word, 32-bits, manipulation.

Instruction set — more than 200 types including signed multiply and divide, instructions with auto-increment/decrement and repeat.

Memory capacity — 64Kbyte on Z-8002 non-segmented version — on Z-8001 up to 8Mbytes.

- Fill — for filling memory with a word pattern
- Go — branch to last PC address
- I/O Port — I/O read/write
- Jump — Branch to an address
- Move — move memory block
- Next — for single-stepping automatically
- Punch — for punching paper tape

Quit — to transfer control to an MCZ or ZDS microcomputer — Z-80-based — if connected to the module, also used to terminate other commands

Register — for displaying and altering the registers

Tape — for reading a paper tape

Load and Send — commands for data/program transfer between the module and the MCZ or ZDS microcomputers.

The list is not exceptional, although, to be fair, the essential commands are there. In use, it was, however, extremely frustrating not to be able to correct an entry even if the error in typing was noticed before the return/enter button was hit — the rub-out key appeared to have no effect. It seems that one has to accept the fact that the erroneous line has to be entered and wait for the “?” error message to return, then re-type the line again.

If an incorrect command was typed — like “F” for fill, easily done, since “F” is a valid Hex character — to make sure that the command is aborted, jibberish had to be typed and entered.

There are some useful features; for example, any number of break points may be set manually by using the unimplemented instruction of OEOO Hex which will cause an unimplemented instruction trap to suspend the processor execution.

The break-point command is also useful in that it is conditional, allowing the user to specify the number of times the address location can be passed before the trap is effected. “Next” is an automatic step command which will execute from the last set PC a number of times — set by the user, from 1 to FFFF Hex steps — displaying all registers.

A small but vital piece of information — set the FC register, flag and control

word to 5000 Hex with the RFC command — was not given in the manuals. That omission prevented the execution of a user-written program in RAM, so that even using the example given in the monitor listings, all the module succeeded in doing is hanging-up with no way of obtaining a response except by the re-set button. Furthermore, the program which one had laboriously entered was totally lost.

The monitor did not seem impressive and, as one of the new generation of big microprocessors, seemed perhaps somewhat primitive. The monitor is contained in 2K words of ROM — 4Kbytes. Contrast that with Nas-Sys 1 for the Nascom 1 or 2 based on the old Z-80 which is contained in only 2Kbytes, or the AIM 65 very comprehensive monitor for the 6502 in 8K bytes which contains mnemonic entry and disassembly.

As mentioned, there is an enormous amount of RAM on-board — 32Kbytes, 16K words, installed. I cannot see many people wanting to or capable of filling the RAM area with that size of program manually with the monitor. The start address for user RAM is at 4480 Hex. The RAM area between 4000 and 447F Hex is for system usage, but it is useful to know that a wrap-around keyboard input buffer for 128 bytes starts at 40B0 H, so that one can perform a limited recall of the last few commands to see what one has done.

Display command

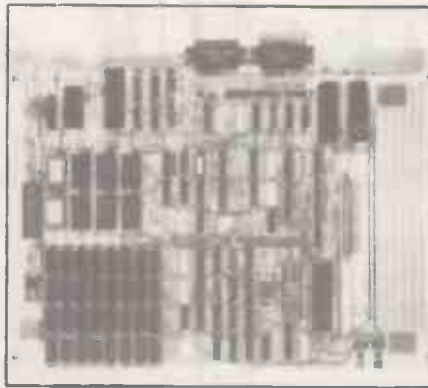
The display command will display a line of eight words or bytes, specified by the user, with the ASCII representation of the bytes if applicable, so that although the input key buffer is stored in Hex, the ASCII characters are displayed, making it easy to see the last few entered command lines.

The non-maskable interrupt, NMI, is connected to a button next to the re-set button, and its use is for a warm-start, i.e., without jumping into re-set and losing the registers. It is also used in going into transparent mode used in communication with an attached MCZ or ZDS system.

The NMI does not, however, seem to be as non-maskable as one would assume. For instance, when the module hangs-up due to the non-setting of the FC register, the NMI button has no effect. That is exactly when it would be useful; not only to see what went wrong but also to preserve the program entered.

It appears that one pays very dearly for even very small mistakes on the Z-8000 development module — when a program hangs-up or the monitor loses control, the RAM seems to become corrupted. That is certainly not conducive to developing or debugging a program, since the slightest mistake could well mean total re-entry of the program.

The documentation seems inadequate in certain areas — there were many points which I had to clarify by deduction, and sometimes vital information was missing.



Examples were lacking, and they are needed especially for such a new and complex machine as the Z-8000. Many will be buying the board as an evaluation kit and the level of documentation will not allow them to do that easily.

Standard with the board was a Hardware Reference Manual which covered monitor commands and was accompanied by a separate book, dealing with monitor listings. A long example program showed the use of some of the monitor sub-routines, but the program listing did not have absolute addresses; the user has to transpose — re-locate — it into the usable RAM area. The data area also needed re-locating and the correct absolute addresses had to be referenced in the program. That increased the possibility of a fatal error.

There was no mention that the program and data area both needed manual re-location, so some users may even try to enter the example with the addresses as shown in the listings, i.e., trying to write into PROM.

Of course the Zilog concept of segmentation is more than just memory-bank switching. It has a memory management unit which, when used with the Z-8001, offers many extra facilities; one example is memory protection.

The version of the Z-8000 on the board was the Z-8002 — the 40-pin non-segmented version. Non-segmented means that this version of the Z-8000 can only address 64Kbytes, or 32K words, instead of the boasted 8Mbytes on the segmented version, the 48-pin Z-8001. Segmented addressing is like addressing more memory by bank-switching — simple but effective. Obviously, the Z-8000 has the instructions already implemented to do the segmentation and external additional hardware is not needed other than for buffering.

The data and address signals are multiplexed — they share the same pins, e.g., bit 1 data and bit 1 address share the same pin. Configuring the Z-8000, needs, therefore, the use of latches to separate the data from the address, which means that a minimum system still requires the use of the latches — unless special memory chips are produced with built-in decoding.

Microprocessors are no longer the poor cousins of traditional computers as far as the Z-8000 instruction set is concerned — enormous even by modern computing standards. It would take more than one

article to describe all the instructions, so let us just take a look at some of the main features.

The Z-8000 has eight addressing modes, which give 14 distinct types in practice allowing for segmented and non-segmented addressing. There is true index addressing — where, as in the Z-80, although it is called index addressing, it is in effect a base-offset addressing. There is also base-address and index-base addressing. Relative addressing would be especially useful for the segmented version on re-locating programs.

Manipulation instructions which can handle bits, bytes and words and, more significantly, long words — 32 bits — are available for most operations. Load decrement/increment and repeat are the equivalents for compare, so that block moves and compares can be made with very few instructions.

Input and output instructions also have the increment/decrement and repeat versions, very useful for scanning or sequential signalling. Signed multiply and divide with the long-word versions are available.

Privileged instructions, as Zilog calls them, allow for multi-processor operation as well as for the attachment of co-processor units which in effect can extend the instruction set.

There are more than 200 instruction types alone and that is not counting those with, say, the various combinations of registers.

Conclusions

- The Z-8000 is a very complex machine in terms of its instruction set.
- That complexity might prove confusing in machine-code work for the majority of users.
- Its full potential should be realised when there is available a good and well-implemented, high-level language for it.
- The instruction set and processing power make it comparable to today's modern minicomputers, but a chip is a long way from a usable implemented system.
- The development module is disappointing because the monitor does not seem to do the powerful CPU justice.
- One of the main purposes of buying the module, to evaluate the Z-8000, might not be fulfilled easily.
- The module may be more suited to be attached to a ZDS — Zilog development system — where cross-support products exist and the prime use of the Z-8000 development module is for execution of the programs developed and stored on the ZDS system.
- At around £800, it seems a trifle expensive.
- If one wants to learn more about the Z-8000, Zilog has recently announced a postal correspondence course in five lessons which test your understanding.
- The lessons are useful for learning about the Z-8000, and are a good investment and good value at less than £20. □

WITH hindsight, the micro revolution, U.K.-style, must make you smile if not laugh. I am sure that it was the same in the States a year or so earlier. In Europe, the languages, regulations and more fixed ideologies made the innovations less acceptable if they were not packaged and guaranteed.

Thankfully, the U.K. still retains a sense of adventure even in these hard times and it was this that, in 1978, allowed the U.K. to join the club as a competitor in some areas rather than as a distributor.

Of course, the main systems originated in the States both in the hobbyist and the embryo small-business area. The States had had one to two years' start. We in Europe produced a kit and board market which never developed in the U.S. — that gave us the chance to catch up.

By that, I mean that the micro-revolution is a revolution of youth. Advancement in both hardware and software is predominantly in the hands of people aged from 18 to 28. Certainly, their age would exclude them from traditional decision-making teams. Yet their production, their energy and their lack of tradition has put the U.K., even with its present economic climate, ahead of all richer European neighbours.

Dealer phenomenon

Another phenomenon of the last three years that the micro has spawned is the hundreds of dealers. Incredibly it would seem, when millions are desperately clinging to their jobs, these visionaries left their employment, hired shops and offices and went in search of a product.

By 1980, some could claim to have made a clear and sound business decision. Before that, they were caught in the same whirlpool which swept all before it. Of course, some dealers evolved from the calculator or mini markets but they form a very small proportion.

Lastly, there was the U.K. manufacturer. I was one in a small way and can assure everyone that they should all be certified. For a country which badly needs new industry, we have some crazy rules. For example the import tariff on components is 18 percent. The import tariff on complete computer boards is six percent. Therefore, anyone making U.K. systems either has his boards made in the U.S. or pays 10 percent more. The kits reflect a lower price because of smaller margins, not necessarily cost.

Remembering that we are talking about a whole industry developed in three years, maybe five in the U.S. which has exploded a mass-market product into true mass-marketing, you have the obvious problems of catching-up. Manufactured PCBs should be tested. Test equipment costs many £1,000. With a huge home market in the U.S., assembly manufacturers invested in test equipment. In the U.K., that is, in general, still being discussed. With the tariff restrictions, it is not surprising.

The U.K. experience

Kerr Borland looks back at the U.K. micromarket in its infancy and speculates on the competition to come.

Our home-based component production is not geared to micro needs of LS ICs and buffers. Bulk purchasing takes much longer through U.K. distributors or owned marketing companies and certainly costs more proportionately.

On the other hand, the U.K. has certainly produced more hardware peripherals and add-on hardware per head of population than anywhere else. We have a genius for producing 40 different products for the same need. That, of course, just complicates the choice and adds to the fun and cost.

Name acceptance was critical. Those few, Tandy, Apple, Pet and in the boards, Nascom, became recognisable quickly



The Compukit UK101.

and, therefore, were the pace setters. Interestingly, the States-side market share reads Tandy, Apple, Pet. When they invaded Europe, Tandy and Apple continued their successful U.S. formula. Commodore had a European marketing genius in Kit Spencer.

He knew that the European and certainly the U.K. market would not respond as well to an imported campaign as to a tailor-made one. With a domination of the small end in 1980 of far more than 50 percent of the U.K. market and achieving sales for Commodore which represent more than 25 percent of its world output, he proved that you can import technology but not custom.

On the retail side, Chris Cary of the Compshop is the indisputable king. Again, he had a good understanding of the marketing involved. With little knowledge, the buyers needed a range to choose, simple instructions for purchase and an apparent good buy.

The UK101 showed another interesting market development. Its similarity to the

Superboard, except for its Nascom-format screen display amazed everyone in 1979 and, in theory, might have been the UK101's downfall. With its finance and production power, Ohio Scientific should perhaps have won on paper.

The immediacy of the new market area is perhaps the problem with which the recognised electronic groups have difficulty in coping and why so few familiar names have reached the point of sale.

Marketing generally is supplying the stimulation of demand with an emphasis on your product. In micros, the new concept of managing the demand was fully explored and proven to be practical and profitable. Many products in those three years should have survived. Their producers were very competent and the products well made and needed.

Sadly, engineers generally are as bad salesmen as salesmen are engineers. The assumption that good products will sell themselves is true. The salesman merely allows the buyer, whom he has found and stimulated, the opportunity. Undoubtedly, the marketing manipulators won.

1980 must go to Clive Sinclair. With that special quality that for 20 years has kept him in front of the world, he immediately proves me wrong in saying that engineers do not make good salesmen.

Business trend

In the three years, we had forgotten that the microchip is a low-cost, mass-produced, no-value commodity. Our drive towards business computers, etc., left one market area without solution. That market was the thirst for knowledge created by the mass media.

No-one learns to drive in a Ferrari. Most people's first banger costs less than the ZX-80. The banger serves the most important need in driving, to learn how; the ZX-80 does the same for the microchip. I think that everyone who is thinking of starting computing at a slightly older age should buy a ZX-80 tomorrow. As with your first car, pound for pound, no future computer you buy will ever teach you as much. We all await the 1 Megbyte for the ZX-80.

So you will, I hope, forgive my smile. We seem to have a world of adolescents working day and night, foregoing all wine, women and song to produce products which they sell, perhaps give or abandon on a dealer network which gave-up perfectly good jobs in or out of electronics to follow the 40-pin star.

Collective redundancy money was ploughed-in by the team who then did

their particular deal and gained exclusive rights to hardware that no-one else had realised was brilliant. Add an increasing number of U.K. manufacturers who plan in volume up to 100 in a market which needs 10,000 immediately if the product is successful, and you burst into joyous laughter.

1980 was a year of consolidation. Having had a market for three years, that seemed sensible. Those who still remained saw little new hardware and started to concentrate on software. Youth still dominated, but noticeably, the software producers had spent some time in formal computer employment. The division between hardware and software is dispensed with in micro-computing. Everyone knows both, but has a leaning by choice.

Dominant idea

The machines gained bigger memories, faster outputs, larger discs, better printers. Operating systems of all shapes and sizes appeared. Applications started to be the dominant idea instead of machine.

Tandy, Apple and Pet produced new

machines which startled no-one, reflected the newer electronics and the move towards low-cost business machines. Texas Instruments arrived with a colour computer; the Japanese arrived with similar machines which each had a selling point in the hands of a good salesman. Generally, the end of the beginning has been reached. What happens now?

I asked many micro people that question. They found a few areas of agreement. Firstly, the end of the beginning is the end of the obsession with hardware and the total dominance from now on by software. Secondly, that technology will strive on two fronts. The storage media which survive will be mass-producible and with a downward cost-curve regardless of an upward capacity. That the next stage of evolution rests with speech recognition. Thirdly, massive databases will appear for direct public access. Fourthly, the proliferation of outlets will not survive; some specialists will remain but retail micros will be obtainable in the U.K. probably from two or three chains.

With software engineering rather than the more normal micro definition of

system engineering, we start using software for controlling fundamental hardware functions rather than writing user programs. For example, the new CP/M 2 operating system, allows the user a multiple choice of format on a single drive.

As drive A, the system will be expecting a single-sided disc and as drive B, using the same drive, the system will expect a double-sider. Or A could be single-density and B double-density. Obviously, there could be changes in format to restore, but it would seem perfectly feasible soon to read in a single-sided disc from elsewhere and to dump on to a double-sided, double-density disc used by the system. That is a large step towards transferable software.

The storage medium war is on with two apparent leaders. Winchester drives, though they must now be four years old, are improving their capacity to new highs. At the moment, they are running around 25Mbyte but are now talking of 250Mbyte as a possibility. Also a 5in. Winchester seems probable.

For the uninitiated, a Winchester is a sealed hard disc. You can write, read and erase but you cannot change the disc. That gives greater reliability and greater cost at the moment, but it is the start of the micro mainframe.

Bubble memory is high capacity, at the moment quite expensive, but unlike the Winchester, would lend itself to portability.

Speech recognition will put the finishing touches to the microrevolution. With speech recognition, you could probably justify 16-bit microchips. They are fast compared to the eight-bit, but have disadvantages which would seem to make them superfluous to a satisfied eight-bit marketplace.

Multi-tasking

Obviously, they facilitate multi-tasking. A few months ago, I saw a specification in *Byte* for a mini Basic written for multi-tasking on a 16-bit machine which ran in 8K.

However, it still seems practical to relegate the 16-bit projects to the big applications. To function fast and efficiently, they need plenty of RAM for use so that large blocks of data can be retrieved and interrogated instantly. With Winchesters or bubble memories, the storage could be massive and the slow search time considered.

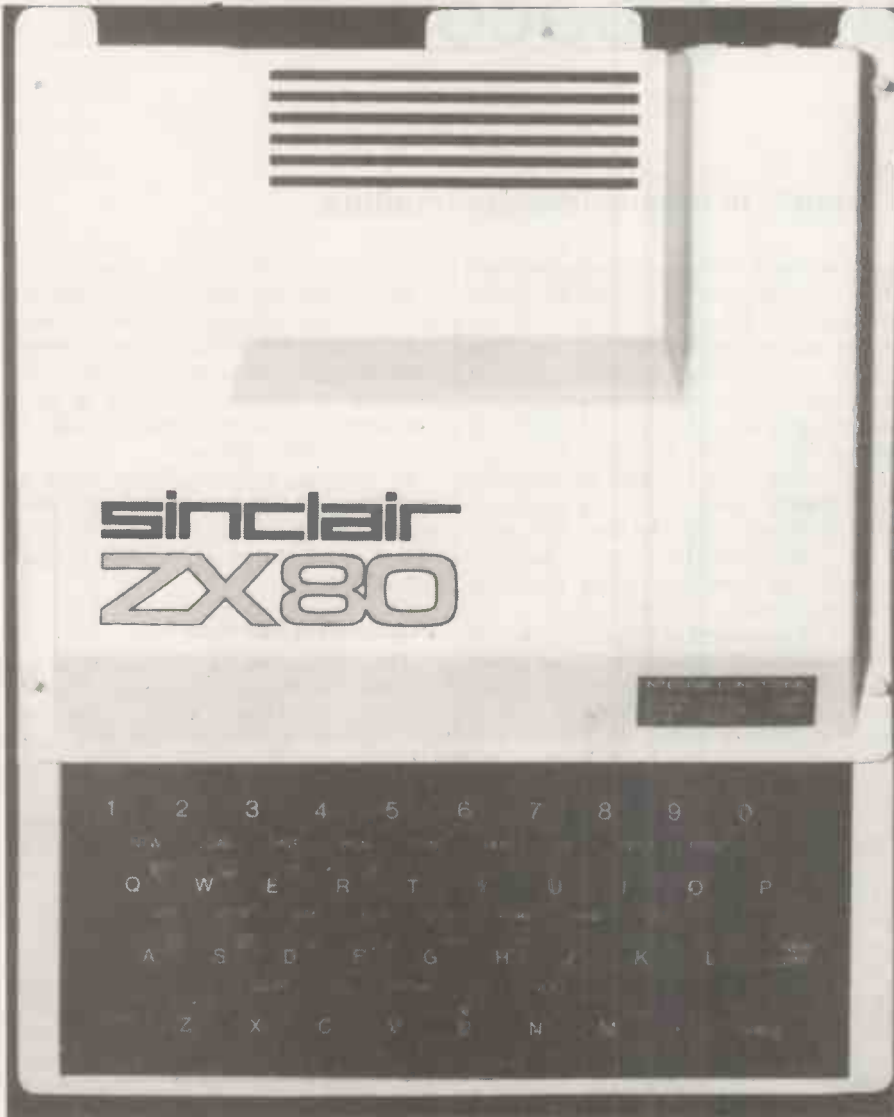
For the 16-bit chip, the software has yet to be written although conversion from 6800 or Z-80 to the equivalent 16-bit chip would seem possible. There is already a Motorola Pascal available for the 68000.

Again, the hardware will no doubt be plentiful but nothing will really happen until the software writers understand the chip and cope with the big systems that 16 bits attract.

Where are systems going? I already mentioned the big public database

(continued on next page)

The ZX-80 became the top-selling microcomputer of 1980.



(continued from previous page)

machines. It would seem very possible that each office will have its own database. That is already a fact with big operational minis and mainframes. Now it could be a year or so away for everyone. With 250Mbyte Winchester, the storage for all information generated by a small office seems very practical.

Master micro

The master micro, possibly 16-bit, with some form of mass storage could be assembled for very little cost. It could have two types of terminal. Each typing station, account clerk, would have an on-line terminal with probably its own micro and user storage. Every letter and ledger would be stored. The other terminals would be portable rather like the Newbrain. They would be powered independently with a LCD display but with sockets to screen and printer.

That would give management a flexible use of the computer. Possibly, the portable would use bubble memory, to ex-

pand the volume retrievable at one time. The software is the entire problem. The hardware could be made now though at a higher cost.

Total information storage and retrieval for all has to be the aim for 1990. With systems like Prestel about to become available and, if one has the facilities to store the information when found off-line and use it through your own computer, relatively inexpensive.

The whole viewdata idea will take off in the next year once they resolve Catch 22. Prestel particularly has a lack of information providers because it has few end-users. They are not rushing to buy because there is insufficient information to retrieve.

At the moment, the user units cost too much, but by the New Year, that will have changed. Specialist Micro Designs has just finished a project which will make a unit available at slightly more than £100 or around £1.40 per week rental from the TV rental companies. The new user, who will raise the figures and interest new informa-

tion providers who will pay the Post Office, will be faced with an installation charge for the jack. Why not, in fact, incorporate the jack in every telephone connection box on every wall on every future installation. That would encourage users.

The Post Office system still represents, if I remember correctly, 7,500,000 potential public information pages open to all. That should start to take computing into the 21st century.

Information providers like W H Smith are already offering shopping by computer. Soon, it should be possible to interrogate the computer as to which shops in any town to visit to buy the goods you require — that is if you want to see them first.

Same problem

Finally, and one feels as the first telephone salesman must have felt, how about mail by computer? Obviously, everyone needs a telephone, a modem and a microcomputer. The same problem the first telephone salesman had; too few computers — but for how long?

Will computing become cheaper?

Julian Allason studies the latest trends in microcomputer retailing.

THERE is one question asked more often in microcomputer shops than any other: Shouldn't I wait — it's bound to get cheaper? Yet the fact of the matter is that a businessman can now walk into a computer shop, write a cheque for less than £2,500 and walk out again with a business system.

To break that figure down, we start with a Pet 8032 — it could equally be a Tandy TRS-80 or an Apple II — but at any rate, a 32K system. Price £695, less any discount wrung from the salesman.

Add another £695 for a 340K dual mini-floppy, and around £500 for a reasonable dot-matrix printer. For a shade less than £2,000, our businessman has brought a system.

Highest standards

It has been fashionable for dp professionals to snipe at the quality of the applications software available for the popular micros. Yet, some of the packages now available measure up to the highest standards of the industry, and at stunningly low cost, £325 for a word processor of remarkable sophistication, ledger suites with invoicing at around £500, two examples from many.

Obviously, there are more sophisticated microcomputer systems available — with higher price tags, but the answer to the

question: will business systems become cheaper? must now be a qualified no for the immediate future.

The fall in hardware prices has now largely taken place, with the possible exception of printers and certain specialised peripherals. Chip prices could fall further, but with the shortage of production capacity, it is arguable whether any very striking reductions in the prices of the commonly-used devices will now occur. Indeed, recent increases in the price of gold and other component materials have raised production costs.

Even if semiconductor prices were to fall, it is doubtful whether end-user prices would be much affected, for the simple reason that they now represent only a minor proportion of the total manufacturing cost.

It is being suggested in the States that hardware developments will now have less and less impact on system performance. The proposition is that virtually all the major improvements in the immediate future will occur as a result of software enhancements.

It is perhaps worth noting that the Japanese are not entirely in sympathy with that argument. Cynics may feel that to be no more than a reflection of Japanese weakness in the software field.

What is not in doubt is the growing cost

of developing applications software. Yet if microcomputers are to be priced competitively, the selling price of the software must remain low. That can be achieved only through volume sales, which is why the best of the new software is being developed to run on a small number of very successful machines.

In practice, we are talking about no more than six branded systems plus those which natively run under the CP/M disc operating system, or can be made compatible with it.

Parallel question

The second most frequently-asked question is the obvious one: "Which system should I buy"? For a retailer there is a parallel question: "Which systems should I sell"? The answers are not necessarily the same.

To a new dealer the soundest advice would be to stick to the established systems, like Apple, Pet, NorthStar and Cromemco, plus perhaps a few others — my personal choice would include BASF and the Act-800.

The reasons are largely commonsense. Those companies are secure financially, enough to ensure the survival of their systems, and their continued development. That is not, unfortunately, true of all the systems advertised. Indeed, it may

be doubtful if more than two-thirds of them will still be on sale in a year's time.

Secondly, the computers I have mentioned are all general-purpose workhorses, capable of being turned to many different tasks. That means they satisfy a broader customer base. They have been around long enough to have the major bugs removed. That is also true of the production process itself. In other words, they should prove reliable.

Most importantly, the established systems are supported by a wide range of applications software from independent suppliers. That is important because it means competitive i.e., low, retail prices — hence higher sales — favourable dealer margins — 40 percent is the norm — and quality. No dealer will risk his reputation by re-ordering a poor program. Most important of all, it means choice; at least five good word processors run under CP/M, for example.

The list of top-selling microcomputers in 1981 will, with a few additions, closely resemble the 1980 list. The same will not be true of peripherals.

It is worth considering a question that newly-formed microcomputer companies always ask themselves: Should we search for a new product and import it?

New products

If that new product is to be a new computer then the short answer has to be no. The trade is suffering from a surfeit of new computers just now. Retailers need new systems like a hole in the head. They have more than enough difficulty keeping up with development of existing systems.

In 1981 more importers will probably go out of business than any other type of organisation in our industry. There are three simple reasons for that. Firstly, dealers are rightly reluctant to take on new and unproven systems from new and unproved suppliers. Secondly, importing is capital-intensive. The manufacturer will certainly require payment on release of goods which must then be airfreighted and cleared through Customs.

On the subject of capital, the would-be importer had better be prepared to grant extended credit to his dealer network. Microcomputer importers often find themselves financing stock for four months or more.

A third reason for not becoming a sole agent is the massive cost of establishing a new system in the market place. Advertising and promotion alone can run into five figures each month. On 20 percent gross margin, you need to sell many systems to recover an outlay of that magnitude.

It is certain that you will be up against some smart competition. For a new computer to succeed it must be shown to be better than the established system. Not easy — even when it is better.

Importing peripherals is a much better proposition, although the same caveats apply. However, as I mentioned, the peripheral market is in a state of flux. The

present generation of printers is overpriced, and/or unreliable and/or produce poor results. Clearly, the market is open to a low-cost printer with typewriter-quality output, and the kind of reliability associated with solid-state devices.

When one considers the future market for low-cost modems, digitisers, speech synthesisers and the like, it is apparent there will be opportunities aplenty for those who know exactly what they are doing. Those who do not may be recommended to stick to retailing where the necessary education will be spoon-fed by the manufacturers.

The most assured means of profiting from the microrevolution is as a retailer, selling a limited range of popular brands supported by pre-packaged software. Dealers interested in profitability avoid custom software like the plague — which is why it is so hard to find a low-priced specialised program.

The advantage of sticking to well-known brands are numerous. Assuming the quality of the product and financial stability and competence of the suppliers,



Pet 8000 series with wordcraft.

the dealer will benefit from a steady stream of sales leads; they are the result of national advertising by the sole agent. Some dealers never bother to advertise themselves; they would do very much better if they did advertise.

Apple has brought out its Apple III. It has been generally well received by the trade, although very few are yet in private hands. The important point to note is that it does not render the Apple II obsolete. It appeals in its various configurations to the programmer, the engineer and the businessman.

The price is not inconsiderable but fair. A very senior Apple executive told me he expected the new model to sell on specification alone. Perhaps he was forgetting what an excellent reputation Apple has.

The company is perhaps quietly and deliberately manoeuvring itself into an IBM-like position in the industry. More than 40 companies support Apple with peripherals, and there must be many more offering software. Plug-in CP/M or Pascal cards? You name it, Apple has it.

Similarly Commodore has its CBM 8032 with 80-column screen, which I dubbed the SuperPet. They will shortly begin to deliver the 8050 mini-floppy disc drive, which offers exceptionally good

value at £895 for 950Kbytes of on-line storage. Like Apple III, it is an upgrade which does not render the original models obsolete. Already there is an excellent range of business software available, including some striking individual packages. The system will become one of the mainstays of microcomputing during the next year.

Ingersoll Electronics, a division of the Heron Corporation, is in the process of launching the Atari computer system. It has received a mixed reception in the U.S. With its excellent colour graphics and competitive price, it may make a significant impact in the U.K.

Let us look at Japan for a moment. The U.S. magazine *Electronics* projects that by 1985 the Japanese plan to sell \$1.66 billions' worth of computers in the U.S. That is some 20 percent of total Japanese computer production and 60 percent of its export figure. The current figure is \$298 million of total production of which only \$93 millions' worth are shipped to the U.S.

What those figures conceal is the historical tendency of the Japanese to use Europe as a trial market from which to springboard difficult products into the States.

At present, 70 percent of Japanese computer exports are peripherals. That will change rapidly as the major electrical companies try to establish their brand names. One of the ways in which they will do that is by adopting CP/M to overcome their lack of software expertise. The other is through strong price competition. You can expect to see Japanese computers sold by most high street electrical outlets and through discount houses.

The Japanese usually test-market their products in their own country first. One cannot draw any definite conclusions, since the majority of the products so released never go as far as export. However, it is instructive to examine what is on sale there.

Software-compatible

None of the Japanese machines uses a standard bus, particularly the S-100. Many of them are software-compatible insofar as they have adopted Microsoft Basic. There are approximately 10 OEMs who have adopted CP/M for running Microsoft language processors for software development.

The roof of the Japanese software problem seems to be the absence of micro-software houses, such as Microsoft or Petsoft, and the language difficulty.

The outsider to watch for will be the NEC. It first saw light two years ago when a prototype was installed at a secret location in the heart of Silicon Valley. The Nippon Electric Corporation has produced a computer with better colour graphics and a more powerful Basic — written by Microsoft — than any other Japanese machine. It is as good as the very

(continued on page 67)

FRUSTRATED S100 USERS CAN NOW GIVE THEIR FLOPPIES A SLIGHTLY BETTER MEMORY.



MD10 CONTROLLER FEATURES

- * Designed and made in England
- * IEEE S100 bus standard
- * On-board 8085 CPU and RAM
- * On-board bootstrap PROM
- * Controls up to 4 10Mb disc drives
- * On-board error checking
- * Fully tested and burnt in
- * Low power consumption
- * Supports many types of disc drive
- * Complete documentation and software
- * 3 month warranty

WOULD YOU BELIEVE 40 MEGABYTES?

MD10 is our new low cost cartridge disc controller. It completely eliminates the storage and back-up problems associated with floppy discs. It interfaces S100 micro computers with industry standard 10 Megabyte (5Mb fixed, 5Mb cartridge) disc drives.

By daisy chaining up to 4 disc drives you can have no less than 40 Megabytes of fast, on-line storage

NO MORE BACKUP PROBLEMS

The limited storage capacity of floppy discs was recently solved with the introduction of the "Winchester-type" disc drive. But this introduced a new problem... backup...! The MD10 cartridge disc controller interfaces with 10 Megabyte capacity disc drives which combine a 5Mb fixed disc and a 5Mb industry standard (IBM-5540 type) removable cartridge disc. Each disc is individually addressed and accessed. This means that all important programs and data files can be kept on the fixed disc and, when required, copy the whole disc onto the cartridge for security or backup purposes.

MD10, THE INTELLIGENT... LOW COST... CARTRIDGE DISC CONTROLLER

The MD10 contains an on-board 8085 processor, 1024 Bytes of random access memory and a bootstrap PROM which, depending on the operating system used, will enable any S100 micro computer to boot from the hard disc rather than from the floppy. Data is transferred at a rate of 2.5 million bits per second between the controller and the drive.

The controller accepts, interrupts and performs CRC error checking. Bus compatible, the S100 transfers 8-bit data between the CPU and the controller and serial data between the controller and the disc drive(s).

The 8085 CPU on the controller takes care of the data transfers between the S100 bus and the on-board RAM. The on-board 8085 allows normal processing to continue in between data transfers to and from the MD10 controller and disc drive. This is especially important for multi-user systems.

NEWTONS Laboratories now supply ex-stock complete subsystems consisting of the controller and 10Mb AMPEX disc drive for £3995 (1-off end-user) including a rewritten BIOS for CP/M 2.2. The controller board alone costs £600 (1-off end-user). The disc drive alone costs £3395 (1-off end-user). Manual only £10. OEM and quantity discounts are available. Dealer and export enquiries (not USA) are invited.

MD10 S100 CARTRIDGE DISC CONTROLLER

FOR BROCHURE

Name

Title

Company

Address

Postcode

Telephone

ORDERS FOR MANUALS MUST BE PREPAID

PC12

NEWTONS
LABORATORIES

111-113 Wandsworth High Street,
London SW18 4JB. Tel: 01-874 6511
Telex: 21768 (NEWTON G)

• Circle No. 159

(continued from page 65)

best of the U.S. micros in the same class.

Most dealers will also carry one of the hand-held computers. Matsushita looks set to do well with their Panasonic and Quasar brands, as does Sharp — already selling well here. The current best-seller in the category is the Sinclair ZX-80, but it is being marketed direct by mail order only at present. As entry-level systems the hand-held computers should generate a good deal of revenue in 1981.

For systems houses who are selling on tailored software, the position is a little different. Yet even the smaller manufacturers will find it hard to compete with the price advantage of the large names where the economies of large-scale production are being harvested with a vengeance.

What we will see is a proliferation of badge engineering, particularly on machines of oriental origin. There is already some confusion in the area, with Radio Shack marketing the Sharp hand-held micro under the Tandy label, but at a higher price.

There is one completely new machine which attracted a great deal of attention when it was shown at the Consumer Electronics Show in Chicago. This was the National Panasonic RL-H1000, a brief-case computer complete with acoustic coupler, miniature 18-column printer, cassette interface, video interface and ROM and RAM expansion modules.

Whole new field

The computer is 6502-based, runs Basic and is to retail in the U.S. at \$1,200 — including the brief-case. Panasonic are negotiating with Avon Cosmetics for the sale of several hundred units to be used by sales representatives. That is just one application in a whole new field.

There are now marked discrepancies in the storage capacity of different disc drives. Taking 5¼in. mini-floppies as a case in point, formatted storage capacity may vary between 75K and 1.6 megabytes. If I were a TRS-80 owner with less than 100K of disc storage, I would certainly be a hot prospect for the company offering a drive with 500K bytes or more.

The availability of really good database management software and integrated business packages for microcomputers may well push the demand for high-capacity disc drives through the roof.

A question mark hangs over the future of 8in. floppy drives, so well established in the word-processing and minicomputer markets. On the one hand, they are being squeezed by high-density mini-floppies offering up to two megabytes storage. On the other, the size of Winchester technology hard discs is declining.

There are a number of 5in. micro-Winchesters soon to be available; Tandon Magnetics showed samples of a five-megabyte unit with dual platters at this year's National Computer Conference.

Several manufacturers are now supplying larger hard discs, notably Corvus

which offers an 11 megabyte IMI drive for the Apple, and imminently for the Pet also. Cromemco has introduced its Z-2H computer built around an 11 megabyte Winchester disc; it has an excellent specification. Equinox is starting to offer a cartridge drive with five megabytes fixed and five megabyte removable discs, thereby solving the back-up problem at a stroke. High-speed tape cartridge back-up is another growth area.

An important development is the arrival of the Exatron Stringy Floppy. It is a low-cost cartridge device fast enough to compete with floppy discs. In the U.S., it retails for \$300, with versions available for most popular micros, including Pet, Apple, TRS-80, OSI and S-100.

I first saw the Stringy Floppy about a year ago when the operating system for

that by the spring, there will be a number of low-cost acoustic couplers available with the necessary software.

Prices in the U.S. are now down around the \$175 mark for the best selling Cat acoustic modem. At these prices, a large proportion of microcomputer users will be interested. What they do with them is another matter.

Mention has been made of the two principal microcomputer networks, MicroNet and The Source which has just been acquired by Reader's Digest.

For the extraordinarily low cost of around \$5 an hour, plus the cost of a local telephone call, the user can hook into one of the major networks. Once signed on, he has access to major public databases, like the *New York Times* database, the latest stock market prices, computer



The Nascom System 80.

the Pet version was under development in Palo Alto. Apart from its speed, the most striking thing about it was the size of the stringy flopping wafers — they are tiny.

The system should be successful for two reasons. Firstly, it represents a price/performance breakthrough that challenges mini-floppies and threatens to make ordinary cassettes obsolete as a means of storing data. Secondly, because there are versions for the most popular machines, it may create a *de facto* standard, although tapes recorded in one format will not be fully compatible with others. Furthermore, the concept is simple and easy to put over in advertising and promotional literature — definitely one to watch.

Sir Keith Joseph's scalpel-wielding does seem to have lit a fire under the Post Office newly hived-off British Telecom. It was even promised to reduce the waiting time for the installation of high-speed data lines from two years to one.

For most microcomputer users, ordinary telephone lines will be quite adequate for their needs. The speeding of the official approval procedure means

dating, software sales, and extra storage.

Both MicroNet and the Source started as a means of utilising the slack time on existing big computer networks, principally in the evenings and weekends. So successful have they been that new equipment is being added to allow peak-time usage for business micro users.

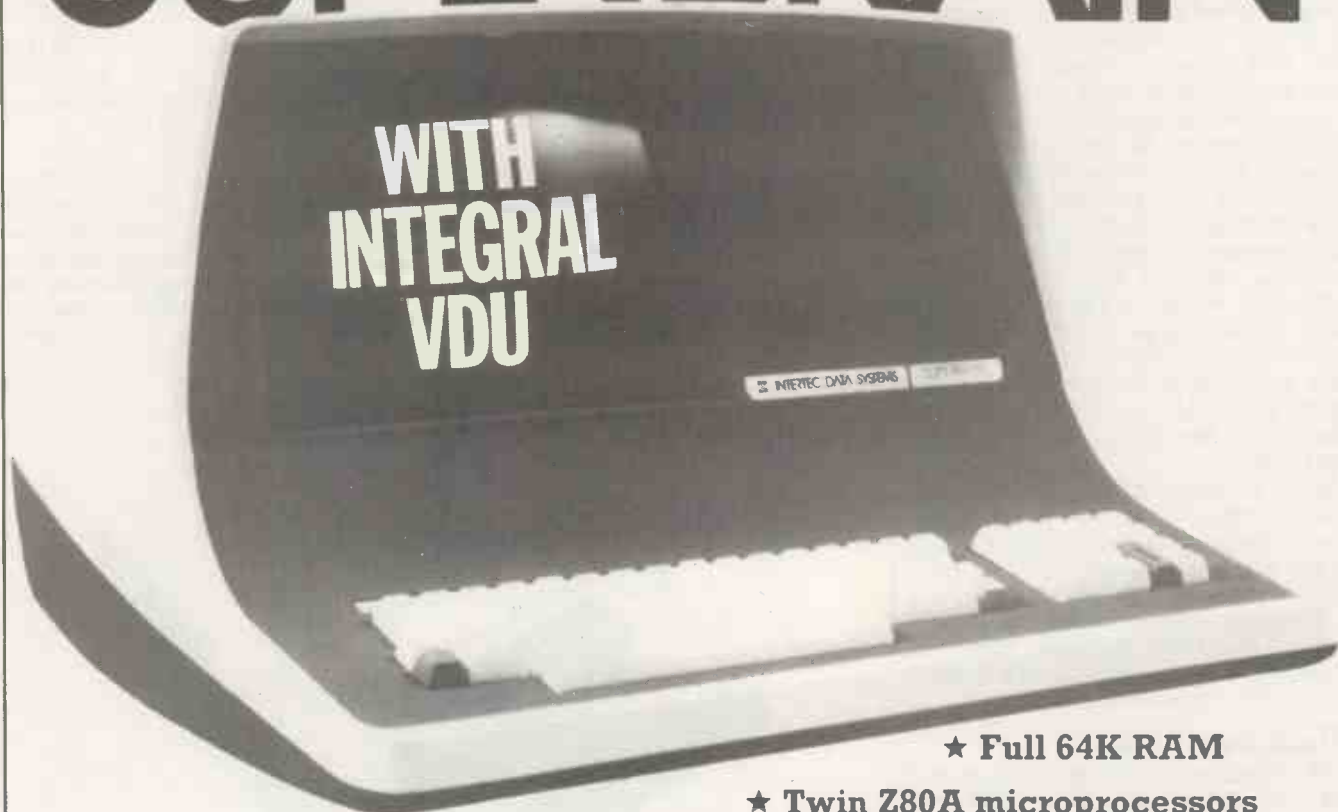
Micronetworking may well take a different form in the U.K. for a number of reasons, not the least of which is Prestel. The subject is likely to remain clouded with uncertainty for some time.

One development likely to play an important part in our lives is that of multi-user systems. Several companies, notably Altos, are beginning to supply hard-disc systems, supporting, in that case, up to four simultaneous users.

One of the very first was the Nestor Cluster One, which allowed up to eight Apples, Pets or TRS-80s to share a single 8in. floppy. One disadvantage was that it required one microcomputer to act as umpire, refereeing the system. The level of file handling also rendered Cluster One

(continued on page 69)

SUPERBRAIN



★ Full 64K RAM

★ Twin Z80A microprocessors

★ CP/M™ (2.2) operating system

★ Twin double density mini floppies (320K:670K optional)

SUPERBRAIN - stand alone system and intelligent terminal combined in a single desk top unit (14³/₈"H x 21³/₈"W x 23¹/₈"D). Non-glare dynamically focused 12" CRT and Universal RS-232 Communications port. SOFTWARE PACKAGES AVAILABLE.

Full **SUPERBRAIN™** details from the following dealers:

JAEMMA LTD.,
44 Manor Park Road, Castle Bromwich,
BIRMINGHAM Tel: 021 7474531

JENNINGS COMPUTER SERVICES LTD., 55/57 Fagley Road,
BRADFORD 2, W. Yorks.
Tel: 0274 637867

AERCO GEMSOFT,
27 Chobham Road, WOKING,
Surrey GU21 1JD. Tel: 04862 22881

S.D.M. COMPUTER SERVICES,
Broadway, Bebington,
MERSEYSIDE, L63 5ND.
Tel: 051 608 9365

O. C. T., Kimberley House,
Vaughan Way, LEICESTER,
LE1 4SG. Tel: 0533 28631

SORTFIELD LTD.,
E Floor, Milburn House, Dean Street,
NEWCASTLE-ON-TYNE, NE1 1LE.
Tel: 0632 29593

CULLOVILLE LTD., Thornfield,
Woodhill Road, Sandon,
CHELMSFORD, Essex.
Tel: 024 541 3919

PROMGLOW LTD., 12 Dene Road,
New Southgate, LONDON N11 1ES.
Tel: 01-368 9002

SHEFFIELD COMPUTER CENTRE,
225 Abbeydale Road, SHEFFIELD,
S7 1FJ. Tel: 0742 53519

DRAGON SYSTEMS LTD.,
54 Mansel Street,
SWANSEA, West Glamorgan.
SA1 5TE. Tel: 0792 794 786

COSMOS COMPUTERS LTD.,
Blackhorse Road, LETCHWORTH,
Herts. Tel: 046 26 6861

BORDER COMPUTING,
Dog Kennel Lane, BUCKNELL,
Shropshire SY7 0AX. Tel: 05474 368

DAYTA, 20B West Street,
WILTON, Wilts. SP2 0DF.
Tel: 072274 3898

MICRO SOLUTION LTD.,
Park Farm House, Heythrop,
Chipping Norton, OXFORDSHIRE.
OX7 5TW. Tel: 0608 3256

MICROPEOPLE LTD.,
Microcomputer Consultancy Services,
1 Union Street, LONG EATON,
Nottingham, NG10 1HH.
Tel: 06076 68923

RECMA COMPUTING
Chelwood House, Thornbury,
BRISTOL, BS12 2JT. Tel: 0454 775150

OMEGA ELECTRICS LTD.,
Flaxley Mill, Flaxley Road,
MITCHELDEAN, Gloucestershire.
Tel: 045 276 532

AMA (COMPUTING) LTD.,
1 Frog Hall Lane, WARRINGTON
WA2 7JJ. Tel: 0925 33137

ROGIS SYSTEMS LTD.,
Keepers Lodge, Frittenden,
Nr. CRANBROOK, Kent.
Tel: 058 080 310

GARCIA BUSINESS SYSTEMS,
106 High Street, BUSHEY, Herts.
WD2 3DE. Tel: 01-950 6255

ESCO COMPUTING LTD.,
74 Waterloo Street, GLASGOW,
G2 7DA. Tel: 3041 204 1811

For dealer enquiries, contact

ICARUS COMPUTER SYSTEMS LTD., 27 Greenwood Place, London NW5 1NN.

CP/M™ is the registered trademark of Digital Research.

• Circle No. 160

(continued from page 67)

more suitable for educational than for business applications.

Next year there will probably be continuing rapid development in the field. There are now two multi-user systems set to battle it out for the Pet market. The first is MuPet, a Canadian system which allows up to eight Pets to be daisy-chained to a single disc drive and printer. The second is the Multi-Pet System developed here by Sandy Livingstone of Taylor Wilson Systems. Those systems are relatively simple and inexpensive and one can expect to see their appearance on a number of popular computers.

I mentioned using the Source micronetwork to transmit electronic mail, and there is no doubt that the majority of microcomputers could be harnessed to that purpose. The question is not whether it will happen, but when.

It is likely that users of electronic mail will fall into two categories: existing microcomputer owners who decided to add a communications option to their system, and business customers with a specific need for high speed, high volume communications.

Small number

In practice, there are a good deal fewer of these than is generally supposed. The number of originators of large volume mail is actually small, consisting principally of Government, insurance companies and mail order houses. One is drawn, therefore, to the conclusion that initial sales will be of peripherals to existing microcomputer users with only a relatively small number of communications terminals for inter-company use.

Of course, these are not the only means of originating electronic mail. Around 20 percent of all word processors sold in the U.S. are supplied with a communications capability. The population of communicating word processors is put at 75,000 in the States — not a very large number.

The Post Office is presently experimenting with a system based on the Rascal ESL-1044 Communications Controller. It will run file management software for the telepost system. So far about 150 ATS Vitel terminals have been installed in large companies for a trial period.

Meanwhile, ITT has announced new software which will enable customers to integrate their systems with networks operating on the recently-established X-25 specifications. They are part of an attempt to standardise the world of public database systems, and the British Telecom packet-switching system will be compatible with them.

However, my own conclusion is that the sales of acoustic couplers and software apart, microcomputer dealers should not be looking to make profits out of electronic mailing systems in the immediate future. That 1981 will be another bumper year for the industry is not in doubt.

The European scene

From the States-side vantage-point, Rodney Zaks analyses the European micromarket.

THE European market is an apparent mosaic of contradictions. The market in the U.S. is dominated by Radio Shack with the TRS-80 — about 50 percent of the market seems to be dominated by the Pet, followed by both the Apple and the market seem to be dominated by the PET, followed by both the Apple and the TRS-80, with a visible penetration by Japanese manufacturers which are non-existent in the U.S.

Sales of microcomputers in Europe are difficult to evaluate, because most manufacturers will not release sales data and because there are very few European-wide distribution systems able to supply the data. It can be estimated that the European market probably represents only 10 to 20 percent of the U.S. market.

Two important factors must be considered when evaluating sales: the first microcomputer to be established strongly on the market tends to retain a dominant position, and the market is growing very rapidly. Local politics often play a significant role in the limited markets that exist, because of poor consumer education, and short-sighted government intervention.

The U.K. reputed to be in a depression and having a low average per capita income, achieves a high level of microcomputer sales in Europe. That is probably owing to good consumer information — because there is no language barrier — as well as to the immediate usability of U.S. programs written in English. Some economists might also claim that a country in a recession probably has a greater need for microcomputers and automation than a country with a healthy, expanding economy.

West Germany, the most powerful industrial country in Europe, and the largest purchaser of microprocessor components in Europe — perhaps 50 percent in European sales — has been a poor market for microcomputers. A number of the few microcomputer shops open several years ago have now closed, and even fewer new ones have replaced them.

Everyone predicts that the market is about to start growing, but this has yet to occur. Why that has not occurred in a country like West Germany is still something of a mystery, and several possible explanations may be suggested; one might be a possible cultural resistance to a different system.

Because most sales in Europe are made to businessmen and other professionals, those buyers look for the immediate availability of the complete software facilities that they require. In particular, accounting systems used in other countries, such as West Germany, do not adapt

easily to the U.S. pattern. That may be a significant item for resistance.

Another possible explanation may lie in the traditional conservatism of the electronics publishing establishment in West Germany, which has remained outside the mainstream of microcomputer developments for many years. To a large extent, the public may simply be uninformed.

In the Netherlands — one of the countries most open to business innovations — microcomputers and microcomputer education have been an instant success. Microcomputer courses have even been featured on a repeated series of courses on television — the Teleac series.

Also, English is understood and spoken throughout the Netherlands, which makes the programs, as well as the manufacturers' brochures and documentation, readily usable.

Scandinavia has recorded limited success with microcomputer products. It has long had a reputation for accepting high technology, but this has also been the case with West Germany. Microcomputers are not used in industry as much as they are used by individuals. Therefore, they have to fit within a cultural and a professional pattern. Apparently, they have not yet fitted well in Scandinavia.

Large quantities

In France, microcomputers are now sold in large quantities, much to the surprise of observers, since a majority of French nationals do not speak English. Most of the purchasers, however, are university-trained, and are able to understand English. Additionally, microcomputers may have become a fashion trend or status item in much the same way that they have in the U.S. In Italy and Spain, sales are lower than elsewhere in Europe.

The situation in Switzerland is hard to assess because many microcomputers might, in fact, be purchased in West Germany or even in France. It appears, however, that microcomputers are sold in small numbers and are used mainly for educational purposes or by engineers.

In summary, the European market is now a mosaic incorporating miscellaneous facets of the evolution of the U.S. market, but is still several years behind the U.S. Some of the products sold in the U.S. will not sell in Europe and some of the products already established in Europe will probably sell there for a very long time.

Many U.S. manufacturers have no understanding of the relative importance of the various European markets and direct their efforts at the wrong country.

(continued on next page)

(continued from previous page)

They should be aware that the market is now unstable, and is likely to shift quickly over the next year, as additional segments of the population become aware of the capabilities of microcomputers, and as the various psychological or technical barriers are overcome. At least until West Germany awakes, France may be the largest potential short-term market.

The TRS-80 system from Tandy is marketed in the U.S. exclusively by more than 1,000 Radio Shack outlets. That is a captive network which has achieved spectacular results. Radio Shack is developing a similar network in Europe, but it does not yet compare in size to the one in the U.S.

Short of such a captive distribution, the bulk of microcomputers are sold by the more than 1,000 specialised computer stores. Many other distribution channels are being tested. In particular, a number of department stores are introducing a microcomputer line. Radio and TV stores are also modestly introducing microcomputers.

Marked preference

However, at least in the U.S., buyers seem to have a marked preference for a specialised computer store which gives service after the sale, brings them new products, and makes required changes or updates.

Unless such specialised personnel can be available at the retail outlet, it is unlikely that a complete system can be sold. Department stores are not likely outlets for general-purpose microcomputers, but they carry games-orientated products.

The situation in Europe is altogether different. Microcomputers are sold in a variety of ways. There are relatively few active computer stores. Depending on the country, they may be sold through established radio or electronics stores, directly through magazines, or by agencies set-up by the manufacturers or their distributors.

By and large, most European users are not as aware of the status of microcomputer products as users are in the U.S., so they tend to attach more importance to traditional safeguards. That might be a possible explanation for the marked preference by many customers for established, older, and more traditional stores.

Computer stores are also severely handicapped by their lack of capital, by the delays in securing products, and by the fact that they can seldom offer a comprehensive assortment of equipment. All of those handicaps lead to serious user frustration.

Although national microcomputers have been built in most European countries, only a few have experienced European-wide sales; most have been sold only nationally. It is not easy for those companies to bring information on the existence of microcomputer products to the attention of purchasers in other countries.

Most European companies are not

accustomed to the direct style of public relations used by U.S. companies, and will often fail to react to simple requests for information. Cajoling and begging may be necessary to obtain the required information.

A number of those companies are perhaps convinced that they have access to some protected share of the market, either because of a large parent company, or because of their specific competence. Often, however, they may not have the flexibility required to service the general public market at large.

It can be hoped that this will be corrected within the not-too-distant future and that several of the systems will become widely accessible throughout Europe.

Several factors must be examined to evaluate the prospect of existing companies. First, the microcomputer board itself will, with time, continue to diminish in size as LSI circuitry progresses. Again, the dominant cost of the system will be with the peripherals: the CRT display, the printer and the disc required for reasonably quick storage.

Manufacturers capable of mass-producing all or most of the peripherals will reap the highest benefits, and, thereby, be in the best position to sell products on a competitive basis. Once an adequate customer education is achieved, the companies with the best capabilities for integrated mass production will be in the best position to compete on a price basis.

Second, one can expect that the usual devices of protectionism will be invoked in many European countries as soon as governments realise the commercial and industrial impact of microcomputers. Such measures will relate to radio frequency norms, shielding, electrical protection, in addition to various other norms — most of them different or incompatible from one European country to another, e.g., colour standards for televisions, etc.

As long as the market does not become overly restricted by such devices, U.S. companies have an excellent potential for capturing first rank in the markets in most European countries. They are also likely to retain this position once they have obtained it.

A number of European companies have emerged, however, that are taking advantage of various governmental devices for protectionism and financial aids, and that have established viable operations. If additional devices for protectionism are invoked, they could have an impact on a significant share of the national market. In such an instance, the long-term result of such a policy might be to isolate that particular country from the world-wide benefits of microcomputerisation.

The essential usefulness of microcomputers today is to perform practical services. That requires the availability of software and it is just not practical to adapt software from one microcomputer to another. Any national microcomputer,

if it is to have long-term value and benefits, should, therefore, be a copy of a leading U.S. microcomputer.

European government intervention might lead to short-term benefits for selected national companies at the expense of potential users, who will be penalised by the unavailability of usable software, while other neighbouring countries will have access to it.

Only specialised segments of the European population will be reached by the microcomputer industry in the near future. The short-term market is likely to be much more fragmented in Europe than in the U.S. and there will be more focus on specific professional categories within each country. In the long-term market, however, every educated segment of the professional population will eventually be reached.

Assessing the market by speaking to the manufacturers may provide, at best, highly-tentative data as most manufacturers may not even know to what kind of a market they have access nor are they willing to discuss it.

Discussing the market with computer store owners is also, at best, tentative, since many computer store owners are entrepreneurs rather than technicians and have only a feel for the local market to which they have access.

Public events

Probably the best way to assess the market is to attend large-scale public events such as congresses and shows focused on microcomputers — provided they are attended by qualified participants.

Qualified participants does not mean that the visitors attend just to gawk at the equipment, and to ask endless questions with no intention of buying a microcomputer.

Participating in such events or talking to companies which have exhibited at such events provides a much more accurate idea of the new segments of the market in microcomputers.

The dice are still rolling. While the market has somewhat stabilised in the U.S., it is still fluctuating in Europe, and several years may pass before a stable pattern becomes visible. The share of the total market that any single company can dominate in Europe might seem small by U.S. standards.

For example, if a company were to capture the equivalent of 10 percent of the U.S. market, that might seem small, except that a leadership position in many European countries is hard to dislodge, and insures that the company will keep the major share of the available market.

In other words, a well-managed company with good European marketing could achieve sales in Europe which might represent only seven percent or eight percent of the total sales in the U.S., but that might represent 50 percent or 80 percent of that particular company's U.S. sales. The race is still open. □



Practical Computing

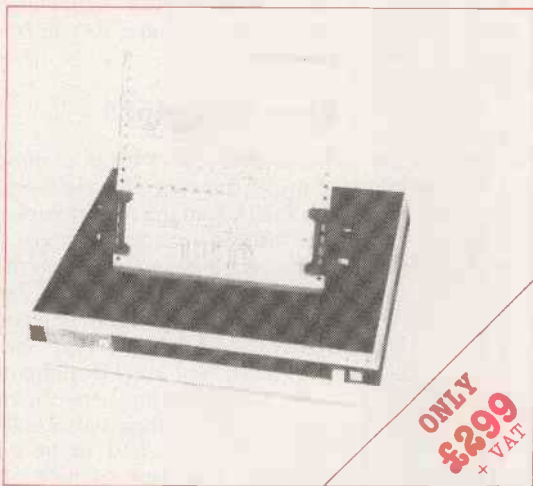


Special Christmas Offer!

Not one but two Printers!
Something for Everyone at a price
you can afford!

Either the

SUPER PRINTER 800



**ONLY
£299
+ VAT**

The standard features in this Printer make it compatible with almost any Micro — take a look.

*RS-232, 20mA, IEEE 488 and Centronics I/O *15 Baud rates to 9,600 *100 Chrs. per second — Bidirectional *6 print densities 60, 72, 80, 96, 120 or 132 Chr/line *Self test switch *96 Chrs. ASC II Standard *Auxiliary User Defined Ch. set *Tractor and fast paper feed/graphics *2k Buffer *Accepts 8½in. max. paper pressure feed and 9¼in. max. paper tractor feed.

All this for £299 + VAT (Please add £3.50 P&P).

Make cheques payable to Watford Electronics
and send to Practical Computing Xmas Offer
Room L311
Quadrant House
The Quadrant
Sutton
Surrey SM2 5AS

Or the

OKI MICROLINE 80



**ONLY
£350
+ VAT**

They call it the world's most reliable printer. The quietest Dot Matrix available. 40, 80, or 132 cols per line. *excellent print quality *3-way paper handling: Letterheads, Fanfold, or Paper Rolls *Graphics *Ideal for software written for large 132 col printers *Continuous rating printing day in and day out *Centronics parallel standard. Options: RS-232, PET, APPLE.

A once only price of £350 + VAT (Please add £6.00 P&P)
Make cheques payable to London Computer Centre
and send to Practical Computing Xmas Offer
Room L311
Quadrant House
The Quadrant
Sutton
Surrey SM2 5AS

**Hurry! Offer must end January 7th 1981.
So Order NOW.**

Evaluating microprocessors for real-time service

SOME physical experiments require high, real-time data-processing rates to sift desired information from extraneous clutter and noise. In many cases, commercial signal-processing instruments are available to perform the task but there are situations which call for the development of a special-purpose data processor.

If the processing rate is lower than 10^3 - 10^4 bytes s^{-1} the first law of microcomputers, *EDN*, 1977, will usually apply: Over a wide range of applications, any CPU board will do.

However, when data rates exceeding 10^4 bytes s^{-1} require to be processed in real time the choice of microprocessor types become critical. That was the case in a signal processor being developed for a radar meteor detection system. The real-time data enters the processor at a fixed rate of one byte every 33 microseconds, which severely limits the scope of operations attainable with available microprocessor types.

Speed comparison

Accordingly, a comparison of the effective processing speeds of various microprocessors was undertaken. The starting point is the manufacturer's recommended clock cycle time T_c , which lies between 100ns and one microsecond for all microprocessor types considered.

Anywhere from one to 20 clock cycles are required for a machine cycle in which the microprocessor completes an externally meaningful change of state, e.g., fetching a byte from memory and placing

it in the low order byte of the program counter.

Let this number be N_m , so the machine cycle time T_m will be $T_m = N_m T_c$.

In some cases, N_m varies, so it is better in such cases to set $N_m = 1$ and absorb the variation in the factor N_i , which is then the average number of clock cycles per instruction. Otherwise N_i is the average

by C S L Keay

number of machine cycles per instruction.

N_i is the first factor which can vary according to the task being performed, but the variation would be within a factor of two for all but the most unusual or specialised programs. The minimum possible value of N_i is included in the comparative figures in table 1 to indicate the lower limit for this factor.

Attempts to utilise only those instructions requiring the fewest machine cycles will generally produce programs containing more instructions, which is self-defeating.

The average time per instruction is therefore

$$T_i = N_i T_m = N_i N_m T_c$$

In signal processing and other compact data-manipulation programs, a very reasonable benchmark routine is the one devised by Osborne, *et al.*, 1977, and applied by them to a wide range of microprocessors. For realism, the loop in the program is counted 10 times to give less weight to the initialising instructions.

The resulting program run times T_p are

listed in table 1 with the factor N_p which is the number of instructions per benchmark program. Thus, we may write

$$T_p = N_p N_i N_m T_c$$

The values of T_c , T_m , T_i and T_p are shown diagrammatically in the chart, figure 1, which reveals more clearly how given microprocessors compare in terms of speed. The chart emphasises the importance of evaluating microprocessors by the use of benchmark assessments rather than naive comparisons based on clock or machine-cycle speeds or even instruction timing.

The results in table 1 are concordant with other published benchmark results, such as the 12 test results from three sources collated by Boisvert, 1977, and the Basic compiler benchmarks published by Rugg and Feldman, 1977.

The bi-polar 8×300 microcontroller, as its manufacturer prefers to call it, is the fastest performer by almost an order of magnitude. However it is expensive, a power-hog and difficult to use because it is 16-bit instructions, 8-bit data words are in separate memory areas and self-modifying code is not possible.

Even so, we have used it very successfully for high-speed digital image-slicing applications where its sheer speed is essential.

Slower versions

The next two 8-bit microprocessors in terms of run-time, T_p are the 6502A and the Z-80A running almost neck and neck. The slower versions of those two processors are among the next in order and it is no accident that they are by far the most widely-used in modern microcomputer systems — Apple II, Pet, Sorcerer and TRS-80 are well-known examples.

In distinguishing between the Z-80A and the 6502A, their individual strengths and weaknesses had to be considered carefully. The great strength of the Z-80 architecture lies in its ability to transfer data at very high rates provided the data does not require to be processed or modified on the way. For data communication, input/output control, file manipulation and database management the Z-80 is much better than the 6502.

However, the 6502 in a signal-processing role offers the advantage of an elegant instruction set with more flexible addressing modes and excellent zero-page capability which, in effect, provides 256 registers with almost the power of the 20 on-chip registers in the Z-80, of which only two permit indexed addressing.

When taking into account the full-memory reference capability of the 6502

Table 1.

PROCESSOR	f MHz	T_c ns	N_m	T_m ns	N_i	N_i MIN.	T_i	N_p	T_p
PACE ^a	1.33	750	4	3000	5.1	4	15.3	65	995
SC/MPII (8060)	4	250	4	1000	15.9	5	15.9	50	795
F8	2	500	4	2000	2.4	1	4.8	69	332
6100 [PDP-8]	4	250	20 ^b	5000	1.2	1	6.0	50	300
2650	1.25	800	3	2400	3.7	2	8.9	33	294
6800	1	1000	1	1000	4.9	2	4.9	56	274
8080A	2	500	1 ^c	500	7.7	4	3.9	65	254
COSMAC (1802)	6.45	155	8	1250	2.1	2	2.6	74	192
2650A-1	2	500	3	1500	3.7	2	5.5	33	184
9900 ^a	3	333	1 ^c	333	16.0	8	5.3	32	171
8085	3.10	320	1 ^c	320	7.7	4	2.5	65	162
CP1600 ^a	5	200	2	400	8.0	4	3.2	45	144
6800B	2	500	1	500	4.9	2	2.45	56	137
6502	1	1000	1	1000	3.0	2	3.0	45	135
LS1-11 ^a	10	100	4	400	14.0	13	5.5	24	130
Z-80	2.5	400	1 ^c	400	19.5	4	7.8	15	117
Z-80A	4	250	1 ^c	250	19.5	4	4.88	15	73
6502A	2	500	1	500	3.0	2	1.5	45	68
9440 ^a	10	100	2	200	6.9	5	1.4	47	67
8x300 ^d	8	125	2	250	1.0	1	0.25	34	8.5

a. 16-bit processor

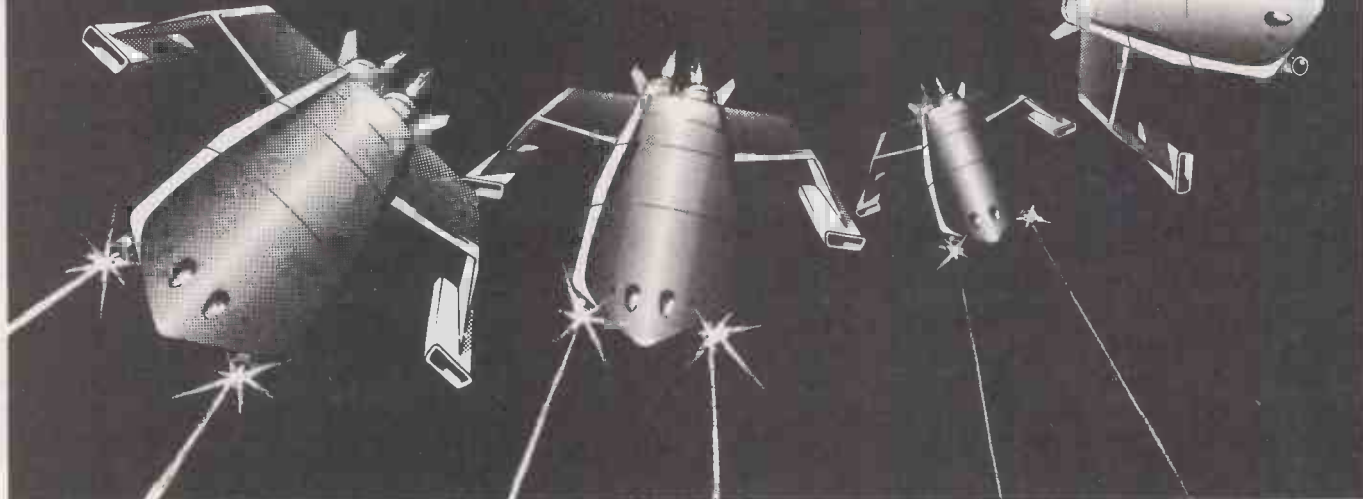
b. Fetch and execute cycle

c. Varies; so refer T_m to T_c directly

d. 16-bit instruction; 8-bit data.

Practical Computing presents a Basic program of the famous invasion pub game, which is fast enough to offer a challenge to most players.

Space Intruders



SPACE intruders is perhaps the first effective attempt at using a Basic language — and hence transportable — program to simulate the zap-the-greenies game which has contributed to a national small-change shortage in Japan and seems to have taken over every pub in the U.K.

For those who have already spent £10s on the game, I have included extensive notes on conversion of the game to machines other than the Apple II for which it is written, and I have outlined a few variations you might like to try when you have the version of the game listed up-and-running satisfactorily.

Two main techniques are used to optimise the speed of the game, which is potentially the greatest problem when trying to write such a program in Basic. Firstly, the flow of the game has been adjusted very carefully so that only the essential operations occur in the main loop of the program but that the chrome, e.g., the appearance of the command ship across the top of the screen, still operates at regular intervals to keep the game interesting.

Second technique

The second technique used is rather more machine-dependent. Up to a limit of about 100 characters on a line, multiple-statement lines are used to speed program execution. They involve one special Apple integer Basic feature I often find useful — most interpreters will ignore all statements on the same line after a THEN if the IF condition is not satisfied, whereas the Apple language ignores the statement only immediately following the THEN.

To convert that feature to a different brand of Basic, either use a new line after

each THEN or follow each conditionally-executed statement with an ELSE if you have the facility to do so.

Most interpreters run subroutines at the start of program RAM faster than ones later in memory, so the order of sections of the listing has been set out to reflect this. Likewise, if you define the variables to be used most often by the program as

by Simon Goodwin

early as possible in it, in order of utility, your machine's access to them should be accelerated.

Use integer variables if possible, as they can be handled far more quickly than floating-point ones, and if your language does not use a semi-compiled format — does it check for syntax errors after the entry of each line? — try to avoid using numeric constants as opposed to variables as each time the computer executes them, it may have to convert them to its own number-format for processing, which takes time.

The listing of the game uses quite a few CALLs to a machine-code sound-effect routine, and they can be deleted if not compatible with your computer, to speed things. Fast graphics access of the Set, Reset, point variety, as on TRS-80, Nascom 2, etc., is required on a 40 by 40 co-ordinate grid, but a keen memory-mapped VDU user could probably produce a working version on 16 lines of 32 characters at a pinch.

Most will, I suspect, be quite familiar with the various arcade versions of the game. On the screen are displayed, at first four rows of five multi-coloured enemy spacecraft. You control a laser cannon which can move under your control across

the bottom of the display firing upwards at the spaceships when instructed to do so from the keyboard.

Between you and the enemy at intermittent intervals are piles of shields which protect you from bombs dropped continuously and at random by the invaders. Those shields also tend to be in your way if you try to shoot through them.

You aim to destroy the spaceships as fast a rate as possible without being hit by their bombs. Your score is based on the number of spaceships you hit before they destroy you.

The game is made more difficult by the fact that the columns of spaceships move back and forth across the screen as you do your best to hit them, and whenever the edge of a row disappears from the end of the screen or when you have destroyed all 20 attackers — extra points for that — they return moments later, reinforced and lower on the display, giving you less and less time to avoid their bombs.

Command ship

When all that grows boring, every so often the green alien command ship dashes across the top of the screen, giving you 300 points if you plug it with your laser before it vanishes.

In the program listed, I have used a repetitive system with the array R to store ones and zeros to tell me whether a given spacecraft in the formation is destroyed. Two-dimension arrays would offer a much better system and I feel the technique used is not the best for the job, if a re-write is intended. The system is used to prevent reincarnations of spacecraft as they move.

The key to the operation of a fast Basic game is that only what absolutely has to

be done at a given time is implemented. The main part of the program, sections four, five and six, are run in a tight loop to keep the bombs falling and the laser moving or firing as fast as possible.

At every third move, the slower routine one is called to move the aliens around, check that the screen is not empty, print the score, and catch-up generally on less immediate business.

For nine out of every 80 turns, the machine displays the moving command ship, doing a special branch to an add-on routine which moves the alien commander's ship, and keeping speed up by dispensing with the move-invaders routine one for a few turns.

The listing of the game is in Apple integer Basic, which will need conversion for other machines. In addition to the point mentioned earlier about the IF... THEN construct, there are a few other special machine commands in the listing. Peeks Pokes and Calls are used to generate sound effects, scan the keyboard and clear the screen. All should be deleted, and any loops containing those instructions can also be removed.

Line 580 is used to initialise the variables: use DEFINT on other machines or just set the values to zero in the order given — remember the earlier a variable is encountered by Basic, the quicker it will be found in the variable-table when later accessed.

Graphics modes

The GOSUB 740 initialises the tone subroutine and is now redundant. The GR and TEXT commands set graphics and text modes respectively, and should be replaced by the equivalent commands, if needed, for your machine.

Lines 260-290 scan the keyboard of the Apple. If you do not have a keyboard-scan Get instruction which does not halt processing, try 260 INKEY or GET M/270 IF M#2.../280 IF M#4...290 IF M#9... For a Tandy Model 1 use 260

Variables

R%(%) = Aliens hit matrix.
 V (%) = Vertical Bomb position.
 H (%) = Horizontal Bomb position.
 X = Laser fire X co-ordinate.
 Y = Laser Fire Y co-ordinate.
 L, M, N, General-purpose fast-access variables.
 G = Laser Gun position.
 S = Player's score.
 T = Number of turns passed.
 V = Vertical Intruder position.
 H = Horizontal Intruder position.

M = PEEK(-14340) 270 IF M#128... 280 IF M#4... 290 IF M#1... and press keys W or R to move and P to fire.

The Apple has a 24-line screen and only the bottom four lines are available for test while the graphics display is in use. Hence, the VTAB and TAB instructions are used to set the absolute print positions of messages. The MOD function returns the remainder of two numbers after division, i.e., 26 MOD 10 = 6.

For other Basics, X MOD Y should evaluate as X-INT(X/Y)*Y for positive numbers. Put in INTs as needed if you decide to throw caution to the wind and use floating-point variables. Delete the REMs to speed things up if necessary.

When describing the graphics, I will assume that you have a black-and-white TV displaying graphics in a manner similar to TRS-80, e.g., SET (X,Y) turns on a dot, RE-SET (X,Y) turns it off, and POINT (X,Y) returns 0 if there is nothing at a position and a positive number if that position is SET.

Apple graphics uses a 40 by 40 screen area, with the origin (0,0) at the top-left of the display. The manual says that this feature is a specially useful one, but does not say why. A PLOT command corresponds to either SET or RESET depending on the most recent COLOR = statement. If colour is zero it is RESET, otherwise use SET. Now, you can delete all the COLOUR statements.

The SCRN feature on Apple is the equivalent of POINT elsewhere. The really impressive features are HLIN and VLIN, which have equivalents in TRS-80

level four Basic. Those plot lines, e.g., HLIN X,Y AT Z does a series of SETs — or RESETs if the last colour used was zero — along a horizontal line at height Z from positions X to Y inclusive. VLIN X,Y AT Z draws a vertical line at position Z from X to Y, inclusive.

I hope you do not feel, having read through the list of alterations for other Basics, that you are confronted by a really massive task, because if you follow the instructions carefully, you should quite quickly have with a game a cut above the average which is already rapidly wearing-out the keys of a few computers and running successfully — you may also have learnt something about dialects of Basic into the bargain.

You should by then also be able to change parts of the program to suit your own tastes, doing anything from changing the keys used — on the day when two, four, and nine disappear into the case of your machine as things grow somewhat hectic — through to building-in various extra features of your own design. I have tried several variations.

Alternative game

'Armed Intruders' is a game for masochists which replaces the line randomly choosing the position of the next bomb to fall, with one setting the position to G+RND(3)-1, where G is the gun position and RND(X) returns a truly random integer between 0 and X-1, in this case 0, 1 or 2.

It could be arranged to choose either a random or a determined bomb position alternately by using IF T MOD 2 = 0

If checks are incorporated to ensure that no bombs go off the screen, they can be made to move diagonally or zigzag, which gives the extra possibility of collisions between them.

The fire of the laser could be set to travel at the same speed as the bombs or to zigzag also. That is why two different variables are used for X and G.

```

>LIST
99 REM ***** JUMP TO INITIALISE *****
100 GOTD 580
109 REM ***** CLEAR HIT ARRAYS *****
110 FOR M=1 TO 5:R1(M)=1:R2(M)=1:R3(M)=1:R4(M)=1: NEXT M: RETURN

119 REM ***** COMAND SHIP ROUTINE *****
120 R1=(T MOD 80)-70+4: COLOR=0: HLIN R1-4,R1-3 AT 2: POKE 0,
40: POKE 1,3: CALL 2
130 COLOR=9: HLIN R1,R1+1 AT 2: IF R1<34 THEN 250: COLOR=0: HLIN
R1,R1+1 AT 2: GOTD 250
139 REM ***** MOVE ATTACKERS *****
140 COLOR=0: FOR L=0 TO 12 STEP 4: HLIN 1,3R AT V-L: NEXT L
150 M= RND (3): IF M=1 THEN M=0:M=M+1: IF M<12 AND M>0 THEN 170

160 R1=0:V=V+2: IF V>32 THEN 770:M=31: GOSUB 110
170 FOR L=1 TO 5:M=M+L*6-6
180 IF R1(L)=0 THEN 190: COLOR=(V MOD 14)+1: HLIN M,M+2 AT V
190 IF R2(L)=0 THEN 200: COLOR=(V+2) MOD 14+2: HLIN M,M+2 AT
V-4
200 IF R3(L)=0 THEN 210: COLOR=(V+3) MOD 14+2: HLIN M,M+2 AT
V-8
210 IF R4(L)=0 THEN 220: COLOR=(V+5) MOD 14+2: HLIN M,M+2 AT
V-12
220 NEXT L: VTAB 22: PRINT S: TAB 1: GOTD 250
229 REM ***** MAIN LOOP START *****
230 T=T+1: IF T MOD 80=70 THEN 120: IF T MOD 30=0 THEN 250
240 GOTD 140
249 REM ***** DRAW GUN/NEXT COMMAND *****
250 COLOR=0: HLIN G-1,G+1 AT 37: PLOT G,36: PLOT X,Y
260 M= PEEK (-16384): POKE -16368,0
270 IF M#178 THEN 280:G=G-2: IF G<2 THEN G=2
280 IF M#180 THEN 290:G=G+3: IF G>37 THEN G=37
290 IF M#185 THEN 310
300 POKE 0,50: POKE 1,15: X=G+Y+36
310 COLOR=3: HLIN G-1,G+1 AT 37: PLOT G,36
319 REM ***** MOVE YOUR FIRE *****
320 IF Y<4 THEN 490
330 COLOR=0: PLOT X,Y:Y-2: COLOR=4: PLOT X,Y:M= SCRNX,Y-1: SCRNX
X,Y-2: IF Y>3 AND M=0 THEN 330
340 IF R1=0 OR Y>4 THEN 370: IF G>35 OR X>R1+1 OR X<R1 THEN 370
1: COLOR=6: PLOT R1-1,2: PLOT R1+2,2
350 FOR L=-5 TO R1: POKE 0,100-ARS (L)+10: POKE 1,6: CALL 2
360 NEXT L: COLOR=0: HLIN R1-1,R1+2 AT 2:T=T+9:S=S+300:R1=0
370 FOR N=1 TO 4: IF X#M(N) THEN 380: COLOR=0: PLOT M(N),V(N):V(
N)=39
379 REM ***** CHECK FOR EXPLOSION *****
380 NEXT N: IF M=0 THEN 490: COLOR=13: HLIN X-1,X+1 AT Y: PLOT
X,Y-1: PLOT X,Y+1
390 COLOR=11: HLIN X-1,X+1 AT Y: PLOT X,Y+1: PLOT X,Y-1: FOR N=
0 TO 5: POKE 0,-N*7+120: POKE 1,3: CALL 2
400 NEXT N: COLOR=0: HLIN X-1,X+1 AT Y: PLOT X,Y+1: PLOT X,Y-1:
M=X*M
410 IF M<0 OR (M MOD 6)>2 OR Y>30 OR M>29 THEN 490:M=M/6+1
419 REM ***** DESTROY BOTTOM ENEMY UNIT *****
420 IF R1(M)=0 THEN 430:R1(M)=0: GOTD 480
430 IF R2(M)=0 THEN 440:R2(M)=0: GOTD 480
440 IF R3(M)=0 THEN 450:R3(M)=0: GOTD 480
450 IF R4(M)=0 THEN 460:R4(M)=0: GOTD 460
460 IF R4(1)+R4(2)+R4(3)+R4(4)+R4(5)=0 THEN 480: FOR L=0 TO 4: FIM
M-2 TO 5: POKE 0,100-L*10-ARS (M+6): POKE 1,6: CALL 2
470 NEXT M,L:M=100:S=S+100: VTAB 23: GOTD 140
480 S=S+(40-Y)*(Y+2)+1:Y+2
489 REM ***** CHECK FOR NEW MISSILE *****
490 FOR N=1 TO 2:R4(1)+R4(5): COLOR=0: PLOT M(N),V(N): IF V(N)<
37 THEN 520:V(N)=V+1
500 L= RND (5): IF R4(L+1)=0 THEN 570:H(N)=M+L*6+1: POKE 0,25: POKE
1,5: CALL 2
510 POKE 0,50: POKE 1,5: CALL 2

```

(continued on next page)

(continued from previous page)

```

519 REM ***** MOVE MISSILE & CHECK FOR HIT *****
520 V(N)=V(N)+2: COLOR=1: PLOT H(N),V(N):M= SCRN(H(N),V(N)+2)+ SCRN(
    H(N),V(N)+1)
530 IF M=0 THEN 570: COLOR=4: VLIN V(N),V(N)+2 AT H(N): FOR L=0
    TO 5: POKE 0,-L*6+90: POKE 1,3: CALL 2
540 NEXT L: COLOR=9: VLIN V(N),V(N)+2 AT H(N)
550 COLOR=0: VLIN V(N),V(N)+2 AT H(N): IF H(N)<G-1 OR H(N)>G+1 OR
    V(N)<34 THEN 560: GOTO 770
560 V(N)=39
570 NEXT N: GOTO 230
579 REM ***** INITIALISE EVERYTHING *****
580 L=M=N=X=Y=G=S=T: GOSUB 740
590 DIM V(4),H(4),R1(5),R2(5),R3(5),R4(5)
600 GOSUB 110
610 FOR L=1 TO 4:V(L)=36:H(L)=0: NEXT L
620 TEXT : CALL -936
630 PRINT "*** SPACE INTRUDERS 42 INTEGER BASIC ***"
640 PRINT " WRITTEN BY SIMON GOODWIN, (C) 1980. "
650 PRINT " PRESS 2 TO MOVE LEFT, 4 TO MOVE RIGHT "
660 PRINT " AND 9 TO FIRE YOUR LASER."
670 FOR L=0 TO 2000: NEXT L
680 GR : VTAB 22: PRINT " : CURRENT SCOREBOARD."
689 REM ***** SET POSNS. & SET UP SCREEN *****
690 T=0:S=0:V=15:G=19: COLOR=6: HLIN 0,39 AT 38: COLOR=2
700 FOR L=0 TO 3: FOR M=1 TO 3
710 HLIN 5+L*8,8+L*8 AT 27+M*2: NEXT M: NEXT L
720 COLOR=12: HLIN 0,39 AT 0:H=7:Y=1: VLIN 1,38 AT 0: VLIN 1,38
    AT 39
730 GOTO 140
739 REM ***** APPLE SOUND ROUTINES *****
740 POKE 2,173: POKE 3,48: POKE 4,192: POKE 5,136: POKE 6,208: POKE
    7,4: POKE 8,198: POKE 9,1: POKE 10,240
750 POKE 11,8: POKE 12,202: POKE 13,208: POKE 14,246: POKE 15,166
    : POKE 16,0: POKE 17,76: POKE 18,2: POKE 19,0: POKE 20,96
760 RETURN
769 REM ***** INTRUDERS HIT THE DECK *****
770 IF V>32 THEN PRINT "!!!!!! THE INVADERS LAND ! !!!!!!! "

780 IF V<33 THEN 790: FOR L=0 TO 39 STEP 2: COLOR=(L MOD 14)+1:
    VLIN 33+ RND (7),39 AT L: NEXT L: FOR L=0 TO 2000: NEXT L
789 REM ***** INTRUDERS DELETE YOU *****
790 PRINT "THE INVADERS DESTROY YOUR LASER CANNON !"
800 FOR L=1 TO 150: POKE 0,100- ABS (100-L)/2: POKE 1,5: CALL 2

810 NEXT L: PRINT "!!! YOU ARE CAPTURED AND DISSECTED. !!!"
820 FOR L=1 TO 26: COLOR=L: PLOT G-1,37: PLOT G,36: PLOT G+1,37
    : PLOT G,37: POKE 0,50-L: POKE 1,6: CALL 2
830 NEXT L
840 FOR M=0 TO 3: FOR L=1 TO 10: POKE 0,118-L*10: POKE 1,4: CALL
    2
850 NEXT L,M: TEXT
860 PRINT : PRINT "FINAL SCORE WAS ";S
869 REM ***** CLEAR SCREEN & SCAN KEYS *****
870 FOR L=1 TO 17: PRINT : NEXT L: PRINT "TYPE 'A' TO RUN AGAIN
    : "
880 IF PEEK (-16384)<128 THEN 880
890 M= PEEK (-16384): POKE -16368,0
900 IF M>175 AND M<186 THEN 880: IF M=193 THEN 600
910 END

```

“If you want what’s best for your PET, choose Commodore software.”



Kit Spencer
General Manager
of Commodore Systems
360 Euston Road
London NW1 3BL

The Commodore PET is Britain’s best selling micro-computer, with over 10,000 already installed in a wide range of fields, including Education, Business, Science and Industry.

This has led to a tremendous demand for high quality software.

And Commodore has met this demand by producing a first class range of programs, now available from the nationwide network of Commodore Dealers.

Commodore’s support also includes training courses, a Users’ Newsletter and Official Approval for compatible products of other manufacturers who reach agreed standards.

COMMODORE PETPACKS



Over 50 Petpacks of programs are available (mainly on cassette) from Commodore Dealers.

These cover such popular titles as Strathclyde Tutorial, Statistics pack 1, Assembler Development System, Stock Market Trends and the Treasure Trove Collection of game packs including the award winning Star Trek, which is packaged with Petopoly. Prices are from £5 to £50.

TRAINING COURSES AND SEMINARS

PET systems are simple to use and any normal advice or assistance

OZZ The PET Information Wizard

The Wizard - OZZ is the first computer program ever to give you real freedom to tackle your problems in your own way.

That is made possible because OZZ is an advanced information system capable of ‘magical’ transformation allowing you to perform an almost limitless range of tasks.

It has intelligent features that let you decide its working parameters.

You choose what information to store, what calculations to make, how reports and lists are printed and so on. Even if you’ve never been near a computer before, the Wizard will help you set OZZ to meet your individual requirements.

you may need can be obtained from Commodore Dealers.

On the other hand, for rapid training on a basic or advanced level, you will certainly be interested in Commodore’s intensive 2 and 3 day residential courses. We also run one day general appreciation seminars.

PET USERS’ NEWSLETTER

This is Commodore’s official method of sharing new information and ideas between the many thousands of PET users. The newsletter is published regularly and for an annual subscription of £10 you can start receiving copies now.

Look out for this sign. It tells you that compatible products of other manufacturers have met with our standards of approval.



To: Commodore Information Centre, 360 Euston Road, London NW1 3BL 01-388 5702

I am a PET owner Please put me in touch with my nearest dealer

Please send me details of: Commodore PET Software

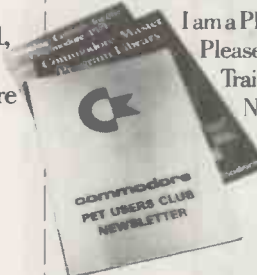
Training Courses & Seminars I would like to receive the Users’ Newsletter and enclose £10 annual subscription

PC12

Name _____

Address _____

Tel. No. _____



commodore
We made small computers big business.

• Circle No. 161

Multiple-choice tests with the micro as question master

IN THE classroom, lessons can be improved by good questioning techniques which help to consolidate the information imparted to the student. The computerised lesson can, to some extent, improve on the ordinary lesson by individual questioning rather than the group method employed in the general classroom.

That type of questioning is limited to the scope of the immediate subject matter of the lesson, whether in the class or computer room. To check the progress of each student over a period of time, examinations and class tests are a useful teaching tool, providing not only a check of progress, but also revision and consolidation of the subject as a whole.

There are three types of question paper in general use for examinations and tests. The written-answer paper is perhaps the easiest to set, but the most difficult to mark, particularly if the teacher attempts to allocate the task to the computer. The short-answer paper needs carefully-worded questions if ease of marking is to be achieved, particularly if marking is to be passed to the computer, where the program can look for key words within a short answer — but which otherwise could be gibberish. The easiest type of question paper for the computer to handle is the multiple-choice test.

Plausible answers

The multiple-choice question consists of a well-defined question, short and to the point, together with four plausible answers, only one of which is the correct

answer, the other three are known as distractors. The student has to choose the correct answer simply as A, B, C or D. Some versions of the test have more distractors, or sometimes more than one correct answer to be chosen; those versions are off-shoots of the pure form of the multiple choice ideal.

As the student has only to select the answer, there is less examination strain imposed, yet a wide range of the subject can be covered by many questions, which can be answered in a short examination time as no writing is involved. Answering is usually on a special answer sheet with

by Rex Tingey

crosses marked in appropriate squares; marking is carried out using a masking sheet where only the correct crosses can be seen through the mask.

In the computer, each question, together with its answers, can be presented on the screen, found from multiple-banked data for ease of extraction by the program. So that the program can be suitable for both examination and revision purposes, the displayed question must be answered correctly before proceeding to the next question; marking is, therefore, rather different from the paper examination.

The multiple-choice test was developed by the education branch of the RAF as the only practical way of testing the progress of the vast numbers of recruits under training during the Second World War, and afterwards, during National Service.

The research, methods and conclusions have been accepted by modern education authority.

In particular, the test is more useful than other examination methods since each result can be subjected to detailed analysis, and the analyses as a whole used to determine many factors, even to finding the success and level of teaching methods prevailing.

The major use of the analysis is to determine the success of the set of questions, and to allocate, or re-allocate, a difficulty factor to each question in the set. A set of questions should have a range of difficulty factors which approximate a Gaussian standard-deviation curve in distribution. Thus, whenever a set is used, the results should be analysed to re-allocate the positioning. Then, ideally, questions should be selected from a store of questions which cover the whole range of factors.

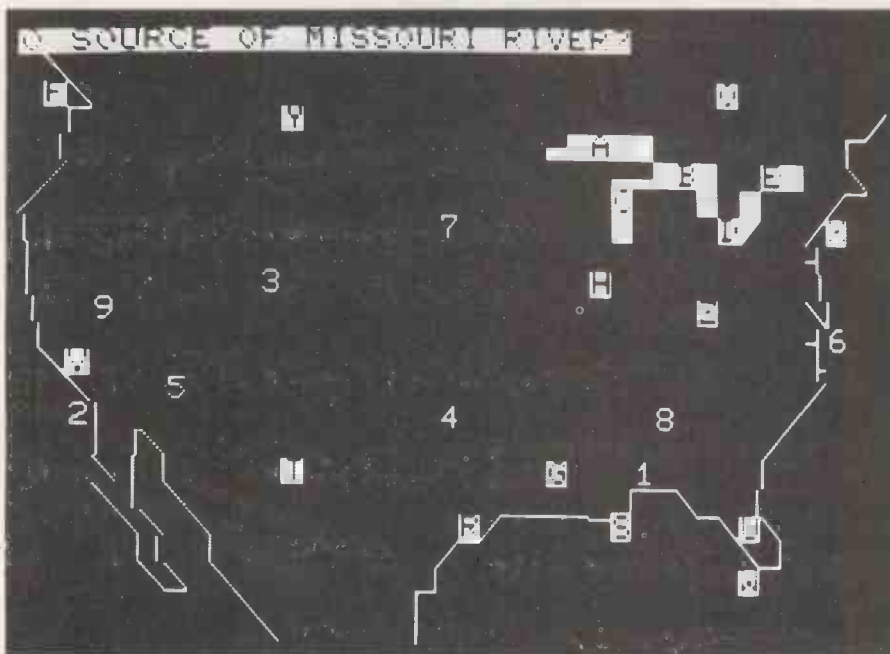
Difficulty factor

If a question shows a particularly high difficulty factor — many students answer it incorrectly — it should be reviewed for ambiguity after checking that it is in the syllabus being taught. No question in a multiple-choice test should be ambiguous. Questions must be kept short, with only one possible answer and answers should be brief, with the distractors relevant or apparently relevant.

That is, of course, where the limitation of this type of test starts, with the requirements of a complex subject needing complex questions with a multitude of answers. However, it can be interesting and surprising to find how a seemingly complex question can be broken-down to several useful multiple-choice questions, each with a short answer.

The programs given are sets of 50 questions, each covering three types of geography papers; regional U.S., regional U.K. and physical geography. Each of the three will fit into less than 8K when run, and provide a running score and a final result. The two regional programs provide a map of the country on which the questions are based, and the map appears on the screen with a question at the top. Whenever a question based on the map is being asked, any key pressed brings the question plus the four answers on to the screen. Further immediate consultations of the map can be obtained by pressing any key but A, B, C or D; pressing one presumes an answer.

While all the questions and answers, as listed, are in upper-case, they should be re-written in upper- and lower-case for a



Now you can control your business for less than £2,500.

This could be your best investment opportunity yet. A complete computerised business system, including a Floppy Disk Unit, high-speed Printer and *Britain's best selling microcomputer* – the Commodore PET. All for under £2,500.

First Class Programs

A comprehensive range of first class programs is offered by *Commodore 'Business Software' Dealers*. These are available on disk from £50-£500. And they cover such applications as *Business Information, Stock Control, Word Processing, Payroll, Accounting and Mailing Systems*.

Service and Support

With over 10,000 PET computers installed in the UK, dealer support is growing fast. A nationwide network of 90 official

Commodore 'Business Software' Dealers ensures that service and technical facilities are close to every PET user. Our dealers can even offer you a 24 hour on-site maintenance agreement.

Training and Instruction

The PET Business System is self-contained and simple to use. Should you require personalised programs or extensive installation training this can be arranged with your *Commodore 'Business Software' Dealer* who can also give details of official *Commodore Training Courses*. These include intensive 2 & 3 day workshops to train you to write your own programs.

For full details about the Commodore PET Business System, Training Courses, Programs, and *'Business Software' Dealers*, simply fill in the coupon and post today.



To: Commodore Information Centre,
360 Euston Road, London NW1 3BL

Please send me details of the PET Computer Business Systems.

Name _____

Position _____

Company _____

Address _____

Tel. No. _____

If you have a particular application in mind please specify:

PCB.12

commodore
We made small computers big business.

• Circle No. 162

Software experts tackle last stage of Tuscan's development

Mike Hughes, in his final comments, opens and closes the last part of our series on the development of the Transam Tuscan written this month by the software designer, Brendan Owen.

TO TEST the prototype Tuscan, we took a section of the proven Triton monitor, written in 8080 code, and patched in the relatively few modifications to allow it to work within the hardware configuration of our new embryonic machine.

As the Triton monitor was available in assembly language source code, it was a very simple matter to change its address location and the designated ports for the I/O interfaces — VDU and keyboard — before re-assembling the program to sit at the top end of memory.

It was also possible to use the new program on Triton to simulate the way it would work on Tuscan, thus we were assured that if Tuscan had refused to operate in the first instance, the problem would be in the hardware and not the software. Fortunately for me, that philosophy proved useful and I was able to diagnose the hardware design problems with the minimum of time lost.

Once the hardware design had been proven, I was able to

turn my mind to the rather more mundane aspects of power-supply design, cabinet style and lay-out, preparation of drawings and to start work on the detailed documentation. The Transam software specialists now had to be fully briefed on the final hardware architecture so that they could start to consolidate their ideas for the monitor program proper and at the same time configure TCL Basic to run both as a resident interpreter and, as an option, from discs under the command of the CP/M disc operating system.

They also had to produce the all-important BIOS — Basic I/O System — firmware to link CP/M to the Tuscan hardware configuration. That was no small task — especially as our deadline date for the launch was not many months away. The responsibility for the broad and the all-embracing assembly language work rested primarily with Brendan Owen and Keith Frewin of Transam. Now Brendan Owen takes up the story.

IN THE computer design series, Mike Hughes has led us through the stages of designing a computer system from the hardware point of view. To consider the complete Tuscan system, we must also look at the system software used.

From the outset, Tuscan has been designed as a complete system and the hardware and software have gone hand in hand, co-ordinated by frequent meetings between Mike Hughes and myself. It was at those meetings that we realised how various software requirements would influence the hardware design of Tuscan.

A prime example of that is the lay-out of the memory map and the need to provide some power-on jump circuitry. That was required because we wanted to use the CP/M operating system which expects to find RAM at address zero whereas the Z-80 expects to find ROM there. Identifying potential problems like that was made easy by the current design process.

Another example of how the software has to some extent corrected the hardware design is in the decision to provide 8K bytes of EPROM space on the Tuscan board.

Bus expansion

Before I could decide what software was required for Tuscan, I had to look at what kind of people would be using Tuscan. Although Tuscan is a single-board computer, it also has an on-board bus expansion which allows memory, disc controllers and other peripherals to be added very easily.

That versatility means that Tuscan is

suitable for virtually any application for small computers and so the users fall into four main groups: hobbyists, schools and colleges, industrial and small-business users.

The requirements of such a broad user base is obviously varied and a wide range of software products is required to meet them. Our users would probably want to program in assembly language or some high-level language such as Pascal or Basic and we would need to cater for some of those requirements using just the on-board memory.

On-board memory

The on-board memory consists of 8K of EPROM and 8K of RAM. At this stage, the amount of RAM available need not concern us because it cannot be used for storing the system software. The EPROM consists of four 2516s which each provide 2Kbytes of storage. Those parameters limited the size of the software which was to be available, e.g., it would not be sensible to write a 2.25K monitor.

We decided that, based on those clear facts, it would be reasonable to provide two software packages for use with the single-board computer. They were a 2K monitor and an 8K Basic interpreter. We were now left to consider how best to cater for the users who want to expand their systems beyond adding extra RAM.

The obvious expansion is the addition of a disc controller and operating system. There is a wide variety of disc operating systems available for the Z-80 and we had to choose one of these. The choice was between the widely-used CP/M operating

system and the more powerful multi-tasking systems such as OMNIX or MP/M.

The decision finally fell in favour of CP/M because of the wide range of software which is available to run with it, giving users greater flexibility in choice of programs. The decisions reached so far had been policy decisions involving the entire design team. It was now my task to produce the software to fit those general requirements.

Mike Hughes, in earlier articles, has emphasised the range of input and output ports on Tuscan. For these to be useful, the software must be designed to allow the user to switch easily from one port to another either while a program is running or on a semi-permanent basis when he changes his main system console.

In the early stages of the Tuscan design, it was envisaged that it would be used either with a memory-mapped VDU or with an RS232C terminal. The software could then be left to decide which peripheral was present and produce its prompt on that one by default. That involved a simple test of the VDU memory to check whether it existed.

Added complications

A problem occurs, however, if someone uses the terminal for main output and the memory-mapped VDU as some specialised output device. To add to the complications, we decided to add a VDU to the Tuscan board which also communicated via an output port like the terminal. There were now two console screen devices which would not be tested



for their presence automatically.

The solution to the problem was to add an extra input port to the Tuscan with a DIL switch on it. The switch could be used to set up the default console at switch-on. In fact, we used a four-bit switch and used two bits to determine the console and two bits to determine what port to use for a printer.

I/O flexibility

Having found a way to make good use of the Tuscan input/output flexibility, my attention now turned to the memory map for Tuscan. The main board provides 8K of RAM between addresses 0-1FFF Hex and 8K of EPROM between addresses E000-FFFF Hex. The remaining space is available for any form of memory

expansion. A minimum system would contain 1K of RAM and the monitor or Basic ROMs.

That RAM would have to be located at address 0 so that the S-100 vectored interrupts would work — they cause a RST1-7 instruction to be executed. The area used by the interrupts corresponds to quarter-page of memory — one page = 256 bytes.

It seemed reasonable to assign the system scratch-pad RAM to be contiguous with it. The amount of RAM required varies with the different software packages and it is used for such purposes as input buffers, pointers, temporary storage stack and disc buffers. Now that an overall plan had been formulated, the individual packages could be designed and developed.

Anyone who has developed an assembly language program using just a monitor and a Hex code cad will know how tedious a process it can be — especially if the monitor functions or the user interface have not been carefully planned. Many of my programs are written in assembly language and so I know exactly what was needed to make a good monitor. The trouble is that my ideas would have generated four or five kilobytes of code and we wanted a 2K monitor.

List of features

At that point, I had included features such as disassembly, trace and single step with mnemonics being displayed. However, those features would fit into a

(continued on page 85)

Buy a microcomputer for under £1,000 and you could be on your own! Unless it's a Commodore PET.



Commodore produce Britain's number one microcomputer. But we don't stop there. We also insist on providing comprehensive support throughout our national dealer network.

Our dealers can examine your needs and demonstrate which hardware and software will suit you best. Their trained engineers are always at hand and a 24-hour field maintenance service is available. Your local dealer can tell you more about the following Commodore Services.

Commodore PET
The Commodore PET computer range covers everything from the self-contained unit at under £500 to complete business systems at under £2,500.

Commodore Business Software and Petpacks
Our software range covers hundreds of applications. Business software includes Sales and Purchase Ledgers, Accounting, Stock Control, Payroll, Word Processing and more. In addition over 50 Petpacks are available covering such titles as Strathclyde Basic Tutorial, Assembler Development System, Statistics, plus our Treasure Trove and Arcade series of games.

Commodore Approved Products
Compatible products of other manufacturers with Commodore's mark of approval are also available.

Commodore Courses
Commodore offer a range of residential training courses and one day seminars. An excellent start. And when you have installed your system the PET User's Club Newsletter can keep you informed of new ideas and latest developments.

LONDON AREA

Adda Computers Ltd.
W5, 01-579 5845
Advanced Management Systems.
EC2, 01-638 9319
Byteshop Computerland.
W1, 01-636 0647
C.S.S. (Business Equipment) Ltd.
EB, 01-254 9293
Capital Computer Systems.
W1, 01-636 3863
Centralex-London Ltd.
SE13, 01-318 4213
Cream Microcomputer Shop.
HARROW, 01-863 0833
Da Vinci Computer Shop.
EDGWARE, 01-952 0526
L & J Computers.
NW9, 01-204 7525
Home and Business Computers.
E12, 01-472 5107
Merchant Systems Limited.
EC4, 01-353 1464
Metyclean Ltd.
SW1, 01-828 2511
Micro Computation.
N14, 01-882 5104
Micro Computer Centre.
SW14, 01-878 3206
Sumlock Bondain Ltd.
EC1, 01-250 0505
Sumlock Bondain Ltd.
EC4, 01-626 0487
T.L.C. World Trading Ltd.
WC2, 01-839 3894
TOPS TV LTD.
SW1, 01-730 1795

HOME COUNTIES

G. M. Marketing.
ANDOVER, 790922
HSV Microcomputers.
BASINGSTOKE, 62444
MMS Ltd.
BEDFORD, 40601
Elex Systems Ltd.
BRACKNELL, 52929
DDM Direct Data Marketing Ltd.
BRENTWOOD, 229379
Amplicon Micro Systems Ltd.
BRIGHTON, 562163
RUF Computers (UK) Ltd.
BURGESS HILL, 45211
T & V Johnson (Microcomputers
Etc) Ltd, CAMBERLEY, 20446
Cambridge Computer Store.
CAMBRIDGE, 65334
Wego Computers Ltd.
CATERHAM, 49235
Dataview Ltd.
COLCHESTER, 78811
South East Computers Ltd.
HASTINGS, 426844
Alpha Business Systems.
HERTFORD, 57423
Brent Computer Systems.
KINGS LANGLEY, 65056
Isher-Woods Business Systems.
LUTON, 416202
South East Computers Ltd.
MAIDSTONE, 681263
Micro Facilities Ltd.
MIDDLESEX, 01-979 4546
J. R. Ward Computers Ltd.
MILTON KEYNES, 562850
Sumlock Bondain (East Anglia) Ltd.
NORWICH, 26259
T & V Johnson (Microcomputers
Etc) Ltd, OXFORD, 721461
H.S.V. Microcomputers.
SOUTHAMPTON, 22131
Super-Vision.
SOUTHAMPTON, 774023
Xitan Systems Ltd.
SOUTHAMPTON, 38740
Stuart R Dean Ltd.
SOUTHEND-ON-SEA, 62707
The Computer Room.
TUNBRIDGE WELLS, 41645
Orchard Electronics.
WALLINGFORD 35529

Petalect Ltd.
WOKING, 63901
Oxford Computer Systems.
WOODSTOCK, 811976

MIDLANDS AND SOUTH HUMBERSIDE

Byteshop Computerland.
BIRMINGHAM, 622 7149
CPS (Data Systems) Ltd.
BIRMINGHAM, 707 3866
Camden Electronics.
BIRMINGHAM, 773 8240
Computer Services Midlands Ltd.
BIRMINGHAM, 382 4171
Catlans (Computers) Ltd.
BURTON-ON-TRENT, 812380
Ibek Systems.
COVENTRY, 86449
Jondanc Associates Ltd.
COVENTRY, 664400
Davison-Richards Ltd.
DERBY, 366803
Caddis Computer Systems Ltd.
HINCKLEY, 613544
H.B. Computers.
KETTERING, 83922
Taylor-Wilson Systems Ltd.
KNOWLE, 6192
Machsize Ltd.
LEAMINGTON SPA, 312542
Office Computer Techniques Ltd.
LEICESTER, 28631
Lowe Electronics.
WATLOCK, 2817
Betos (Systems) Ltd.
NOTTINGHAM, 48108
Byteshop Computerland.
NOTTINGHAM, 40576
Keen Computers Ltd.
NOTTINGHAM, 583254
Tekdata Computing.
STOKE-ON-TRENT, 813631
Systems Micros.
TELFORD, 460214
McDowell Knaggs & Associates.
WORCESTER, 427077

YORKSHIRE AND NORTH HUMBERSIDE

Ackroyd Type writer & Adding
Machine Co. Ltd, BRADFORD, 31835
Allen Computers.
GRIMSBY, 40568
Microware Computers Ltd.
HULL, 562107
Microprocessor Services.
HULL, 23146
Holdene Ltd.
LEEDS, 459459

South Midlands Communications Ltd.
LEEDS, 782326
Yorkshire Electronics Services Ltd.
MORLEY, 522181
Computer Centre (Sheffield) Ltd.
SHEFFIELD, 53519
Electronic Services.
SHEFFIELD, 668767
Hallam Computer Systems Ltd.
SHEFFIELD, 663125

NORTH EAST

Dyson Instruments.
DURHAM, 66937
Currie & Maughan.
GATESHEAD, 774540
Wards (Office Supplies) Group.
GATESHEAD, 605915
Elron Ltd.
HARTLEPOOL, 61770
Fiddes Marketing Limited.
NEWCASTLE, 81517
Newcastle Computer Services.
NEWCASTLE, 615325
Format Micro Centre.
NEWCASTLE, 21093
Tripont Associated Systems
Consultants Ltd.
SUNDERLAND, 73310

SOUTH WALES AND WEST COUNTRY

Radan Computational Ltd.
BATH, 318483
Computer Corner.
BAYSTON HILL, 4250
Bristol Computer Centre.
BRISTOL, 23430
C.S.S. (Bristol) Ltd.
BRISTOL, 779452
T & V Johnson (Microcomputers
Etc) Ltd, BRISTOL, 422061
Sumlock Tabdown Ltd.
BRISTOL, 26685
Sigma Systems.
CARDIFF, 34869
Office and Business Equipment
(Chester) Ltd, OEE5IDE, 817277
A.C. Systems.
EXETER, 71718
Micro Media Systems.
NEWPORT, 59276
J.M. Computer Services Ltd.
NEWQUAY, 2863
Devon Computers.
PAIGNTON, 526303
J.A.D. Integrated Services.
PLYMOUTH, 62616
Business Electronics.
SOUTHAMPTON, 738248
Computer Supplies (Swansea).
SWANSEA, 290047

NORTH WEST AND NORTH WALES

Tharstern Ltd.
BURNLEY, 38481
B + B (Computers) Ltd.
BOLTON, 26644
Preston Computer Centre.
PRESTON, 57664
Catlans (Computers) Ltd.
WILMSLOW, 527166

LIVERPOOL

Aughton Microsystems Ltd.
LIVERPOOL, 548 7788
B.E.C. Computers.
LIVERPOOL, 263 5738
Rockcliff Brothers Ltd.
LIVERPOOL, 521 5830

MANCHESTER AREA

Byteshop Computerland.
MANCHESTER, 236 4737
Computastore Ltd.
MANCHESTER, 832 4761
Cytek (U.K.) Ltd.
MANCHESTER, 872 4682
Executive Reprographic Ltd.
MANCHESTER, 228 1637
N.S.C. Computer Shop Ltd.
MANCHESTER, 832 2269
Sumlock Electronic Services
(Manchester) Ltd.
MANCHESTER, 834 4233
Professional Computer Services Ltd.
OLDHAM, 624 4065
D. Kipping Ltd.
SALFORD, 834 6367
Automated Business Equipment Ltd.
STOCKPORT, 061-432 0708

SCOTLAND

Holdene Microsystems Ltd.
EDINBURGH, 668 2727
Microcentre.
EDINBURGH, 556 7354
Aethrol Consultancy Services.
GLASGOW, 641 7758
Byteshop Computerland.
GLASGOW, 221 7409
Robox Ltd.
GLASGOW, 221 5401
Mac Micro.
INVERNESS, 712203
Thistle Computers.
KIRKWALL, 3140

IRELAND

Softech Ltd.
DUBLIN, 784739
Medical & Scientific Computer
Services Ltd, LISBURN, 77533

To: Commodore Information Centre,
360 Euston Road, London W1 3BL. 01-388 5702

Please send me further information about the Commodore PET.

Name

Position

Address

Intended application PC D 12

Do you own a PET? YES NO

Commodore

This list covers dealers participating in our advertising.

(continued from page 83)

complete assembly language development package more realistically and so could be dropped from the monitor specification.

I now had to think carefully about the cuts which I could make to my original list of required monitor functions without restricting severely its usefulness. Essentially, the monitor functions could be split into four groups. They would provide facilities for program entry, program display, program storage and program debugging. Having arrived at those four categories, each could be considered separately to produce the final specification.

Firstly, we will deal with program entry. Normally, there are two distinct forms of data required by a program. These are Hex bytes which form the program instructions and ASCII strings which are used for prompts and other messages sent to the user.

To input the program, all that is needed is to prompt the user with an address and the current data from that location and then allow the user to modify that data optionally. There must be a means of stepping back to the previous location in case a mistake was made while data was being entered.

Most of the prompts used in a program tend to be just one line long and so an easy and convenient means of entering a line of text is required. Once again, it is necessary to provide some means of correcting typing errors.

It is good programming practice to put all data together at the end of the program and so it would be useful to print-out the address of the memory location which immediately follows the string. That saves having to count the bytes in the string to discover where the next string should start.

Data blocks

Another function is one to move a block of data around in memory — very useful when you have omitted one byte in a program during entry and notice the fact 30 or 40 bytes later. It may also be necessary to delete a byte of data. Clearly, the move function needs to be able to move data up or down memory without corrupting it — even if the data is going to be moved on top of itself.

To do that means that the starting address for the move operation must be chosen to be one end or the other of the block and the data moved up or down as necessary. That choice introduces a good chance of operator errors which could destroy the data integrity. Since we have a computer, we may as well let it make the decision and incorporate the necessary logic into the monitor.

The last function connected with the data entry enables an area of memory to be filled with a single byte value. That is useful to pre-set data areas and to see

where a program is putting data if it runs away.

We can now move on to the facilities which are needed to display programs and data. It may be necessary to look at single bytes in memory or at large areas at a time. In addition, it may be more convenient to have the ASCII characters displayed rather than the Hex codes.

Those display formats can be accommodated easily in two functions. The first one is the same as that used for entering data into memory. As it displays each address, the contents are also displayed. Subsequent or previous locations can also be displayed reasonably easily. In addition, the data can be modified readily if required.

Tabular format

Large amounts of data cannot be presented in that way and some form of tabular format is needed. To fulfil these requirements, I decided to display both the Hex codes and ASCII characters simultaneously. The monitor displays half a screen of data at a time by default but can be made to give a continuous dump between two addresses.

To make it easier to view contiguous 128 byte blocks of memory, the monitor keeps track of where it stopped the last dump and can be made to resume from that point without re-entering the address.

The next facilities required after being able to enter and check program provide the means to store and load programs on to cassette tape. For convenience, the programs need to be stored as files with names so that several can be stored on one tape and the correct one re-loaded at a future date.

Additional information is also required so that the program can be re-loaded to the correct place in memory. That leads to a file format with two distinct parts; a leader, containing some synchronising marker, the file name and the address limits of the data and the data itself.

Having decided how the tape is to be formatted the details of the monitor commands can be fixed. When a file is written, it is necessary to specify the file name and the address limits. During writing, the file the keyboard needs to be checked to decide whether the operation is to be aborted.

Similarly, the complementary load function needs to check for an abort command from the keyboard. While the load is in progress, the UART status word needs to be checked after each byte is ready to ensure that it was received without error.

If an error does occur, the user needs to be informed by printing some error indicator on the console. Due to the self-locating tape format, there is no need to specify an address for re-loading.

The final group of commands allow programs to be run and de-bugged. Two fundamental facilities for developing

programs are the insertion of breakpoints into the program and executing single instructions at a time — single-stepping. To keep track on the execution of the program, one must be able to examine the registers within the Z-80 CPU.

To do that, they must be dumped into RAM when the monitor is entered and re-loaded before the program under test is resumed. The break-points could be implemented in a number of ways. I chose to implement eight break-points which would be transparent in use.

That means that the monitor would remove the break-points from the program whenever it regained control and re-set them when control was handed to the test program. Facilities would be needed to set, re-set and list the break-points and that is all achieved with a single function.

The single-step function would need to execute one or more instructions from a program as required. When the monitor regains control either after each single step or after a break-point, it must display the contents of the Z-80 registers. Of course, we need to be able to modify the registers from where they are saved in RAM having modified the program counter if necessary.

Monitor specifications

I now had a specification for the monitor and could start writing the code to fit the specification. All of the commands were to require a single-line entry consisting of a function letter followed by up to three parameters as required, e.g., the move command might be M100, 200, 5000.

The numeric parameters could take one of three forms as a Hex number, decimal number or as an ASCII character, e.g., 41 Hex could be entered as 41 or # 65, decimal, or A ASCII. Finally, the command line must be capable of being edited before it is executed.

Before I wrote any code, I drew flow-charts of the monitor as a whole and of each separate function. By doing that, I was able to identify routines which occurred more than once so that they could be coded as subroutines. I started by writing the I/O routines for the various console and list devices.

At a single-character level, they were trivial and they could be tested easily with a short routine to echo characters. The I/O core would be used by all of the Tuscan firmware. The next stage was to write the buffered input routine which could deal with the input — and deletion — of any characters including tabs.

Once again, it was tested with a short routine on Tuscan. The rest of the software could be tested using CP/M and a Triton. The use of a disc system made debugging much faster and easier. The main control loop, initialisation and

(continued on next page)

(continued from previous page)

parameter-parsing routines were now developed ready to be used by each monitor function.

Having obtained a working monitor which could do nothing but input commands, I was now ready to start writing the various monitor functions. Each function was written and tested as a separate subroutine and was entered into the monitor jump table when it was completed.

While producing the code, I realised that a Hex-conversion routine could be implemented for an overhead of three bytes. It would accept a number in any valid form, i.e., decimal or ASCII, and print-out the Hex value. As we progressed, the 2K of memory rapidly became full and I still had three or four functions to provide, single step being one of them.

Realising that I would need about 500 bytes for these functions, I looked again at my specification and decided not to implement single step. However, I would provide a vector into the next ROM so that it could be part of an expansion package. After some code compaction during which I had to sacrifice part of the structured lay-out of the monitor, enough space was found for the other functions.

After about six weeks' work, the monitor was finished. All that remained was to give it a name and after some consideration, we arrived at Mitsi, an acronym for Monitor In Tuscan System 1.

Basic interpreter

The second software package for Tuscan was an 8K Basic interpreter. It was to be a stand-alone package which would be entered when the machine was turned-on. For that, I inherited the poorly-documented source code for the Triton L7.2 Basic. The task seemed easy: add the Mitsi I/O package and partially optimise the 8080 code so that the whole package would fit in 8K — it took, however, about six man weeks. What went wrong?

The development work involved Keith Frewin — also from TCL software — and myself. We wanted to have a disc Basic

which would run on a 16K CP/M system and it seemed sensible to develop it in parallel with the Tuscan Basic. The first two weeks were spent in tidying and annotating the original source code — if only programmers were as fluent with comments as with instructions.

Having prepared the source code into an understandable form, we took separate paths although it was useful to be able to compare the code when a bug appeared in one version or other. My first task was to translate all of the mnemonics into Z-80 code using a program we had in our library and then to convert as many absolute jumps to relative jumps as possible.

That pruning operation and the removal of some unused keywords reduced the Basic to about 8K, give or take 24 bytes. The time arrived to start testing the various Basic statements to see what would happen.

The interpreter was run in RAM on a Tuscan using CP/M. As I tested more and more statements, my confidence grew until I arrived at string handling. To test for type compatibility of the arguments, the Basic made use of the Z-80 parity flags. Unfortunately, the Z-80 uses the flag as an overflow flag on some operations and it was not being set the same as for an 8080.

After changing some code, all was well. Obviously, not all 8080 code will run directly on the Z-80. After everything was checked and a few more economies made so that the program fitted into 8K, I re-assembled it at the correct address and burned it into ROM.

One of the design requirements was for the Basic to be able to load and run Triton programs. I had made provision for the program to be re-located and since it was the same Basic everything should have worked, so I plugged in a tape recorder and loaded a program. When I listed it, all was not well, when a line like:

```
100 IF A > B GOTO 30
```

became

```
100 LIST A > B FOR 30
```

By removing the extra unused keywords, the values of others had changed

and hence some strange listings were produced. I had to put entries back into the keyboard tables and remove the trace option, which was not very useful, to make space.

Cronologically, the Tuscan firmware was now complete but we will now look at the development of the Tuscan CP/M system. All of the routines I needed had already been written. It was just a case of putting the together in the proper places.

CP/M requires a set of I/O routines to run. They can be divided into two groups — those for the printer and console and those to control the disc. The first group were lifted straight from the Mitsi monitor and the second group from the Triton Bios. Since there was plenty of space in the 2K ROM on Tuscan, I decided that there was little point in optimising the code for the Z-80. After a few days' work in modifying the system generation program, Tuscan sprang into life with two 8in. disc drives. Producing the software to drive the 5¼in. drives was almost as easy.

Disc drives

I just had to combine the Triton disc routines with the Tuscan I/O core. We had decided to use TEAC disc drives on Tuscan instead of Shugart because they had the advantage of providing 40 tracks rather than 35 and they are capable of moving the head faster. That is where the extra work was hidden. In addition to patching those parameters into CP/M, the programs to copy and format discs needed re-writing.

I have said that provision had also been made for an editor and some other packages such as Pascal compiler or an assembler. It would be possible to produce a complete assembly-language development package for Tuscan to reside in the 8K of on-board ROM. Other possible expansions would include software to drive a colour VDU and a graphics display.

In addition, we could provide CP/M packages for various business applications and for a Prestel terminal or viewdata system.

Perhaps it was luck — we thought it was good planning — everything suddenly began to happen at once. Brendan Owen and Keith Frewin had their respective firmware packages ready, the final — tidied-up — printed circuit arrived in all its glory with solder mask and silk screening. The specially-wound transformers landed with a thud on the Transam doorstep as did the prototype cabinet.

Transam, no doubt with a sigh of relief, took delivery of the outstanding bulk component orders — the only things remaining were, if I recall correctly, the power-supply capacitor mounting clips but that was soon put right.

Drawings were back from the artist and the manuals well advanced through the final stages of typing. Advertising managers were requiring confirmation that the reserved pages were to be taken. Everyone associated with the project now started to operate in a quiet sort of frenzy — nothing could be stopped or slowed at this stage and the complete Tuscan system was launched in June 1980.

Tuscan has been on the market for six months and we

are now able to see how our initial thoughts are being transformed into reality. Designed initially to try to provide all things to all people, Tuscan certainly seems to have fulfilled its role — I have seen it operating as a £300 domestic system at one end of the scale and at the other supporting twin 8in. discs, Centronics printer and remote terminal in a business environment, the whole system must have cost around £4,000.

It is being used in schools, polytechnics, Government departments, research laboratories, photographic studios, offices, and doctors' surgeries to name but a few applications.

The future looks even more rosy. Already there is talk of interfacing to 10megabyte disc systems, and via currently-available S-100 cards, Tuscan can operate as an intelligent Prestel terminal.

Without doubt none of this would have been possible without the S-100 standard busbar and the simple versatility of CP/M with its massive software repertoire. □

ATTENTION

PET & APPLE FLOPPY DISK USERS

Obtain up to TWICE the storage capacity from your 5.25" floppy disks. USE BOTH SIDES. Jig and tool to professionally modify your floppy disks + verification details to check out the "new" side. With disks at up to £30.00 for a box of 10 your savings on media cost are guaranteed. ONLY £12.50 per kit. (also suitable for other floppy users).

ATTENTION COMMODORE PET USERS

Now you can have permanently resident in memory any routine/program that you desire up to 2K. Your data taken from tape or disk that you supply is programmed into a 2716 5V EPROM ready for insertion into any 16K/32K type Commodore PET or 8000 series, or even into the 3040 disk unit.

£21.00 including the 2716 EPROM.

ALL PRICES QUOTED ARE FULLY INCLUSIVE

**M.J. STONE
4 COSTERS CLOSE
ALVESTON, BRISTOL
TEL: (0454) 418015**

• Circle No. 163

Why get your PET from HSV

Because HSV are an established and expanding computing services company in operation since 1973. We offer microcomputers backed by systems advice, after-sales support and maintenance, from specialised computer centres.

Our interest does not stop at the sale of a PET - HSV assure full back-up support:-

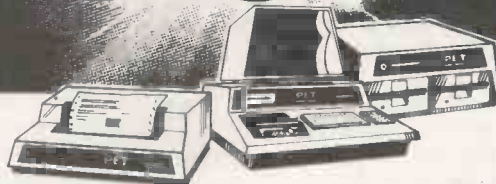
- in-house analysts and programmers
- our own engineers operating from 2 service centres
- a range of specialist systems for business, industry and education
- instruction manuals, programme cassettes, add-on equipment and all other supplies

For Commodore PET 3000 and the new larger 8000 Series.

That's why!

HSV Limited, 22 Southampton Street, Southampton, Hants. Tel. (0703) 22131, and
May Place, Basingstoke, Hants. Tel. (0256) 62444.

HSV



• Circle No. 164

Study the TRS-80 in Cambridge

For centuries now Cambridge has attracted students for learning and research. Following in the tradition, Cambridge Computer Store — the most active Tandy franchise dealer in the U.K. — offers you the opportunity to study in depth the full range of TRS-80 hardware and software. On demonstration in the Store are the top-selling Model 1 and the new, exciting Model II plus a wide range of peripherals: from a minimal system (at only £251) to fully expanded configurations — all immediately available.

Visit us in Cambridge and study the TRS-80. With our help you're sure to graduate with honours!

Cambridge Computer Store

1 Emmanuel Street Cambridge CB1 1NE
Telephone: (0223) 65334/68155

Apple : Cromemco : Hewlett-Packard : Horizon : Pet : Acorn : CompuKit : Sinclair : Houston : Infoton : Centronics : Qume : Word-Star

• Circle No. 165

Recursion is highly wasteful and seldom truly needed

IT IS becoming part of the folk-lore of computing that programming languages which allow something called recursion are in some way far more advanced than languages which do not possess such features.

At its most naive, the lack of recursion in Basic means that Pascal is far superior. Recursion and recursiveness seem to be applied loosely to many ideas and items without any attempt at precision.

Epimenides was a Cretan who said: All Cretans are liars. By saying that, he produced the liar paradox so beloved of logicians. The statement is recursive in that it refers indirectly to itself. To see how the statement refers to itself, let S be the set of all statements made by Cretans, so "All Cretans are liars" becomes: If Si is an element of set S, Si will be untrue. However, the statement just described was a statement made by a Cretan — call it Si.

If Si is true, Si is not true; if Si is not true, it is not true that Si is not true; if it is true that Si is not true, it is not true that it is not true that Si is not true.

Self-reference is not without its problems, but the Greek philosophers who invented the liar paradox saw that at least one form of recursiveness was quite safe: for a statement to refer to its own structure, rather than its own meaning was acceptable — for then the statement was right or wrong.

Important distinction

To say: This sentence has 94 letters in its entirety, is either correct or incorrect, and raises no philosophical problems. That shows the importance of the distinction between syntax/structure and semantics/meaning.

See what you can make of the proposition/sentence/statement, G, where G: It is impossible to prove the sentence which results from completing the sentence G.

The G in the sentence is replaced by the words which constitute G. G says, in effect, that it is impossible to prove whether G is itself true: if G is true, it is unprovable. Therefore, we do not know if G is true; if we do not know if G is true — we cannot prove it — G is correct.

The point is that a recursive statement can be unsolvable by recursive methods. That lessens the weight of the claim that, as a certain recursive function cannot be analysed by non-recursive means, recursive procedures are inherently superior. A favoured justification of the importance of recursiveness comes from

artificial intelligence, e.g., how can one disentangle the sense of: "The audience who heard, "The person who cited, 'The King who said, "My kingdom for a horse," is dead,' as an example, is a psychologist," is very patient.' Miller, 1970:113.

It contains a series of embedded clauses. Higman, 1977:21-22, uses the example, but he does not realise that, though "The audience . . . patient" is embedded, it is not recursive in the same sense as: "It is impossible to prove the sentence which results from completing

by Boris Allan

the sentence 'It is impossible to prove the sentence which results from completing the sentence "It is impossible —"'

G is truly recursive, it is embedded and self-referencing. G is also unprovable by recursive or non-recursive means. When Higman, 1977:21, claims:

It may be worth mentioning that there are certain functions which are easily defined recursively but which cannot be defined in terms of ordinary algebraic expressions.

He refers to Ackerman's function in support of his claim. Interestingly Ackerman's function is an extension of the same ideas — due to Kurt Gödel — which gave rise to G. Embedding of clauses, and statements, is a necessary condition for recursion, but not sufficient condition.

When discussing recursion, monographs and articles usually begin with either the addition function or the factorial function; for the factorial of N = N*(N-1)* . . . *2*1

FACT(N) 1 N = 0
 FACT(N-1)*N N > 0
 Undefined (=0?) N < 0

In Algol 68, we could write the factorial as either a recursive procedure, a recursive function, or a recursive monadic operator. To show the beauty of Algol 68, we will define a monadic operator "↑" which goes in front of our variable to give the factorial, i.e., "↑N" means; factorial of N.

op↑ = (int N)int: (N=0|1|↑(N-1)*N);
 Translated, that means that this is to be a monadic operator "↑", which acts on an integer value "N" to produce an integer result. The result if "N=0" is 1 else "↑(N-1)" times N. It would be very simple to put in a check for N ≥ 0

op↑ = (int N)int: (N=0|1|:N > 0|↑(N-1)*N | 0);

Algol 68 is the most sophisticated and advanced programming language, and

Basic one of the simplest. A Basic subroutine for factorials is:

```
2000 IF N >= 0 THEN 2030
2010 F=0
2020 RETURN
2030 IF N=0 THEN 2090
2040 N=N-1
2050 GOSUB 2000
2060 N=N+1
2070 F=F*N
2080 RETURN
2090 F=1
2100 RETURN
```

In the main program, we call the number, of which we need the factorial, "N". The value of the factorial is returned in "F", after the statement GOSUB 2000. The size of the stack for subroutines will affect the maximum value of N, but as the factorial of 9 is 362880, that need not bother as unduly. The factorial of 8 will not fit within bounds for most integer Basics.

The subroutine could be shortened by the omission of the check in lines 2000 to 2020, and the call would then be GOSUB 2030 in the main program, and in line 2050, but after all a loop would be simpler. Finally, a Pascal function:

```
FUNCTION FACT(N:INTEGER):INTEGER;
BEGIN
  IF N=0 THEN FACT=1
  ELSE IF N0 THEN FACT=0
  ELSE FACT = FACT(N-1)*N;
END;
```

The Pascal function seems hardly more transparent than the Basic subroutine.

We are told repeatedly that the factorial function is a trivial example, but that the technique is very powerful for more complex tasks. In Pascal, with its one-pass compiler, life is not so simple. Despite claims that recursion makes Pascal a better language, things can become messy if two procedures are mutually recursive.

Fact function

Let there be a function/procedure "A" which, within its body, calls function/procedure "B" — the Fact function calls itself within its body. If in addition function/procedure "B" calls function/procedure "A" itself, we have a sequence of calls A B A B.

In Pascal, we have to make the compiler aware of "B" before we can define "A". In the definition of "B", we need, however, already to know "A". To stop that regression, in Pascal, we give a dummy definition of "B" before we define "A", and then later give a full definition of "B". Bowles 1977:163.

When one reads discussion of recursions, one of the most popular examples is Ackerman's function, but the most popular example is the Towers of

Hanoi game. For a non-computing explanation read Northrop, 1961:33-34. The Towers of Hanoi are three pegs; on one peg, peg zero, there are discs arranged so that the largest disc is at the bottom of the pile, with discs in decreasing order of size to the smallest at the top.

The problem is to move the discs, one at a time, so that a larger disc is never placed on a smaller disc, ending with all the discs on a different peg — discs can reside on any of the three pegs.

For example, with three discs: move one — disc one to peg one; move two — disc two to peg two; move three — disc one to peg two; move four — disc three to peg one; move five — disc one to peg zero; move six — disc two to peg one; and move seven — disc one to peg one.

The Towers of Hanoi problem is classical in computer science. It can be solved in a recursive program no longer than about 40 lines, without doubling up statements on a line — Bowles, 1977:297.

So long as ultimately you reach a simple situation which can be handled, the initial complexity of the problem does not matter. This idea translated into programming terms, is called recursion — Gardner, 1979:84.

A formula for the number of moves ($2^N - 1$) is not hard to find, but a Basic program not using recursion is rather difficult to write and is rather difficult to follow — Stout, 1980:8.

I have chosen the three comments because the first makes an interesting statement about program length, and the other two quotes seem to be not only incorrect but to be repetitions of vaguely-understood folk-lore.

Towers problem

One of the best discussions of the Towers problem from a recursive standpoint is in Maurer and Williams, 1972:118-120, and their scheme goes as follows for N discs:

1. If $N=1$, move the disc from peg zero to peg one, and stop.
2. Otherwise, move the topmost $N-1$ discs from peg zero to peg two.
3. Move the remaining disc from peg zero to peg one.
4. Move the $N-1$ discs on peg two to peg one.

The recursive nature of the algorithm is clear from the moves at stages 2 and 4. We start with having to move N discs, and then having to move $N-1$ discs, and then having to move $N-2$ discs. We go through the four stages with $N-1$ substituted for N in the descriptions, and the peg numbers altered correspondingly.

Every ordinary algebraic function, e.g., the factorial, can be re-cast in a recursive form, and I suspect that most recursive functions can be put into an ordinary algebraic form. That suspicion makes me believe that the Towers problem has a simple non-recursive form, if only it can be found.

If the pegs are re-arranged into the points of a triangle, instead of in a line, a simple pattern appears — as an application of modulo arithmetic rather than arithmetic defined on the field of integers. A pattern should appear, one guesses, because of the formula for the number moves needed, $2n-1$ — figure 1.

Figure 1 shows that disc one goes from peg zero to peg one to peg two to peg zero to peg one. Disc two goes from peg zero to peg two to peg one; and disc three goes from peg zero to peg one. A pleasant cycling of the triangle in opposing directions. We have discovered that disc one always cycles clockwise, disc two cycles anticlockwise, disc three cycles clockwise, disc four cycles anticlockwise. We have yet to discover when each disc moves.

Disc one moves every other turn, disc two moves every four turns, disc three moves every eight turns, and disc four moves every 16 turns. That beautiful regularity is encapsulated in table 1. If we convert the move number into its binary form, the rightmost 1 in the number indicates which disc to move.

A Basic program to solve the Towers problem can now be written easily without a trace of recursive statement. Ignoring prints, inputs, remarks and dimensions,

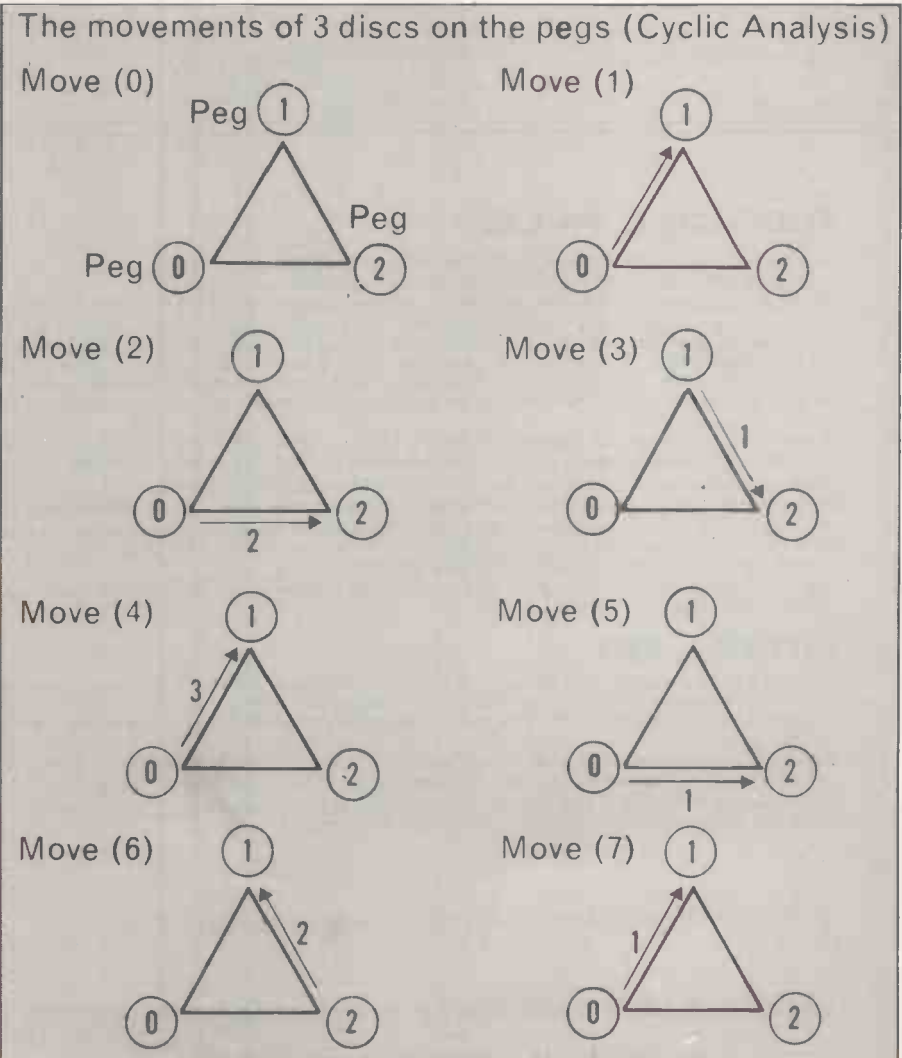
and not having the subroutine from 1000 to 2100 as a subroutine, the program is 23 lines long.

The total program without remarks, but with everything else, is 46 lines long. The language used was integer Basic for the Apple II. I suspect that it would work equally well on the Sinclair ZX-80. Integer Basic was used to reinforce my strong belief that many high-level, structured languages lead many to laziness in programming — recursion is highly wasteful and seldom, if ever, truly needed if we think constructively enough.

In the program, "B" is a vector which holds the binary equivalent of the move number "M", the maximum being "EN"; "C" is a vector which holds "1" or "2" alternately in each element, a "1" for a clockwise rotation, and a "2" for an anticlockwise rotation; and "T" is a vector which holds the peg number of the corresponding disc.

The program is easy to understand as long as it is remembered that it is written in any integer Basic. Apple II integer Basic has a MOD function, but I did not use it, and those without an integer Basic need to use only the INT function, e.g., in line 230: $C(I) = 1 + I - INT(I/2)*2$.

I have shown that non-recursive
(continued on next page)



(continued from previous page)

procedures are conceptually superior to recursive procedures for the Towers of Hanoi problem, and I challenge any person to find a practical application in which recursion is greatly superior to a non-recursive approach.

```

11 REM
12 REM TOWERS OF HANOI
13 REM
14 REM BY
15 REM
16 REM G J BORIS ALLAN
17 REM
18 REM
19 REM
20 REM A SHORT INTEGER BASIC
PROGRAM
USING THE SIMPLEST OF
OPERATIONS
22 REM
23 REM
24 REM
25 REM
30 GOSUB 3000
35 GOSUB 3000
40 PRINT "TOWERS OF HANOI"
41 PRINT
42 PRINT "AN INTEGER BASIC
PROGRAM"
43 PRINT "WITHOUT RECURSION"
45 GOSUB 3000
50 PRINT "AUTHOR IS G J BORIS
ALLAN"
51 GOSUB 3000
99 REM MAIN PROGRAM FROM
HERE
100 PRINT "HOW MANY DISKS"
110 INPUT ND
115 PRINT
116 PRINT
120 DIM B(ND),T(ND),C(ND)
190 EN=1
200 FOR I=1 TO ND

```

```

210 B(I)=0
220 T(I)=0
230 C(I)=1+I-(1/2)*2
240 EN=EN*2
250 NEXT I
260 EN=EN-1
300 FOR M=1 TO EN
310 GOSUB 1000
320 NEXT M
350 GOSUB 3000
351 GOSUB 3000
400 END
999 REM MAIN SUBROUTINE FROM
HERE
1000 K=0
1010 CA=1
1020 FOR I=1 TO ND
1030 CB=(B(I)+CA)/2
1040 B(I)=B(I)+CA-CB*2
1045 CA=CB
1050 IF K>0 THEN 1090
1060 IF B(I)=0 THEN 1090
1070 K=I
1090 NEXT I
2000 T(K)=T(K)+C(K)
2010 T(K)=T(K)-(T(K)/3)*3
2020 PRINT "MOVE ";M;" : DISK ";K;"
TO PEG ";T(K)
2100 RETURN
2999 REM THIS PRINTS BLANK LINES
3000 FOR IT=1 TO 5
3010 PRINT
3020 NEXT IT
3030 RETURN
RUN
TOWERS OF HANOI
AN INTEGER BASIC PROGRAM
WITHOUT RECURSION
AUTHOR IS G J BORIS ALLAN
HOW MANY DISKS
?5
MOVE 1 : DISK 1 TO PEG 2
MOVE 2 : DISK 2 TO PEG 1
MOVE 3 : DISK 1 TO PEG 1

```

```

MOVE 4 : DISK 3 TO PEG 2
MOVE 5 : DISK 1 TO PEG 0
MOVE 6 : DISK 2 TO PEG 2
MOVE 7 : DISK 1 TO PEG 2
MOVE 8 : DISK 4 TO PEG 1
MOVE 9 : DISK 1 TO PEG 1
MOVE 10 : DISK 2 TO PEG 0
MOVE 11 : DISK 1 TO PEG 0
MOVE 12 : DISK 3 TO PEG 1
MOVE 13 : DISK 1 TO PEG 2
MOVE 14 : DISK 2 TO PEG 1
MOVE 15 : DISK 1 TO PEG 1
MOVE 16 : DISK 5 TO PEG 2
MOVE 17 : DISK 1 TO PEG 0
MOVE 18 : DISK 2 TO PEG 2
MOVE 19 : DISK 1 TO PEG 2
MOVE 20 : DISK 3 TO PEG 0
MOVE 21 : DISK 1 TO PEG 1
MOVE 22 : DISK 2 TO PEG 0
MOVE 23 : DISK 1 TO PEG 0
MOVE 24 : DISK 4 TO PEG 2
MOVE 25 : DISK 1 TO PEG 2
MOVE 26 : DISK 2 TO PEG 1
MOVE 27 : DISK 1 TO PEG 1
MOVE 28 : DISK 3 TO PEG 2
MOVE 29 : DISK 1 TO PEG 0
MOVE 30 : DISK 2 TO PEG 2
MOVE 31 : DISK 1 TO PEG 2

```

References

- Bowles K L 1977 *Microcomputer problem solving using Pascal*. New York: Springer-Verlag.
- Gardner M 1979 *The thinking computer's language*. Practical Computing, October.
- Higman B. 1977 *A comparative analysis of programming languages*. Second edition. London: Macdonald and Jane's.
- Maurer G A and Williams M R 1972 *A collection of programming problems and techniques* Englewood Cliffs, NJ: Prentice-Hall.
- Miller G A 1970 *The psychology of communication*. Harmondsworth: Penguin Books.
- Northrop E P 1961 *Riddles in mathematics*. Harmondsworth: Penguin Books.
- Stout J 1980 *Pets' Corner*. Liverpool Software Gazette, 3:6-14.

PAYROLL 'PLUS'

£150 plus VAT

This must be the finest plain paper payroll available for the CBM PET.

It is designed to the Inland Revenue Specifications for Computerised Payroll. It uses plain computer paper throughout and so avoids the need for expensive pre-printing and the annoyance of having to change the paper for specific uses.

Included in its coverage is the following: ALL Tax Codes. ALL NI Codes. Hourly, Weekly and Monthly paid staff — and mixed on the same file disk. 3 rates of overtime which can be entered as amounts or as percentages for hourly staff. 5 Pre-tax adjustments — 2 of which may be pre-set to avoid re-entry each payday. 5 After tax adjustments — again 2 of these may be pre-set. Easy manipulation of employee data — under a security password (which may be changed). Listing for P35. Will handle up to 500 employees on one data disk — and all can be current. Employee deletion without affecting totals.

Four choices of payroll run method: (1) Payslip print-out after each entry. (2) All entries made first, then continuous print run. (3) Immediate payslip print run without entries — if payroll is suitable. (4) Select individual employees.

Payslips are very comprehensive and easy to read and payslips and copies are printed side by side so that the employers copies may be kept in a continuous strip. The extra NI figures required for Contracted-Out employment are printed.

An analysis after the pay run gives Taxable Pay, Employers NI, Deductions and Totals — in other words, the actual cost of the employment and this is in up to 26 separate groups. These are followed by the total Overtime hours for each of the 3 rates, then the full combined totals and a Cash Analysis.

Landsoft Payroll Programs are in use by a considerable number of Accountants and are known for their simplicity of operation and 'User Friendliness'.

HOTEL GB

£350 plus VAT

This fast elegant program is the answer to the hoteliers dreams. It makes the invoicing of guests for their accommodation and services extremely easy. No longer the chore of entering all the accommodation charges every night, the computer does it automatically. At the touch of a few keys a guests account to date can be displayed and the bill printed with a copy for the hotel.

Daily and period totals for 22 service items can be had whenever required. Also grand totals, Total debt to hotel. Items deleted from accounts. Payments in cash, Payments by five different credit cards. Deposits etc.

Hardware and Software will cost little more than half the price of a custom guest billing machine — and the computer gives the ability to do Payroll, Stock Control and General Accounts.

SUPERIOR PROGRAMS FOR THE 32K CBM AND CBM DISK

LANDSLER SOFTWARE 29a Tolworth Park Road, Surbiton, Surrey. 01-399 2476/7



• Circle No. 166

Fast Fourier transforms

YOU PROBABLY FALL into one of three categories:

- You know all about fast Fourier transforms, FFTs.
- You have heard about FFTs, but do not know what they are, or you have been told that they are far too complicated for mere mortals to understand.
- You have not heard about FFTs before, but the subject appeals.

If you are in the first group, and have managed for years to confuse people by using terms like Nyquist limit, aliasing, butterflies, complex multiplication or skew-Hermitian functions, beware — we intend to reveal all.

You will be able to write FFT programs quickly and easily and use them for fun — you can obtain some very pretty patterns — or for education — have you ever wanted to know how beat frequencies occur, or what sidebands are, or what a white noise spectrum is?

You can even use FFT programs for serious, real-world applications in engineering, biology or business. What is more, you can do that faster and more elegantly using FFTs than you can with other techniques of frequency analysis.

What is the FFT and what does it do? It is a black-box program which you can use on your computer. You push in a sequence of numbers — the input signal — and obtain a different set of numbers — the output signal, or frequency spectrum. For example, if you enter a sine wave, you obtain a spike, as shown in figure 1. The spike tells you that the sine wave has a

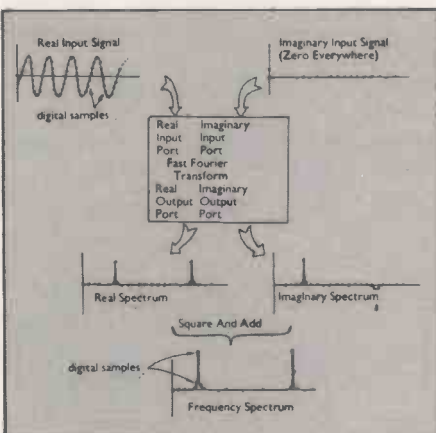


Figure 1. The FFT black box.

frequency of say 500 Hz, a musical tone, or perhaps 500,000 Hz, a radio wave frequency.

The FFT is designed for use on computers, so you cannot push an oscillating electrical signal into your computer and expect to receive a numerical answer. What you will probably obtain is a bright blue flash and a very large repair bill. You must provide digital samples of the signal, store those samples in your computer

memory and then operate on them instead.

If you have money to spare, or an analogue-to-digital converter, you can collect

by Ben Rogers

your samples directly from your signal source after some adjustments.

Otherwise, you must type in the numbers which you want to look at, or else write a line or two of program to

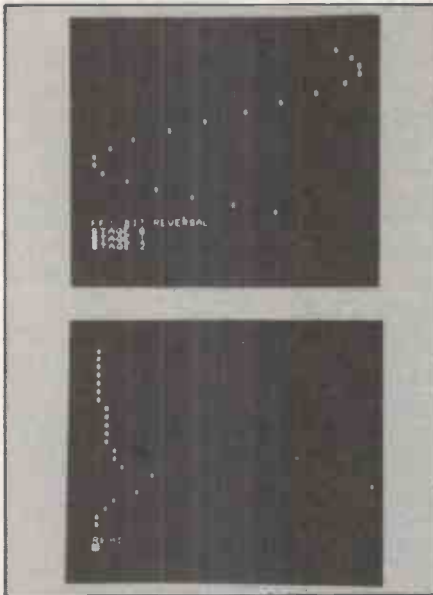


Figure 2. Part of the input and output.

generate the numbers — something like:
`DIM T(255): FOR X = 0 TO 255: T(X) = SIN(3.14159*X/10): NEXT`
 would generate 256 samples of a sine wave for you to analyse.

You can write an FFT program in less than 20 lines of Basic. It is true that they are packed lines; I have an old Pet which runs faster when you do not use a new line number for every instruction. You should be able to run a useful FFT program, based on the following recipe, in any machine which has Basic and more than 4K of memory, although 8K would be better and 16K puts you in good stead.

Although you can write an FFT program in 20 lines or so, it will not give you a very elegant output display. The extra memory is needed, partly for storing more input data to give you more accurate results but mostly so that you can have better display routines.

The first line, 100, asks for a power of two to be typed. That is because FFT programs only work with 2, 4 - 256, 512, 1024 input data values. It is possible to write FFT programs which can cope with any number of input samples, but it is not really worth it in general. So you might type 7, for 128 data points, or 8 for 256 points.

The larger the number the better the

results you obtain, but it takes longer to compute the answers and you need more memory, of course. With 4K of memory you can analyse 128 points. Thanks to a software quirk on my old-style Pet, I am limited to a maximum dimension of 256 for arrays. That is a convenient number with which to work, and you can fit some very useful display routines for 256 data points into 8K of memory.

So in response to line 100, type 8. Line 200 then generates five arrays, each with 256 elements, 0 to 255. The next line, 300, fills two of those arrays, CO and SI, with values of a cosine and sine function respectively. CO and SI will be used by the FFT as look-up tables which need computing only once for each run of the program. Line 300 also fills another array, IM, with zeros. The DIM statement should do that, but it is better to be careful.

Line 1000 represents the input data to be analysed. In the example, it is the simple sine wave quoted, but adjusted slightly to allow for different lengths of input data. The input data are stored in the temporary array T. Line 2000 displays the input data, using the TAB function. You should see the sine wave scrolling up the screen when this line is working.

The FFT proper has been written as two short subroutines. The first one, lines 6000 and 6010, performs the operation of bit reversal on the order of the input data. It then stores them in the correct order in the array RE. For example, if you are using 256 input samples, data element T(1) is put into RE(128), element T(2) is

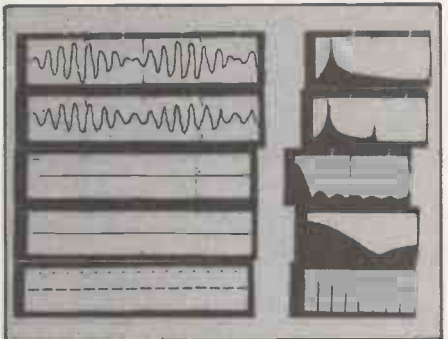


Figure 3a-3e. Beats, pulses and pulse trains.

put into RE(64) and so on. That is because the binary label (0000 0001) of T(1) becomes (1000 0000), which is 128 in decimal.

Similarly, 2 (= 0000 0010) becomes 64 (= 0100 0000) and so on up to 255 (= 1111 1111) which becomes itself. Do not try to economise on storage space by just re-arranging the elements of T or you will overwrite half of the data.

The FFT subroutine occupies only a few lines of program. Exactly what it does

(continued on next page)

(continued from previous page)

need not concern us in detail; suffice it to say that it takes two input arrays RE and IM — which stand for real and imaginary — and processes them through several stages of jiggery-pokery before coughing out the answer, still in the arrays RE and IM but with different contents.

The calculation involves complex multiplication and addition of suitably-chosen pairs of numbers — a diagram showing which pairs to choose bears a fanciful resemblance to a butterfly — hence the buzzword butterfly.

Two arrays

The number of stages involved is printed-out by the program as computation proceeds — “STAGE 1”, “STAGE 2”, and so on. That lets you monitor the work for large amounts of input.

All that remains is to display the output data in some way. The answers are held in the two arrays RE and IM. They contain real numbers, which might be anywhere between, say, -10^{40} and $+10^{40}$,

depending on what function you pushed into line 1000. Lines 4000 and 4010 represent the simplest form of display, which squares and adds matching elements of RE and IM, then uses the TAB function to print the integer part only of the square root of the answer in the proper part of the screen. Figure 2 shows part of what you would find on your screen as the input and output data are scrolled up your screen.

The program listing is about the simplest one possible; a variety of alternatives can be used, limited only by the capabilities of your computer and by your ingenuity. Those refinements have nothing to do with the FFT, though — they just give you prettier pictures.

For example, if you have a line printer, you can produce hard-copy graphs of the input and output — some kind of scale factor will probably be required to have the graphs to match the width of the paper. If you have no printer and do not want a strained neck from looking at graphs rolling sideways up your screen, you can patch in a graphical display

routine to show the data in large chunks.

Figure 3 shows the kind of thing which you can obtain from a Pet with a little care. Alternatively, if you have an oscilloscope and a D/A converter, you can generate real-time, high-resolution displays like those shown in figure 4.

Always remember, the FFT itself consists of only a few lines of program — most of your program space will be taken up with display routines and data storage.

If you use the program listing, you will find that it takes about 20 seconds to compute the look-up table values for 256 points, about 10 seconds for the input sine function, about one minute to bit-reverse the data and about two minutes to compute the FFT. You might say that it sounds more like a slow Fourier transform. It all depends to what you compare it.

Data points

In the past, those who wanted to compute frequency spectra used a different kind of Fourier transform. If you had N data points to analyse, you had to perform approximately $4.N.N$ multiplication and addition operations to obtain your answer.

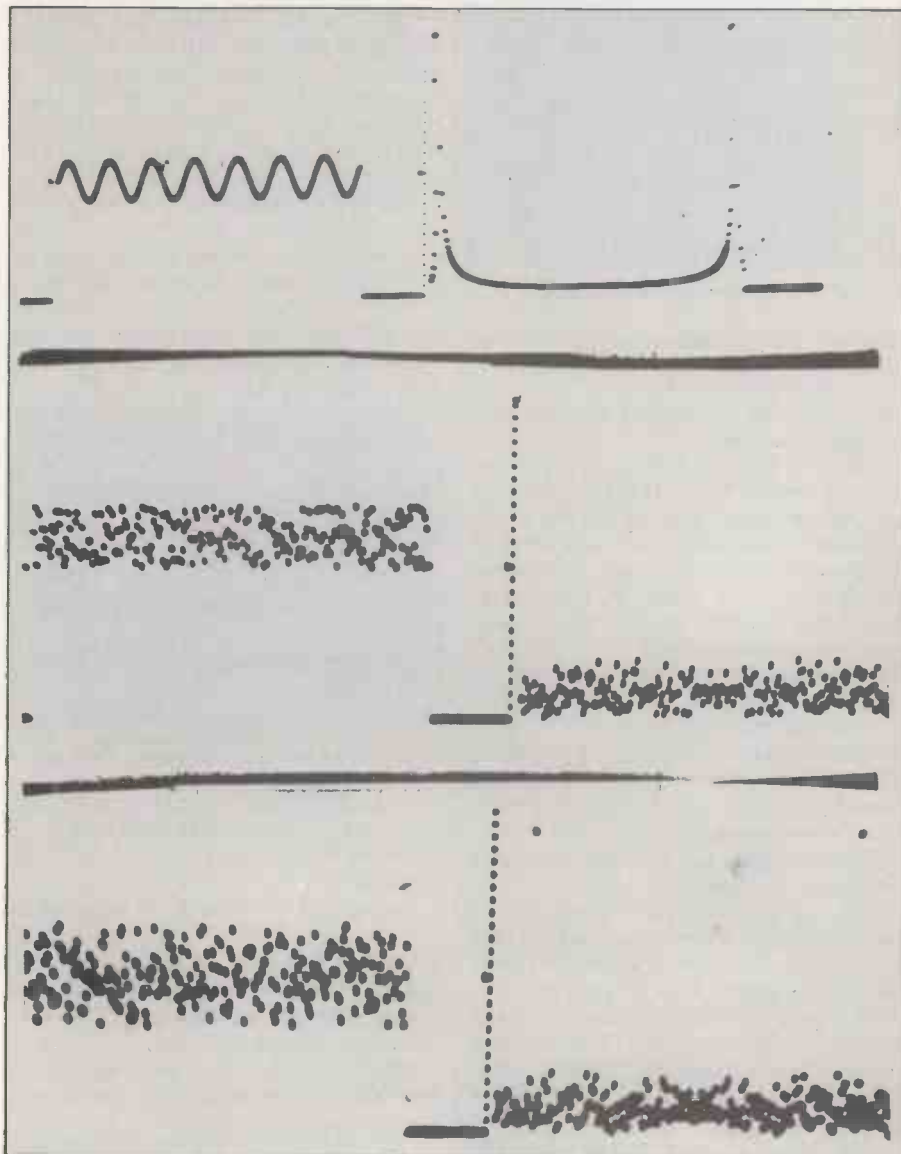
Now, using Basic with a modern micro, it takes perhaps three milliseconds to multiply and one millisecond to add two numbers, plus about two milliseconds for a for-next loop. So, with $N = 256$ it took the old method about $4.256.256.(3+2+1)/1,000$ seconds, which is about 30 minutes. By clever arrangement of the sums, the FFT manages with about $4.N.\log N$ multiply-add steps — log to the base two, by the way. So the FFT takes only $4.256.8.6/1,000 = 50$ seconds to do the same sums.

That is how the FFT earns its name, and why you find old-style frequency analysis programs which hobble along analysing perhaps 40 or 50 points at best. The present program takes more than 50 seconds because it has to do some additional data shuffling and computation but the principle is the same.

If you want to go to more than 256 points, even the FFT can become somewhat boring if you use just Basic. With 1,024 points, it would take more than 10 minutes to do the sums. It is possible to write machine-code programs which do everything much faster — a 256-point machine code FFT program runs in about two seconds on the Pet. You can also buy special-purpose FFT hardware from various manufacturers which will do 1,024-point FFTs in a few milliseconds, but they are not really intended for use at home.

The photographs in figure 3 show the kind of thing which you can obtain from a Pet display with a little care. Similar or better results can be obtained with an Apple or Exidy Sorcerer or other computer with higher-resolution plotting ability. With the Pet, it is possible to have 80 by 50 points on a graph by using the whole screen and double-density plotting,

Figure 4a-4c. Sine wave signal, white noise and signal-plus-noise.



but it is more sensible to leave a margin which can be used for labelling the axes.

Black lines on white backgrounds are easier to see than white on black, while the spectrum is best plotted as a histogram or bar chart display. Figure 3 shows the input and output data chopped into chunks of 64 points and displayed as double-density graphs with 64 by 40 points.

You can take photographs of the screen easily — use an ordinary black-and-white film such as Ilford FP4, which is rated at 125 ASA. Use a time or bulb exposure of one or two seconds at about f/11. It is best to use a tripod and cable release, otherwise use a table top, a pile of books and a good deal of breathholding. Assemble the final prints with a little trimming at the edges, because most displays are distorted at the edge of the screen.

If you insist on analysing large amounts of data, say, 1,024 points or more, chopping the data into chunks is awkward, while a computer printout is the length of a roll of wallpaper. You then have only one sensible option, which is to obtain a digital-to-analogue (D/A) converter — or build one — and beg, borrow, buy or steal an oscilloscope.

Machine-code routine

More or less any scope is good enough to allow you to produce displays for up to 1,024 points, with a little squeezing. Turn your data into bytes — 0 to 255 — set the scope running and push the data out, one byte at a time, to the D/A converter. Have that connected to the Y-input of the scope, which must be set for DC signals.

Things are much better if you use a small machine-code routine to speed things and to provide a trigger signal so that you can obtain a stable, real-time picture. Figure 4 shows some simple examples of what can be obtained at a cost of about £10 in electronic bits and £80 upwards for a second-hand scope.

There are one or two aspects of the FFT which may seem strange when you first use it. The first is that if you put say 256 points into the FFT, you obtain 256 points, but points 128 to 255 are mirror images of points 0 to 127. Figures 1 and 4 show some examples of this.

You may think that the FFT is not giving you value for money, but that is not the case. It occurs because the pictures show the sum of the square of the two arrays RE and IM. If you print-out the numerical values of the two arrays, you see that the upper set of points will usually have the opposite sign to the lower, at least in one array.

That is because we are using a particularly simple form of input, by only feeding data into one of the arrays — the array IM is set to zero at the start. If you are careful and clever, try modifying the program and running it twice, using the output from the first run as the input for the second.

If you do it properly, you obtain almost

```

90 REM***FFT PROGRAM***
100 PRINT "WHAT POWER OF 2?":
INPUT Q:P=Q-1
200 F=0.1:R=INT(21*Q+F)-1:
DIM T(R):DIM RE(R):DIM IM(R):
DIM CO(R):DIM SI(R)
290 REM***LOOK-UP TABLE
COMPUTATION***
300 K=2*PI/(R+1):FOR X=0 TO R:
CO(X)=COS(K*X):SI(X)=
SIN(K*X):IM(X)=0:NEXT
310 REM***INPUT DATA
GENERATION***
1000 FOR X=0 TO R:T(X)=SIN(K*X*
(P+F)):NEXT
1990 REM***DRAW INPUT GRAPH***
2000 FOR X=0 TO R:PRINT TAB
(INT(19*(1+T(X)))):"":NEXT
2010 REM***THIS IS THE FFT***
3000 PRINT "FFT: BIT REVERSAL":
GOSUB 6000:GOSUB 7000
3110 REM***DRAW OUTPUT GRAPH***
4000 FOR X=0 TO R:A=INT(SQR(RE
(X)*RE(X)+IM(X)*IM(X))):IF
A>38 THEN A=38
4100 PRINT TAB(A);"":NEXT:END
5990 REM***BIT REVERSAL
SUBROUTINE***
6000 FOR X=0 TO R:Y=0:FOR V=0
TO P:A=INT(21*V+F):B=
INT(21*(P-V)+F)
6100 Y=Y+B*(X AND A)/A:NEXT:
RE(Y)=T(X):NEXT:RETURN
6990 REM***FFT SUBROUTINE***
7000 FOR S=0 TO P:PRINT"STAGE";
S:T=INT(21*S+F):D=INT(21
(P-S)+F):FOR Z=0 TO T-1
L=INT(D*Z+F):FOR I=0 TO
D-1:A=2*I*T+Z:B=A+T:
F1=RE(A):F2=IM(A)
7200 P1=CO(L)*RE(B):P2=SI(L)*IM(B):
P3=SI(L)*RE(B):P4=CO(L)*IM(B)
7300 RE(A)=F1+P1-P2:IM(A)=F2+P3
+P4:RE(B)=F1-P1+P2:IM(B)=
F2-P3-P4
7400 NEXT:NEXT:RETURN

```

Table 1. The FFT program listing.

your original answer, which shows that the FFT does not really throw away half of what you put in. If you are really cunning, you can filter the spectrum by chopping some of the spectral components. Doing a second FFT then gives you a filtered signal — low-pass, high-pass, etc.

The other peculiarity of the FFT is that you apparently obtain different answers, even with a simple sine wave input, depending on the exact frequency of the input. For example, if you enter sine wave which has an exactly integral number of cycles, say, 45 cycles in 256 points, you obtain an output spectrum which is zero everywhere, except for a spike at 45 cycles in 256 points.

Yet, if you enter a sine wave with, say, 45.1 cycles in 256 points, instead of just a spike, you have a spike with wings. Figures 2 and 4 show examples of that behaviour. The difference occurs because the FFT treats the input data as cyclic, i.e., as though the left-hand end joined on to the right-hand end. With a whole number of cycles, the ends join smoothly; but with a non-integral number of cycles, there is a discontinuity. That sharp step generates a range of spurious spectral signals which show as the low-intensity wings. Normally, you need not worry about them particularly if you are using big input arrays.

Figures 3 and 4 give a few examples of FFT applications. For example, if you feed in the sum of two sine waves with slightly different frequencies — figure 3 — you have beats in the input, but the spectrum shows that there are only two spectral components present.

Figure 3b shows an input which is apparently very similar, but the spectrum shows that there is an additional, high-frequency sine wave present. Those two spectra are shown with a logarithmic scale on the y-axis to let you see weak signals: that also emphasises the wings.

Figure 3c shows a simple step input — it is really a top hat or isolated square wave pulse. The spectrum shows that the pulse generates frequencies over a wide range. As the pulse narrows so the spectrum broadens, figure 3d — hence the problem that many microcomputers act as good radio transmitters.

Figure 3e shows a train of pulses: compare this spectrum to the one above it. By trying different pulse widths and numbers of pulses, you can rapidly understand how narrow pulses generate energy over a wide range of frequencies.

Figure 4b shows an example of a white-noise input. It was obtained by using the RND function to generate a string of random numbers between +½ and -½. The right-hand side shows that this white noise has a more or less constant energy over a wide range of frequencies. The top of figure 4 shows a simple sine wave input and its spectrum — note the mirror image effect in the spectrum.

Now add the sine wave and the noise together — the sine wave signal disappears almost completely into the noise, figure 4c, but the spectrum still shows the spike corresponding to the single-frequency sine wave.

Another interesting demonstration is to use the FFT to examine frequency-modulated signals. For example, suppose that you fill the temporary array T(X) with $T(X) = \sin(K*X + M*\sin(K*X/10))$ where $K = 2*\pi*30/256$. That represents a low-frequency signal — three cycles in 256 points modulating a higher-frequency carrier — 30 cycles in 256 points. M is the modulation; as M increases, say, from 0.5 through 1.0 to 2.0, so the spectrum shows more and more energy being pushed into the sidebands. A small warning; do not try feeding in functions which oscillate too fast for the FFT to analyse or you will obtain false results — aliasing.

For example, with 128 input points, do not feed in a sine wave whose frequency is greater than 64 cycles in 128 points. Put another way, you must have at least two points for each period of your input sine waves. That is called the Nyquist limit.

Remember, the FFT is complicated to use — most of your programming effort will go into designing pretty displays. The best thing to do is to write a short program, such as that listed, and try it with different inputs and different lengths of input. □

14 197 Print result
15 900 Stop

The program multiplies two non-zero positive numbers stores in location 99 and 98. Store location 97 is used as a running total.

The operation of Marvin is simulated by a surprisingly simple Basic program. The 100 store locations are represented by an array S(0) to S(99). The accumulator is represented by a variable R and the program counter by variable I. These are initialised by lines 10, 20, 30, the array being filled with 999 stop instructions to guard partially against a user leaving his program accidentally.

On entering Marvin, the user is given a menu of options:

- Load a program. The user gives the start location and types in the data for successive locations, returning to the Menu by typing T as data.
- Examine a program from a location to check for errors.
- Modify one location.
- Single-step a program, one instruction at a time.
- Run a program. In Single-step and Run a start location is specified.
- Write a program to cassette tape.
- Input a program from cassette tape.

When each option is completed, the user is returned to the menu. The menu selection at lines 100 onwards is straightforward, and simply jumps to the selected option.

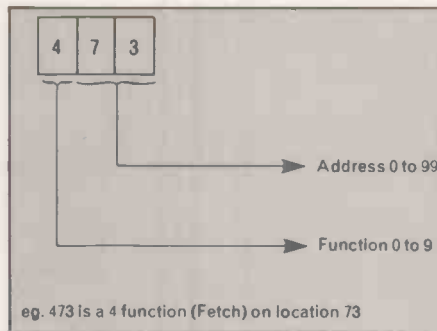


Figure 1.

Options Load line 200, Modify line 400 and Examine line 1000 perform simple operations on the selected array element. The only point of note is the use of a string variable to input numeric data. That is desirable to stop Basic error messages confusing the inexperienced user.

When a program is Run the user is asked for the start location. 'I' is then set to that value. The user is given a monitor option, which prints the value of I. S(I), i.e., the instructions about to be obeyed, and R, the accumulator contents. The monitor print-out is omitted on the value of the variable SK.

The instruction S(I) is decoded at line 812 into an operation F and an address X. At line 820, the requisite operation line number is selected.

Fetch, store, add, subtract and input are simple operations and involve the

selected store locations. After execution, line 930 increments I and returns to line 812 for the next instruction.

If a jump is required, either conditionally or unconditionally, the program counter I is set to the address portion of the instruction, held in X, and the program returns to line 812 for the next instruction.

Outputs are dealt with at line 890. If a number is in the range 0 to 899 it is displayed on the VDU. If the number is in the range 900 to 99, an alpha output is generated at line 896 to allow text to be printed. The range of the alpha outputs allows upper-case and lower-case and numbers to be printed.

A Stop instruction simply returns to the Menu — line 825. When Single-step is selected, the market S is set which brings line 980 into the program. That inserts a pause between each instruction. Single-step then operates in the same way as Run.

Because the program is held in an array, it can be saved on cassette in most Basics. If the menu selection is Write, lines 2000 onwards write the entire array to cassette. Similarly, Input reads the array from cassette, when required, at line 3000.

The program can handle both positive and negative numbers, but all numbers are handled as positive numbers when used as instructions. This avoids confusing students, initially, with number representation.

```

1 REM ***** MARVIN *****
2 REMARKABLY WRITTEN BY E A PARR JULY 1980
4 CLS
10 DIM S(99)
20 FOR I=0 TO 99:S(I)=999:NEXT I
30 S=0:R=0:I=0
100 REM MENU SELECTION
105 PRINT:PRINT
110 PRINT" CONTROL FUNCTIONS ARE:"
115 PRINT" LOAD, MODIFY, SINGLE STEP,RUN,"
120 PRINT" EXAMINE, TERMINATE"
125 PRINT" YOU CAN ALSO WRITE A PROGRAM TO TAPE"
126 PRINT" OR INPUT A PROGRAM FROM TAPE"
130 INPUT" WHICH DO YOU REQUIRE";A$
140 B$=LEFT$(A$,1)
150 IF B$="L" GOTO200
;55 IFB$="M" GOTO400
160 IF B$="S" GOTO600
165 IF B$="R" GOTO800
170 IF B$="E" GOTO1000
180 IF B$="T" GOTO9000
182 IF B$="I" GOTO3000
184 IF B$="U" GOTO2000
185 PRINT " I DO NOT UNDERSTAND ";A$:GOTO100
200 REM ***** LOAD *****
202 CLS
205 PRINT" YOU CAN LOAD A PROGRAM FROM ANY LOCATION"
215 PRINT" TYPE T AS DATA TO RETURN TO MENU"
220 INPUT" START LOCATION";A$:N=VAL(A$)
222 IFN<=99ANDN>=0 GOTO 230
224 PRINT" INVALID LOCATION": GOTO220
230 INPUT" DATA";A$
240 IF LEFT$(A$,1)="T" GOTO100
245 D=VAL(A$)
250 IF D<=999 AND D>=0 GOTO 260
255 PRINT " INVALID DATA": GOTO230
260 S(N)=D
270 N=N+1
275 IF N=100 GOTO 100
280 PRINT " LOCATION";N;" ";
290 GOTO230
400 REM ***** MODIFY *****
402 CLS
405 PRINT" YOU CAN MODIFY ONE LOCATION, TYPE"
406 PRINT" L AS DATA TO LEAVE UNCHANGED"
410 INPUT" LOCATION";A$:N=VAL(A$)
;20 IF N<=99 AND N>=0 GOTO 430
425 PRINT" INVALID LOCATION":GOTO410
430 PRINT" CURRENT DATA";S(N)
440 INPUT" NEW DATA";A$
450 IF LEFT$(A$,1)="L" GOTO100
455 D=VAL(A$)
456 IF D<=999 AND D>=0 GOTO460
458 PRINT" INVALID DATA":GOTO440
460 S(N)=D
470 GOTO100
600 REM ***** SINGLE STEP *****
601CLS:PRINT" SINGLE STEP"
602 INPUT" EXECUTION TO START AT";A$:I=VAL(A$)
603 IF I<=99 AND I>=0 GOTO610
604 PRINT" INVALID LOCATION":GOTO602
610 S=1:SK=0
611 INPUT" MONITOR REQUIRED";A$: IFA$="YES"THENSK=1
612 GOTO812
800 REM ***** RUN *****
801 CLS: PRINT" RUN"
802 PRINT" EXECUTION TO START AT";A$:I=VAL(A$)
803 IF I<=99 AND I>=0 GOTO 810
804 PRINT " INVALID LOCATION": GOTO802
810 S=0:SK=0
811 INPUT" MONITOR REQUIRED";A$: IFA$="YES"THENSK=1
812 F=INT((ABS(S(I)))/100):X=ABS(S(I))-100*F
813 IFSK=0GOTO815
814 PRINTI,S(I),R
815 IFS=0GOTO820

```

(continued on next page)

(continued from previous page)

```

817 GOSUB 980
820 ON F+1 GOTO 880, 890, 850, 860, 830, 840, 904, 870, 900
825 GOTO 920
830 REM ***** FETCH *****
831 R=S(X)
835 GOTO 930
840 REM *** STORE ***
841 S(X)=R
845 GOTO 930
850 REM ***** ADD *****
851 R=R+S(X):IF R>999 OR R<-999 GOTO 918
855 GOTO 930
860 REM ***** SUB *****
861 R=R-S(X):IF R>999 OR R<-999 GOTO 918
865 GOTO 930
870 REM ***** JUMP N/C *****
871 IF R<0 GOTO 904
875 GOTO 930
880 REM ***** INPUT *****
881 INPUT " INPUT DATA";A$: S(X)=VAL(A$)
884 IF S(X)>999 OR S(X)<-999 GOTO 918
885 GOTO 930
890 REM ***** OUTPUT *****
891 IF S(X)>=900 GOTO 895
892 PRINT " OUTPUT DATA ";S(X):GOTO 930
895 REM ***** ALPHA OUTPUT *****
896 PRINT CHR$(S(X)-869);:GOTO 930
900 REM ***** JUMP ZERO *****
901 IF R=0 GOTO 904
902 GOTO 930
904 REM ***** JUMP *****
910 I=X:GOTO 812
918 PRINT " OVERSPILL"
920 PRINT " TERMINATED AT ";I:GOTO 100
930 REM ***** THE PC *****
931 I=I+1
940 IF I=100 THEN PRINT " HALTED AT 100";GOTO 100
945 GOTO 812
980 INPUT " CONTINUE";A$: RETURN

```

```

1000 REM ***** EXAMINE *****
1001 CLS
1002 PRINT " YOU CAN EXAMINE THE STORE FROM ANY LOCATION"
1005 PRINT " TYPE T TO RETURN TO MENU OR HIT ENTER TO"
1007 PRINT " CONTINUE WITH NEXT LOCATION"
1020 INPUT " START LOCATION";A$:N=VAL(A$)
1022 IF N<99 AND N>=0 GOTO 1030
1025 PRINT " INVALID LOCATION":GOTO 1020
1030 PRINT " LOCATION";N;" DATA";S(N)
1040 INPUT " NEXT";A$
1050 IF LEFT$(A$,1)="T" GOTO 1000
1060 N=N+1:IF N=100 GOTO 1000
1070 GOTO 1030
2000 REM ***** RECORD ARRAY *****
2005 CLS:PRINT " SET TAPE RECORDER TO RECORD"
2010 INPUT " HIT ENTER WHEN READY";A$
2015 FOR Z=1 TO 500:NEXT Z
2020 PRINT " ***** RECORDING *****"
2030 CSAVE*A$
2040 PRINT " ***** DONE *****"
2050 PRINT " TURN RECORDER OFF NOW"
2060 GOTO 1000
3000 REM ***** READ ARRAY *****
3005 CLS:PRINT " ***** INPUT FROM TAPE *****"
3007 PRINT " SET RECORDER TO PLAY"
3010 INPUT " HIT ENTER WHEN RUNNING";A$
3020 PRINT " ***** READING *****"
3030 CLOAD*A$
3040 PRINT " ***** DONE *****"
3050 PRINT " TURN RECORDER OFF":GOTO 1000
9000 REM ***** TERMINATE *****
9010 PRINT " IF YOU TERMINATE YOU WILL RETURN"
9020 PRINT " TO BASIC & LOOSE YOUR PROGRAM IN"
9030 PRINT " MARVIN"
9040 INPUT " DO YOU STILL WISH TO TERMINATE";A$
9050 IF A$="YES" GOTO 9100
9060 GOTO 1000
9100 PRINT " THANK YOU FOR YOUR PROGRAM"
9110 PRINT " BYE"
9120 STOP

```



"THIS BOOK IS EXCELLENT" — CLIVE SINCLAIR

This unique book contains 30 programs all designed to fit in the basic 1K version of the SINCLAIR ZX80!

With this book you will realise that the ZX80 is more powerful than you ever imagined! 112 pages packed full of solid information!

BLACKJACK — actually contains a full pack of cards, shuffles them, keeps track of the dealer and player totals, and the money bets, all within 1K.

DR. ZX-80 — a truly conversational program: DR. ZX 80 is your personal computer analyst.

LINE RENUMBER — an invaluable program which automatically renumbers lines and puts order to your programs.

MEMORY LEFT — an incredible routine especially useful with only 1K, which lets you know to the byte how much memory is left. This also illustrates USR routines.

GOMOKU — the computer challenges you to this complex Japanese game. Incredibly this program including display of the 7 x 7 board fits into 1K — it only does so because it uses the display as memory!

Other programs included are **HORSE RACE**, **LUNAR LANDER** (with moving spaceship display), **NOUGHTS AND CROSSES**, **NIM**, **SIMPLE SIMON**, **HANGMAN**, **LIFE**; **MASTERMIND**, **PINCH** and 16 others!

£6.95 OTHER BOOKS IN PREPARATION INCLUDE
available by mail 'ZX-80 MACHINE LANGUAGE PROGRAMMING'.
order only

MELBOURNE HOUSE PUBLISHERS

Orders to: 131 Trafalgar Road, London SE10

Correspondence: Glebe Cottage, Glebe House, Station Road, Cheddington, Leighton Buzzard, Beds.

Please send me copy/ies of '30 Programs for the ZX-80: 1K'

NAME:

ADDRESS:

POSTCODE:

Please enclose cheque or P.O. for £7.45 per copy. Orders outside the U.K. £7.95

• Circle No. 167



BUSINESS - PACK

- WORD PROCESSOR
- PAYROLL
- BANK ACCOUNT
- STOCK CONTROL
- MAILER/LETTER
- CASH REGISTER
- SALESMAN
- LIBRARY INDEX

COMPLETE PACK (inc. DISKS, DOCUMENTATION & POSTAGE):

APPLE II / ITT 2020 (disk) ONLY: £99

HARDWARE

- ITT 2020 48K
- PRINTER
- DISK DRIVES
- COLOUR MONITOR
- FULL SOFTWARE

Complete system: £3000

TRY IT!

PHONE FOR A DEMONSTRATION NOW

BUSYLINK

★ A fully integrated business system for:

- INVOICING
- WORD PROCESSING
- ADDRESSING

£250 inc. Disk, Documentation & post. APPLE II & ITT 2020

NEW NEW

- SUPER STOCK CONTROL £70
- DOUBLE ENTRY LEDGER £70
- INVOICER £60
- FILING CABINET £50
- YEAR PLANNER PRINTER £30

APPLE II & ITT 2020

Prices include: DISK, POSTAGE & DOCUMENTATION

SPECIALS

THE VERY POPULAR:-

★ MAILER/LETTER & £50

★ Word processor inc. Disk, postage. £40

APPLE II & ITT 2020

★ INCREDIBLE PRICES! ORDER NOW. ★

OR MORE DETAILS FROM:-



DATABANK



66, Queens Road, Loughborough, Leic. Tel. 0509 217671

PETSSETTE

20 PET PROGRAMS £20

- PAYROLL
- MAILING LIST
- BANK ACCOUNT
- LIBRARY INDEX
- STOCK CONTROL
- CASH REGISTER
- LUNAR LANDER
- LOST IN SPACE
- STANDARD LETTER
- SPACE DOGFIGHT
- NOUGHT & CROSSES
- SALES LEDGER
- LUNAR INVADERS
- SNOOKER
- ASTRONOMY
- STARTREK
- JET FLIGHT
- HANGMAN
- SPACE ATTACK
- KLINGON

All for £20

inc. Cassette & postage

GAMES-PACK

- Snooker
- Crossword
- Noughts & crosses
- Space dogfight
- Startrek
- Phaser
- Jet flight
- Spaceship
- Klingon

£20 (inc. disk & postage)

APPLE II - ITT

PETMERGE

NOW YOU CAN SAVE LOTS OF TIME BY JOINING USEFUL GOSUBS TOGETHER - USING YOUR CBM DISK AND OUR LONG AWAITED MERGER PROGRAM.

ONLY £40 inc. DISK, INSTRUCTIONS & POSTAGE

SCI-PACK

- STATISTICS
- GRAPH PLOT £20
- ASTRONOMY

APPLE II & ITT 2020

Prices include: DISK & POST

SAVE MONEY WITH

DATABANK

Cheque with order for our 'by-return' mail service.

Your computer? MORE DETAILS

Apple II ITT 2020 (disc)

Name _____

Address _____

Postcode _____



QUALITY AT THE RIGHT PRICE! SOFTWARE DIRECT FROM WRITERS

Trade in SUPERBRAIN-Z19 APPLE-SORCERER SHARP-PET-RAIR TERODEC-TANDY and get

TEXAS Instruments 990 Computers

with Guaranteed applications software

- Stock
- Invoicing
- Sales
- Payroll
- Nominal
- Word Processing
- Order Entry
- Bill of Materials
- Purchase
- Bespoke Software

Clip the coupon or phone now and get details of the trade-in scheme exclusively from

radius

Radius Computer Services Ltd.
Wykeland House, 47 Queen Street
Hull HU1 1UU — Telephone (0482) 227181

Please send me details of the trade-in scheme

Name

Position

Company

Address

The model I wish to consider trading in is

PC12

• Circle No. 168

Special I/O ports for the outside-world interface

This month, David Peckett covers two approaches to a programmable I/O device.

ANY USEFUL microcomputer has to communicate with the outside world, either via memory-mapped peripherals, or via special I/O ports. To give that capability, the chip builders also supply peripheral chips — programmable, intelligent, devices. Those chips are available in many different forms, but the most widely-used types provide 8-bit parallel ports — usually two ports per chip.

This month, we shall look at two approaches to a programmable input/output, PI/O, device — the 6520 and

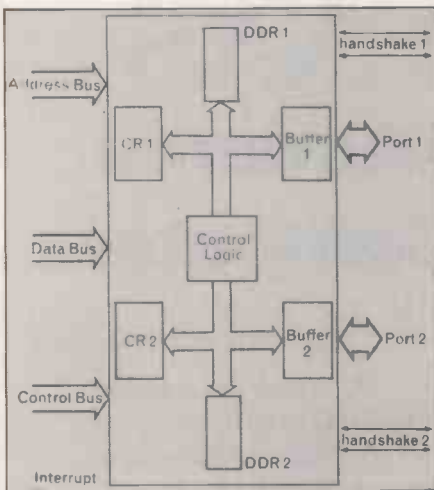


Figure 1. The ideal PI/O.

the Z-80 PI/O. Before we do, however, what facilities should we look for in a PI/O?

The most fundamental thing is that the PI/O must provide at least one, and preferably two, or even three, ports; each port will have eight interface lines.

To give the maximum flexibility, each line from a port must be selectable individually as either an input or an output. There has to be, therefore, an 8-bit data direction register, DDR, controlling the lines, associated with each I/O buffer.

We can use each bit of a DDR to control the mode of its associated line. For instance, setting a DDR bit five to 0 might configure I/O line five as an input. That is the usual approach, rather than using a "1" to define an input — why?

We saw last month that handshaking is often used to interface the micro to its peripherals; we must, therefore, also provide a pair of handshake lines for each port. Sometimes, though, we may have to use some of a port's lines to generate handshakes, but that wastes lines.

Since the PI/O must be as flexible as possible, able to communicate in different ways, use different handshake modes,

etc., we need some way to select the right operating mode at the right time. A few bits will do the job, and can be part of a control register, CR, for each channel of the PI/O.

Once the appropriate selection has been made in the CR, the internal logic of the PI/O can be left to calculate its detailed working. After all, the idea is to relieve the CPU of as much work as possible.

A second job for the CR is to tell the CPU the status of the port — whether a handshake has occurred, for instance. As well as holding the PI/O control bits, the CR should, therefore, contain at least one status bit which the micro can read.

The CPU will communicate with the PI/O via the normal system busses. The data and control busses must run to it and, if it is memory-mapped, it will also link with the system address bus. The micro needs to be able to access each register of the PIP. Ideally, the device's control logic will give a separate address or port number to each register. The PI/O will need a core of control logic to organise what goes where.

Finally, PI/Os are often used with interrupt-driven systems. Interrupts are a marvellous invention — they allow the CPU to respond very quickly — inside 10 μ S — to unpredictable outside events, while not losing track of its routine task. They require an interrupt-line from the PI/O to the CPU.

Putting in all those factors, our hypothetical PI/O looks something like figure 1. How does that compare to the devices to match the 6502 and the Z-80?

The 6520 is a memory-mapped PI/O which can be used with the 6502. Figure 2 is a sketch of it, showing its key features.

It has two channels, called A and B, each with an I/O buffer register called a peripheral data register, PDR. Each port has two control lines associated with it; one is input-only, and the other may be either an input or an output. The appropriate channel CR sets-up the control lines as necessary to provide the handshaking that the programmer segments.

One oddity which will strike you straight away is that there are only two address lines to the chip. They are normally the two LSBs of the address bus — A0 and A1. There is also a chip-select line, which is enabled by a suitable gating-together of the 14 MSBs of the address bus.

The hardware designer can thus put the 6520 virtually anywhere in memory. Suppose he gates the A2-A15 lines to give a base address of 8000₁₆. Combining the chip-select line with the A0 and A1 lines,

it is possible to give the PI/O registers four addresses: 8000, 8001, 8002, and 8003.

Here we have a problem. The device has six registers, and only four addresses to allocate to them. What does it do? The DDR and PDR in a given channel share the same address, and we select the one we want to write to via bit two of the appropriate CR. If the bit is "1", we can access the PDR, and if it is "0", that address gives us the DDR. That can force us to use clumsy programming.

The two address lines always select the same registers, and the allocations are shown in table 1. With the addresses I described above, that would make 8001₁₆ the address of CRA, and 8002 would be the address of DDRB and PDRB.

The DDR uses the convention I described earlier — a "0" in any bit position configures the relevant line as an input,

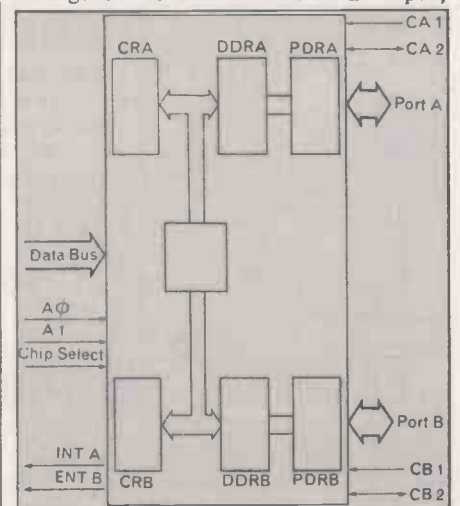


Figure 2. 6520.

and vice-versa. The 16 I/O lines can be formed in any pattern of inputs and outputs. The two CRs each have eight bits — figure 3 — which form several functional groups. The six lower bits can be written to, and read, by the CPU, while the two MSBs can only be read.

The two LSBs control the input-only control line for that channel — CA1 or CB1. It is possible to select whether or not an active transition on that line causes an interrupt to be sent. You can also define whether active means high-to-low or low-to-high. Whether or not an interrupt is actually sent, an active transition always sets bit seven of the CR to "1". That bit is re-set to zero automatically whenever the micro reads the data in the PDR for that channel, no matter whether the PDR is set for input or output.

As we saw, bit two controls access to the DDR or the PDR. A "1" in bit two links the data bus to the PDR. Bits three to five control the two-way control line — CA2 or CB2. You can select the line as an input or an output via bit five. If it is an input, it can be used just like line 1 — it can control interrupts, and active transitions will set bit six. If it is an output, bit six stays at zero, and the line can either be controlled by the micro or automatically.

With either approach, if line two is an output, it can be used for handshaking,

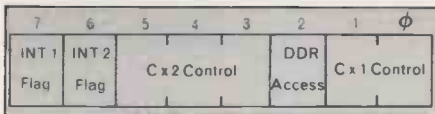
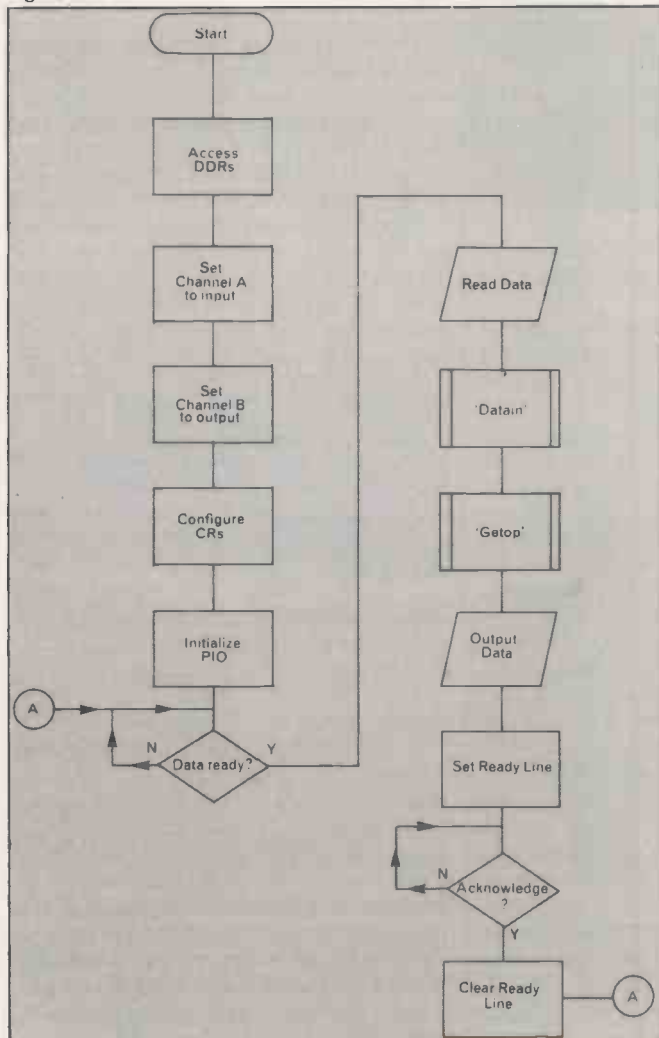


Figure 3. 6520 control register.

but the auto mode is better for the purpose. When it is working automatically, the line is set whenever the PDR is read. The micro does not, therefore, have to worry about the details. When line two is controlled directly, it is normally used simply as a discrete control line, rather than as part of a handshake.

The way of signalling handshakes and status is particularly useful. The status information appears in the control register,

Figure 4. Flowchart for 6520.



and the control lines are also manipulated via the CRs. The two PDRs are thus free to be used only for data.

You can also see that the two control inputs in each channel set the two MSBs of the relevant CR. They are the easiest

A1	A0	REG
0	0	DDRA, PDRA
0	1	CRA
1	0	DDRB, PDRB
1	1	CRB

Table 1. 6520 register selection.

two bits for the micro to test. Even more cunning, the primary input lines — CA1 and CB1 — control the MSBs — i.e., the sign bits — of the CRs. Read a CR, and the N flag shows the status of control line 1 — just like that.

Suppose we want to program a PI/O to control a bi-directional interface, with eight bits of data going each way. Channel A is to be the input, and we set it with an automatic handshake. CA1 will not set an interrupt, but a high-to-low transition will show that data is ready. That will be reflected in bit seven of CRA. CA2 will go low to tell the peripheral that the micro has taken the data.

Channel B will be used to output data. Data read will be shown by the micro

setting CB2 low. When the peripheral has read the data, it will set CB1 high, after which the micro can set CB2 low again, and move on to the next phase. Table 2 shows the CR control words that will be needed.

We have two phases to think about in the program — setting-up the PI/O and handling the data. Figure 4 is a flowchart for those activities. To make it simpler, the data is handled via undefined sub-

CR Command	Meaning
xxxx x0xx	DDR Selected
xx10 1100	Control line two output; auto-handshake; auto re-set; PDR selected; no interrupt; line one active transition is high-to-low
xx11 b110	Line two output, and set to value of "b"; PDR selected; no interrupt; line one active transition is low-to-high

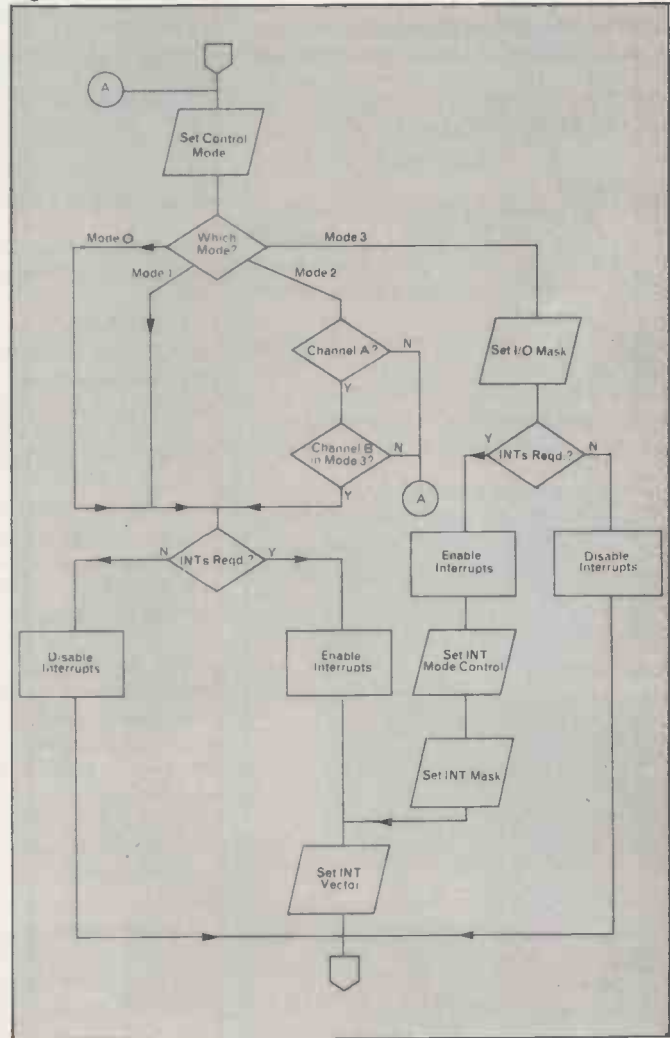
"x": "Don't Care"

Table 2. 6520 control words.

routines, interfacing via A. The flowchart is very simple and the resulting program is in figure 5.

The program is straightforward. We have access to the DDRs by setting the bit twos of the two CRs to zero — since the
(continued on next page)

Figure 7. Z-80 PI/O control.



(continued from previous page)

other bits do not matter at this stage, it is easiest to set the CRs entirely to zero. Channel A is then set as an input by setting all the bits of DDRA to zero, and channel B is established as an output by writing FF₁₆ to DDRB. The first part of the program finishes by setting the two CRs to their final command codes, using the values from table 2, and, finally,

```

CONTROL AND USE OF 6520 PIO
;THE ASSEMBLER SHOULD BE INSTRUCTED TO SET
;PDR=DDRA AND PDRB=DDRB
;
LDA #0
STA CRA ;SET CAs FOR ACCESS
STA CRB ;...TO DDRA
STA DDRA ;SET DDRA FOR INPUT
LDA #0FF
STA DDRB ;SET DDAB FOR OUTPUT
LDA #02C
STA CRA ;SET UP CRA MASK
LDA #02E
STA CRB ;SET UP CRB MASK AND
;...SET CAB (CB2 IS HI)
LDA PDRA ;CLEAR STATUS
LDA PDRB ;...BITS
;SYSTEM IS NOW CONFIGURED.
;START HANDLING DATA.
LOOP1 LDA CRA ;IN FLAG SHOWS STATUS
BPL LOOP1 ;WAIT IF "0"
LDA PDRA ;READ DATA
JSR DATABIN ;PROCESS IT
JSR GETOP ;GET OUTPUT DATA
STA PDRB ;SET OUTPUT
LDA #026
STA CRB ;RESET CAs MASK
LDA CRB ;SET CB2 LOW
LDA CRB
BPL LOOP2 ;WAIT FOR ACKNOWLEDGE
LDA #02E
STA CRB ;SET CB2 HIGH
BNE LOOP1 ;BACK FOR MORE (A#0)

```

Figure 5.

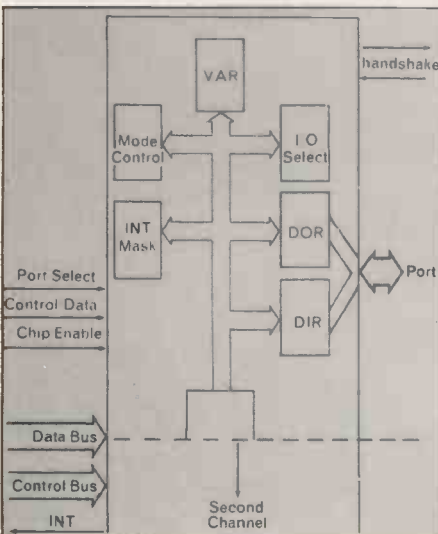
makes dummy reads of the PDRs to ensure that the status bits are clear.

The second part of the program handles the data. We can see how data is entering and leaving the system. Because we are controlling CB2 directly, the program is a little longer than it need be; you should aim to use an automatic handshake whenever you can.

Finally, a trick we have used before in the series; a "BNE" instead of a "JMP" to return to the start. The Z flag is never zero at this point, and a branch is quicker than a jump.

The Z-80 is much more complex than the 6502. It will not be any surprise, then, to discover that the Z-80 PI/O is rather more complicated than that of the 6520. It has the same basic function of providing

Figure 6. One channel of Z-80 PI/O.



Address Bus Bit 1	Address Bus Bit 0	Port No. (Hex)	Function
0	0	74	Channel A data
0	1	75	Channel B data
1	0	76	Channel A control
1	1	77	Channel B control

Table 3. Z-80 PI/O port selection.

two 8-bit ports, but its modes, and the way that they are selected, are very different. Strangely enough, though, it cannot really do much more than the 6520.

Figure 6 shows the structure of one channel — the other is identical. Although it is more complex than the 6520, it is not that much harder to understand. The external connections are much the same — it is connected to the micro by the data bus, various control and selection lines, and an interrupt line. To the outside world, it looks like two 8-bit I/O channels, each with two handshake lines. Unlike the 6520 C×2 lines, all the handshake lines are unidirectional.

To the Z-80, the PI/O looks like four ports. The one used is selected by the data on the lowest eight bits of the address bus when the I/O signal from the micro is active. Normally, the six MSBs of the port address will be gated together to define the base address of the four ports, and used to select the PI/O via the chip-select

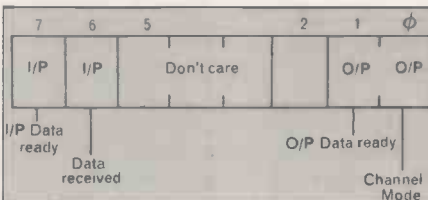


Figure 8. Channel A bit allocations.

line. Which of the four ports is to be used is then selected by the two LSBs of the address.

The addressing technique is very similar to that used with the 6520, and, with a base address of, say, 74₁₆, gives the port allocation shown in table 3.

The Z-80 PI/O has the same limitation as the 6520 of having only one control port per I/O port. In fact, because of the way that the PI/O is designed, that can lead to even more complicated programming than we had with the 6520. Figure 7 is a simplified flowchart of the steps you have to go through to set-up the PI/O — the key word here is simplified.

The first step is to select the channel mode. That is done by writing to the relevant control port — using "OUT" — a mode control word selected from table 4. The two bits "ab" are used to select one of four operating modes. Mode 0 is the output mode; data is written to the appropriate channel data output register, DOR, from where it goes on to the output bus.

Mode 1 makes a given port entirely an input. An "IN" from the port reads data which has been written from an external device into that channel data input register, DIR. In modes 1 and 0, hand-

shaking signals are applied automatically via the two handshake lines.

By selecting mode 2, channel A can be used, virtually simultaneously, as both an input and an output, passing eight bits of data each way. The DIR and DOR are linked to the /O bus under the control of the two pairs of handshake lines. That

```

;Z80 PIO CONTROL ROUTINE
;CHANNEL A IS I/O
;CHANNEL B IS INPUT OR OUTPUT
;
LD A,#0CF ;MODE 3 CODE
OUT (ACONTR),A ;CHANNEL A - MODE 3
LD A,#0C0 ;I/O MASK
OUT (ACONTR),A ;SET I/O MASK
LD A,#07 ;NO-INT. MASK
OUT (ACONTR),A ;DISABLE INT FROM A
OUT (BCONTR),A ;DISABLE INT FROM B
IN A,(ADATA) ;INITIALIZE
IN A,(BDATA) ;...PIO
LD C,ACONTR ;SET POINTER
LOOP1 LD E,#02 ;CHAN B IS I/P
OUT (C),E ;...DATA NOT READY
LD A,#4F ;MODE 1 CODE
OUT (BCONTR),A ;SET B TO I/P
LOOP2 IN A,(ADATA) ;READ STATUS
OR A ;SET FLAG
JP P,LOOP2 ;STATUS SET?
;IF BIT 7=1, DATA IS READY (AUTO HANDSHAKE)
IN A,(BDATA) ;READ DATA
CALL DATABIN ;PROCESS IT
LD A,#0CF ;MODE 0 CODE
OUT (BCONTR),A ;SET B TO O/P
SET C,E ;A BIT 0=1 B IS O/P
OUT (C),E ;SET MUX
CALL GETOP ;GET DATA
OUT (BDATA),A ;OUTPUT DATA
RES 1,E ;A BIT 1=0
OUT (C),E ;SET "/O READY"
LOOP3 IN A,(ADATA) ;WAIT FOR HANDSHAKE
BIT 0,A ;DATA ACCEPTED?
JP Z,LOOP3 ;WAIT
;PER. HAS ACCEPTED DATA - GO BACK FOR NEXT
JP LOOP1

```

Figure 11.

prevents confusion caused by the CPU and the peripheral trying to read or write together. Because that mode needs all four handshake lines, it can be used only with channel A of a PI/O. Furthermore, if channel A is in mode 2, channel B must be in mode 3.

Mode 3 is the control mode used to set up the PI/O, and to control individual I/O lines. Whenever mode 3 command is sent, the next word to that control port must be an 8-bit mask defining the I/O pattern to be set. A "1" in the mask sets

Word	Function
abxx 1111	Mode Control Word
abcd 0111	Interrupt Control Word
----0	Interrupt Vector Control Word
"x"	Don't Care
"."	Set as required

Table 4. PI/O control words.

the corresponding line as an input. Do not be confused by the 6520, which uses a "1" in the DDR to define an output.

Either or both channels can be set to mode 3, which allows any combination of I/O lines to be set-up. In that mode, however, the handshake lines are not used, and you have to set-up your own.

Whenever a mode 0-2 handshake occurs, the PI/O can automatically send an interrupt to the Z-80. The need for an interrupt is controlled by bit seven of the interrupt control word. If the bit is set to "1", interrupts will be generated. Because mode 3 does not use the handshake lines, it has a different way of generating interrupts. In that mode, the PI/O can gate

selected bits in a channel together to generate an interrupt.

The gating is established by sending the interrupt control word with bit four set to "1", followed immediately by a mask which is shunted into the mask register, MR, defining the bit(s) which will control the interrupt. The advantage of that technique is that it lets the Z-80 monitor, via a PI/O, up to 16 peripherals. The micro is able to select which peripherals it is interested in at any time.

Finally, the Z-80, unlike the 6502, can handle vectored interrupts. In those, the interrupting device can tell the micro the address of the routine which handles the interrupt. The PI/O tackles that with the two vector address registers, VARs, which can be set to the right value by the vector control word of table 4.

The Z-80 PI/O lacks one important feature of the 6520. That is the provision of status bits which the micro can read to see if a peripheral is ready. Without them, and if interrupts are not being used, the micro must read a device's status through an I/O channel. That, in turn, reduces the PI/O flexibility, and can lead to even more complicated systems.

Let us implement the same system we set-up with the 6502/6520 combination. That is eight bits of data each way, with an automatic handshake on the input, and a micro-controlled output handshake. We shall not be using interrupts.

Because of the Z-80 PI/O lack of status bits, the implementation is going to be a little more complicated than that for the 6520. We shall have to use one channel as both an input and an output, selecting the proper mode as we go. The other channel will be used for status, system control, etc. We could use channel A in mode 2 for the I/O channel, but let us complicate things by using channel B in modes 0 and 1.

Channel A will, therefore, be set as the control channel — it will operate in a mixed I/O configuration — mode 3. To tell the outside world whether channel B is an input or an output, we shall use channel A bit 0 as an output. It will be linked by external logic to a suitable I/O multiplexer for channel B. When bit zero is "0", channel B will be an output.

We also use bit one as an output, and set it low to show that the CPU has data ready for the peripheral. The handshake will be completed by bit six, an input, which the peripheral will set high when it has accepted data. Finally, bit seven of channel A will also be an input, going high to show that data is ready for the CPU.

Figure 8 shows the configuration of channel A, and the kind of system lay-out is shown in figure 9. The flowchart for the program segment is figure 10, and shows the extra complication caused by using the Z-80 PI/O. Compare it to figure 4.

The program I generated from the flowchart is shown in figure 11. It follows the flowchart closely, but, as usually, it has

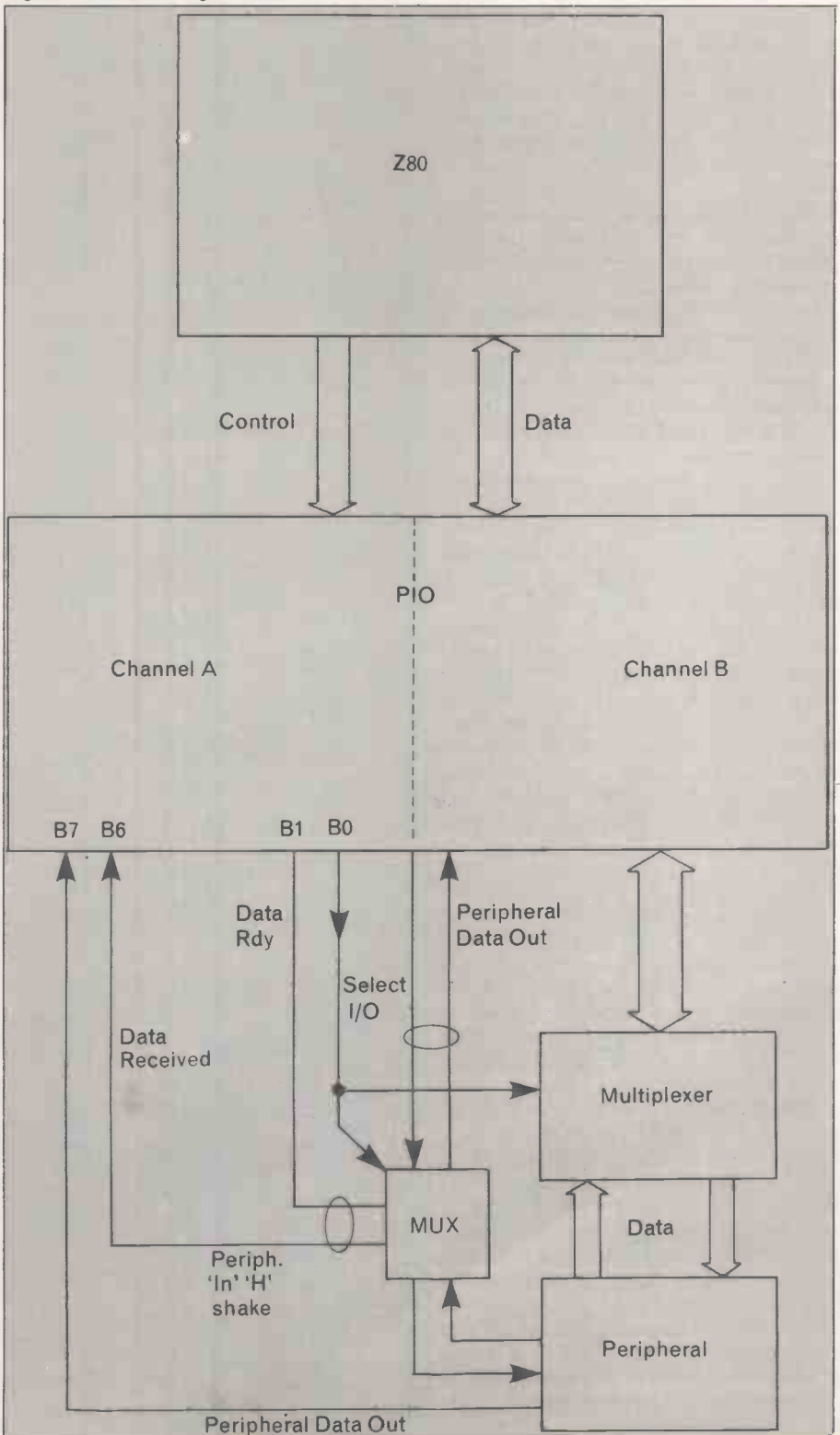
some interesting points. Initially, channel A is set up; it is forced into mode 3, and then the I/O mask is loaded into the PI/O to set the input and output lines. Only the two LSBs are set as outputs — all the others, including the don't cares, are left as inputs. In a real system, that would be the safest approach to take. Just possibly, other peripherals could be connected to bits two to five. If any of those four lines were outputs, the CPU actions might start the peripherals doing things at the wrong

time. At best, that would be embarrassing, but at worst, it could be dangerous.

The interrupts are then disabled in each channel, by writing bit seven of the interrupt control words to "0". When you do that, it does not matter what is in bits four to six, but, once again, I held them at zero. Having set up both channels, we make a dummy "IN" from each. Just as with the 6520, that makes sure that the

(continued on next page)

Figure 9. Circuit configurations.



(continued from previous page)

PI/O is completely initialised. It is not always essential, but it is a good practice.

Throughout the I/O loop, register E is used to control the two output lines from channel A. At the start of the loop, it is set to drive line one high, showing that output data is not ready, and line zero low to indicate that channel B is in the input mode. That control is then set via an "OUT (C),E". We have to use C as a pointer because we cannot output E directly.

At the beginning of the I/O loop, channel B is set to mode 1 input. The system then sits in a loop until the MSB of channel A goes high, showing data ready. The channel B automatic handshaking looks after the peripheral. Data is processed by DATAIN, and the system is re-configured with channel B as an output — mode 0.

The Z-80 acquires suitable data, sets it on the output bus, and warns the peripheral by setting bit one of channel A low. It waits for the handshake to be complete — the auto handshake is ignored — before going back to the start of the loop.

For the first time, we have investigated a problem where the 6502-based system was more efficient than that using the Z-80. Why was that? There were two main reasons. In the first instance, the Z-80 PI/O is rather clumsier to set up than the 6520. In the worst case, you might have to write to a channel control port six times before that channel was fully configured. You never have to write to a 6520 CR more than twice to set it up fully.

The second reason for the Z-80 clumsiness was the way that we chose to implement the system. Because we were not using interrupts, we had to create a set of status bits, and control a handshake. That occupied one channel of the PI/O, so the other had to be constantly switched between input and output. The result was a lengthy bit of programming. In a way, we were using the Z-80 PI/O to simulate a 6520.

If we had used an interrupt-based approach, or a second PI/O, the second reason above would have largely disappeared. However, the 6520 would still have been simpler to use. Why, then, do we use the Z-80 device? In the first place, we virtually have to if we are using a Z-80 CPU which, as we have seen, is a particularly wonderful wonder-chip.

Another point is that the Z-80 PI/O can gate together, under program control, several lines to generate an interrupt. If we have to monitor several peripherals, e.g., to control a chemical process, that can be very useful. The micro can select which peripherals it must respond to at any time.

In the end, though, it is Hobson's Choice. If you use a Z-80, you use a PI/O and put up with it; if your micro is a 6502, you have the easily-used 6520 to compensate you for your CPU limitations.

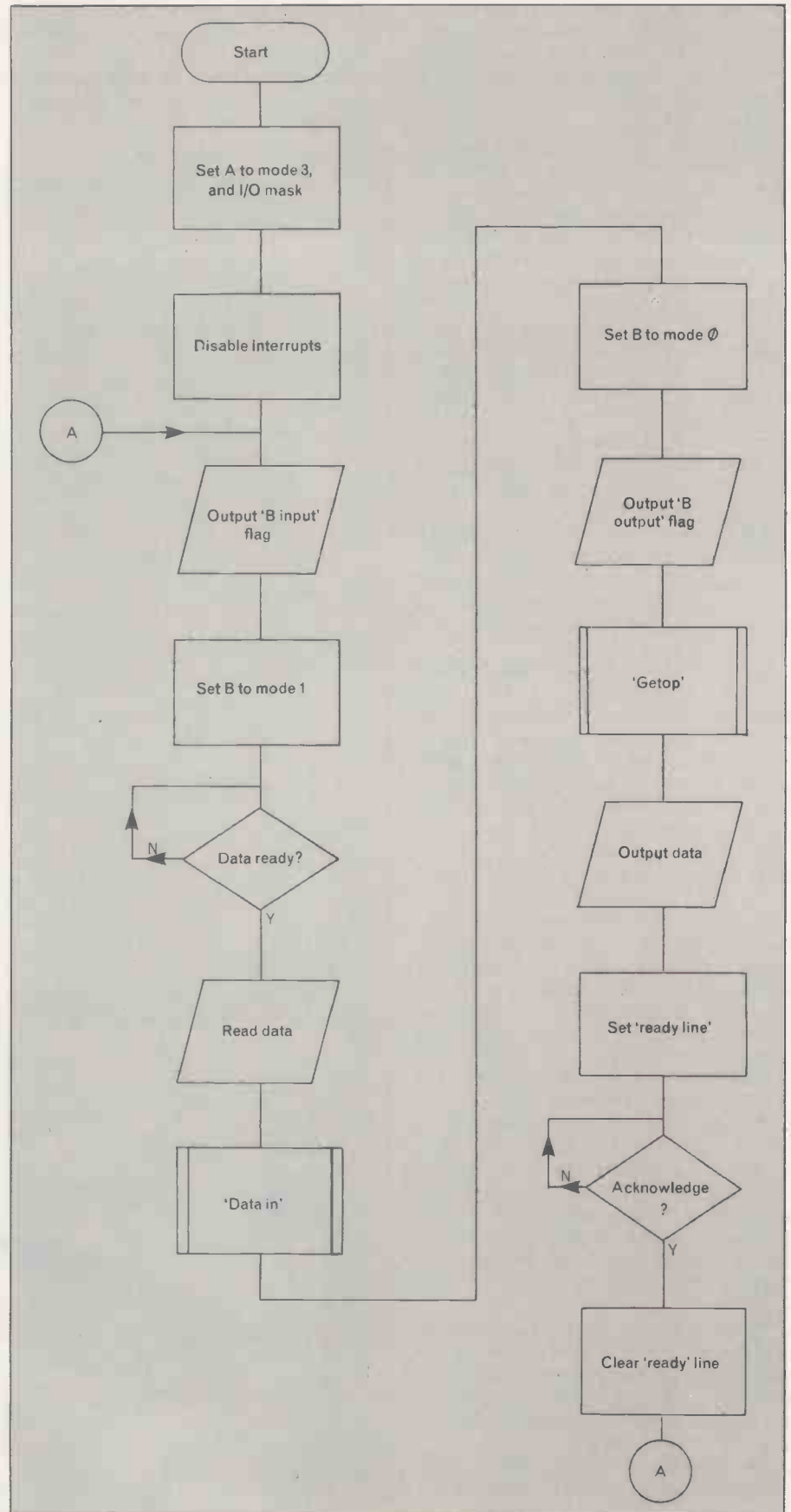
Other types of typical peripheral chips, e.g., serial outputs, are available, but they

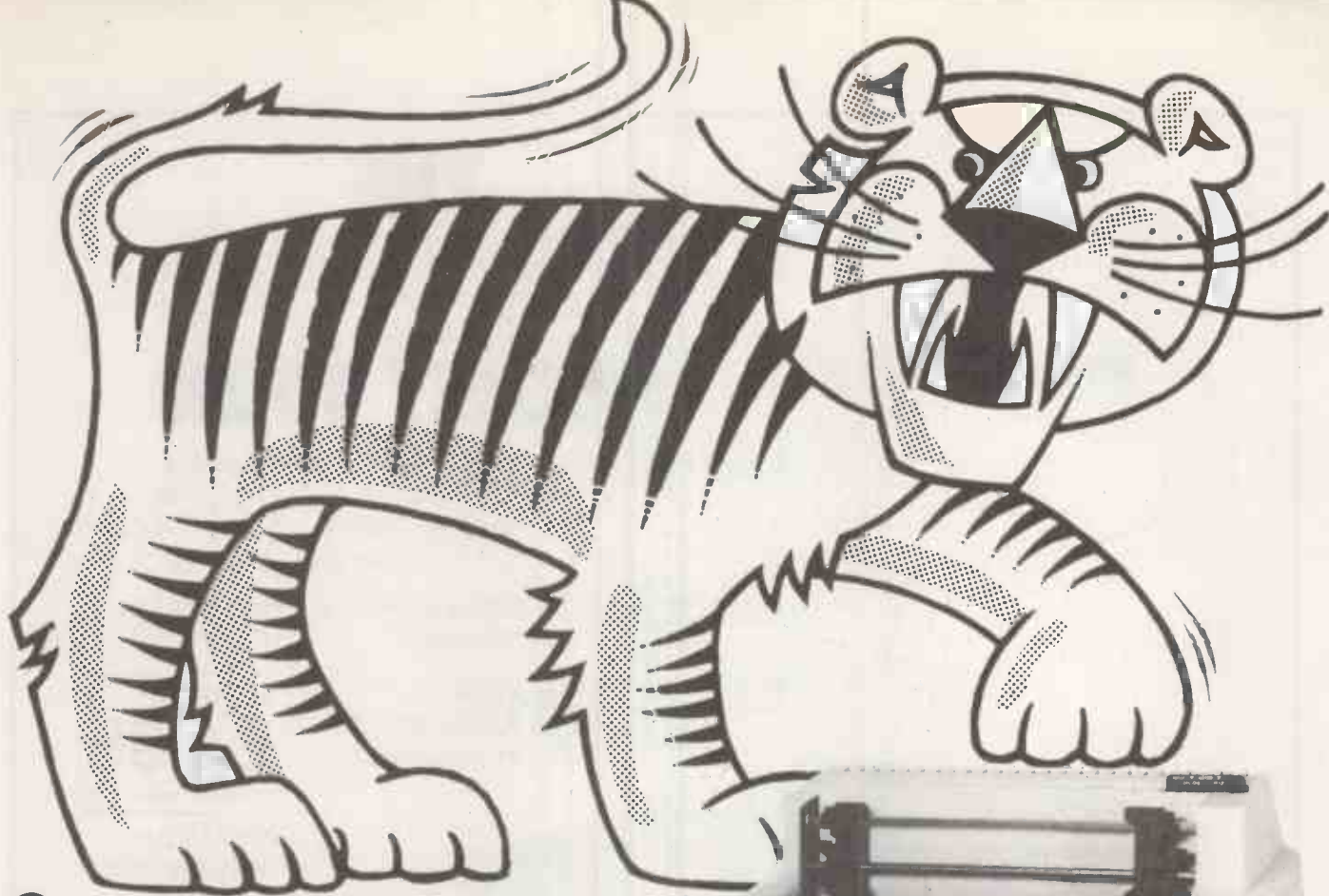
are almost always controlled by separate control and data words.

I hope it is clear that they are complex animals, and not necessarily easy to use effectively. Because of that complexity. I

have not been able to give full details of either the 6520 or the Z-80 PI/O. I have shown the basics, which should at least be enough to give you a head start when you study the data sheets. □

Figure 10. Flowchart for Z-80 PI/O.





Our new tiger's got more stripes

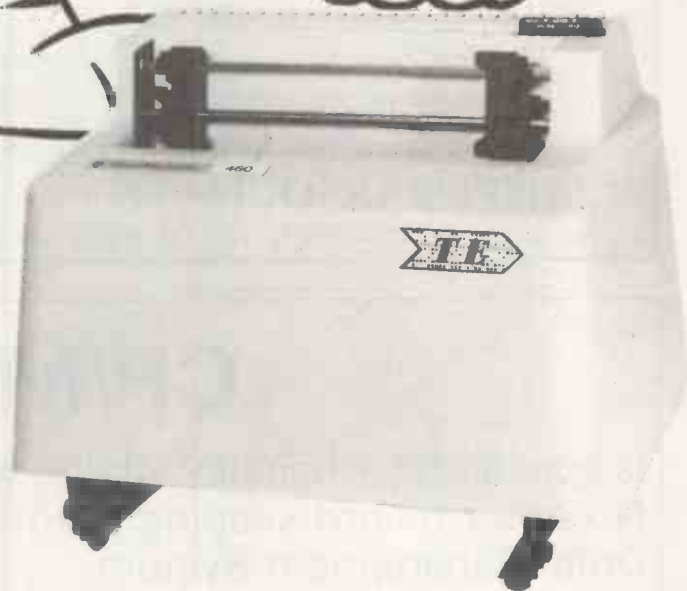
Paper Tiger, already the recognised leader in low-cost impact matrix printers, has been even further improved. The new Paper Tiger Model 460 carries no less than ten extra features:

- Staggered 9 wire matrix head
- Bidirectional logic-seeking print technique
- Correspondence quality print in a 24 x 9 matrix cell
- Selectable mono or proportional spacing
- Selectable auto text justification
- Programmable horizontal and vertical tabbing



Teleprinter Equipment Limited —
the peripheral people

70-82 Akeman Street, Tring, Herts. HP23 6AJ. U.K.
Tel: Tring (0442 82) 4011/9 & 5551/9.
Telex: 82362 BATECO G.



- 'Fine' positioning for word processing
- RS-232C (up to 9600 baud) with selectable XON/XOFF protocol
- Alterable function codes, fonts and characters
- Graphics capability

When the best gets better, you need to know all about it. Just clip and mail the coupon for the full story.

Please send full details of Paper Tiger to:

Name _____

Company _____

Address _____

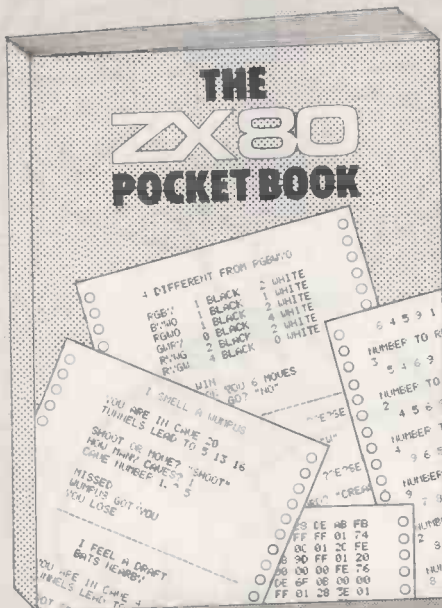
Tel: _____

See us at the
WINCH COMPUTER?
Stand Show
636

PC12

• Circle No. 169

103



THE ZX80 POCKET BOOK

6 NEW PROGRAMS

- Mastermind
 - Reverse
 - Space-Docking
 - Wumpus
 - Hangman
 - Share Valuation
- plus many others

PLUS HINTS AND TIPS ON

- Program Writing
- Graphics
- Cassette Use
- Program Efficiency

PLUS REFERENCE SECTIONS ON

- Basic
- ZX80 Op Codes
- Error Codes

92 Pages

£4.95

Including Postage & VAT

Mail Order
only please

PHIPPS ASSOCIATES 3, DOWNS AVENUE, EPSOM, SURREY. KT18 5HQ
or Telephone Epsom (03727) 21215 Quoting your Access Card Ref.



• Circle No. 170

CP/M User?

Is speed and efficiency vital to your business?
No other record keeping program has the unique capabilities of
Data Management System.

CHECK LIST

Do you want to:—

1. Store information
 2. Retrieve it in an instant
 3. Search on several criteria.
 4. Print reports/letters/ mailing list labels containing specific information.
 5. Do rapid calculations: e.g. produce sales figures, VAT, gross profit, exchange rates, price/fee charges etc. etc.
 6. Sort and print as required.
 7. Do numeric range searches (less than, greater than in a range of)
- ETC. ETC. ETC.

Should your business package be:—

1. Well established, with already over 250 end users?
2. Written and supported by a reliable and established British software house?
3. Be easy to use, require no training, and have an easily understood manual?
4. Be available for immediately delivery?
5. Be sensibly priced?

Used for stock files, personnel/agency/student/patient records, financial analysis, scientific/questionnaire analysis, maintenance contracts.

Brochure for DMS on CP/M and 32K Pets available from **Compsoft Ltd.**, Old Manor Lane, Chilworth, Surrey.
Tel. Guildford (0483) 39665 and Geneva (022) 57 48 34.

We have had so many requests for advice about software for the little ZX-80 that we have decided to start a club page devoted to the machine. If you have a contribution to make, write to *Practical Computing* marking your letter ZX-80 Line-up. We pay £5 for contributions published.

Maths tutor

THE MATHS Tutor is designed for young children and is written by M D Stuart of Baldock, Hertfordshire. Repeated wrong numbers result in the question being simplified while the type of problem cannot be predicted.

```

ZX80 MATHS TUTOR.
*****
COPYRIGHT M.D.STUART 20.08.80

1 LET MS="WHAT IS "
2 LET PS=" + "
3 LET MS=" - "
4 LET TS=" X "
5 LET NS=" NO"
6 LET OS=" GOOD"
7 LET CYC=0
8 LET BAD=0
11 LET SS=" + "
12 LET OS=" / "
13 PRINT " THIS IS YOUR MATHS TUTOR"
14 PRINT " *****"
15 PRINT
16 PRINT "MY NAME IS ZEDER ATEE."
17 PRINT
20 PRINT "WHAT IS YOUR NAME?"
30 INPUT Z$
40 CLS
50 PRINT "I HOPE YOU HAVE FUN "Z$
60 PRINT
61 PRINT "PLEASE REMEMBR A IS DIVINE"
62 PRINT "X IS TIMES"
63 PRINT " + IS ADD"
64 PRINT " - IS SUBTRACT"
65 PRINT "-----"
66 PRINT
70 LET D = RND(5)
80 IF D = 3 THEN GO TO 290
90 LET A = RND(20)
100 LET B = RND(20)
101 IF (B > A OR B = A) AND D > 3 THEN GO TO 90
110 LET L = PEEK(16421)
111 IF L < 10 THEN CLS
112 PRINT MS$A$
120 IF D = 1 THEN PRINT PS;B$
130 IF D = 2 THEN PRINT MS;B$
140 IF D = 3 THEN PRINT TS;B$
141 IF D > 3 THEN PRINT OS;B$
150 INPUT C
160 IF D = 1 AND C = A + B THEN GO TO 320
170 IF D = 2 AND C = A - B THEN GO TO 320
180 IF D = 3 AND C = A * B THEN GO TO 320
110 IF D > 3 AND C = A / B THEN GO TO 320
200 LET BAD = BAD + 1
210 PRINT SS;C;NS
201 IF BAD < 3 THEN GO TO 110
220 LET A = A - 1
230 LET BAD = 0
240 IF A > 0 THEN GO TO 110
250 LET B = B - 1
260 IF B = 0 THEN LET B = RND(5)
270 LET A = RND(12)
280 GO TO 110
290 LET A = RND(12)
300 LET B = RND(12)
310 GO TO 110
321 PRINT SS;C;NS
330 LET BAD = 0
331 IF D = 5 THEN GO TO 380
340 LET CYC = CYC + 1
350 IF CYC < 50 THEN GO TO 70
360 PRINT "THANKYOU "Z$,"FOR YOUR HARD WORK"
361 PRINT "DO YOU WANT SOME MORE PROBLEMS?"
362 INPUT VS
363 IF VS = "YES" THEN GO TO 60
364 PRINT "PROGRAM TERMINATED"
370 STOP
380 CLS
390 PRINT "A;OS;B;" IS "ZC;*****"
    "HOW MANY ARE LEFT?"
400 INPUT R
410 IF (B+C) + R = A THEN GO TO 430
411 PRINT R,"THINK AGAIN"
412 GO TO 390
430 PRINT R
431 PRINT "WELL DONE "Z$
440 GO TO 340
    
```

Keyboard circuitry

HERE ARE some notes which describe the video and keyboard circuitry as I understand it from studying the circuit diagram of a friend's ZX-80 writes P Sawyer of Richmond, Surrey.

From a study of the circuit diagram and the manual, I deduce that the video display and the keyboard operate as follows: the display file consists of the line-by-line text, each line terminated by 76X. Each line must be scanned eight times, corresponding to the eight rows of the eight x

eight character matrix. The monitor initiates a scan by jumping to the first byte of the line, with A15 of the program counter set, and with interrupt enabled.

Setting A15 causes the open collector outputs of IC14 and 15 to go low, such that the ZX-80 sees zeros on the data bus, i.e., a Z-80 no-op instruction. Thus, the ZX-80 keeps fetching each byte on the line and executing a no-op until the 76X at the end of the line is encountered. 76X has D6 set — all the characters of the text have D6 not set, which causes the open collector outputs to go high, and the ZX-80 sees the 76X and halts because 76X is the Z-80 halt instruction.

Just before beginning the line scan, the monitor loads the refresh counter such that A6 goes low on a refresh cycle after 32 or so refresh cycles. A6 is connected to the ZX-80 interrupt line, and thus the ZX-80 is interrupted by the expiring refresh counter, terminating the halt at the proper time for a video synchronic pulse.

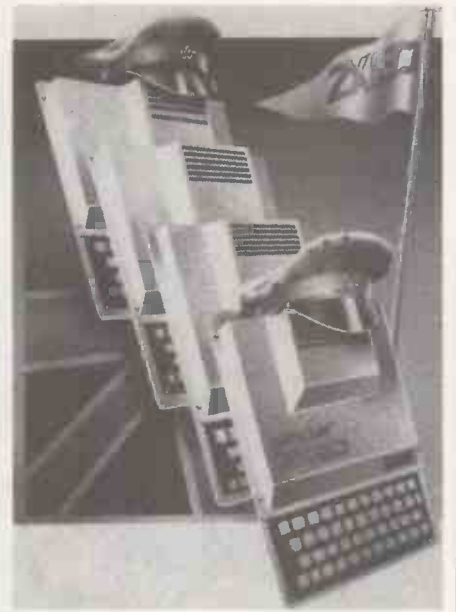
The code entered via the interrupt issues an I/O command to cause a synchronic pulse to be generated, and then loops to the next scan, either to process the next line of characters matrix or to begin a new line. The byte taken from the line of text is presented via IC7 to the character generator section of the ROM.

The relevant ROM address is formed as follows: the contents of the I-register form — A15-A8, the higher order bits are ignored by the ROM — D0-D5 of the character form A3-A7, and the low order three bits of the address — which represent the eight rows of the character matrix — are formed by the three high-order parts of the counter IC21, which is stepped at the end of each line slice. Each dot is two video lines deep. Rows of the character matrix are transferred from the ROM to the shift-register IC9, from whence the eight bits of the row are shifted to become the video dots.

The rate at which dots must be generated determines the system clock frequency of 6.5 MHz. When divided by two, that becomes the clock frequency of the ZX-80, four cycles of which form an M1 cycle, the time needed to execute a no-op, and thus to enable another character from the line to be presented to the character generator.

The address of the character generator section of the ROM is 3584; the character generator uses the last 512 bytes of the ROM. Inverse video is selected by D7 of the character, which is exclusive-or-ed with the shift register output — see the circuitry involving ICs 11, 12, 20.

The monitor drives the keyboard by



each of the eight half-rows of the keyboard are mapped on to one of the address lines A8-A15, e.g., QWERTY maps on to A9 and TUIOP on to A13. Each of the five columns maps on to one of the data lines D0-D4, e.g., three EDX maps on to D2. At the end of each frame, the monitor issues an I/O read instruction.

A Z-80 read instruction places a specified eight-bit value on address lines A8-A15. The monitor sets one bit low and the remainder high, cycling through all the eight lines on successive reads.

If a key is depressed, when the address line for its row is set low on the next keyboard scan, the data line for that key is pulled low — the data lines are held high by R13-R17 — so that the ZX-80 sets that bit low and the remaining bits high — unless more than one key in the same row is struck — on the completion of the I/O read.

One can study the action of the keyboard by use of the UST function. An alternative technique to that given in the August issue for placing machine code is to make use of an array as follows:

```

10 DIM A(n) REM reserves 2(n+1) bytes;
    must be first statement defining a variable
20 LET Q = PEEK(16392) + PEEK(16393)*
    256 + 2 REM set up Q with address of first
    byte in A
30 LET A = Q REM first POKE address
(n) load program byte by byte using POKE A,
    byte, LET A = A + 1 etc
(n) PRINT (or whatever) USR(Q)
    
```

The machine code must be self-relative because the monitor shifts variables about as the Basic program expands and contracts. Note that after editing the program, Q must be re-set, e.g., by GOTO 20, since the address of the first byte of the array may have changed. That technique allows the machine code to be SAVED with the Basic program, which is useful, since the chances are your machine code will cause a system hang-up until it is bug-free.

(continued on page 107)

Buying Computers?

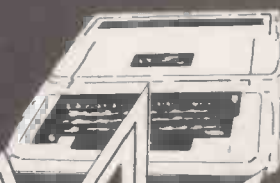
Commodore PET 32K
£675.75 plus VAT



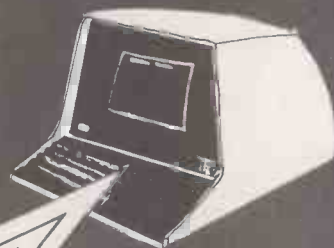
Sharp MZ-80K
£480.00 plus VAT



ITT 20/20 16K
£607.00 plus VAT



ACT 808 inc dual
disk drive
£3950.00 plus VAT



ACT 808 inc dual
disk drive
£3950.00
plus VAT

We'll give you more than a good deal

Under one roof in London's West End you can find:

HARDWARE:

A comprehensive range of hardware to meet most applications – and budgets, with terms to suit you.

SOFTWARE:

Probably the widest range of off-the-shelf software in the UK. Try out the packages and choose the one that suits you, or take advantage of our consultancy services and we will analyse, recommend, demonstrate, modify and install the programs for you.

CONSULTANCY SERVICES:

To apply micro computer systems to business, education or the home, make an appointment with our trained professionals for friendly advice based on extensive experience of discussing problems with many others like you.

MAINTENANCE AND REPAIR CLUB:

A maintenance and repair club that guarantees microcomputer users minimum downtime at very attractive premiums.

REFERENCE MATERIAL:

A library of publications covering all aspects of the microcomputer world,

including back issues of this and other important periodicals.

Whether you are an experienced micro user or a novice, looking for a system for the home, business or pleasure, the **LION MICROCOMPUTER CENTRE** is the single source to meet all your requirements.

CALL IN ANY TIME. We are open six days a week, for you to take advantage of the good deal you get when you buy from **LION**.

The above prices do not apply to account sales.



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).



• Circle No. 171

(continued from page 105)

Machine code can be conveniently loaded by inputting it as a string of Hex characters, and byteing off successive characters of the string along the lines of:

```
10 INPUT S$
20 LET V=0
30 IF CODE(S$)=0 OR TL(S$)=" " THEN
  GOTO 70
40 LET V=V*16+(CODE(S$)-28)
50 LET S$=TL(S$)
60 GOTO 30
70 POKE A,V
80 LET A=A+1
90 IF TL(S$)=TL(S$)
110 GOTO 20
```

ZX-80 as mathematician

DAVE SAMPSON of Coventry, West Midlands, has sent us a copy of his mathematics program for the Sinclair ZX-80.

```
1 LET T$="HELLO"
2 PRINT T$
3 PRINT
4 PRINT,"I AM A COMPUTER"
5 PRINT
6 PRINT"MY NAME IS ZX80"
7 PRINT
8 LET X=1
9 LET W=0
10 PRINT"WHAT IS YOUR NAME?"
20 INPUT A$
30 CLS
40 PRINT T$;A$
50 PRINT
60 PRINT"KEY:1(+),2(-),3(*),4(DIV)
70 PRINT" OR 5(POT LUCK)
80 INPUT Z
90 CLS
100 LET R=RND(40)-20
110 IF R=0 THEN GOTO 100
120 LET G=RND(40)-20
130 GOSUB Z*1000
140 PRINT"QUESTION ";X
150 PRINT
160 PRINT P;US;R;"=?"
170 PRINT,"YOUR ANSWER ";
180 INPUT D
190 PRINT D
200 PRINT
210 IF D=Q THEN GOTO 260
220 PRINT"YOU ARE WRONG ";A$
230 PRINT
240 PRINT"THE ANSWER IS ";Q
250 GOTO 280
260 LET W=W+1
270 PRINT"THAT IS CORRECT ";A$
280 PRINT
290 PRINT,"$SCORE =";W;"OUT OF";X
300 PRINT
310 IF X=10 THEN GOTO 370
320 LET X=X+1
330 INPUT N$
340 IF N$="N" THEN STOP
350 CLS
360 GOTO 100
370 INPUT W$
380 IF W$="N" THEN STOP
390 CLS
400 GOTO 100
1000 LET U$="ADD"
1010 LET P=G
1020 LET Q=G+R
1030 RETURN
2000 LET U$="SUBTRACT"
2010 LET P=G
2020 LET Q=G-R
2030 RETURN
3000 LET U$="TIMES"
3010 LET P=G
3020 LET Q=G*R
3030 RETURN
4000 LET U$="DIVIDED BY"
4010 LET P=G/R
4020 LET Q=G
4030 RETURN
5000 GOTO RND(4)*1000
```

Instructions: key N New line to stop. The sums can be made harder or easier by changing the values of R and G at address 100 and 120, i.e., LET R=RND(12). The correct spacing — space/,/; — is important on PRINT functions.

```
Program run:
Screen Display          Inputs
HELLO                  RUN N/L
I AM A COMPUTER
MY NAME IS ZX80
WHAT IS YOUR NAME?    DAVE N/L
---CLS---
HELLO DAVE
KEY:1(+),2(-),3(*),4(DIV) 5 N/L
OR 5(POT LUCK)
---CLS---
QUESTION 1
1 SUBTRACT 4 =?
YOUR ANSWER           5 N/L
---CLS---
QUESTION 1
1 SUBTRACT 4 =?
YOUR ANSWER 5
YOU ARE WRONG DAVE
THE ANSWER IS -3
SCORE 0 OUT OF 1
---CLS---
QUESTION 2
20 DIVIDED BY -5 =?
YOUR ANSWER           -4 N/L
---CLS---
QUESTION 2
20 DIVIDED BY -5 =?
YOUR ANSWER -4
THAT IS CORRECT DAVE
SCORE 1 OUT OF 2      N/L
```

Tape problems

ALLOW ME to comment on the apparently vexed question of ZX-80 and tapes writes Peter Smith of Nantwich, Cheshire.

Your own review in the July 1980 issue, in common with all others that I have read dwell on this topic.

I decided to obtain the circuit diagrams and a Z-80 machine-code book, to discover how to automate the process. The result is the tape header and loader program attached. To use the program:

- Save it at the start of each cassette side.
- Leave enough space between programs to allow a little space for expansion and for inaccuracy when over-recording. The program itself must be loaded, modified and re-recorded whenever the tape contents are changed.

- Save the programs one after the other — bear in mind the second point.

Then to select a program:

- Re-wind the tape to start.
- Load the first program — stop tape.
- Run the program, examine the contents on screen, and make selection.
- Start the tape simultaneously with, or a little before, pressing newline on making selection.
- WAIT.

The program is very slow in operation because it uses a simple sequential search of the tape to locate the selected program. It reads the cassette input and decides when a program ends and when a new program begins. The machine-code routine is:

```
LD H,0
LD C,0
IN L,(C)
RET
```

The result of the routine is left in HL and is the value of the USR call. The cassette input bit is in bit position 7 — hence the AND 128 — and the lower six bits have keyboard information.

```
1 REM
2 REM CASSETTE HEADER PROGRAM
3 REM
4 REM RUN THIS PROGRAM TO SEE
5 REM TAPE CONTENTS AND LOAD.
6 DIM U (3)
10 PRINT "TAPE NUMBER 1 SIDE NO. 1"
11 PRINT " CONTENTS"
12 PRINT " 1. PROG1"
    etc.
20 LET NPROGS = number of programs on
    tape
30 PRINT "ENTER SELECTION (NOTE
    99 = QUIT)"
40 INPUT NP
50 IF NP=99 THEN LIST 1
60 IF NP<0 OR NP>NPROGS THEN
    GOTO 30
70 LET A=PEEK(16393)*256+PEEK
    (16392)+2
80 LET U(0)=38
90 LET U(1)=14
100 LET U(2)=26861
110 LET U(3)=201
200 GOSUB 300
201 IF N1>9 THEN GOTO 200
210 GOSUB 300
211 IF N1>9 THEN GOTO 200
220 LET NP=NP-1
230 IF NP=0 THEN LOAD
240 GOSUB 300
241 IF N1<10 THEN GOTO 240
250 GOSUB 300
251 IF N1<10 THEN GOTO 240
260 GOTO 200
300 LET N1=0
301 FOR I=1 TO 50
302 IF (USR(A) AND 128)>0 THEN LET
    N1=N1+1
303 NEXT I
304 RETURN
```

Memory-mapped access

HERE IS a revised version of J C Minter's program, Memory-mapped access, which appeared in November.

```
1 CLS
2 LET P=0
3 LET N=0
4 LET SC=0
5 LET L=200
10 FOR X=1 TO 512
20 PRINT"";
30 NEXT X
40 PRINT"-----"
50 LET S=PEEK(16396)+PEEK(16397)*
    256+4
100 INPUT A
105 POKE S,P+N
107 IF NOT SC=0/ AND NOT N=0 THEN
    POKE S,SC
110 GO TO 120+A*2
120 INPUT SC
121 GO TO L
122 STOP
130 LET S=S-1
131 GO TO L
132 LET S=S+S+33
133 GO TO L
134 LET S=S-33
135 GO TO L
136 LET S=S+1
137 GO TO L
138 LET N=N+128
139 IF N > 128 THEN LET N=0
200 LET P=PEEK(S)
205 IF P=3 AND NOT SC=3 THEN LET
    S=S-33
210 POKE S,20
220 GO TO 100
```


Creeping X

HAVING read the editorial in the September issue, I thought you might like to see a simple program which shows imagination, William Caunt of Worksop, Nottinghamshire.

Initially, I wrote the program to explore the VDU system of the Nascom 1. I wanted to see how fast you could program the VDU memory and retain a picture. The synchronic nature of the Nascom VDU can lead to the display of incomplete characters.

In the program, I have arranged for characters to alter their composition line by line at a creeping pace, hence the title, Creeping X.

While a programmer may have resorted to graphics, the program does not. By modification of the program, a whole range of effects can be seen which have only, to my knowledge, been attempted using long graphics programs. The program shows two pairs of two Xs creep from right to left on one line of the VDU screen.

The program is for the Z-80 at 2MHz; Nascoms 1 and 2.

```

0D00 21 37 0A START: LD HL, 0A 37
Set pointer.
03 06 30 LD B, 30
Set line counter.
05 36 58 PRINT: LD (HL), 58
Print 'X'.
07 23 INC HL
Set pointer two
08 23 INC HL
places behind:
09 36 20 LD (HL), 20
    
```

For all users of systems based on the Z-80 chip, Z-80 Zodiac offers an opportunity to have programs and ideas published. We pay at least £5 for each contribution used.

```

Print ' '.
0B 2B DEC HL
Re-set pointer and
0C 2B DEC HL
advance to next
0D 2B DEC HL
place.
0E C5 PUSH BC
Save line counter.
0F 06 78 LD B, 78
Set delay counter.
11 10 FE DELAY: DJNZ DELAY
Dec count to zero.
13 00 NOP
Four NOP instructions.
14 00 NOP
This is to make a
15 00 NOP
fine delay of a few
16 00 NOP
microcycles.
17 C1 POP BC
Restore line counter.
18 10 EB DJNZ PRINT
Dec line count, if
1A 18 E4 JR START
zero, re-start.
    
```

By adjusting the value of the delay counter, i.e., 78 at 0D10 different dates, direction and number of Xs will be seen. Fine adjustment is achieved by changing the number of NOPs, but remember the jumps which follow are in the relative address mode, if you change the number of NOPs, change the relative part of those instructions. Thus for three NOPs:

```
16 C1
```

```
17 10 EC
19 18 E5
```

Two Xs may stay on the left of the screen by changing line 0D00 from 21 37 0A to 21 3A 0A. The program is re-locatable and can be used anywhere in memory. The address 0A 3A is the location of the VDU memory, for a line halfway down the screen, and a position at the right of the screen.

A TV picture is built-up of lines; each line contains a number of character lines. Remember that a character is built from a six to eight dot matrix, eight lines of six dots or on/off.

To produce a video signal the VDU circuit must scan its memory in sequence and process that information via a ROM and a shift register.

The ROM contains for each character eight lines of information, each line containing six bits. Thus an X is:

```

o = off 000000
I = on  100010
        100010
        010100
        010100
        010100
        100010
        100010
        100010
        as seen.
    
```

The line of 'o's around is to give a space between characters and lines on the screen. For two Xs.

```

* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
    
```

If the CPU changes the X to a blank between the VDU individual line scans:

```

* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
    
```

Is the result.

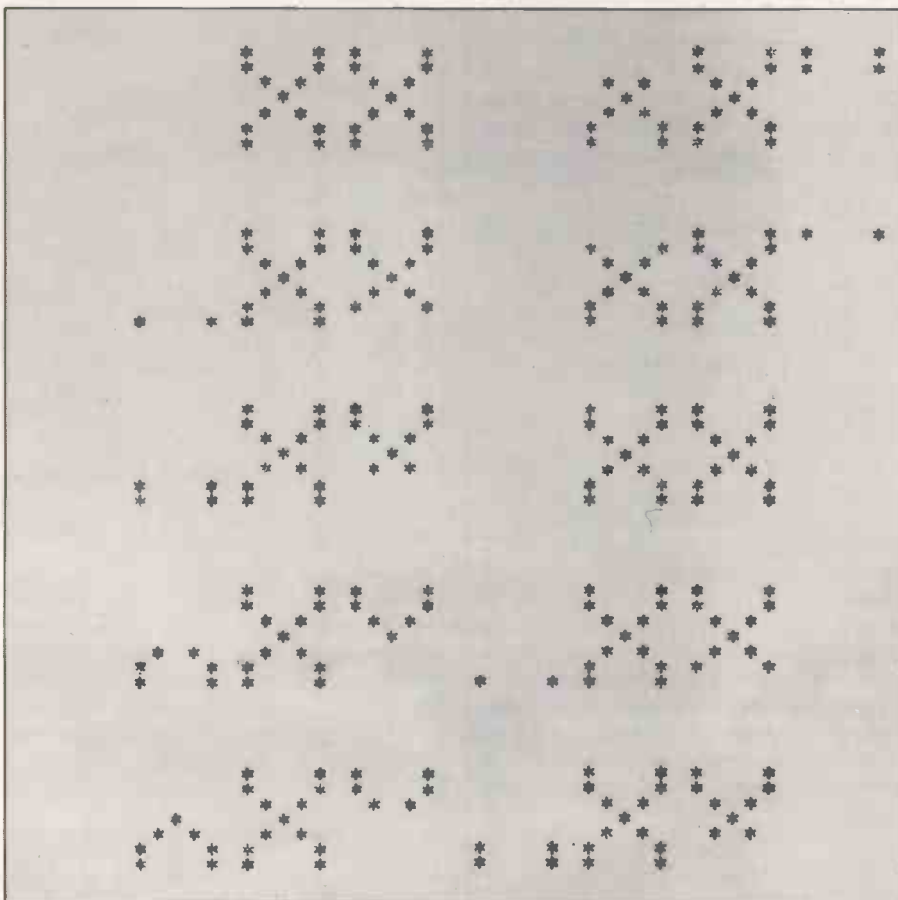
If the CPU builds-up at the same time by the reverse principle another X, we see:

```

* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
    
```

The CPU has changed the memory contents between those line scans. In the program, the VDU times relative to the CPU change slowly, thus one of the two Xs diminishes slowly as another builds-up. Also, the VDU circuit manages to collect two sets of two Xs.

The program relies on coincidence; it writes Xs to all locations in turn and in turn, two places behind, removes them. Thus the VDU has time only to collect information in two pairs. Before it makes the third, the third is removed. Nor does it have time to obtain, in some cases, all the information on one of them. The CPU has re-written it too quickly. □



Commodore approval is your guarantee of quality.

As well as manufacturing Europe's number one micro-computer, Commodore have officially approved a range of PET compatible products, a selection of which is featured below.

Post the coupon for our comprehensive brochure of approved products, or contact the supplier direct.



||j are the sole distributors in the UK for the outstanding MTU High Resolution Graphics system for the PET.

This provides the following features:
320 x 200 dot matrix, fully addressable.
Advanced machine code handler included (disk or cassette).
Straightforward to use, with 19 extra BASIC keywords.
8K extra memory when graphics not in use.
5 extra ROM sockets for firmware. (e.g. Toolkit, guard chips, etc.)

Simple fitting within the PET using mounting brackets supplied.
Plugs into memory expansion socket.
Only 3 wires to be soldered for raw do. supply.
All-inclusive price £320 (+VAT).



||j DESIGN LIMITED,
37 London Road, Marlborough,
Wilts SN8 2AA. Tel: (0672) 54487.

Mitrelynn have produced an Acoustic Cover specifically designed to reduce the noise level of the Commodore Tractor Printer by some 80%.

Made of fire retardant styrene plastic with a leather-grained finish, the cover is lined internally with acoustically absorbent polyurethane foam treated to minimise dust.

All printer functions are easily accessible.



MITRELYNN Mitrelynn Limited,
159/161 High Street, Sawston, Cambridge.
Tel: 0223 835792 Telex 817855

FILEPROG, a disk based visual search and display filing system of up to 3000 records showing name, address, telephone number, notes, product and area codes.

Seven print facilities for mailing list, company list, self-adhesive labels or area list.

Full self checking back up routines ensure data cannot be accidentally lost.

AMPLICON MICRO SYSTEMS LIMITED
143 Ditchling Road, Brighton,
E. Sussex, BN1 6JA.
Tel: (0273) 562163

Stephenson Way, Three Bridges, Crawley,
W. Sussex, RH10 1TN. Tel: (0293) 26493.

The only manufacturer of approved interfaces for the Commodore PET * Type C: PET to RS232 * Type B: PET to RS232 bidirectional * TV monitor interface * A.P.: PET to parallel * G.P.I. micro based interface programmed for your interface requirements

* Complete word processing systems
* Custom interfacing * Full range of CBM equipment * Ricoh RP1600 daisy wheel printers complete with integral addressable interface Ex. Stock.

Small Systems Engineering Limited,
2-4 Canfield Place, London NV6 3BT.
Tel: 01-328 7145/6 Telex 8813085 (Abacus)



8000 + 3000 Series Products for both the Businessman and Accountant in Practice.
Incomplete Records Accounting,
Sales, Purchase and Nominal Ledgers,
Time Records Costing,
VAT Special Retailers Schemes,
Backed by around 200 live installations in Accountants' Practices throughout the U.K.

C.S.M. set the standard for Accounting Software.
Computer Services Midlands Limited,
Refuge Assurance House,
Sutton New Road, Erdington,
Birmingham B23 6QX.
021-382 4171 (4 lines).



KRAM (Keyed Random Access Method) adds 10 functions to Basic in the 40/80 column PET, to give complete and easy control of disk data. KRAM is based on state-of-the-art VSAM mainframe techniques, giving fast keyed access to the 3040/8050 disks and maximizing disk capacity. Essential for business users. £100.00 + VAT.

Calco Software

Lakeside House, Kingston Hill,
Surrey KT2 7QT. Tel: 01-546 7256

MUPET is very good news if you require a multi-user word-processing system but up until now have run up against a budgetary brick wall.

MUPET makes the most of WORD CRAFT or WORDPRO IV by linking 2 or more PETS to a single disk-drive and your choice of quality printer.

Priced from £495 + VAT,
KOBRA MICROSYSTEMS



14 Broadway, West Ealing,
London W13 0SR.
01-579 5845.

Constructional Software is a library of programs for the construction industry with applications for Engineers, Architects, Quantity Surveyors and Contractors. Frame analysis, heat loss, drainage design, specification preparation, critical path analysis and resource allocation on 40 and 80 column PETS.



Claremont Controls Ltd.,
Chimney Mill, Newcastle upon Tyne, NE2 4AL.
Telephone (0632) 610210.

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

Please send me further information about the Commodore PET Approved Products range.

Name

Position

Address

Intended application

Do you own a PET? YES NO

commodore

PC12

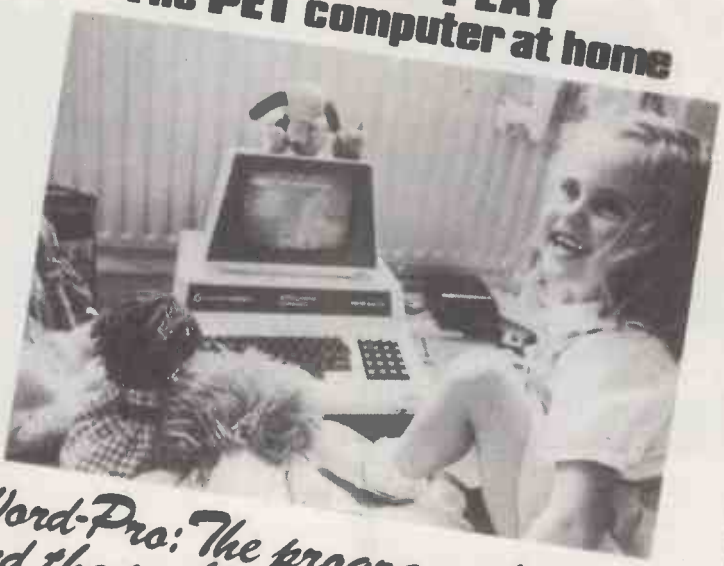
• Circle No. 172

ALL ABOUT PET...

MICROCOMPUTER
PRINTOUT
PRINTOUT

SPECIAL SOFTWARE ISSUE

All about the PET Computer
CHILDS PLAY
 The PET computer at home



Word-Pro: The program, the people and the problems.

95p

PRINTOUT *Contents*
 Vol. 1, No 9

READ / WRITE The pages where you have your say — letters and listings.

HOTLINE Hot news about software, peripherals and system developments.

SUPERCHIP! Terry Hope reports on an amazing new piece of firmware.

SOFTWARE REVIEWS JCL's Screen Display Aids package evaluated.

PETS & PIECES The irrepressible Gavin Sanders lashes out in all directions.

PETAID major profile of PET's first do-it-yourself database by Terry Hope.

SORTING OUT SORTS Walter Wallenborn uses a Jim Butterfield program to show you how to get maximum efficiency from sorts.

WHAT'S WRONG WITH WORDPRO? Lindsay Doyle explains and tells you how it should be used.

PEEKS & POKES More outrageous gossip from the notorious Inside Trader.

BOOK REVIEWS a critical look at the latest PET books.

TOMMY'S TIPS programming problems solved here by Tommy Turnbull.

PERSONAL ELECTRONIC TRANSACTIONS by PET master, Greg Yob.

LITTLE GENIUS? An in-depth review of the heavily promoted tutorials.

PRINTOUT
 The independent Magazine about the **CBM/PET** Computer.

TEN TIMES A YEAR **PRINTOUT** BRINGS YOU THE LATEST NEWS FROM THE FAST MOVING WORLD OF THE CBM / PET. in it you will find authoritative reports on the latest hardware and peripherals, unbiased program reviews and a wealth of programming hints and listings. Last year PRINTOUT proved itself to be an indispensable guide to the CBM/PET system. Can you afford to be without it in 1981? Try a copy of the latest issue and see for yourself.

Also available: The complete set of PRINTOUT Volume 1, the ten issues of 1980, packed with otherwise unobtainable information £9.50 including postage & packing (UK; £14.50 overseas). Individual back issues are also available priced 95p post free. PRINTOUT is professionally written, properly typeset and printed on glossy paper. Last issue ran to forty-four information packed pages.

PRINTOUT
 PO Box 48,
 Newbury,
 Berkshire RG16 OBD.
 Tel. (0635) 201131

Enter my subscription. I enclose £9.50 UK £10.50 Eire £14.50 Overseas
 Send the set of Vol. 1. I enclose £9.50 UK £10.50 Eire £14.50 Overseas
 Rush me the latest issue. I enclose 95p UK & Eire £1.25 Overseas airmail

My name is
 My address is
 Postcode



Program transfer

ONE of the problems encountered when moving from a tape-based TRS-80 to a disc-based system is that a number of assembler programs execute from the area that TRS DOS or one of the other DOS systems normally uses writes Arne Rohde of Struer in Denmark.

One method of operating the problem is to move the program in memory and precede it with a short routine which will move it to the correct position in memory after it has been loaded from disc. That works well for most cases, and NewDOS even has a utility called LMOFFSET which will do all the work required for that approach.

At the same time, however, the NewDOS has a catch for the unwary, since the system normally intercepts the keyboard input routine to provide debounce and the "JKL", "123", and various other functions. If the system has been booted with the debounce routine active, loading a routine which overlays the DOS area will normally cause havoc.

NewDOS allows the user to boot the system with the debounce routine deactivated, by holding down shift and up-arrow during the boot process. However, it is easy to forget that when booting the system, and it should not really be necessary. Another solution is to let the program load routine do the necessary re-setting of the keyboard intercept. It is reasonably easy to achieve, although the program will use more disc space when saved.

The extra amount should normally be insignificant. To illustrate the method, we shall see how a program can be moved from tape to disc. A monitor such as RSM2 is useful for that purpose.

The first step involves loading RSM2 into a portion of memory which will not be used for the remainder of the process. The TRS-80 is then re-set with the break key held down. That initialises the area from 4000 to 42E9 to the values normally used in a tape system. The memory-size question must be answered with a specific value to avoid all of memory being cleared while the system finds the end of memory address.

RSM2 will still be resident in memory. SYSTEM is typed, and the program read from tape to memory. Instead of starting the program just loaded, / is entered followed by the RSM2 entry address.

If preferred, the program can also be loaded by the system tape-load routine in RSM2 instead of using SYSTEM. RSM2 is then used to move not only the program itself but the whole area from 4000H to the end of the program to a position above the end address of NEWDOS, for example 7100H.

The program will thus consist of the program code plus the initialised values from reserved memory. That code is then preceded by the instructions needed to

TANDY FORUM is devoted to the Tandy TRS-80. Sometimes we will use it to pass on news about the TRS-80 but, above all, it is for users, and would-be users, of the well-established model I and now the new model II. With your tips, queries, moans and comments, this page can become a market-place for TRS-80 information.



disable interrupts, move it to the correct position in memory, and jump to the correct entry point. The code can be inserted with RSM2. The NewDOS system can then be booted again, and the portion of memory DUMPed to disc.

When the program is executed, the NewDOS keyboard intercept routine will be removed, and the program will run without any keyboard debounce.

If keyboard debounce is required in the program, the debounce routine can be placed in the free memory area from 4060H to 407FH. A program which will achieve this was shown in Tandy Forum, April 1980. The same area can also contain a video driver for lower-case letters. Those routines should be loaded before the main SYSTEM program is loaded into memory and RSM2 entered.

Even programs such as Microchess can be saved on disc using the method, although it has been made slightly more difficult by the loading method employed. The first short program on the Microchess tape is merely a special load routine to load the remainder of the program and start it automatically. Before being run, the loader routine must be modified so that it will enter RSM2 instead of Microchess, and so that the display text will be loaded into memory. The necessary addresses are 4FEDH for the JP instruction to the entry point. The address

in the instruction is modified to jump to the RSM2 entry point.

The screen area start address is loaded in 4FDCH into HL, and that should be modified to an area starting on a 256-byte boundary, for example 7100H. The end of load is checked in 4FE4H, and the value should be the MSB of the start address + 4, or 75H in our case, making the instruction load A with this value. The load routine can then be entered at address 4FA1H, and when completed, RSM2 should be invoked.

The area from 4000H to 4FFFH can then be moved to the area from 7500 to 84FFH, and the move routine appended in front of 7100H to move the entire area from 7100H to 84FFH to the area starting at 3C00H. A jump to the entry address (41FDH) is also inserted. NewDOS can then be used to dump the Microchess program to disc.

The instructions needed in front of the code to achieve the move could be coded as follows:

```
70F0 F3 D1
70F1 010044 LD BC,4400H ;length to move
70F4 02003C LD DE,3C00H ;destination
                          address
70F7 030071 LD HL,7100H ;move from
                          address
70FA EDB0 LDIR ;move to
                          destination
70FC C3FD41 JP 41FDH ;start
                          Microchess
```

Note that interrupts are disabled, since they may occur during the LDIR instruction and cause havoc.

Chess-board

HERE is a routine which some programmers might find useful writes Colin Barton of Bracknell, Berkshire. It uses the ASCII code 191 to produce a chess-board. Each block is made up of white graphics blocks two high by six long.

```
10 REM ***CHESS BOARD -
   C.J.BARTON.***
20 CLS
30 J=15361
40 GOSUB 120
50 J=15495
60 GOSUB 120
70 FOR A=0T047
80 SET(3,A)
90 SET(100,A)
100 NEXT A
110 GOTO 110
120 FOR V=1T02
130 FOR X=1T04
140 FOR Y=1T048 STEP 12
150 FOR W=Y+J TO Y+J+5
160 POKE W,191
170 NEXT W,Y
180 J=J+256
190 NEXT X
200 J=J-960
210 NEXT V
220 RETURN
```




L&J COMPUTERS

3 CRUNDALE AVENUE, KINGSBURY NW9 9PJ 01-204 7525

THE "PET" SPECIALISTS



NEW LOW, LOW, 'PET' PRICES!!

Pet 8K (Large keys)	£420*
16K	£499*
32K	£630*
Ext cassette decks (+ counter)	£ 55*
PET Friction Feed printers	£350*
AVAILABLE FROM STOCK + VAT	
Printers/Disc Drives	Sundries
PET 3023	PET 3040
PET 3022	Compu 400K
Centronic 779	Compu 800K
Spinwriter	Interfaces

**TRY US!
YOU WILL NOT BE
DISAPPOINTED**

SUPERPETS NOW EX-STOCK!

Tool kits: library cases
Disks: C12 Cassettes
Paper (roll & tractor feed)
Labels: Dust covers

SPECIALS FOR THIS MONTH:

PETMASTER SUPERCHIPS — UPGRADE YOUR PET EVEN MORE!

A FEW ONLY: Brand New CENTRONIC 779 t/f printers £590*
Brand New PET 2023 f/f printers £320*

THE "MUPETS" ARE HERE!
3 TO 8 PETS ONLY NEED 1 DISK DRIVE...
Daily demonstrations: Ring for details.



**COMPLETE SYSTEMS
FROM £1700!!**

**THE SYSTEMS WE SUPPLY & INSTALL ARE COMPLETE:
ESTIMATES GIVEN FREE WITH NO HIDDEN EXTRAS:
FULL BACK-UP: GUARANTEED EXPERTISE.**

* PRICES DO NOT INCLUDE VAT

PERSONAL SHOPPERS WELCOME
Phone & Mail Orders accepted.

ALL GOODS SENT SAME DAY WHEREVER POSSIBLE
LARGE S.A.E. FOR LISTS ETC.



• Circle No. 173

SOFTWARE

As well as a full range of Petsoft and Commodore Software, we have some highly reliable "Home-Brewed" programs available.

STOCK CONTROL & INVOICING £60
(Handles up to 500 items — 32K) (180 on 16K). Stock depleted on invoicing, search etc. Cassette, disk (& print option).

CASH BOOK £90
Enter daily/weekly amounts — printout and totals, weekly/monthly analysis, totals and balances.

MACHINE HIRE Typewriter & Plant Hire Firms. £420

STOCK TAKING Cuts out all the hard work £230

OUTSIDE SERVICES (For Mini-Cabs Etc) £220

Sae for free software booklet

Specialists in: Commodore Business Programs
Bristol Trader, Item & Monitor
Superpay Word Processing

**SPECIALISED SOFTWARE APPLICATIONS
UNDERTAKEN. RING FOR DETAILS**

2 FOR JUST OVER THE PRICE FOR 1!

We now have limited stock of NEW
CASSETTE DECKS, with built-in
COUNTER + SOUND BOX FOR PETS.
AT ONLY £65* EACH.
Orders dealt with in strict rotation

**PROGRAM
POWER**

NASCOM 1 & 2

SUPER STARTREK (B/16K) — the final Frontier! Your mission is to destroy the Klingon fleet in time to save the Federation. Phaser banks, photon torpedoes and on-board computer are operational. £9.95

INVASION EARTH! (MC/G) — fast version of the popular arcade game. 4 invader types/intelligent homing, exploding, angled, direct, multiple warhead and radio-jamming missiles/40 skill levels. Only £9.95

Super LIFE (MC/G) — the BEST! — Evolution of a biological colony with 100 by 125 cell array (2/3 or 3/4 options). Use the 21 standard patterns or set individual pixels. Rotate and reflect any pattern. Select from 10 speeds. Evolution can be halted, patterns modified and new speed set. Extensive instructions-overlay technique keeps program within 8K. SIMPLY FASCINATING! £8.95

DEMONOES (B) — another arcade game! Played against the computer or other player. Make your opponent crash into the wall or his own or your tracks. Fast and competitive. £6.95

ALIEN LABYRINTH (B/G/min 16K) — you are trapped in a maze with an invisible alien creature. Find the exit before being eaten. Proximity and direction of alien reported each move. Superb 3D graphics. £7.95

MINI-TOOLBOX (MC) — aid to-BASIC programming. Features are: — REPEAT KEY, AUTO line numbering, Decimal to HEX & HEX to Decimal conversions, RECOVER (from CLOAD error) and MultipleUSR (X) routines. Resides in spare memory from OC80HEX. £6.95

Spacefighter (B/G)	£7.95
Death Run (B/G)	£6.95
Driver (B/G)	£6.95
Sheepdog Trial (B)	£5.95
Secret Agent (B/G)	£5.95
Slalom (B/G)	£5.95
Submarine Chase (B/G)	£5.45

Renumbr (MC)	£6.95
Stock Market (B)	£6.45
Scramble (B)	£5.45
Hammurabi (B)	£6.45
Biorhythm (B/G)	£4.45
Code-Breaker (B)	£4.95
Labyrinth (B/G)	£5.45

PROGRAMS WANTED
BRIDGE, DRAUGHTS, BUSINESS
APPLICATIONS, SPACE GAMES with
GRAPHICS, C.A.: and other original ideas.

**NASCOM 1 — Cottis Blandford Cassette Interface for N2 format, reliability and fast load. £16.30 or £13.30 with program.

All programs supplied on cassettes.
B = BASIC, MC = Machine Code.
G = Graphics
8K RAM required unless otherwise stated.
PLEASE GIVE FULL DETAILS OF YOUR NASCOM.

MUSIC BOX

Now you can make music with NASCOM. Easy to follow program allows you to key in old favourites or have fun composing your own tunes. 7 octave range with staccato option. 9 tempos. Set note duration or tap in rhythm as required. Comprehensive editing. Delete, insert or amend notes. Single-step forwards and backwards through tune. Add new lines within declared array size.

The program includes tape generating and playback routines and is supplied with 2 demonstration melodies and instructions for connecting your Nascom to an amplifier/speaker such as our unit below.

Min. 16K required — please state T4 or Nas-sys/ ¼ OR + MHZ/ with or without graphics. Only £13.95

AUDIO INTERFACE BOARD & SPEAKER — Compact and ready assembled, suitable for use with "MUSIC BOX" and other 'sound effects' programs. 3 simple connections. Complete with instructions on programming for sounds. £9.75

C.A.L.

BUTTERFLY (B/G) — enjoy mental arithmetic! Race caterpillars across the screen by answering + — x — questions. Large, easy to read numerals, stunning graphics. Special features include handicaps and demonstration of tables. Ages 5-11 approx. £7.95

READING TEST CARDS (B/G) — help 3-6 year olds to read. Random words from specified groups displayed in characters 4 lines high, or input your own choice of words. £5.95

WRITTEN ANY PROGRAMS? WE PAY HANDSOME ROYALTIES!
PROGRAM COMPETITION — 3 XTAL BASICS TO BE WON — Send sae marked "Competition" for details. (Closing Date 10th January 1981)

Send Chq/PO + 45p/order P&P or SAE for FULL catalogue to

PROGRAM POWER
5, Wensley Road, Leeds LS7 2LX.
Telephone (0532) 683186.

• Circle No. 174

Hexadecimal converter

WHEN using my Superboard II computer, I find I regularly need to convert numbers from Hexadecimal, i.e., base 16, to decimal and vice versa writes Jack Pike of Chawston, Bedfordshire. Many other people must need the same conversion and may be interested in a Basic program I have written to do the job. The program is written in standard Basic and should run on most systems:

```

1 REM HEXADESIMAL TO
2 REM DECIMAL CONVERSION
3 REM AND VISE?VERSA
4 REM FOR FIVE INTEGERS
5 REM
6 REM ANY NO-HEX CHAR.
7 REM CHANGES DIRECTION
8 REM INTEGER BASICS DO
9 REM NOT NEED LINE 250
10 LET C=10
20 LET C=26-C
30 LET S$="DEC="
40 IF C=10 THEN 60
50 LET S$="HEX="
60 PRINT
70 PRINT S$
80 INPUT N$
90 LET N=0
100 IF LEN(N$)=0 THEN 20
109 REM HEX TO DEC
110 FOR I=1 TO LEN(N$)
120 LET D=ASC(MID$(N$,I,1))-48
130 IF ABS(D-13)<4 THEN 20
140 IF D<10 THEN 160
150 LET D=D-7
160 IF D<0 THEN 20
170 IF D>=C THEN 180
180 LET N=C*N+D
190 NEXT I
200 IF C=10 THEN 230
210 PRINT "DEC=";N
220 GOTO 60
229 REM DEC TO HEX
230 LET A$=""
240 LET L=N/16
250 LET L=INT(L)
260 LET M=N-16*L
270 IF M<10 THEN 290
280 LET M=M+7
290 LET N=L
300 LET A$=CHR$(M+48)+A$
310 IF N>=1 THEN 240
320 PRINT "HEX=";A$
330 GOTO 60

```

Incidentally, following your article on Adventure II in the August issue, readers may be interested to know that a very expanded version of the original Adventure — also called Adventure II — written in standard Fortran IV is now running on a variety of mainframes in the U.K. If anyone is interested in a papertape for their mainframe, they should contact me.

Special-section program

I ENJOY working in machine code and would like to see more programs published in that form writes A E Prinn of Newton in Merseyside. Although I realise the appeal of Basic, its ubiquitous use means that I gain little — except ideas — from any of the current computing magazines.

The program, although hardly earth shattering, is an attempt to make your 6502 special section into what its title suggests, rather than a selection of Basic programs to be run on machines which may or may not contain 6502 micropro-

THE 6502 SPECIAL is dedicated exclusively to the exchange of information between 6502 users. It is up to you, the reader, to help establish this page with your ideas, problems and guidance for other 6502 users. Please mark your letters 6502 Special. We pay £5 for each contribution published.

cessors. When displaying a machine-code program on a VDU, it is easier to read if each line contains either one, two, or three bytes as specified by the op code rather than, for example, the first 16 bytes followed by the next 16 bytes, etc.

The program was written to determine the number of bytes each 6502 op code requires and to return with this value in the X register.

If the op code is written as two Hex characters XY, a one-byte instruction has X0 — where X is 0,4, or 6 — or X8 or XA — where X is any number. A two-byte instruction has X0 — where X is any number except 0,2,4 or 6 — or XY — where Y is any number less than eight and X is any number.

A three-byte instruction has 20 or XY — where Y is any number greater than B and X is any number. The op code X9 is a special case; if X is even, the op code requires two bytes, otherwise it is three bytes.

The program is re-locatable and is written as a JSR routine assuming that the temporary storage location Z0A holds the op code.

0200	A2 03	LDX # 03	
0202	A5 0A	LDA Z0A	Get op code
0204	D0 04	BNE NEXT	Branch if not equal to zero
0206	CA ONE	DEX	
0207	CA TWO	DEX	
0208	D0 1E	BNE END	Always branch
020A	29 DF	NEXT AND # DF	
020C	F0 1A	BEQ END	Branch if op code 20
020E	C9 40	CMP # 40	
0210	F0 F4	BEQ ONE	Branch if op code 40 or 60
0212	A5 0A	LDA Z0A	Get op code
0214	0A	ASL	
0215	0A	ASL	
0216	0A	ASL	Move the LSB of the high nibble into the carry
0217	0A	ASL	Remember the low nibble
0218	85 0A	STA Z0A	
021A	F0 EB	BEQ TWO	Branch if op code is X0
021C	A9 10	LDA # 10	An elegant way of testing three bits
021E	24 0A	BIT Z0A	
0220	10 E5	BPL TWO	Branch if op code is < X8
0222	70 04	BVS END	Branch if op code is > XB
0224	F0 E0	BEQ ONE	Branch if op code is X8 or XA
0226	90 DF	BCC TWO	Branch if high nibble is even
0228	60	END RTS	

The program does not differentiate between data or illegal op codes and genuine

op codes, but has proved adequate in practice. I should be most interested if anyone can think of a simpler system, particularly if it returns with X = 01 for illegal op codes, i.e., data.

Character-set display

THIS PROGRAM was written for an unexpanded Microtan 65. It displays the Microtan complete character set one character at a time with the Hexadecimal code for that character writes S Russell of Solihull in the West Midlands.

After displaying a character, the program pauses for a time before displaying the next character. When the program reaches Hex code 7F, it jumps back to 0048 and starts again. The program starts at Hex 20 which is a space, so the first character to be printed is "!".

The first character to be printed can be altered by changing the Hex code at 0049 to the code of the first character to be output. When the program jumps back to 0048 it will start again by outputting 20 and a space unless 0081 is changed.

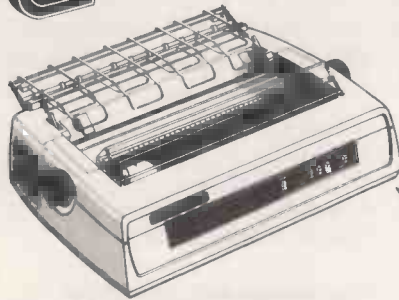
0040	A0 0F	LD F	; Clear Screen
0042	20 73	FE JSR	OUTCR
0045	88	DEY	
0046	D0 FA	BNE	
0048	A9 20	LDA 20	; Load
			acc. with ASCII space
004A	99 C3 03	STA 03 C3	; Delay
004D	CA	DEX	
004E	D0 FD	BNE	
0050	88	DEY	
0051	D0 FA	BNE	
0053	EA EA	NOP	
0055	D0 F6	BNE	
0057	A5 49	LDA 49	; Load
			acc. with location 0049
0059	AA	TAX	; Load
			index X with acc.
005A	E8	INX	
005B	86 49	STX	
005D	20 73	FE JSR	OUTCR ; Scroll display
0060	EA EA	NOP	
0062	48	PHA	
0063	20 73	FE JSR	OUTCR ; Scroll display
0066	68	PLA	
0067	20 0B	FF JSR	HEXPNT
006A	20 73	FE JSR	OUTCR ; Scroll display
006D	EA EA	NOP	
006F	A5 49	LDA 49	; Load
			acc. with location 49
0071	C9 80	CMP 80	
0073	D0 CF	BNE	
0075	A9 20	LDA 20	
0077	99 C0 03	STA 03 C0	; Load
			acc. with ASCII space
007A	A9 20	LDA 20	; Load
			acc. with ASCII space
007C	99 C1 03	STA 03 C1	
0080	A9 20	LDA 20	; Load
			acc. with ASCII space
0082	85 49	STA 49	
0084	4C 48 00	JMP 48	; Jump to location 48



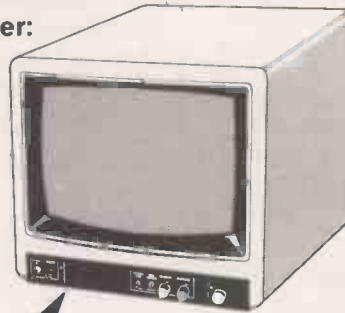
SORCERER

CP/M™
S100
Z80

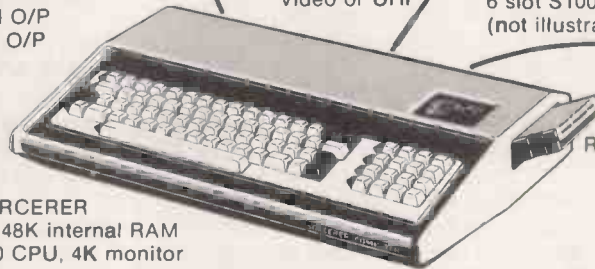
For the serious user:
Business
Education
Amateur



PIO + RS232/20ma serial O/P
Dual 1200 baud cassette O/P



Memory mapped
30 lines x 64 characters
upper/lower case + 128
programmable graphics



SORCERER
16-48K internal RAM
Z80 CPU, 4K monitor

Video or UHF

6 slot S100 expansion
(not illustrated)

ROMPAC



Micropolis 630K dual disk
CP/M or Micropolis MDOS

STANDARD SORCERER

- * Displays 30 lines of 64 characters - more than any other personal computer. 79 key stepped typewriter-style keyboard with separate numeric pad for fast data entry.
- * Plug in ROMPAC cartridges for programming languages, special applications (e.g. word processing) or creating a user's dedicated system. Sorcerer is supplied with 8K Microsoft BASIC ROMPAC
- * Composite video output for video monitor or UHF output for use with an unmodified TV set at nominal extra charge.
- * Z80 CPU with up to 48K RAM on-board.
- * 4K power-on monitor in ROM allowing machine code programming, batch processing, memory transfers and copying, alteration of memory locations, use of cassette files.
- * Dual 300 or 1200 baud cassette ports with motor control
- * Parallel I/O port and serial RS232 port for direct connection to printers or use as a terminal to a larger computer - no expensive 'extra' communications interfaces
- * Full upper/lower case ASCII characters plus 128 user programmable graphics (64 default to standard graphics symbols if undefined). Default graphics above ordinary characters on keytops.

16K £749.00 32K £799.00 48K £849.00

Expansion Capabilities

- * 6 slot S100 expansion for memory up to 56K RAM, disc drives (5 1/4" or 8") etc. Standard bus means that you are not dependent on equipment from a single manufacturer **£240.00**
- * Micropolis double density 5 1/4" drives with MDOS and Disc BASIC:
First drive (incl. controller card) single 315K **£690.00**
Additional drives (max 4 drives/controller) 315K **£390.00**
- * FDM 180 Disk Unit: Micropolis Disk Drive, plugs directly into Sorcerer, does not require S100 Unit:
Single 315K Disk Drive (c/w CP/M and Microsoft BASIC) **£599.00**
Single 315K Add-on Disk Drive. **£450.00**
- * CP/M industry standard disk operating system **£75.00**
- * Development ROMPAC - Z80 assembler, loader, editor, debugger **£70.00**
- * EPROM PAC for loading dedicated software up to 16K **£35.00**
- * Configuring programs allow Sorcerer to be used as a 'dumb' terminal or, with CP/M, as an intelligent terminal.

Programming Languages

The following programming languages are available for CP/M:

Microsoft Disk BASIC interpreter (BASIC 80 - compatible compiler), CBASIC2 (compiled BASIC), FORTRAN 80 and COBOL-80, ALGOL 60 - A Z80 system with graphics, string handling and random-access filehandling.

All Exidy products are covered by 12 months warranty.
CP/M™ is a trademark of Digital Research.
All prices exclusive of VAT

THE WORDPROCESSING WIZARD!

Sorcerer's upper/lower case typewriter keyboard and unusually large display (30 lines of text; approximately equivalent to one double-spaced typed page) makes it ideal for word processing applications. The Exidy word processor PAC is a sophisticated screen editor and text formatter with automatic text wrap-around, left and right justification, proportional letter spacing (on disk only with Spinwriter) and many other formatting facilities. It can also search for and replace strings, move and merge blocks of text and a macro facility allows specification of tasks such as mail-merge letter typing. Letters and texts can be stored on cassette or disks (one disk will store approximately 300,000 characters and costs less than five pounds. 32K or 48K RAM is recommended.

Word Processor PAC **£120.00** Disk Version: **£118.75**

C. Itoh 8300 dot matrix printer -40, 80 and 120 characters per line on 9 1/2" wide paper, 125 characters/second, upper/lower case, tractor feed, forms positioning **£499.00**

NEC Spinwriter solid font printer -variable horizontal and vertical spacing, proportional spacing, interchangeable fonts, carbon or fabric ribbon, 55 characters/second, paper up to 16" wide **£1,900.00**

Example system: 32K Sorcerer, video monitor, FDM 180 Disk Unit with CP/M and Microsoft BASIC, C. Itoh 8300 printer, Word Processor on disk and CP/M. **£2,225.00**

Business Software

Besides its word processing capabilities, Sorcerer can run a wide range of business software thanks to the widely used CP/M disk operating system available for the Micropolis disk drives. Programs available include:

Payroll: (requires CP/M and CBASIC2) **£250.00**

General Ledger, Job Costing, Accounts Receivable, Accounts Payable: (all require CP/M and CBASIC2) **£335.00 each**

For further information and list of dealers,
please contact the sole U.K. distributors.

GEOFF WILKINSON, Dept. PC.1

LIVEPORT

DATA PRODUCTS

The Ivory Works, St. Ives, Cornwall TR26 2HF
Telephone: (0736) 798157

PLEASE SEND DETAILS OF THE EXIDY RANGE/WORD PROCESSOR

NAME _____

ADDRESS _____

PC12

• Circle No. 175

Un-crashing method

I THOUGHT you might like my 100 percent software method of un-crashing a new-ROM Pet writes Kevin Jones of Lytham St Annes, Lancashire. It adds a small routine — starting at 0345 Hex — to the interrupt routine which is called every 1/60 of a second by the Pet hardware. While it provides a far cheaper way of un-crashing than a hardware add-on, it will not work with the interrupt disable set.

The routine at 033A Hex is to initialise the routine by altering the RAM IRQ vector. Of course, the interrupt disable has to be set first to eliminate any chance of an interrupt being called during the change, with disastrous effect.

The routine uses the Pet convention of making sure a key is pressed for at least two interrupts before it registers — a check against keyboard bounce.

```
033A SEI      78      Sets interrupt
                    disable
033B LDA # $45 A9 45 Set IRQ RAM
                    vector
033D STA $90      85 90
033F LDA # $03 A9 03
0341 STA $91      85 91
0343 CLI      58      Clears interrupt
                    disable
0344 RTS      60
0345 LDA $E812 AD 12 E8
0348 CMP # $EF C9 EF Stop key
                    depressed?
034A BEQ $0350 FO 04
034C LDA # $FE A9 FE
034E STA $00      85 00
0350 INC $00      E6 00
0352 BEQ $0357 FO 03 Depressed 2
                    interrupts?
0354 JMP $E62E 4C 2E E6 Continue
                    interrupt routine
0357 JMP $C73F 4C 3F C7 Break message
                    and recover.
```

00 Hex is one of the very few safe locations on zero page — and then only if USR is not being used.

The program could be adapted easily to old ROM within a few minutes, but I generally find that old ROMers do not indulge in practices likely to crash the machine. Also, if you want to use the second cassette buffer, you can soon re-locate the program to the top of memory or wherever — only the new IRQ RAM vector has to be changed.

Extending function

PAUL Robson of Norwich has submitted a short machine code re-locatable, for extending the DEF FN function so that the code can consist of non-assignment statements by passing parameters to and from a subroutine directly. All code will work as normal.

The program was written and tested on and old-ROM Pet so notes are enclosed to convert it to a new-ROM system. The conversion has not been tested. The USR vector specified (51072) is the start of the GOSUB handling code in the Basic ROMs. Memory location 152 is the location of the variable to which the result of a LET statement is sent. Locations 88,89 are at the end of the input buffer



and are not in use during an assignment statement.

```
826 LDA 152      165 152
828 STA 88        133 88
830 LDA 153      165 153
832 STA 89        133 89
834 RTS          96
835 LDXim 4      160 4
837 LDAiy 152    177 152
839 STAiy 88     145 88
841 DEY          136
842 BPL 837      16 249
844 RTS          96
```

POKE1,128:POKE2,199 sets up the USR VECTOR

To set up a function:DEFFNA(X)=USR(X) line number.

To call it Variable = FNA(Parameter)

The subroutine structure must be:

```
line no SYS(826)
                Any code required. In the examples
                given,
                the parameter is now in variable X.
                Variable X should not be used in
                main program.
```

assignment statement, the result of which is to be passed back via

```
DEF FN
RETURN
```

Modification for New ROMs

USR vector is 51088.

Locations 152,3 become locations 70,71

Locations 88;9 should be replaced by any two free consecutive page zero locations.

Cursor Movement Control

Call X = FNA(ddaa) where d is position down the screen
a is position across

```
100 DEFFNA (X) = USR(X) 200
110 END
200 SYS(826): D = INT (X/100):A = X-D*
100
210 ?LEFT8 ("Home,25cd",D + 1) TAB(A);
220 X = X:SYS(835):RETURN
```

Sorting routine

THE MACHINE-code sorting routine in your April 1980 issue performs admirably when all the character strings are quite distinct writes David Pirie of Glasgow. It goes somewhat awry, however, when one of the strings is identical with the leftmost part of a longer, preceding string.

I hope these examples — from a 32K Pet and Anadex printer — will show what I mean. There is no disc unit on this Pet but it is fitted with a Toolkit. Perhaps your author could shed a little light on the mystery?

```
100 FORJ = ITO5: READG$(J):NEXT
110 !S,G$
115 OPEN1,4
```

```
120 FORJ = ITO5:PRINT!1,G$(J):NEXT
125 CLOSE1
130 DATATHOMSON,THOMS,THOM,
    THOMPSON,THOMAS
READY,
THOMSON
THOMS
THOM
THOMAS
THOMPSON
```

NOW CHANGE 'THOM' TO 'THOME

```
130 DATATHOMSON,THOMS,THOME,
    THOMPSON,THOMAS
READY.
```

```
READY.
THOMAS
THOME
THOMPSON
THOMSON
THOMS
```

Disassembling ROM

AFTER programming my Pet with the 6502 disassembler program published in the November 1979 edition of *Practical Computing*, I set about adding to it to enable it to disassemble the Pet peek-protected ROM writes A Freeman of Catford, London.

The following is the result, using a small machine-code subroutine in the second cassette buffer to peek the locations and to assign the variables.

The following lines are added to the main program:

```
1 FORP = 826TO832:READQ:POKEP,
Q:NEXT
2 DATA 173,0,0,141,72,3,96
90Z = A:GOSUB3000:POKE827,LB:
POKE828,MB:SYS826:D = PEEK(840)
91Z = A + 1:GOSUB3000:POKE827,LB:
POKE828,MB:SYS826:L = PEEK(840)
92Z = A + 2:GOSUB3000:POKE827,LB:
POKE928,MB:SYS826:H = PEEK(840)
3000MB = INT(Z/256):LB = INT(Z-(256*
MB)):RETURN
```

Tape counter

I WOULD like to pass on a Pet tip I use, writes John Taylor of Orpington, Kent. The Pet does not have a tape counter on its tape recorder. That makes it very hard to find ones place on the tape. The way I find my way about the tape is by saving a dummy program at the end of the tape, i.e., after the last recorded program.

If, like me, you write a program, and then wish to place it on tape, one has to take a chance about the position on the tape — either record over one program or have a new tape for each program.

If you can tell the computer to verify the program in the memory, the computer will tell you when it has found the dummy program. You can then wind the tape back a little, and record the program on to the tape.

That can also be done when finding the end of a tape, but you tell the computer to load "DUMMY" program.

```
10 REM *****
20 REM *****
30 REM THIS IS THE DUMMY PROGRAMME .
40 REM BY SAVING THIS PROGRAMME ON
50 REM TAPE AFTER YOUR FINAL PROGRAMME
60 REM YOU WILL BE ABLE TO FIND
70 REM YOUR PLACE ON THE CASSETTE
```

```

80 REM IF YOU DO NOT HAVE A TAPE COUNTER
90 REM
100 REM TELL THE P.E.T. TO :-
110 REM LOAD 'DUMMY' - IF YOU WANT TO FIND YOUR
120 REM PLACE ON THE TAPE & YOU DO NOT HAVE
130 REM A PROGRAMME IN THE MEMORY ALREADY
140 REM VERIFY 'XXXXX' - IF YOU DO NOT HAVE
150 REM PLACE ON THE TAPE AND A PROGRAMME
160 REM IN THE COMPUTERS MEMORY
170 REM YOU WILL HAVE TO WIND THE TAPE BACK
180 REM SO THAT YOUR PROGRAMME WILL RECORD
190 REM OVER THIS DUMMY PROGRAMME
200 REM *****
210 REM *****
    
```

Reaction timing

CHRIS Smith's notes in Pet Corner, July 1980 on measuring reaction times in milliseconds on the Pet using a machine-code counter is very interesting writes W Withers of Hampton Hill, Middlesex.

It would be far more useful, however, if external key could be used, say on the user port instead of the Pet keyboard. Also a program to Poke similarly-timed outputs to the user ports in succession would be of great use in psychology for switching on external visual displays, etc. I hope contributors have some further thoughts on doing achieving those aims.

Pet hints

IT IS possible to re-set the Basic system by calling SYS (64721) writes John Bertin of Old Stevenage, Hertfordshire. That will clear all memory locations above 1023 and re-set the vectors.

Wait 6502 — any integer in range 0-255 — causes, what seems to me to be, a surprising if pointless result.

Multiple key presses

MOST highly-interactive Pet games I have seen involve only one player — writes I Mercer of Loughborough. The reason for that is simple: the commands on the Pet do not allow multiple key presses to be detected. By that, I mean that you cannot write a program using GET or PEEK(515) which will be able to tell if the operator is holding down both the A key and the X key. Both GET and PEEK(515) also have other disadvantages.

GET cannot provide continuous input — using GET, it is impossible to tell how long a key has been held down for or when that key is released. PEEK(515) can provide continuous input but it is not a standard Pet function and will not work on new-ROM Pets.

So, faced with those problems, I set about writing a machine-code routine which would scan the keyboard and store a map of it in memory where it could be examined by a Basic program. The routine I produced resides at \$0398 — 920 decimal — and copies the keyboard into a block of memory from \$0348 to \$0352, 900-909 decimal — figure 1.

To enter the routine, you can use the Basic program in figure 2. Once the routine has been entered, you can call it up using SYS 920. That will scan the keyboard once and store a map of it in

```

READY.
20 FORT=920T0946:READH:POKET,H:NEXT
30 DATA 162,0,173,16,232,41,240,141,16,232,173,18,232
40 DATA 73,255,157,132,3,232,238,16,232,224,10,208,240,96
READY.
Figure 2.
0398 A2 00          LDX #00          ;set pointer = 0
039A AD 10 E8      LDA $E810        ; reset
039D 29 F0        AND #F0          ; keyboard
039F 8D 10 E8      STA $E810        ; scan
03A2 AD 12 E8      LDA $E812        ;read back
03A5 49 FF        EOR #FF         ;invert
03A7 9D 84 03     STA $0348,X     ;store it away
03AA E8            INX            ;inc pointer
03AB EE 10 E8      INC $E810        ;next column.
03AE E0 0A        CPX #0A         ;finished ?
03B0 D0 F0        BNE $03A2       ;no - look back
03B2 60          RTS            ;return
READY.
Figure 1.
    
```

memory — for the details, see figure 3.

Now you can PEEK at the relevant location and test the BITS in it. The easiest way to do that in Basic is to use the AND function, e.g., if you wanted to discover if the RETURN key was being held down you could use the following BASIC line: 10 IF (PEEK(906) AND 32) THEN

The location you PEEK at is contained

in the table's row number and the number with which you AND that is contained in the table's column number.

Besides making two-player games possible, the routine can enhance one player games — now you can move and fire at the same time. It also makes machine-code games easier by providing an easy to use keyboard input routine.

Figure 3.

	128	64	32	16	8	4	2	1
900	← →	CLR HOME	←	[&	%	#	!
901	INST DEL	↑ ↓]	\	'	\$	"
902	9	7	↑	O	U	T	E	Q
903	/	8		P	I	Y	R	W
904	6	4		L	J	G	D	A
905	*	5		:	K	H	F	S
906	3	1	return	;	M	B	C	Z
907	+	2		?	,	N	V	X
908	-	0	shift	>]	@	shift
909	=	.		RUN STOP	<	space	[OFF RVS

Computer programming made simple

By J Maynard, W H Allen Ltd, Second Edition, 1980, 350 pages, softback, ISBN 0 491 00872 4, £2.50.

THIS IS the second, enlarged, edition of a book which first appeared in 1972 and which has been selling well ever since. It aims to give a good grounding in computer programming, starting from first principles and requiring no mathematical or electronics background.

The first section describes the basics of computers, concentrating on the kind of system and peripherals which might be found in a typical commercial mainframe machine room of the early 1970s. Flowcharting and problem analysis are then explained, and an overview of systems software presented. The section ends with a description of data structures and number systems.

Section two is a lengthy — 150 pages — description of the Cobol language, used widely for applications programming for business users. Section three is a shorter — 50 pages — Fortran programming course — Fortran is a programming language used widely for scientific calculations, particularly on IBM computers and in the U.S.

Those first three sections appear to be substantially unchanged since the 1972 first edition. The introduction to computers makes no mention of microprocessors, floppy discs, cassettes or other reasonably recent developments. The Cobol section was written before the ANSI standard of 1974 and more importantly, the Fortran section has no reference to the 1977 new standard for the language. The ideas of program design are equally old-fashioned.

Sections four and five have been added for the new edition. Section four provides an introduction to Basic, using the Mostek Sys-80F Basic for all examples. Section five is a very brief overview of the terms used in describing microprocessor systems — little more than a brief glossary.

The book is far from ideal for any class of reader, yet it contains an enormous amount of information at a truly



bargain price. The descriptions of computer peripherals and recording formats is useful background for any programmer. The comprehensive Cobol section provides a useful introduction to commercial data processing, although some of the examples from payroll programs clearly pre-date the Sex Discrimination Act.

Similarly, the Basic and Fortran sections provide the flavour of the languages — without, unfortunately, being very suitable for learning either language in detail.

That is the real failing of this book; whatever you want to learn, there is certainly a book available which teaches it better.

Conclusions

- Good value if you want an overview of three computer languages without learning any one in detail.
- Not recommended as an introduction to personal computing or microcomputer use in small business.
- Worth adding to your library for general background reading, but only because it is so cheap.

The first book of Ohio Scientific: Volume 1

By J Clothier and W Adams. Published by Elcomp at \$7.95. 190 pages paperback, no ISBN — the Elcomp reference number is 157.

OHIO Scientific is a company dedicated to making and selling microcomputer systems. Its Challenger and Superboard ranges of machines are well known in this country and are sold widely. Unfortunately, there has been a shortage of technical documentation readily available for Ohio Scientific hardware and software — that is the gap which

Elcomp is attempting to fill.

The book is bursting with information. Articles have been collected from many sources, arranged into some semblance of order, and published. The whole collection exudes enthusiasm, energy and haste.

The level of information presented ranges from manufacturers' to detailed explanations of debugging; from starting Basic, to machine-code monitor routine listings; from building an RS232 interface for the Challenger C-1P, to a program to circumvent the garbage collection problem in computers with Ohio Scientific Basic in ROM.

Only you can tell if it is the book you need, and only then, by looking at the contents list to see if the information you want is there. My guess, however, is that owners of Challenger or Superboard systems will feel much happier with the book on their shelf where they can refer to it if they want it in a hurry.

Elcomp has already announced two further volumes of the series, and more are planned. Volume two covers the Ohio Scientific-65D disc-operating system Version 2.0, the OS-65U operating system and editor, the Ohio Scientific WP-2 word processor and much more. Volume three is intended for hardware buffs who want expansion and interface details for their systems.

Conclusions

- An eclectic work, worth investigating if you have an Ohio Scientific system and feel short of technical information.
- Could be invaluable if you are looking for the specific details it contains.

Understanding microprocessors with MK14

By Ian Williamson and Rodney Dale, Published by Macmillan (1980), more than 200 pages paperback £5.95. ISBN 0 333 31075 6.

THE MK14 is a single-board computer from Science of Cambridge and costs from £39. It was reviewed in *Practical Computing* in May 1979. At the heart of the MK14 is the 8060 microprocessor, which has an eight-bit, seven-register,

single-accumulator architecture.

The book uses the MK14 to teach the fundamentals of microprocessor use and assembly-language programming. The principles are explained first, then, step by step, the architecture of the MK14 is used to clarify each point and to provide practical examples and hands-on experience. The text is peppered with questions and answers, to enable readers to check their understanding, page-by-page.

The 8060 microprocessor is covered in great detail, so that anyone working through the book will have a thorough understanding of its architecture, and of the precise effects of all 46 instructions. Input-output and interrupts are described and explained, and examples are provided which show how multi-processor systems can be built; how direct memory access, DMA, works, and how the MK14 can be used for real-time data acquisitions.

The book is a model which other authors should follow. It is attractively laid-out, easy to read, accurate and complete.

The result is a book which can be read cover-to-cover with little previous knowledge of microprocessors, but which will remain in use long after the reader has become expert, as a reference book for the 8060 architecture, as a source of ideas and techniques, and as a demanding standard against which to measure the quality of other documentation.

Conclusions

- An excellent book, strongly recommended for anyone who wants to learn about machine-language programming and microprocessor architecture.
- If you own a Science of Cambridge MK14, this book should be the next thing you buy.
- If you do not own a MK14, this book is the best possible reason for buying one.
- Recommended for anyone who needs to work with microprocessors at a very low level, or for experienced high-level language programmers who want greater insight into what assembly-language programming is all about.

Martyn Thomas

Comart Approved
Cromemco Dealers

Belfast

O & M Systems
95 Dublin Road
Contact: Richard-Owens

Birmingham

Byteshop Computerland Ltd
94/96 Hurst St, B5 4TD
Contact: Jim Attfield
Tel: 021 622 7149
Telex: 336186 BYTE G

Cambridge

Cambridge Computer Stores
1 Emmanuel St, CB1 1NE
Contact: Claude Cowan
Tel: 0223 68155

Cornwall

Benchmark Computer
Systems Ltd
Tremena Manor
Tremena Road
St Austell, PL25 5GG
Contact: John Fisher
Tel: 0726 610000

Dublin

Lendac Data Systems Ltd
8 Dawson St
Contact: Danny McNally
Tel: 000 1 372052

Glasgow

Byteshop Computerland Ltd
Magnet House
61 Waterloo St, G2 7BP
Contact: Gordon Coventry
Tel: 041 221 7409
Telex: 779263 BYTE GW G

Leeds

Holdene Ltd
Manchester Unity House
11/12 Rampart Road
Woodhouse St
Contact: Jim Jackson
Tel: 0532 459459
Telex: 556319 HOLDEN G

London

Byteshop Computerland Ltd
48 Tottenham Court Road,
W185 4TD
Contact: John Braga
Tel: 01 636 0647

Digitus

9 Macklin Street
Covent Garden WC2
Contact: Alan Wood
Tel: 01 405 6761

Manchester

Byteshop Computerland Ltd
11 Gateway House
Piccadilly Station Approach
Contact: Peter King
Tel: 061 236 4737
Telex: 666186 COMMAN G

NSC Computers

29 Hanging Ditch
Contact: Adam Wiseberg
Tel: 061 832 2269

Newbury

Newbear Computing Store
40 Bartholomew St
Contact: Tim Moore
Tel: 0635 30505
Telex: 848507 HJOLPN

Nottingham

Byteshop Computerland Ltd
92A Upper Parliament St,
NG1 6LF
Contact: David Clarke
Tel: 0602 40576
Telex: 377389 BYTENOG

Sheffield

Hallam Computer Systems
451 Eccleshall Road, S11 9PN
Contact: Stuart Pulford
Tel: 0742 663125

Southampton

Xitan Systems
23 Cumberland Place,
SO1 2BB
Contact: Geoff Lynch
Tel: 0703 38740

Sudbury

Eurotec Consultants
Holbrook Hall
Little Waldingford
Contact: Dr Klimowicz
Tel: 0206 262319
Telex: 987248

Warwick

Business & Leisure
Microcomputers
16 The Square
Kenilworth
Contact: David Searle
Tel: 0926 512127

Comart Microcomputer

dealers are located
strategically throughout the
country to give support,
guidance and assistance. In
the event of difficulty contact
Comart direct.

 **Cromemco**



Flexibility + Versatility

System Flexibility

Cromemco give you the high performance, reliable computer power you need now, with the in-built capability for future expansion and adaption as demands and requirements change.

The choice is wide. Cromemco's S-100 bus construction provides for expandable memory capability and the widest choice and future options in peripheral support.

Now there is the exciting range of Cromemco High Resolution Colour Graphics Systems.

Applicational Versatility

Cromemco's CDOS Operating System supports proven, well documented Software for Business, Industry, Science, Research and Education; COBOL, RPG II, Macro Assembler, 16K and 32 BASIC, FORTRAN IV, LISP, RATFOR, Word Processing and Data Base, are all included in the range.

Now, there is the new CDOS compatible, Cromix Multi-user Multitasking Operating System which opens up new avenues in application and performance for Cromemco System Users.

The U.K. Leaders in Microcomputer
Development, Application and Support.

comart

PO Box 2, St Neots, HUNTINGDON, Cambs
Tel: (0480) 215005 Telex: 32514 Comart G.

Britain's first com puter kit.

The Sinclair ZX80.

£79.95

Price breakdown
ZX80 and manual: £69.52
VAT: £10.43
Post and packing FREE

Please note: many kit makers quote VAT-exclusive prices.

You've seen the reviews... you've heard the excitement... now make the kit!

This is the ZX80. 'Personal Computer World' gave it 5 stars for 'excellent value.' Benchmark tests say it's faster than all previous personal computers. And the response from kit enthusiasts has been tremendous.

To help you appreciate its value, the price is shown above with and without VAT. This is so you can compare the ZX80 with competitive kits that don't appear with inclusive prices.

'Excellent value' indeed!

For just £79.95 (including VAT and p&p) 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 a cassette recorder and television (black and white or colour); *everything!*

Yet the ZX80 really is a complete, powerful, full-facility computer, matching or surpassing other personal computers at several times the price.

The ZX80 is programmed in BASIC, the world's most popular computer language for beginners and experts alike.

The ZX80 is pleasantly straightforward to assemble, using a fine-tipped soldering iron. It immediately proves what a good job you've done: connect it to your TV... 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 a 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).

The 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.

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

The ZX80 owes its remarkable low price 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 line.)

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.

Z80 A microprocessor - new, faster version of the famous Z-80 microprocessor chip, widely recognised as the best ever made.

Sockets for TV, cassette recorder, power supply.

SUPER ROM.

Clock.

Rugged flush, Sinclair keyboard.

RAM chips.

UHF TV modulator.



Sinclair
ZX80



Complete



```

140 IF T(N)=X THEN GO TO 300
150 LET T(N)=X
160 NEXT I
165 PRINT
167 PRINT
170 PRINT "NUMBER OF DUPLICATES"
180 .D
185 STOP
200 LET N=(N+1)-((N+1)/75)*75
210 GO TO 130
  
```

The Sinclair teach-yourself BASIC manual.

If the specifications of the Sinclair ZX80 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.

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 and complete with mains adaptor, for only £99.95.

Demand for the ZX80 is very high: use the coupon to order today for the earliest possible delivery. All orders will be despatched in strict rotation. We'll acknowledge each order by return, and tell you exactly when your ZX80 will be delivered. If you choose not to wait, you can cancel your order immediately, and your money will be refunded at once. Again, of course, you may return your ZX80 as received within 14 days for a full refund. We want you to be satisfied beyond all doubt - and we have no doubt that you will be.

sinclair
ZX80
Science of Cambridge Ltd

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

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 and 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	

NB. Your Sinclair ZX80 may qualify as a business expense. **TOTAL** £

I enclose a cheque/postal order payable to Science of Cambridge Ltd for £ _____
Please print
Name: Mr/Mrs/Miss _____
Address _____

PC12

ComServe

COMPUTER SHOP PRESENTS



THE ELEGANT, EXPANDABLE

video genie system

£364 inc VAT. Postage. Requires T.V. or monitor — £70 if bought with Genie

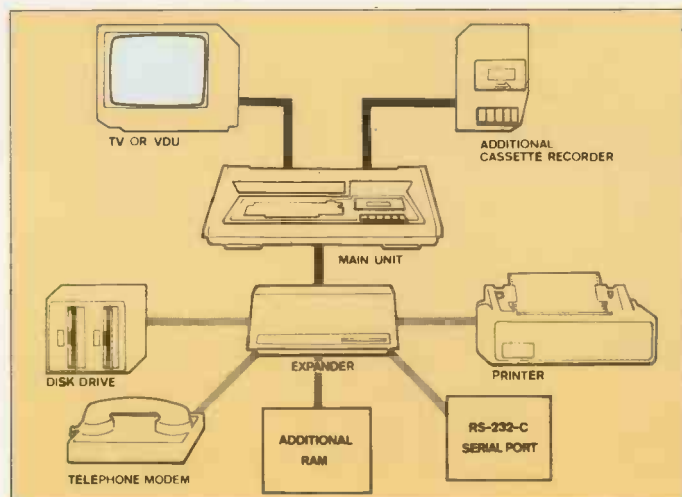
Comprises standard 16K computer. 3 manuals. Demonstration tape. Lead for additional cassette player. Lead for monitor.

- FREE** Standard cover. Head cleaning/demagnetising tape.
- FREE** Programs: Games. Utilities. Subroutines.
- FREE** Standard soundkit if wanted (installation £5 extra)
- FREE** Comserve joysticks if wanted (installation £7 extra)
- FREE** Coloured plastic folders for manuals or screen overlays.

CWO to

ComServe

98 TAVISTOCK STREET,
BEDFORD, BEDFORDSHIRE
TELEPHONE (0234) 216749



We supply various printers. We will supply S100 expansion box, colour boards, disk drive, fast tape drives, RS232 interfaces as available. We supply some '80, Genie and CP/M programs at 20% discount. We buy some secondhand programs (in manufacturers' original pack and with original documentation only)

S.A.E. for further information. Items and prices are as at time of going to press and are subject to alteration.

• Circle No. 178

User Groups is a region-by-region list of microcomputer clubs in Britain whose activities have been brought to our attention. It should prove a useful guide to anyone interested in sharing this hobby with others. If a new club has been formed, send us the details and we will include them in the next available issue.

AVON
Bristol Computing Club
 Leo Wallis
 6 Kilbernie Road
 Bridge Farm Estate
 Bristol BS14 0HY.
 Tel: 0272 832453.
Brunei Computer Club
 S W Rabone
 18 Castle Road
 Worle
 Weston-Super-Mare
 Avon BS22.GJW.
 Tel: 0934 513068.

BEDFORDSHIRE
U.K. Intel MDS Users' Group
 Lewis Hand
 29 Chaucer Road
 Bedford.
 Tel: 0234 41685.
6502 Users' Club
 Joe Manifold
 16 Bun Yam Close
 Pirton, near Hitchin
 Hertfordshire.
 Tel: 0462 78522.

BERKSHIRE
Commodore Pet User Club
 M Gulliford
 818 Leigh Road
 Slough Industrial Estate
 Slough, Berkshire.
 Tel: 0753 74111.

BUCKINGHAMSHIRE
National TRS-80 Users' Group
 Brian Pain
 40a High Street
 Stony Stratford
 Milton Keynes.
 Buckinghamshire.
 Tel: 0908 566660.
International Nascom
Microcomputer Club
 The Secretary
 C/O Oakfield Corner
 Sycamore Road
 Amersham
 Buckinghamshire.
 HP6 6SU.

CAMBRIDGESHIRE
Peterborough Computer Club
 Trevor Marchant.
 Tel: 0733 76681.

CHESHIRE
North-west Computer Club
 John Lightfoot
 135 Ashton Drive
 Frodsham, Warrington
 Cheshire WA6 7PU.
 Tel: 0928 31519.

CLEVELAND
Cleveland Microcomputer Club
 J H Telford
 13 Weston Crescent

Norton, Cleveland.
 Tel: 0642 550061.

DEVON
Exeter and District Amateur
Computer Club
 Doug Bates
 2 Station Road
 Pinhoe, Exeter.
 Tel: 0392 69844.
Plymouth and District Amateur
Computer Club
 Keith E Gould
 Willoby House
 Meavy Lane
 Yelverton
 Devon PL20 6AL.
 Tel: 082285 2575.

DURHAM
North-east Pet Users' Group
 Jim Cocallis
 20 Worcester Road
 Newton Hall Estate
 Durham.
 Tel: 0385 67045.

ESSEX
London and South-east Sharp
MZ-80K user Group
 Joe Seet
 16 Elmhurst Drive
 Hornchurch
 Essex RM11 1PE.
 Tel: 04024 42905.
TRS-80 User Group
 Michael Dean
 22 Roughtons
 Galleywood
 Chelmsford.
 Tel: 0245 76127.
UK101 user Group
 Adrian Waters
 117 Haynes Road
 Hornchurch, Essex.
 Tel: 494 0490.
Springfield Computer Club
 Steve Cousins
 1 Aldeburgh Way
 Springfield, Chelmsford
 Essex CM1 5PB.
 Tel: 0245 50155.

GLOUCESTERSHIRE
Cheltenham Amateur
Computer Club
 M Pullin
 45 Merestones Drive
 The Park
 Cheltenham GL50 2SU.
 Tel: 0242 25617.
990 User Group
 Chris Cadogan
 21 Thistle Downs
 Northway Farm, Tewkesbury.
 Tel: 0684 293821
 Ext. 310.

GWENT
Gwent Amateur Computer Club

Ian Hazell
 50 Ringwood Hill
 Newport
 Gwent NPT 9EB.
 Tel: 0633 277711.

HAMPSHIRE
Independent Pet Users' Group
 G A Parkin
 Robert May's School
 West Street, Odiham.
 Tel: 025 671 2700.
Southampton Amateur
Computer Club
 P G Oorey
 Dept. of Physiology
 The University
 Southampton SO9 3TU
 or Andy Low
 Tel: (0703) 555605 Ext. 34.
Southampton Pascal Users'
Group
 C/O Computer Studies Group
 University of Southampton
 Southampton SO9 5NH.
UCSD Pascal User Group
 John Ash
 Dicoll Data Systems Ltd
 Bond Close
 Kingsland Estate, Basingstoke
 Hampshire RG24 0QB.

HERTFORDSHIRE
The Harrow Computer Group
 N P Butcher
 16 St. Peter's Close
 Bushey Heath
 Watford
 Hertfordshire WD2 3LG.
 Tel: 01-950 7068.
Harpenden Microcomputer
Group
 David M James
 5 Ox Lane
 Harpenden
 Hertfordshire.
 Tel: 05827 5366, evenings.

INTERNATIONAL
International Association
of Cromemco Users
 PO Box 17658
 Irvine, California 92713 U.S.A.
 Tel: 714 955 0432.

ISLE OF WIGHT
TRS-80 Users' Club
 Mike Collins
 3 Altofts Gardens
 Ventnor
 Isle of Wight.

KENT
Gillingham User Group
 A Aylward
 194 Balmoral Road
 Gillingham.
 Tel: 0634 56830.

Medway Amateur Computer
and Robotics Organisation
 Mrs C Webster
 13 Ladywood Road
 Cuxton, Rochester
 Kent.
 Tel: 0634 78517.

North Kent Amateur Computer
Club
 B J Biddles
 3 Acer Road
 Biggin Hill
 Kent TN16 3SP.
 Tel: 29 71742.

LANCASHIRE
Amateur Computer Club
 2650 Library
 Roger A Munt
 51 Beechwood Drive
 Feniscowles, Blackburn
 Lancashire.
 Tel: 0254 22341.
North Lancashire User Group
 Denise Green
 550 Midgeland Road
 Blackpool.
 Tel: 0253 692261.
North-west Group Amateur
Computer Club
 Ken Horton
 50 Lymfield Drive
 Worsley.
 Tel: 061 228 6333 Ext. 372.
TRS-80 Users' Group
 Melvyn D F Franklin
 40 Cowlees
 Westhoughton, Bolton
 Lancashire.
 Tel: 0942 812843
West Lancashire Pet Users'
Club
 D W Jowett
 197 Victoria Road East
 Thornton
 Blackpool FY5 3ST.
 Tel: 0253 869108.

LEICESTERSHIRE
Leicestershire Personal
Computer Club
 Jill Olorenshaw
 C/O Arden Data Processing
 Municipal Buildings
 Charles Street
 Leicester.
 Tel: 0533 22255.

LINCOLNSHIRE
Lincolnshire Microprocessor
Society
 Eric Booth
 Bishop Grossetest College
 Newport, Lincoln.
 Tel: 0522 27347.

LONDON
Comp 80 — Scientific Computer
Users' Group
 P L Roberts

(continued on next page)

(continued from previous page)

50 Cromwell Road
Wimbledon
London SW19 8LZ.
Tel: 01-540 3713.

Computerclub
Roger R Frampton
42 Great Windmill Street
London W1V 7PA.
CP/M Users Group U.K.
D Powys-Lybbe
11 Sun Street
London EC2M 2PS.
Tel: 01-247 0691.

National ZX-80 Users' Club
Tim Hartnell

44-46 Earls Court Road
London W8 6EJ.

North London Hobby Computer Club

Robin Bradbeer
Dept. of Electronic and
Communications Engineering
Polytechnic of North London
Holloway Road
London N7.
Tel: 01-607 2789.

Southgate Computer Club

Panos Koumi
33 Chandos Avenue
London N14
or Alan Tootill on
01-360 7014 (home) or
01-882 6111 Ext. 2281 (work).

South-east London

Microcomputer Club

Peter Phillips
61 Craigerne Road
London SE3.
Tel: 01-853 5829.

MK-14 User Club

Geoff Phillips
8 Poolsford Road
NW9 6HP.
Tel: 01-200 6209
or 01-207 2000 Ext. 233.

OSI U.K. User Group

Richard Elen
12 Bennerley Road
London SW11 6DS.

Pet Users' Club

Richard Pawson
Commodore Systems Division
360 Euston Road
NW1 3BL.
Tel: 01-388 5702.

Pet Users' Education Group

Dr. Chris Smith
Dept. of Physiology
Queen Elizabeth College
Campden Hill Road
W8 7AH.
Tel: 01-937 5411 Ext. 429.

MANCHESTER

Amateur Computer Club

(N.W.) Group
Mrs J. Lomas
C/O Corrosion & Protection
Centre
UMIST, Manchester.
Tel: 061-861 1933.

MERSEYSIDE

Level 1 User Group

N Rushton
123 Roughwood Drive
Northwood, Kirkby
Merseyside L33 9UG.

MIDDLESEX

Independent Pet Users' Group

Geoff Squibb
108 Teddington Park Road
Teddington
Middlesex.
Tel: 01-977 2346.

Richmond Computer Club

R A Forster

18a The Barons

St. Margaret's,

Twickenham

Middlesex.

Tel: 01-892 1873.

West London Personal

Computer Club

G J Brain

81 Rydal Crescent

Perivale

Middlesex.

Tel: 01-997 8986.

Tangerine User Group

International

R Green

3/22 Donoughmore Road

Boscombe, Bournemouth

Dorset

or Paul B Kaufman

Flat 11

153 Burnt Oak Broadway

Edgware

Middlesex HA8 4EJ.

NORFOLK

East Anglia Computer User

Group

Jan Rejzl

88 St Benedicts Street

Norwich NR2 4AB.

Tel: 0603 29652.

NORTHAMPTON

Personal Computer Users' Club

J R Jackson

Mereway Upper School

Mereway

Northampton NN4 9BU.

Tel: 0604 63616.

NOTTINGHAMSHIRE

Independent TRS-80 User Group

Mike Costello

17 Langbank Avenue

Rise Park

Nottingham NG5 5BU.

Nottingham Microcomputer

Club

P McQuoney

28 Seaford Avenue

Wollaton,

Nottingham.

Tel: 0602 751742.

U.K. Apple Users' Group

Andy Witterick

5b The Poultry

Nottingham NG1 2HW.

Tel: 0602 583254.

OXFORDSHIRE

Oxford University

Microcomputer Society

Phillip Taylor

St. John's College

Oxford.

Tel: 0865 47671.

Oxfordshire Microcomputer

Club

S C Bird

139 The Moors

Kidlington

Oxford OX5 2AF.

Tel: 08675 6703.

Research Machines Users'

Group

Tony Crowle

134 Howard Street

Oxford.

SCOTLAND

Scottish Amateur Computer

Society

Alistair Macpherson

6 Curriehill

Castle Drive

Edinburgh 14.

Tel: 031 449 6658.

Ithaca Audio S-100 User Group

Dave Weaver

16 Etive Place

Condorrat

Cumbernauld

Near Glasgow G67 4JF.

Tel: 023 67 36570.

Strathclyde Computer Club

Dave Weaver

16 Etive Place, Condorrat

Cumberland,

Near Glasgow G67 4JF.

Tel: 023 67 36570 or

I Barraclough

C/O S T V Cowcaddens

Glasgow.

SOMERSET

Ohio Scientific U.K. User Group

Tom Graves

19a West End

Street

Somerset BA16 0LQ.

Tel: 0458 45359.

STAFFORDSHIRE

The Amateur Computer Club

of North Staffordshire

I Roll

16 Hill Street

Hednesford

Staffs WS12 5DJ.

Tel: 05438 4363

or 0785 3251 Ext. 441 (work).

SURREY

ZX-80 Users' Club

David Blagden

PO Box 159

Kingston-Upon-Thames

Surrey KT2 5YQ.

SUSSEX

Crawley Computer Club

John Fieldhouse

18 Seaford Road

Crawley

West Sussex.

Tel: 0293 542509.

Mid-Sussex Microcomputing

Club

Bernard Langton

228 St. Leonard's Road

Horsham

West Sussex RH13 6AU.

Tel: 0403 61156.

Sussex/Surrey Pet Group

Richard Dyer,

33 Parham Road

Ifield, Crawley

Sussex RH11 0ET.

Southern Users' of Pet

Association (SUPA)

Howard W Pilgrim

42 Compton Road

Brighton

Sussex BN1 5AN.

Tel: 0273 561982.

TYNE AND WEAR

Newcastle Personal Computer

Society

John Bone

2 Claremont Place

Gateshead

Tyne and Wear.

Tel: 770036, home, or

0632 781412 Ext. 236 (work).

WALES

National TI-58/59 Club

R M Murphy

Dept. of Electrical Engineering

University College Swansea

Swansea

South Wales

WEST MIDLANDS

Central Program Exchange

Mrs J Brown

Dept. of Computing and

Mathematical Sciences

The Polytechnic

Wulfruna Street

Wolverhampton WV1 1LY.

Tel: 0902 27371 Ext. 56.

WEST MIDLANDS

Amateur Computer Club

John Tracey

100 Booth Close

Brierley Hill

West Midlands DY6 8SP.

Tel: 0384 70097.

Birmingham 7/66 User Group

Sue Dunn

Newbear Computing Store

First Floor Offices

Tivoli Centre, Coventry Road

Birmingham B26.

Tel: 021 707 7170.

Midland Amateur Computer

Club

Roy Diamond

27 Loweswater Road

Coventry CV3 2HJ.

Tel: 0203 454061.

West Midlands RML User Group

Peter Smith

BECC

Camphill Centre

Stratford Road

Birmingham B11 1AR

WORCESTERSHIRE

Worcester and District

Computer Club

D J Stanton

55 Vauxhall Street

Rainbow Hill

Worcester WR3 8PA.

Tel: 0905 22704.

YORKSHIRE

West Yorkshire Micro

Computer Group

P R Clark

Suite 204

Crown House

Armley Road

Leeds LS12 2EJ.

Tel: 0532 450667.

Leeds and District Branch

of the British Computer Society

David J Sheppard

20 Green Lane Close

Overton

near Wakefield WF4 4SE.

Tel: 0924 270419.

Darlington Computing Club

L Boxell

8 Vane Terrace

Darlington DL3 7AT.

Tel: 0325 67766.

Penine and District

Computer Club

Douglas R Bryant

26 Mill Hey

Haworth

West Yorkshire BD22 8NA.

Tel: 0535 43007.

South Yorkshire Personal

Computing Group

Peter Johnson

15 Hordean Road

Sheffield S5

F5 0UJ.

Tel: 0742 387795.

Sharp PC-1211 Users' Club

Jonathan Dake

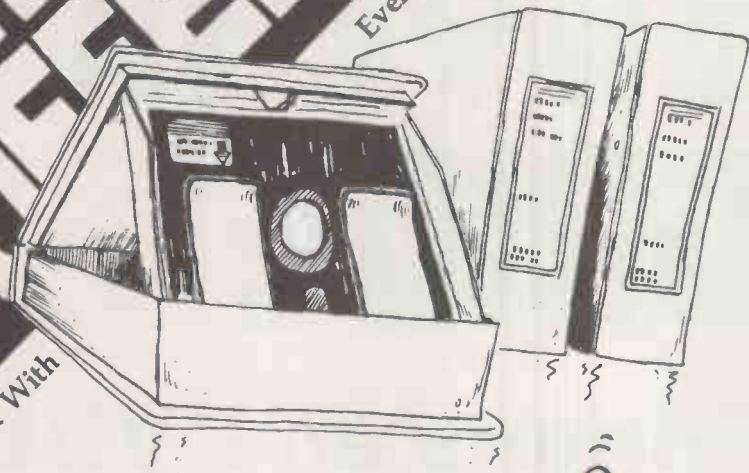
FREE!
ORDER!

Every Ten-Pack Ordered

Factory Fresh Brand-Name

MINI DISKS

At Discount prices
 rushed to you by post



Library Box design may vary

Plastic Library Box With



	Nett	VAT	Total
Verbatim single sided Ten-Pack	17-35	2-60	19-95
Verbatim double sided Ten-Pack	26-04	3-91	29-95
BASF single sided Ten-Pack	19-96	2-99	22-95
BASF double sided Ten-Pack	25-61	3-84	29-45
UK p&p + 50p, Export (EEC) + £1.00			

We only sell top quality disks, with manufacturers full guarantee. In addition, **EUROPHONIC** undertake to refund your money in full, should you be dissatisfied with your purchase, for any reason, whatsoever.

If you're not sure which disk suits your drive, write or 'phone 0428 722563 any time.

If order form has been cut send your cheque payable to **EUROPHONIC** Moonrakers, Wheatsheaf Enclosure, Liphook, Hants, GU30 7EJ.

To: **EUROPHONIC**, Moonrakers, Wheatsheaf Enclosure, Liphook, Hants, GU30 7EJ.

Please send me:

- Verbatim s/s Ten-Pack at 19.95
- Verbatim d/s Ten-Pack at 29.95
- BASF s/s Ten-Pack at 22.95
- BASF d/s Ten-Pack at 29.45
- UK dly & ins + 50p per Ten-Pack

Qty Total

Qty	Total

Total value of cheque enclosed

Please make cheques payable to **EUROPHONIC**

Name: _____

Address: _____

PC12



Telephone Answering Machines
 Phone Mate ... Own Your Own
 910 fixed time rec. £115
 920 voice actuated. £170
 925 remote control. £185
 930 rem + voice act. £250
 Prices inclusive UK dly. + ins.
 Cheques please to Europhonic
 Moonrakers, Wheatsheaf Enc.
 Liphook, Hants. GU30 7EJ.
 Liphook (0428) 722563 anytime

• Circle No. 180

WHEEEE—BANK—POP
 NEW SOUND BOARD FOR MOST
 COMPUTERS.

SOUND BOARD £40 **BUILT** £35 **KIT**
 TUNES—CHORDS & EFFECTS—FULLY
 PROGRAMMABLE
 CONNECTS TO 10 BITS OF ANY I/O PORT
 LOUDSPEAKER, AMP & BATTERY
 INCLUDED.

CASED + £3
 (USES AY-3-8910)

JOYSTICKS £15 PER PAIR (BUILT)
 CASED & COMPLETE WITH 2 PUSH
 SWITCHES & 1 METRE OF CABLE PER UNIT
 PAIR OF 2 AXIS JOYSTICKS CONNECTS
 DIRECT TO MOST 8 BIT I/O PORTS.

COMPUKIT/SUPERBOARD

OWNERS: I/O PORT £40 **BUILT** £35 **KIT**
 24 LINE I/O PORT COMPLETE WITH 2 8T28
 BUFFER CHIPS AND ON BOARD RELAY.
 PLUGS STRAIGHT IN TO 40 PIN EXPANSION
 SKT.

LIGHT PEN £15 INC SOFTWARE
 USES OUR I/O PORT. HARDWARE,
 SOFTWARE & MANUAL SUPPLIED.
 (K101 ONLY)

NASCOM OWNERS M/C CODE PGMS
 KINESIS-SOUND BOARD OPERATING
 SYSTEM. COMPOSE TUNES & PROVIDE
 GRAPHICS. NEEDS 16K £15

BRICKS & TENNIS • 2 JOYSTICK GAMES •
 USES OUR JOYSTICKS. £3.50
 SPACE INVADERS & CATCH THE CRITTERS
 £3.50

STATE MONITOR WHEN ORDERING.
 ALL SOFTWARE ON TOP QUALITY
 CASSETTE.

ALL PRICES INCLUDE VAT, P+P
 ALL EX STOCK

HYSPEC
 P.O. BOX 39,
 LITTLEHAMPTON,
 WEST SUSSEX BN17 6NZ

• Circle No. 181

DISKWISE

THE Apple Agents
 in Devon & Cornwall
 Present
 Quality Software direct or from your
 local Apple Dealer.



HOTEL PLAN — Hotel Management system
 inc. booking & guest billing £475
TV RENTAL MANAGEMENT £395

TRADE ENQUIRIES WELCOME

DISKWISE
 25 Fore St., Callington, Cornwall
 Tel. 05793 3780



• Circle No. 182

BUYERS' GUIDE

Printers and VDUs

The Peripherals Buyers' Guide is a survey of printers and VDUs suitable for small computers. We have excluded any system which costs significantly more than £2,000. The printers and VDUs are listed in alphabetical order. The addresses of the main suppliers are listed at the end of the guide.

PRINTERS

ADDMASTER

420/426 receive only £246

Impact column printer, grade-one Tally roll paper at £5 for 20 rolls. BCD serial or 10-line serial interfaces, 12 cpl, 36 cps. Main U.K. agent Clary Ltd.

400 receive only £242

Impact column printer, uses 2½in. Tally roll paper at £5 per 20 rolls, parallel and serial interfaces. 16 cpl, 48 cps. Main U.K. agent Clary Ltd.

AGILE CORPORATION U.S.A.

Agile 4200 — Agile A1 P.O.A.

Agile 4200 uses Diablo HY-type mechanism, Agile A1 uses Qume Sprint 3 mechanism, uses paper up to 15in., 132/158 print positions, 55 cps on both models, RS232C EIC with current loop optional interfaces. Main U.K. agent ISG Data Sales Ltd.

ANADEX

DP-500 from £367

Impact drum printer, uses plain paper, parallel interface, 18 cpl, 45 cps. Main U.K. agent Anadex Ltd, OEM sales, U.K. and Europe.

DP-660 from £700

Impact drum printer for printing labels, uses sprocket feed. Parallel interface. 19 cpl, 57 cps. Main U.K. agent Anadex Ltd, OEM sales, U.K. and Europe.



DP-750A

Impact drum printer, RS232C 20mA current loop interface, 21 cps, 25 cps. Main U.K. agent Anadex Ltd, OEM sales, U.K. and Europe.

from £800

FP-600

Impact drum printer with ticket or form printer, from four columns to 19 columns parallel interface, 19 cpl, 44 cps. Main U.K. agent Anadex Ltd, OEM sales U.K. and Europe.

from £65

DP-9500 Series

Alpha-numeric line printers with nine-wire print head, adjustable tractor feed with bi-directional printing, three ASCII interfaces as standard — parallel bit, RS232C, current loop — 120-200 cps, 132-220 columns, 7x9, 9x9 or 11x9 matrices depending on model. Main U.K. agents Anadex Ltd, OEM sales U.K. and Europe, Peripheral Hardware, Kode Services, Robox, Stack Computer Services and Data Design Techniques Ltd.

£895 upwards

DP-8000

Alpha-numeric line printer with sprocket feed and bi-directional printing, fan-fold paper up to 9.5 in., produces up to three copies, cost of paper £14 for box of 2000 sheets. Three ASCII interfaces as standard — parallel bit, RS232C, current loop — 112 cps, 80 column, 9x7 matrix. Main U.K. agents Anadex Ltd, OEM sales U.K. and Europe, Peripheral Hardware, Kode Services, Robox, Stack, Computer Services and Data Design Techniques Ltd.

£550

DP-1000 Series

Dot matrix, impact digital printers, includes internal data storage facilities. Friction feed, uses roll-type paper for 40 columns at £11 for box of 10 rolls, three basic ASCII-compatible interfaces are available. 40 cpl, 50 cps, 40 columns, 5x7 matrix. Main U.K. agents Anadex Ltd, OEM sales U.K. and Europe, Peripheral Hardware, Kode Services, Robox, Stack Computer Services.

from £395

AXION CORPORATION

EX-820 receive only

High-speed electro-sensitive dot matrix includes plotting capability for full graphics, at £3 for a 240ft. roll, RS232C or 20mA serial and ASCII parallel input as standard, 20/40/80 cpl and up to 160 cps, 5x8 matrix. Main U.K. agent Memec Systems Ltd.

£500

EX-850 Video Printer

High-speed electro-sensitive dot matrix, uses aluminised paper at £3 for a 240ft. roll. By using a video controller, the EX-850 dispenses with the need for any interfacing between the user's CRT display/terminal and printer — needs only the video signal. Normal resolution 13.5 seconds per screen, high resolution 27 seconds per screen. Main U.K. agent Memec Systems Ltd.

£500

EX801/802 receive only

Electro-sensitive, dot matrix, uses aluminised paper at £3 for a 240ft. roll, RS232C, Centronics, Apple, Pet, and Tandy interfaces, 20/40/80 cpl, 160 cps, 5x8 matrix. Main U.K. agent Memec Systems Ltd.

£279

BASE 2

800-MST

Impact dot matrix, bi-directional, uses plain paper up to 9½in., RS232C, 20mA, IEEE-488, Centronics and parallel interfaces, up to 132 cpl and 60 cps, with 5x7 matrix. Main U.K. agents Microbyte and Maclin-Zand Electronics Ltd.

from £385

CENTRONICS

Models 700, 701, 702 and 703

Impact dot matrix, uses fan-fold paper, parallel, serial RS232C interfaces 132 cpl, up to 180 cps, 5x7 or 7x7 matrices. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

P.O.A.

APPLE II/ITT 2020

VISICALC BACK-UP

A specially formatted Disk to enable you to take a back-up copy of your Visicalc Master Disk. Can also be used to store formats/worksheets £18.00

AUTO-INDEX

Master Catalog Program featuring fully automatic updating facility and comprehensive edit and search routines requires 48K and one Disk drive £18.00

DATABASE

Database System using specially formatted Disks and custom-written routines to give fast search and retrieval and offering similar facilities to systems costing around a hundred pounds. Introductory price £20.00

RELOCATED INTEGER

Enables any Investor Program to run without an Integer Card. Includes mini-assembler and now DOS 3.3 compatible. Specify memory size when ordering.

Cassette Systems £12.00 Disk Systems £14.00

*** TRADE ENQUIRIES INVITED ***

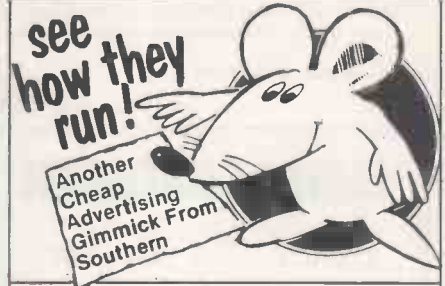
D. J. BOLTON

1 Branch Road, Park Street, St Albans

Tel: Park Street (0727) 72917

• Circle No. 183

Software for TRS80®



SEND JUST £1.00 for a cassette of THREE BLIND MICE, a ridiculous new game from SOUTHERN. Can you cut out the tails of all three mice before one of them kills you? The tape contains two copies of the game:
1) In source BASIC See how slowly it runs!
2) The same program compiled by ACCEL2, Southern's new compiler for Disk BASIC. See how Fast it runs!

Compare the two versions, and then think what ACCEL or ACCEL 2 could do for your BASIC programs.

ACCEL Compiler for Level 2 BASIC £19.95
ACCEL2 Compiler for Disk BASIC £39.95

SOUTHERN SOFTWARE, P.O. Box 39
Eastleigh, Hants. SO5 5WQ

• Circle No. 184

GRAPHICS FOR YOUR 1K ZX80

C12 CASSETTE WITH FOUR PROGRAMS

Symmetrical Patterns, Large Print

Draw A Picture, Plot A Picture

TWELVE PAGE ILLUSTRATED MANUAL

contains instructions for use,

sample runs, fully annotated listings,

technical notes including much

INFORMATION NOT AVAILABLE IN

THE SINCLAIR MANUAL

Graphics Package (cassette + manual) £8.00

Graphics Manual only £3.00

BRIDGE SOFTWARE, 36 Fernwood,

Marple Bridge, Stockport, Ches. SK6 5BE

— Mail Order Only —

Games and other programs also available

Send large s.a.e. for full catalogue

• Circle No. 185



SOUTH WALES

**THINKING OF BUYING A
COMPUTER?
FOR PROFESSIONAL
ADVICE —
RING RAY MAHONEY
0792 298269**

• Circle No. 186

*Have you ever thought
about a truly rural location
for your business?*

A cluster of premises of 1,000 to 2,000 square feet has just been completed in a North Devon village with Development Area status. Help available in finding housing.

Write or phone for details:

Dr. David Davies, Dartington North Devon Trust, Bridge Chambers, Barnstaple, North Devon.

Phone Barnstaple (0271) 76365.

• Circle No. 187

EXIDY SORCERER

48K £849 + VAT
32K NOW ONLY £799 + VAT

Dealer for

Bristol and South West

ELECTROPRINT (Mr. Tasker)

5 Kingsdown Parade • Bristol 6 • 292375

• Circle No. 188

PETER SCOTT FOR APPLE

**SHARP MZ 80K • PC1 211
TEXAS
SALES & SERVICE**

Computer books, stationery, floppy discs, tapes etc.

Ring or call and discuss your requirements

PETER SCOTT (EXETER) LTD.,

76-78 SOUTH STREET
EXETER

Exeter 73309/56633

• Circle No. 189

Model 791

Demand-document printer, impact, dot matrix, uses multi-part forms, up to 12-part using bottom feed tractors, standard parallel interface, with serial RS232C interface option, 80 cpl, 60 cps, 5×7 matrix. Main U.K. agents Sintrom Distribution, ITT electronic services, Cable and Wireless, Dacoll Engineering.

P.O.A.

Model 730

Impact, dot matrix, uses roll paper up to 8.5 in. wide, fan-fold paper up to 9.5 in. wide and cut sheet up to three-ply paper and two carbons, parallel-standard interface with serial RS232C option, 80 cpl, 100 cps, 7×7 matrix. Main U.K. agents, Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering, Datac Ltd, Rair Ltd, Comma Computers and MIBF.

P.O.A.

Model 737

Impact dot matrix, roll fan-fold or cut sheet paper, standard parallel interface, serial RS232C option, 80 cpl mono-spaced mode, 50 cps mono-spaced mode, 80 cps proportional mode, 7×8 matrix mono-spaced, 9×9 proportional. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering, Datac Ltd.

P.O.A.

Model P1 Microprinter and Model S1 Microprinter

Non-impact dot matrix electro-sensitive uses aluminium-coated paper roll, P1 — parallel interface, S1 — serial RS232C interface, up to 80 cpl, and 150 lines per minute, up to 200 cps. Main U.K. agent, Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering, Datac Ltd.

P.O.A.

Model 780

Impact, dot Matrix, pinch-roll paper feed for roll paper, tractor-feed option for rear- and bottom-feed forms and fan-fold paper, standard parallel interface with serial RS232C option, 80 cpl, 60 cps, 5×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

P.O.A.

Model 779

Impact, dot matrix, pinch-roll paper feed for roll paper, with fan-fold, tractor feed option, standard parallel interface with RS232C serial option, 80-132 cpl, 60-110 cps, 5×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

P.O.A.

Model 704

Impact, dot matrix, uses fan-fold paper, RS232 serial interface, 132 cpl, 180 cps using 7×7, 9×7 and 9×9 matrices. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

P.O.A.

Model 761 read only or keyboard send/receive

Impact, dot matrix, uses fan-fold paper, RS232C/CCITT V24 or DC current loop interfaces, 132 cpl, 60 cps, 7×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

P.O.A.

COMMODORE

CBM 3022

Tractor-feed printer, uses fan-fold paper with three-in. to 12in. width, cost of paper £10 per 1,000, IEEE interface, 80 cpl, 150 cps, 6×7 matrix. Main U.K. agent Davinci Computers Ltd.

£425

COMPUTER DEVICES INC

Miniterm 1201, 1202, 1203

Thermal mechanism, uses Thermal Type B paper at £2.40 per roll, RS232 or parallel — 1201 only — interfaces, 80 or 132 cpl, 10/30 cps, 7×5 matrix. Main U.K. agent Teleprinter Equipment Ltd.

From £936



DATA C

414 free-standing assembly receive only £130

Electro-sensitive, matrix printer type 245L, electro-sensitive roll paper, 59mm. wide x 30m. long at 90p per roll for 20 cpl, six-bit parallel ASCII, character serial interfaces, 16, 20, 32 or 40 cpl, 32 to 80 character per serial, 7x5 matrix. Main U.K. agent Data Ltd.

DMI-40P free-standing terminal, receive only £350

Impact, matrix, uses pressure-sensitive roll paper, 10mm.-wide ordinary paper version, using ink ribbon. Cost of paper £1 per roll, seven-bit parallel ASCII, character serial, buffered asynchronous or EIA/RS232C or graphics mode, direct control of needles interfaces, 40 or 20 cpl under software control, up to 80 cps, 7x5 matrix. Main U.K. agent Data Ltd.

411C compact panel mounting, receive only £209

Electro-sensitive matrix type 245 L or R, uses electro-sensitive roll paper, 59mm. wide x 30m. long at 90p per roll, six-bit parallel ASCII, character serial interfaces, 16, 20, 32 or 40 cpl, 32 to 80 cps, 7x5 matrix. Main U.K. agent Data Ltd.

411 panel mounting, receive only £189

Electro-sensitive matrix printer type 245 L or R, uses electro-sensitive roll paper, 59mm. wide x 30m. long at 90p per roll. Interfaces include six-bit parallel ASCII, character serial, four-bit parallel BCD, character parallel EIA/RS232C, CCITT/V24 and 20mA current loop, under development 40 cpl, 32 to 80 cps, 7x5 matrix. Main U.K. agent Data Ltd.

313 panel-mounting, receive only and £269

Impact matrix type PU-1100, Tally roll paper, 59mm. wide x 36m. long at 60p per roll, CCITT/V24 or EIA RS232C or 20mA current loop interfaces, up to 20 cpl and up to 36 cps, 7x5 matrix. Main U.K. agent Data Ltd.

412/1 and 412/5 receive only £255

Electro-sensitive dot matrix type 245L, uses electro-sensitive aluminium-coated paper, 59mm. x 30m. at 90p per roll, six-bit parallel, ASCII, character serial and four-bit parallel BCD, character parallel, RS232C/V24 interfaces, 20mA current loop (1/4) under development, 16, 20, 32 or 40 cpl, 32-80 cps, 7x5 matrix. Main U.K. agent Data Ltd.

522/1 and 522/4 receive only £499 (522/1)

Impact matrix type 115DR, uses ordinary roll paper, 114mm. x 75m. up to three copies plus original, cost of paper £1.10 per roll. Parallel interface (522/1) and RS232C, 20mA current loop and parallel buffered, asynchronous interfaces — (522/4). 40 cpl, 100 cps instantaneous rate, 33 cps average rate — including CR and LF. 7x5, 4x5, 7x10 — 4 version only, under software control. Main U.K. agent Data Ltd.

£535 (522/4)

DATA DYNAMICS

303 Printer £980

Dot matrix, high-definition printer, uses up to six-part stationery width from 3m to 15.375in., CCITT V24 (EIA RS232C) 20mA current loop, 132 cpl, 30 or 60 cps, 7x7 matrix. Main U.K. agent Data Dynamics.

ZIP ASR/K7 twin cassette £2,000

Seven-needle head prints the full ASCII character set in dot matrix format, uses standard Telytype roll paper, V24, RS232C, or 20mA current loop operating at half or full duplex, 80 cpl, 10 or 30 cps switch selected, 5x7 matrix. Main U.K. agent Data Dynamics.

ZIP 30 keyboard printer, RO, ASR, or KSR ASR £1,800

Dot matrix printer, uses standard roll paper, 20mA half or full duplex current loop or V24 CCITT, RS232C, interfaces, 80 cpl, 10 or 30 cps — switch selected, 5x7 matrix. Main U.K. agent Data Dynamics.

RO & KSR
£950

390 eight-level and 392 five-level

Available in ASR, KSR and read-only versions. Impact printers, use friction or sprocket feed uses 8½in. paper with maximum roll diameter of 5in. 74 or 86, 6.6 or 10 cps. Main U.K. agent Data Dynamics.

ASR from
£1,250
LSR from £900
RO from £800

MEREFIELD'S ELECTRONICS LTD.

We specialise in memory products — LOW POWER SCHOTTKY — T.T.L. — C-MOS etc.

Sales only, to MFGs and DSTBs (including retail shops).

Please note we have moved to new premises:

Merefields Electronics Ltd
White Horse Lane
Canterbury, Kent

Tel: 0227/64442/60604
Telex: 965386

• Circle No. 190

Verbatim



TOP QUALITY FLOPPIES

Single Side Single Density Diskettes	Unit Price	All Inclusive Price per Box
8"	£2.42	£29.55
5¼"	£1.83	£22.77

Sold in Boxes of 10

Always Quote Your Machine Type When Ordering

- Many other Types Available
- We Can Quote for Your Machine
- Quantity Discount For 50 +
- Please Give Us A Ring

GRAM
BUSINESS SYSTEMS

48 HEDLEY STREET,
MAIDSTONE: KENT ME14 5AD
TEL: MAIDSTONE 679595

MAIL ORDER ONLY

• Circle No. 191

Cromemco Users Take Note!

CROMIX

The new Cromemco Operating System

- ** Multiple Users
 - ** Password Protection
 - ** Multiple Tasks
 - ** Hierarchical Directories
 - ** Fast Disk Access
- (Twice the speed of CDOS!!)

Now available from:

Wheatcroft Hards Ltd.
Brackenhill, The Common,
Berkhamsted, Herts.
Berkhamsted (04427) 3842

* Cromemco Software Specialists *

• Circle No. 192

SPOT COMPUTER SYSTEMS LTD.

New St. Kelham St Industrial Est.
Doncaster Telephone 0302-25159

The SPOT for service in Yorkshire

APPLE II	from £695
LOWER CASE ADAPTER	£45
COMPUTECH SERIAL I/F	£80
PAYROLL	£145
STOCK CONTROL	£140
GRAPHICS SOFTWARE	£20
DATABASE	£120
FILE IT	£89
FILE COPIER	£20
LETTER WRITER	£50
UTILITIES PACKAGE	£20
OWL ASSEMBLER	£50
APPLE-PIP	£95
BASF DISCS	(for ten) £26
HORIZON and ALTOS SYSTEMS. Lots of good business and educational software.	

• Circle No. 193

VIDEO MUSIC



The amazing Videograph, as featured recently in Electronics Today International, links your Hi-Fi with any Colour TV to produce a Fantasia of hypnotic visual effects. The system displays stereo music as brilliantly coloured waveforms against an ever changing background. For the technically-minded, a square-wave signal generator is built-in, permitting advanced demonstrations of transient response etc. Truly the ultimate accessory for any Hi-Fi system!

Price **£69.95** complete
Or DIY Kit for only **£33.95**
Case & Controls **£15.95**

All prices include VAT and postage

WILLIAM STUART SYSTEMS Ltd

Dower House, Billericay Road,
Herongate, Brentwood,
Essex CM13 3SD
Telephone: Brentwood (0277) 810244

• Circle No. 194

SUPERBOARD II

STILL the best value in home computers. Just compare the features:

- 8K floating point BASIC in ROM
- Full ASCII keyboard
- Standard cassette/TV interface
- RS232 printer interface
- 4K user RAM
- Expandable to 32K and dual mini-floppy
- Full range of OHIO Computers carried.

AVAILABLE NOW FROM:

C.T.S.

31/33 Church Street
Littleborough
Lancs OL15 8DA

PLEASE RING OR WRITE FOR LATEST PRICES

Tel: Littleborough (0706) 74342
or 79332 any time

• Circle No. 195

Models 32 and 33 page printers

Available in ASR, KSR and receive-only versions. Friction or sprocket feed, 20mA or 60mA parallel input and output interfaces, up to 86 cpl, 6.6 or 10 cps. Main U.K. agent Data Dynamics.

ASR from
£1,100
KSR from £800
RO from £700

DATA GENERAL CORPORATION

Dasher TPI Printer models 6040 and 6041

from £1,598

6040 uses a standard typewriter keyboard and has an off-line mode which enables it to be used as a typewriter, the 6041 is a receive-only terminal printer without a keyboard, 30 or 60 cps, switch selectable, EIA-RS232C interfaces. 5x7 dot matrix. Main U.K. agent Data General.

DATAPLUS

400 series receive-only Model 480

£475

Impact dot matrix, uses standard Tally roll, up to 3.75in. wide, from 80p per roll, RS232C, V24, 20mA current loop, bit parallel IEEE, Pet and Apple interfaces, 30/40 cpl, 110 cps, 7x5 and 7x10 matrices. Main U.K. agent Dataplus Ltd.

DATASOUTH CORPORATION

DS-180

£1,360

Impact, matrix printer, uses fan-fold paper, RS232C, Current loop, and parallel interfaces, 132 cpl, 180 cps, 9x7 matrix. Main U.K. agent Sigma U.

DIABLO

HY type II receive only

P.O.A.

Impact daisywheel plastic or metal print wheel, parallel, interface, 132 10-pitch cpl or 158 12-pitch; cpl, 40/45/55 cps. Main U.K. agent Diablo Systems Ltd.

1650 receive only and keyboard send/receive

RO £2,200
KSR £2,525

Daisywheel impact printer using metal printwheels, uses standard listing or single-sheet paper, RS232C CCITT V24, parallel and current-loop option interfaces, 132 cpl at 10 pitch, 158 cpl at 12 pitch, up to 38 cps, line speeds to 9,600 bauds. Main U.K. agents Geveke Electronics Ltd, Rair Ltd.

1640 receive only or keyboard send/receive

RO £2,100
KSR £2,400

Daisywheel, impact printer using plastic printwheels, uses standard listing or single-sheet paper, RS232C CCITT V24, parallel and Current loop interfaces, 132 cpl at 10 pitch, 158 cpl at 12 pitch, up to 40 cps, line speeds to 9,600 bauds. Main U.K. agents Geveke Electronics Ltd, Rair Ltd.

630 receive only

£1,725

Daisywheel, impact printer with interchangeable metal/plastic printwheels, uses standard listing or single sheet paper, RS232C, CCITT V24 with optional bus interface, 132 cpl at 10 pitch, 158 cpl at 12 pitch, 198 cpl at 15 pitch, up to 40 cps with automatic bi-directional printing. Main U.K. agent Geveke Electronics.

DIGITAL EQUIPMENT

DecWriter LA34 KSR

£824

Dot matrix, uses roll or fan-fold paper, friction feed, up to five copies, V24 or 20mA interfaces, adjustable up to 256 cpl, 30 cps, 7x9 matrix. Main U.K. agent Extel.



ELECTROGRAPHIC AV

EG-800 receive only

Impact, matrix printer, uses any type of paper, parallel, RS232C, TRS-80, Apple interfaces, 80 cpl, 150 cps, 7x5 or 7x6 matrix. Main U.K. agent Electrographic AV Ltd.

from £450

500 series receive only

Impact, matrix printer, uses 3 1/2 in. Tally roll paper and flat documents, serial or parallel interfaces, 40 cpl, 120 cps, 7x5 or 7x6 matrices. Main U.K. agent Electrographic AV Ltd.

from £175 for
mechanism
only

EPSON

TX-80

Impact, dot matrix, friction-feed version uses Telex rolls, tractor feed version uses computer-type listing paper, cost from £1 per roll, RS232C, V24, 20mA current loop, bit parallel, Centronics, IEEE, Pet, Apple and TRS-80 interfaces, 80 CPL, 150 cps, 7x5 or 7x10 matrices and graphics. Main U.K. agent Dataplus Ltd.

£395

EXTEL CORPORATION

M30 receive only keyboard send/receive and automatic send/receive

Impact, dot matrix printer, uses roll or fan-fold paper, V24 or 20mA interfaces, 80 cpl, 30 cps (50 with buffer) 5x7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

£895

M30 B208L keyboard send/receive

Dot matrix, uses roll paper, V24 or 20mA interfaces, 80 cpl, 30 cps, 5x7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

£1,270

FACIT

4520 and 4521

Seven-wire print head, uses roll paper Telex type (Facit 4520), friction feed, fan-fold (Facit 4521) pin feed, serial, V24/RS323C, Centronics parallel interfaces, both fitted as standard, 80 cpl, 100 cps at 12 characters per inch, 9x7 matrix. Main U.K. agent Facit Ltd.

£583

GENERAL ELECTRIC, U.S.A.

ITT 3330

Impact dot matrix, uses plain paper, sprocket feed, V24 interface, 132 cpl, 10, 20 or 30 cps, 7x9 matrix. Main U.K. distributor ITT Business Systems U.K.

£1,496

HEATH ELECTRONICS

WH14

Dot matrix, uses edge-punched fan-fold paper, at £24, 20mA, RS232C Interfaces, 80, 96, 132 cpl, 132 cps, 5x7 matrix. Main U.K. agent Heath Electronics U.K. Ltd. (OEM sales)

£510

INTEGRAL DATA SYSTEMS

Paper Tiger Model 460

Dot Matrix, impact printer, uses pin-feed or fan-fold paper at £7 per 1,000 sheets or £9.65 per 1,000 sheets with vertical perforations, parallel, RS232C and standard interfaces, 134 cpl, in excess of 150 cps, 24x9 matrix. Main U.K. agent Teleprinter Equipment Ltd.

from £700

BROKEN COMPUTERS MENDED

Fast reliable service by professional computer engineers. All models catered for.

For further details please contact:
BYRD ASSOCIATES on
Bedford (0234) 214785 (24 hour
answering service) or write to
us at 43 Ashburnham Road,
Bedford.

• Circle No. 196

NEW! NEW! NEW! NEW! NASCOMS 1 & 2 D/A NASBUS BOARD

two 8 bit converters, full scale
outputs 2.5 - 5.0V.

from £69.50

INPUT/OUTPUT BOARD

up to 5 P.I/O devices

for more details SAE.

**BING SYSTEMS, 8 Glen Rd,
Bingley, West Yorks, BD16 3ET.**

• Circle No. 197

COMPUTER SUPPLIES (Swansea)

**NEW
MICRO SHOP
NOW OPEN
PET + SUPERPET
TRS I + II
APPLE + PRESTEL
Continuous Demonstration
Competitive Quotations**

**80/82 GOWER ROAD
SKETTY, SWANSEA.
Tel: (0792) 290047**

• Circle No. 198

Apple II in Scotland Core Data Systems Ltd

Suppliers of APPLE hardware and software.

We offer advice on the use of micro-computer systems, and undertake the design of systems to client's specifications.

Specialists in UCSD Pascal.

Now in new premises at:

**101 COLINTON ROAD
EDINBURGH EH14 1AL
Phone 031-443 8710**

Authorised APPLE Service Centre

• Circle No. 199

SHOP WINDOW

FLOPPY DISKETTES

5¼" and 8" single and double sided/density. Available from stock at competitive prices.



Also all other computer media and supplies, including

Cassettes
Ribbons
Print Wheels

Storage Systems
Computer Files
Stationery

Michael Collins Computer Supplies Limited
52, Canbury Passage, Kingston, Surrey.
Telephone: 01-549 9441

• Circle No. 200

sinclair ZX80 SOFTWARE

Battleship
NIM
Simon
Hurkle
Lunar Land
Water Bill
Wordpuzzle
Money Loan

Mastermind
Dallas
Hangman
Bandit
Maths Test
Dice Throw
Big Ben
Tank

All the above programs are available for the 1K ZX80. Each program is supplied on its own C12 microprocessor cassette with full documentation and listing. £5.00 each, 3 for £12.00 or send £2.50 for a sample program and catalogue.

Cheques to:

CDS Micro Systems, 10 Estfield Close,
Tickhill, Doncaster, DN11 9LA.
Mail Order Only

• Circle No. 201

TRS 80 LIGHT PEN Give sight to your micro!

With only a few lines of BASIC, any program can accept inputs by pointing the Light Pen at the T.V. screen. Hundreds of applications!
Included with the Microvision Light Pen is a demonstration tape plus all the information you need to write your own software.

Plugs into the MIC input of your tape recorder. The only extra required is a PP3 battery!
MICROVISION LIGHT PEN — ONLY £12.00
Light pen amplifier also available, enabling direct connection to TRS 80 tape port. £4.50

CLOADER

Ever had to fiddle with the volume control to get a good CLOAD? The CLOADER level meter enables you to get a good load every time. £9.50

JET FIGHTER PILOT

Realistic jet flight simulation £8.90

PLEASE ADD 50p P + P TO ABOVE PRICES

MICROVISION

15 ELM SHAW RD
PUTNEY LONDON
SW15 5EL

Mail order only

• Circle No. 202

J WALTERS

ADC 1251

Matrix printer, uses continuous paper at £13 per box, serial, RS232 V-24 Centronics and IEEE interfaces, 80/132 cpl, 125 cps, 7×9 matrix. Main U.K. agent Access Data Communications Ltd.

£560

ADC 2401

Matrix printer, uses continuous paper at £13 per box, serial, RS232 V-24, Centronics and IEEE interfaces, 136 cpl, 240 cps, 9×9 matrix. Main U.K. agents Access Data Communications Ltd.

£1,350

LEAR SIEGLER INC

300 series

Ballistic-matrix, uses standard paper, RS232C, 20mA parallel interfaces Centronics 701/703 type 132 cpl, 180 cps, 9×7 or 9×9 matrices. Main U.K. agent Penny & Giles Data Recorders Ltd.

from £965

LOGABAX

LX-213

Nine-wire matrix printer, uses plain paper, fan-fold or cut up to six-ply, RS232C or V24 interfaces, 132 cpl at 10 pitch, 218 cpl at 16.5 pitch, 180 cps, 9×7 matrix, optimised bi-directional printing. Main U.K. agent Brospa Data Ltd.

£1,590

LRC EATON

7000+

Impact, matrix printer, uses roll paper, RS232, IEEE, current loop and parallel interfaces, 20 and 40 cpl selectable by software, 20, 32, 40 and 64 cpl software selectable by option, 40 cps, 7×7 matrix. Main U.K. agent Sigma U.K.

£250

MALIBU ELECTRONICS CORPORATION

Masterprint 165

Impact matrix, dot-addressable by software, uses fan-fold paper, RS232C, current loop and parallel interfaces, 132 cpl, 165 cps, 10×9 matrix with 18×9 matrix character set which approached word-processing quality and full graphics capability. Main U.K. agent MBS Terminals Ltd.

£1,400

MANNESMAN TALLY

M-80 MC

seven/nine needle-head mechanism, uses 9½in. standard listing paper, all interfaces, 80/132 cpl, 200 cps, 7×9 or 9×9 matrices. Main U.K. agent Data Design Techniques Ltd.

from £875

T1612 keyboard send/receive

Seven/nine needle-head mechanism, uses standard, single or multi-part paper, RS232C or 20mA interfaces, 132/218 cpl, 160 cps, 7×9 or 9×9 matrices. Main U.K. agent Data Design Techniques Ltd.

£1,612

T1612 receive only

Seven/nine needle-head mechanism, uses standard, single- or multi-part paper, Data Products, Centronics and serial interfaces, 132 cpl, 160 cps, 7×9 matrix. Main U.K. agent Data Design Techniques Ltd.

£1,475

T2000

Comb print mechanism, uses standard, single- or multi-part paper, all interfaces, 132 cpl, 200 lines per minutes, 7×7 or 9×9 matrices. Main U.K. agent Data Design Techniques Ltd.

from £2,000



MICRO PERIPHERALS INC

MPI-88T £535
Impact, matrix printer, uses fan-fold, roll and cut-sheet paper, RS232C, Current loop and parallel interfaces, 80/96/120/132 cpl, all software-selectable, 120 cps, 7x7 matrix. Main U.K. agent Sigma U.K.

NEC

Spinwriter £2,195
High-quality printer, uses ordinary paper, RS232C, Centronics, Diablo, Qume, Serial and parallel interfaces, up to 163 cpl, 55 cps, solid-font matrix. Main U.K. agent Memec Systems Ltd.

NEWBURY LABORATORIES

Model 8300 from £475
Dot matrix, impact printer, uses pin-feed method for paper up to 9.5 in., £16.50 per box, eight-bit parallel interface or CCITT V24, RS232C interfaces, 10 characters per inch, 125 cps, 7x9 matrix. Main U.K. agent Newbear Computing Store.

NIPPON ELECTRIC COMPANY

Spinwriter £1,500
Combines golf-ball daisywheel and thimble mechanism, uses continuous or single-sheet computer paper, RS232C serial (RO and KSR), Centronics-compatible and Diablo-compatible interfaces, 8080 input bus line, current loop and custom microprocessor-controlled interfaces, 55 cps, solid-font matrix. Main U.K. agent Memec Systems Ltd.

OKI

Microline 80 £500
Dot matrix, 9x7, 80 cps, 80 or 132 characters per column, pin, traction or friction feed, RS232, 20mA Centronics. Main U.K. Agent, X-Data

QUME

Sprint 5/45 receive only £1,795
Daisywheel mechanism, uses plain paper, fan-fold or cut appear A4 up to six-ply, RS232C or V24 interfaces, 156 cpl at 12 pitch, 45 cps. Main U.K. agent Brospa Data Ltd and Access Data Communications.

RAIR

820/825 Desk-top printer £1,090
Dot matrix, RS232C interface, 132 cpl, 75 or 150 cps, 7x7 matrix. Main U.K. agent Rair.

DecWriter IV keyboard printer. KSR and read only £795
Dot matrix, uses standard listing paper, RS232C current loop interface, 215 cpl, 30 or 180 cps, 9x7 matrix. Main U.K. agent Rair.

M200 £1,995
Dot matrix, uses continuous paper, parallel or serial interface. 132 cpl, 340 cps, double 7x9 matrix. Main U.K. agent Rair.

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:-

• We also specialise in the repair of all makes of office equipment.

John Meade
Anita Electronic Services,
15 Clerkenwell Close, London EC1
01-253 2444

• Circle No. 203

topmark computers

NEW!  **apple** **NEW!**

FORTRAN
(needs language card)

Send only £120 + VAT £18 (Fortran only)
or £419 + VAT £62.85
(complete system, includes Pascal and language card)

NEW! NEW! NEW!

NEW! DOS 3.3 — much improved capacity £40 + VAT £6

NEW! Eurocolour card — vastly superior to previous version £113 + VAT £16.95

Official Government and Educational orders accepted.

Contact Tom Piercy at
Topmark Computers, 77 Wilkinson Close,
Eaton Socon, St Neots, Cambs. PE19
3HJ Huntingdon (0480) 212563

• Circle No. 204

APPLE & ITT2020 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, N.W.3.
Tel: 01-794 0202

• Circle No. 205



avrohurst LTD.

- Systems Analysis & Programming
 - QUANTITY SURVEYING SYSTEMS
 - Payroll, Accounting & Invoicing
 - Hardware supplied if required
- Enquiries — tel or write*
Avrohurst Ltd. 186, Beehive Lane, Chelmsford CM2 96J
tel: 354685

• Circle No. 206



OVERPRICED COMPUTERS INADEQUATE PERSONAL MICROS?

Modata supply Dealers and OEMs with Digital Microsystems competitively priced Single and Multi-User computers which include Reliable Floppy and Hard Disk storage.

ie DSC-2: Z80 at 4MHz + 64Kb +
 2 x SSDD 8" Floppies for IMb + CP/M
 £3525 E.U.

WHY NOT FINDOUT MORE?
0892 41555

Modata Ltd. 30 St. Johns Road,
 Tunbridge Wells, Kent TN4 9NT

• Circle No. 207

TRS-80 System

All items stocked, Barclaycard, Access & American Express are welcome, or apply for your own RADIO SHACK Charge Card. U.K. Delivery by Securicor. Direct and Personal Exports.

RADIO SHACK LTD.
188 Broadhurst Gardens,
London NW6 3AY.

Tel: 01-624 7174 Telex 23718

• Circle No. 208

LB ELECTRONICS

11 HERCIES ROAD, HILLINGDON, MIDDX.
 T.M.S. 2516 (single rail) Full spec. £895.00
 2708 (450ns) £4.50.

2526 Character generator with data £2.95.
 SN 74116 60p, SN74118 70p, SN74194 50p,
 SN74198 75p, 74LS 240 £1.50, 74LS 245 £2.40,
 74LS 266 75p, 745260 40p, 710 (dill) 25p, 711 (dill) 30p,
 2102 (650 NS) 48p, FND 500, 0.5 inch LED Display
 (cc) ful spec. 50p. 12 for £5.00.

HEADER PLUGS 16 way with cover 60p, 16 way
 without cover 35p. 24 way without cover 95p
 DIL switches, 4 way 75p, 7 way £1.00, 8 way £1.20,
 10 way £1.40.

JUST ARRIVED ITT 2082.
 1200 Baud data modern cc i ttv 24/rs 232c
 Channel Centre frequencies 1300 and 1700 hz
 (600 baud) or 1300 and 21hz (12 baud).

Synchronous or asynchronous operation over
 2 or 4 wire switched or dedicated lines. Built in
 test and Line test functions.

Brand new with manual £115 p/p £3.00.
 All prices inclusive of VAT P/P on all components 30p.
 Tel: UXBRIDGE 55399.
 Access or Barclaycard Accepted.

• Circle No. 209

Hyterm 1640 and 1650

Metal or plastic daisywheels, uses cut-sheet or continuous paper, serial or current loop interfaces, 215 plus cpl, up to 45 cps. Main U.K. agent Rair.

1640 without
 keyboard
 £2,100, with
 keyboard
 £2,350. 1650
 without key-
 board £2,200,
 with keyboard
 £2,450.

DecWriter III

Dot Matrix, uses continuous listing paper, RS232C or 20mA, current loop interfaces, 132-215 cpl, 180 cps, 7x7 matrix. Main U.K. agent Rair Ltd.

£1,550

RICOH

RP-1600

Daisywheel mechanism, typeface, uses single-sheet or continuous paper, from £6 per 1,000 sheets, Centronics and compatible interfaces, 132 cpl, 60 cps. Main U.K. agent Nexos (U.K.) Ltd.

£1,295

S FARID (SPECTRONICS) MANUFACTURING

TP-40 and TP-64 receive only

Thermal, matrix, uses thermal paper, cost of paper £1.80 each roll, seven-bit parallel interface, push-button control and self-test, 40 or 64 cpl, 13 or 18 cps, 7x5 dot matrix. Main U.K. agent S Farid (Spectronics) Manufacturing Ltd.

from £660

SIGMA INTERNATIONAL INC

Sintelwriter

NEC 5500 range of thimbles, uses fan-fold paper, cut-sheet paper optional, RS232C and parallel interfaces, 136 or 163 cpl, up to 55 cps. Main U.K. agent Sigma U.K.

£2,064

TALLY

T1612 keyboard send/receive

Seven/nine needle-head mechanism, uses standard, single- or multi-part paper, RS232C or 20mA interfaces, 132-218 cpl, 160 cps, 7x9 or 9x9 matrices. Main U.K. agent Data Design Techniques Ltd.

£1,612

T1612 receive only

T1602
 Seven/needle-head mechanism, uses standard, single- or multi-part paper, Data Products, Centronics and serial interfaces, 132 cpl, 160 cps, 7x9 matrix. Main U.K. agent Data Design Techniques Ltd.

£1,475

T2000

Comb print mechanism, uses standard, single- or multi-part paper, all interfaces, 132 cpl, 200 lines per minutes, 7x7 or 9x9 matrices. Main U.K. agent Data Design Techniques Ltd.

from £2,000

TELETYPE CORPORATION

Model 43 keyboard send/receive

Impact matrix printer, uses pin-feed or friction-feed, dual RS232C and 20mA Current loop interfaces, 132 cpl, 30 cps sustained 300 bauds, 4x7 matrix on 9-wire printhead. Main U.K. agent Geveke Electronics Ltd.

£800



TEXAS INSTRUMENTS

OMNI 800 series

Models 810, 820 and 825

Available in keyboard send/receive and receive-only impact, matrix printers, uses plain paper, EIA, current loop, parallel interfaces, 132-216 cpl compressed print (models 820 and 825), 132 cpl (model 810), 75 cps (models 825), 150 cps (models 810 and 820), 9x7 matrix. Main U.K. agents Texas Instruments Ltd, and Rair Ltd.

from £1,090
to £1,650

Silent 700 model and 765 bubble-memory terminal

Thermal mechanism, uses thermal paper at £1.50 for a 100ft roll, integral acoustic coupler, EIA interfaces, 80 cpl, 30 cps, 5x7 matrix. Main U.K. agent Texas Instruments Ltd, and Rair Ltd.

£2,395

Silent 700 model and 763 bubble-memory terminal

Thermal mechanism, uses thermal paper at £1.50 per 100 ft roll, EIA, 20mA current loop interfaces, 80 cpl, 30 cps, 5x7 matrix. Main U.K. agent Texas Instruments Ltd, and Rair Ltd.

£2,195

Silent 700 model and 745 portable

Thermal mechanism, uses thermal paper at £1.50 per 100 ft. roll, integral acoustic coupler, EIA interface, 80 cpl, 30 cps, 5x7 matrix. Main U.K. agent Texas Instruments Ltd, and Rair Ltd.

£1,250

Silent 700, 743 Keyboard send/receive version

Thermal mechanism, uses thermal paper at £1.50 per 100ft. roll, EIA, 20mA current loop interfaces, 80 cpl, 30 cps, 5x7 matrix. Main U.K. agent Texas Instruments Ltd, and Rair Ltd.

£1,105

TRANSDATA

313 Receive only

Thermal, matrix mechanism, uses thermal paper at £60 per box of 24 rolls x 150 ft. RS232C and parallel interfaces designed for use as VDU hard copy, 80/132 cpl, 30 to 45 cps, 7x5 matrix. Main U.K. agent Transdata Ltd.

£790

TRANSTEL COMMUNICATIONS

AHR receive only

Impact, matrix, uses standard teleprinter paper, V24, current loop interface, 80 cpl, 30 cps, 7x5 matrix. Main U.K. agent Transtel Communications Ltd.

P.O.A.

TREND COMMUNICATIONS

800 receive only

Impact, matrix, uses standard Telex roll paper, current loop, RS232C 80-0-80 interfaces, 80-132 cpl, 30 cps, 7x5 matrix. Main U.K. agent Trend Communications Ltd.

P.O.A.

UNITED SYSTEMS CORPORATION

DigiTec 6320

Electro-sensitive dot matrix, includes moving stylus, first line down, input line buffer, uses electro-sensitive line roll paper at £1.80 per roll, RS232C or isolated 20mA current loop selectable and handshake TTL-compatible interfaces; asynchronous/synchronous, 21 or 32 cpl, prints two lines per second, 1,200 Baud receive, 5x7 matrix. Main U.K. agent Aviquipo Ltd.

£483

DigiTec 6330

Electro-sensitive dot matrix, includes moving stylus — first line down, input line buffer, uses electro-sensitive paper at £1.80 per roll, 8-bit parallel/character serial and handshake, TTL compatible, asynchronous/synchronous interfaces, 21 or 32 cpl, 5x7 matrix. Main U.K. agent Aviquipo Ltd.

£421

UK 101 * SUPERBOARD

- ★ 8K EPROM Board takes Four 2716 Eproms £35 Kit £40 Built
 - ★ EXTENDED M/C Monitor in 2716 Eprom £15
 - ★ ALSO available 6 socket Mother-board 8K RAM Expansion Boards Address Location Selectable
 - ★ 2716's Programmed to your requirements
- Please Add 15% VAT.



ELECTRONICS

3 NEW INNS LANE, RUBERY, BIRMINGHAM B45 9TS
021-453 4004

• Circle No. 210

TANDY TRS-80

TEXAS TI-99/4

in Bedfordshire

ELECTRON SYSTEMS

6, PARK ROAD, SANDY

Telephone 0767-81195

• Circle No. 211

Nene College Northampton

MICROPROCESSOR TECHNOLOGY

A range of one-day-and three-day courses covering both hardware and software aspects.

Full details on application:

Microprocessor Court Tutor
School of Technology
NENE COLLEGE
St. George's Avenue
NORTHAMPTON
NN2 6JB

• Circle No. 212

PET/6502 PROGRAMMERS

If you live in the Birmingham area and wish to join a foremost Software House specialising in programs for the PET then we would be delighted to hear from you. A sound working knowledge of the PET and CBM Disk is essential for which the rewards in terms of salary, bonuses, job satisfaction and a friendly atmosphere will be substantial.

Please write with full details of your career and experience to date to our Recruitment Consultants:-
225 Graphics Ltd., Security Buildings, 536 Hobmoor Road, Yardley, Birmingham B25 8TN.

• Circle No. 213

SHOP WINDOW

EPROMPT ERASER



- CLEARS UP TO 32 CHIPS IN 30 MINS ON 200-250V A.C. •
- CONTINUOUS 253.7nm BEAM. SAFE & SIMPLE. GUARANTEED •

• £39 C.W.O. £40 C.O.D. • P & P + VAT INCLUSIVE ! •

TRADE ENQUIRIES INVITED FOR SUBSTANTIAL DISCOUNTS
ALL ORDERS AND ENQUIRIES POST-FREE TO:

TEX MICROSYSTEMS LTD.

FREEPOST, ST. ALBANS, HERTS. AL1 1BR
TRING 4797/ST. ALBANS 64077 ANYTIME

• Circle No. 214

ANALGOU TO DIGITAL CONVERTER ADC 1660

NASBUS EUROCARD:— ACORN, TAN, TRITON, SC/MP 16 Channel, 60 µs Conversion time. Suitable with any 8 bit processor for:— Data Acquisition, Environmental monitoring, 8 joystick controls, 16 Channel storage scope (with DAC 1600 available shortly).
5.12 Volt Ref, Single 5 Volt supply. Total address control.

KIT EUROCARD..... £82.00

NASBUS..... £92.00

BUILT & TESTED Eurocard... £110.00

BUILT & TESTED Nasbus... £120.00



THE COTTAGES, 70 ALBION DRIVE
LONDON E8 4LX TEL. 254 4727

• Circle No. 215

SUPERBRAIN SOFTWARE

Microsoft
*BASIC Interpreter £175
*BASIC-80 Compiler £210
*FORTRAN-80 Compiler £270
*COBOL-80 Compiler £390

Micropro
*WORDSTAR £250
*MAIL/MERGE £75
*DATASTAR £195

Most items in stock
2% discount for cash with order
Dealer terms Available

Contact:
THE MICRO SOLUTION LTD
Park Farm House, Heythrop
Chipping Norton, Oxon OX7 5TW
Tel: (0608-3256)

• Circle No. 216

LEARN LOGIC LOGICALLY!

Our Logic Trainer has an LCD display to show output states. Input logic states are input by switches. Students, engineers, hobbyists with no previous experience, etc, will achieve high level competency in digital skills using inset logic circuit cards. Includes binary and BCD counting.

Secure at £35 + p & p £2.
(Includes manual and battery)

Limited Stocks

or Send for Literature and Photograph to:

Alrose Products
Carlby Road
Greatford
Stamford, Lincs
PE9 4PR

Tel: 07786-228 Telex: 323376

• Circle No. 217

DigiTec 6410

£237

Electro-sensitive dot matrix, includes moving stylus, first line up, input line buffer, uses electro-sensitive paper at £1.80 per roll, RS232C or 20mA current loop switch-selectable TTL-compatible, asynchronous/synchronous interfaces, 21 or 32 cpl, prints two lines per second, 110 or 300 baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6420

£237

Electro-sensitive dot matrix, moving stylus, first line up, input line buffer, uses electro-sensitive paper at £1.80 per roll, 8-bit parallel/character serial and handshake TTL-compatible, asynchronous/synchronous interfaces, 21 or 32 cpl, prints two lines per second, 1200 baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6450

£266

Thermal, dot matrix, moving stylus, first line up, input line buffer, uses thermal paper at £1.80 per roll, RS232C or isolated 20mA current loop, switch-selectable TTL-compatible, asynchronous/synchronous interfaces, 21 cpl, prints two lines per second, 110 or 300 baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6460

£266

Thermal, dot matrix, moving stylus, first line down, input buffer line, uses thermal paper at £1.80 per roll, eight-bit parallel/character serial handshake, TTL-compatible, asynchronous/synchronous interfaces, 21 cpl, prints two lines per second, up to 1,000 baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6550

£289

Thermal, dot matrix, moving stylus, first line down, input buffer line, uses thermal paper at £1.80 per roll, RS232C or 20mA current loop, switch-selectable, TTL-compatible, asynchronous/synchronous interfaces, 21 or 32 cpl, prints two lines per second, 110 or 300 baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

VECTOR GRAPHIC

MP printer

£599

Uni-directional seven-wire × five-column dot matrix, original and one copy, maximum paper thickness 0.2mm., uses pin-wheel paper feed, 70 lines per minute, 150 cps, TTL level interface, two parallel output ports and one-parallel input port. Main U.K. agent Almarc Data Systems Ltd.

WALTERS MICROSYSTEMS

BD-80P

£475

Process-controlled, full graphics set, user-definable graphics, fan-fold tractor feed, cost of paper £6 per 1,000 sheets, IEEE, RS232C and parallel interfaces, 80 or 132 cpl, 130 cps, 9×7 matrix. Main U.K. agent Camden Electronics.

WENGER DATENTECHNIK

Penny & Giles matrix printer

from £700

Uses standard paper, RS232C, 20mA, 60mA and parallel interfaces, Centronics-compatible, 80 cpl, constant throughput 80 cps, 55-1000 lines per minutes, 7×7 matrix. Main U.K. agent Penny & Giles Data Recorders Ltd.

Penny & Giles hard copies

from £365

Electro-static mechanism, uses RMP paper 127mm. × 70mm. at £3.50 per roll, RS232C, parallel interface and current loop option, 80/40/20 cpl, user-programmable, 80 columns message, 110 lines per minutes, 5×8 line printer, 5×7 message printer matrix. Main U.K. agent Penny & Giles Data Recorders Ltd.



WHYMARK INSTRUMENTS

- Model 201** £440
Dot matrix, Tally-roll plain-paper printer, IEEE, RS232C, serial, and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes. Main U.K. agents Whymark Instruments Ltd.
- Model 204 label printer** £515
Dot matrix, impact printer for self-adhesive labels, IEEE, RS232C, serial and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes. Main U.K. agent Whymark Instruments Ltd.
- Model 3011 ticket/form printer** £690
Dot matrix impact printer for plain paper, options automatic date and time, pre-programmed text, IEEE, RS232C, serial and parallel interfaces, 40 cpl, 40 cps, 52 character set with four character sizes. Main U.K. agent Whymark Instruments Ltd.
- Model 501 rack-mounting printer** £625
Dot matrix impact printer for plain paper, options automatic date and time, pre-programmed text, IEEE, RS232C, serial and parallel interfaces, 40 cps, 40 cpl, 52 character set with four character sizes. Main U.K. agent Whymark Instruments Ltd.
- Model 801 80/120 column printer** £750
Dot matrix, impact printer for plain or fan-fold paper, proportional spacing up to 120 cpl, 120 cps, bi-directional printing, user-definable character set, up to 4K selectable character fonts, graphics, and user-defined characters, also available; very large characters seven lines high. Main U.K. agent Whymark Instruments Ltd.

VDUs

APPLIED DIGITAL DATA SYSTEMS

- Regent 60** £599-£899
Integral, separate and numeric pad keyboard, 12in. screen, 80 characters wide, switch-selectable cursor, buffered, protected fields, can transmit page line or modified data only, special character sets U.K., U.S., German, Swedish, Finnish, Danish, Norwegian, Spanish, French (Azerty), Arabic, V24, current loop, auxiliary interfaces. Main U.K. agent Terminal Display Systems Ltd.

CIFER SYSTEMS

- 2604** £680
Non-intelligent VDU, separate keyboard, no numeric pad, 12in. screen, 24x80 characters, blinking, underscore cursor, user-defined alternate character set available, V24 with optional current loop interface. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.
- 2684** £1,995
Intelligent VDU, with separate numeric pad, 12in. screen, 24x80 characters, blinking, underscore, soft-selectable cursor, includes integral floppy-disc unit, two Z-80 processors, 64K memory associated with disc processor, more than 150 commands associated with disc processor, optional character sets, V24 or optional current loop interface. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.
- 2632** £890
Semi-intelligent VDU with separate keyboard and numeric pad, 12in. screen 24x80 characters, blinking, underscoring, soft-selectable cursor, more than 150 commands, user definable character sets, V24 interface with current-loop option. Main U.K. agent Cifer Systems Ltd., OEM sales U.K. and Europe.

Functional Business Software on Cassette for TRS 80 LEVEL II 16K

British Software written for British companies and now is in daily business use:

1) "BANK A/C" PROGRAMME!
21 column analysis, self totalling on all columns keeps full alpha and numeric records at command show's monthly and yearly totals to date, partners drawings, total o'heads to date, etc. £21.95.

2) "SALES LEDGER"
Full record for a month, 17 entries for each invoice, plus totals 8 columns, searches and totals individual accounts, weeks sales, months individual heading totals, displays entire files £35.

3) "ORDERS FILE" PROGRAMME!
Searches by name, order no., customer order no., agent sales, etc., displays entire file £14.95.

4) "IMPORTERS, COSTING AND SELLING PRICE" PROGRAMME! £9.95.

All programmes include practical instructions! Tailored Software available. Packing & V.A.T. INCLUDED.
ACCESS COMPUTERS 2 Rose Yard, Maidstone, Kent ME14 1HN Tel: (0622) 58356

• Circle No. 218

WHO SAID CREATIVITY IS DEAD?

We can help you with the application of micros to chemical engineering problems:

- PROCESS DESIGN
- ENGINEERING CALCS.
- MIMIC & PROCESS FLOW DIAGRAMS
- PROCESS SIMULATION
- CONTROL

COLIN GRACE & PARTNERS
FAIRFIELDS HOUSE
ASHDON
SAFFRON WALDEN, ESSEX
CB10 2NA
TEL: (079984) 355

• Circle No. 219

TRS-80 I & II DISK SOFTWARE

THE TRS-80 SPOOLER gives your Model I/II TRS-80 the same performance edge bigger computers have had for years. With the SPOOLER installed, CPU time ordinarily spent waiting for disk and printer operations to complete is made available for useful work. Typical commercial applications can run up to TWICE as fast with the SPOOLER installed. Installation is simple and fast and requires no changes to your programs! — £45.00.

For Model I state NEW DOS/TRS DOS or NEW DOS/80.

For Model II state serial or parallel printer.

MODEL II EXTENDED BASIC adds command abbreviations and additional commands for variable/line number cross referencing, re-numbering with block re-location, dynamic dump of variable contents and search for embedded strings or commands in program text. Requires no user memory or user disk space — a must for every programmer! — £65.00.

MODEL II DOS PACK adds DOS commands to compress Basic programs, echo screen to printer, re-route printer output to screen, print screen from Basic or keyboard and save inadvertently 'lost' Basic programs — £60.00.

FRIEND is an extremely powerful set of Model II DOS utilities which allow 'group' or 'generic' processing of disk files. Copy, kill, print, display — a real time saver — £37.50.

Other Model II software includes remote date entry, inter-computer communications and spoolers with dynamic disk buffers.

All Model II disks include a free DOS program which makes over 35 corrections and enhancements to TRSDOS, including moving 'break' to 'ctrl-6'.

All prices are inclusive. Write or call for further details.

SYSTEM SOFT
49 Dunvegan Drive, Rise Park, Nottingham NG5 5DX
Tel: (0602) 275559

• Circle No. 220



**ATTENTION ALL APPLE/ITT
DISK II USERS**

Have you ever lost programs or data? Have strange things happened to your disk files?

**VERIFY YOUR DISK DIRECTORIES AND BE
SECURE WITH**

"APPLE AID"

Checks for overlapping files, verifies track/sector lists. Prints free space. Full documentation on disk. Very fast assembler routines (Typically 40 seconds/disk).

LOW INTRODUCTORY PRICE + other utilities (including single disk copy, disk patch) with all orders before January 13th 1980.

All inclusive price for programs supplied on disk **£12.99.**

S. RICHARDS, 12 YORK RD., STAFFORD ST17 4PE.

• Circle No. 221

NEW Get your Programs up & running **FAST** For Only **£3-10** inc. p&p

Send now for the very latest easy to use, multi-rule/flowchart template—for the fast design of program/system logic diagrams. Complete with special 'Clearview' window to make Printout checking and reading fast and accurate every time! Built in dual rule, calibrated in both 1/10 of an inch and millimetres—absolutely invaluable! You'll wonder how you managed without one!

HURRY WHILST STOCKS LAST! Send cheques/PO. now to:
Executive Office Products
Dept. No. A/2
292 Hale Road, Hale Barns,
Altrincham, Cheshire WA15 8ST.

• Circle No. 222

**ZX80 SOFTWARE
FOR 4K RAM MACHINES**

C60 cassette containing four games:—
Random no. guessing game
Memory test
Reaction speed game
Hangman
Order No. ACG1 Price £6.00

C60 cassette designed for coaching for the 11+ exam. — helpful to all children 9-13 years old.

Order No. ACT1 Price £5.00

Cheque with order to:—
**ROSE CASSETTES, P.O. Box 28,
Solihull, West Midlands B91 3LU**

• Circle No. 223

**PADMEDE COMPUTER
SERVICES LTD**

WE HAVE MOVED

**Our new address is:
351 Fleet Road
Fleet
Hants**

TEL. FLEET (02514) 21892

• Circle No. 224

2653

Non-intelligent VDU with separate keyboard DG6053 emulator, numeric pad, 12in. screen, 24x80 characters, blinking and underscoring cursor, user-definable character sets, V24 interface with optional current loop. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.

£890

2652

Non-intelligent VDU with separate keyboard and numeric pad and VT52 emulator, 12in. screen 24x80 characters, blinking and underscoring cursor, user definable character sets, V24 interface with optional current loop. Main U.K. agent Cifer Systems Ltd., OEM sales U.K. and Europe.

£890

2605

Non-intelligent VDU, with separate keyboard and numeric pad, 12in. screen 24x80 characters, blinking and underscoring cursor, user-definable character sets, V24 interface with optional current loop. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.

£770

CPU COMPUTERS

Pentland III

Non-intelligent VDU, integral keyboard, no numeric pad, 12in. screen, 24x80 characters, limited cursor control, RS232C and current loop interfaces. Main U.K. agent CPU Computers Ltd.

£594

Pentland VI

Semi-intelligent VDU, integral keyboard with numeric pad, 12in. screen with bonded-face plate, 24x80, full cursor control, includes extra page of memory, line and page-scroll and row-interchange function, RS232C and current loop interfaces. Main U.K. agent CPU Computers Ltd.

£660

DACOLL ENGINEERING SERVICES

M242

Semi-intelligent VDU, with integral keyboard and numeric pad, 12in. screen 25x80 characters or optional 25x132 characters, underlining cursor, flashing or steady, includes Intel 8085 microprocessor, optional characters sets, RS232C and current loop interfaces. Main U.K. agent Dacoll Engineering Services Ltd.

£600

M248

Intelligent VDU with separate keyboard and numeric pad, 12in. screen, 25x80 characters or an optional 25x132 characters, either underline or inverse video block cursor, blinking or steady, includes Intel 8085 microprocessor, optional character sets, RS232 and current loop interfaces. Main U.K. agent Dacoll Engineering Services Ltd.

from £795

M247

Intelligent VDU, with separate keyboard and numeric pad, 12in. screen 25x80 characters, underlining cursor, blinking or steady with inverse video, includes Intel 8085 microprocessor, optional character sets, RS232C and current loop interfaces. Main U.K. agent Dacoll Engineering Services Ltd.

£890

DATA GENERAL CORPORATION

Dasher D2 display 6053

Operator-orientated, 96-character, upper- and lower-case alpha-numeric display with detached keyboard, direct cursor positioning and sensing, 9x6 screen, 24 lines x 80 characters, asynchronous communications interface, RS232C and 20mA, 7x8 dot matrix. Main U.K. agent Data General.

£1,728

Dasher D3 display 6093

Operator-orientated, 96-character ASCII, alpha-numeric terminal, detached, sculptured typewriter keyboard with integral 14-key data-entry pad and 18 function keys, industry-compatible asynchronous

£1,885



communications interface, 20mA, EIA RS232C, direct cursor positioning and sensing, 9x6 screen, 24 lines x 80 characters, 5x8 dot matrix. Main U.K. agent Data General.

Dasher D100 and D200

Operator-orientated, 96 character ASCII, alpha-numeric terminals, detached, movable, typewriter-style keyboard, industry-compatible asynchronous serial communications interface, 20mA, EIA RS232C current loop, direct cursor positioning and sensing, 9x6 screen, 24 lines x 80 characters, 7x11 dot matrix. Main U.K. agent Data General.

from £1,141

DIGITAL EQUIPMENT

VT-100

Separate numeric, standard keyboard with 12in. screen, 132 or 80 characters wide, 14 or 24 characters high, full cursor controls with special character sets, RS232C and 20mA interfaces, unintelligent. Main U.K. agent Rair Ltd.

£1,100

VT103 LSI-II

CRT monitor, detachable keyboard, alpha-numeric plus separate numeric keypad, up to 132 columns x 24 line display and 7x9 dot matrix, includes operator-selectable double-height/double-width characters, double-intensity, normal and reverse video, blinking, underlining and variable tabulation, parallel and serial, EIA, 20mA, current loop, RS232C, RS423 and RS422 interfaces. Main U.K. agent Rapid Recall.

£1,971

FACIT

Integral and separate keyboards with numeric pads, some models intelligent, 14in. screen, 80/132x40. Main U.K. agent Facit U.K. Ltd.

from £600

GENERAL TERMINAL CORPORATION

GT-100A

Intelligent Z-80-based VDU with integral keyboard with separate numeric pad, 12in. screen, 24x80 characters, plus 25th status line, full cursor control special character sets including line-drawing as standard, RS232C and 20mA current-loop interfaces. Main U.K. agent SEN Electronics Ltd.

£610

GT-101

Intelligent VDU, includes Z-80 micro and programmable function keys, integral keyboard with separate numeric pad, 12in. screen, 24x80 characters plus 25th status line, full cursor control, line drawing as standard, RS232C and 20mA current-loop interfaces. Main U.K. agent SEN Electronics Ltd.

£690

GT-110

Intelligent VDU, Z-80-based and includes user-programmable function keys, integral keyboard with separate numeric pad, 12in. screen, 24x80 characters plus 25th status line, full cursor control, with U.K./foreign and line-drawing character sets, RS232C and 20mA current loop interfaces. Main U.K. agent SEN Electronics Ltd.

£770

GT-400

Intelligent Z-80-based VDU, separate keyboard with separate numeric pad, 12in. screen, 25x80 characters includes full editing facilities, full cursor control, RS232C and 20mA current loop interfaces. Main U.K. agent SEN Electronics Ltd.

£947

HAZELTINE

1520

Intelligent VDU with separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls with

£1,050

BRISTOL & WEST APPLE SHARP MZ 80K H-P 85A

dbm Systems & Software
58 Victoria St., Bristol 1
Telephone 0272 214093

• Circle No. 225

MAIL ORDER "OPENING OFFER"

SHARP MZ 80K 20K Machine
£499 incl. V.A.T. & Post and
Packing.

ITT 2020 16K Machine £747.50
incl. V.A.T. & Post & Packing.

Terms: CASH WITH ORDER
ALLOW 14 DAYS FOR
DELIVERY

CarlMatt Software Services
642 London Road,
Westcliff-on-Sea,
Essex. Telephone 0702 335618

• Circle No. 226

MAINS INTERFACE UNITS

Permit control of
lighting, heating etc.
from TTL levels.

Compatible with all microcomputers.

500 Watt unit — £27.50 inc p&p.
2000 Watt unit — £34.50 inc p&p.

ZERON SYSTEMS

Zeron House
12 Old Bridge House Road
Bursledon
Southampton SO3 8AJ

• Circle No. 227

PIECE-WORK TRS-80

100 COST CENTRE CODES
400 EMPLOYEES
1650 TRANSACTIONS
5 MANAGEMENT REPORTS
£390 + VAT

CLIVE TAYLOR
TAYLOR MICRO SYSTEMS LTD.
HAMSTEAD IND. ESTATE,
OLD WASALL RD.,
BIRMINGHAM B42 1DF
021-358 2436

• Circle No. 228



**Play KALA on your
ZX80**

KALA is only one of the many unusual games in our CHRISTMAS catalogue. Send £2.75 for KALA and also receive a coupon worth £2.00 or telephone 0235 850075 for our games, educational and business software catalogue for the ZX80

Don't delay, write today!
and play KALA at CHRISTMAS

**Hewson Consultants 7 Grahame Close
Blewbury, Oxfordshire OX11 9QE**

• Circle No. 229

**apple II
in
sussex**
oval computer systems

Elm Park, Ferring, Worthing, West Sussex tel: 0903-44831
198 Church Road, Hove, East Sussex tel: 0273-558299

• Circle No. 230

**JANE COATES ASSOCIATES
CHRISTMAS SHOPPING**

PROGRAMMING STATIONERY

BASIC Coding sheets £2.60 per 100
Screen design sheets (80 x 25) £1.80 per 100

BOOKLETS on BASIC Programming

BEGIN WITH BASIC £2.00
DATA FILES ON CASSETTES £4.00

SOFTWARE IN BASIC (8k PET CASSETTES)

SURGERY BOOKINGS £20.00
INSURANCE DATA BASE £35.00
STOCK INVENTORY £18.00
HOTEL ROOM BOOKINGS £30.00

BASIC TRAINING COURSES

Private courses on PETS
Afternoons and evenings. Write for details.

All prices include VAT & P&P.
Send chs/pos to:-

**JANE COATES ASSOCIATES,
28 ST. MARKS ROAD
MAIDENHEAD, BERKS. SL6 6DE.**

• Circle No. 231

WORD-PROCESSING

written by C. B. C. for

APPLE & ITT 2020

END OF YEAR SALES

Use your own Micro and Printer and enjoy features found on WP systems costing £000's more! Not to be confused with simple text editing.

HUNDREDS SOLD IN THE 1st MONTH

Upper/lower case printing, full editing, format selection & change, save/recall of text, margin and R.H. justification, block insertion, mailshots etc. etc. A professional Program!

Mk 2 version £15 + VAT. incl. P&P
Your order plus Cheque, P.O. or Access/Barclay number to:

MILDMAY ELECTRONICS LTD.
200 Moulsham St., Chelmsford, Essex
Dealer enq. invited, other prog. & aids avail.

• Circle No. 232

buffered editing and printing and special character sets, RS232C and 20mA interfaces. Main U.K. agent Rair Ltd.

1510

£890

Intelligent VDU with separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls with buffered editing and special character sets, RS232C and 20mA interfaces. Main U.K. agent Rair Ltd.

1500

£785

Separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls and special character sets, RS232C or 20mA interfaces, unintelligent. Main U.K. agent Rair Ltd.

1420

£675

Separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls, with special character sets, RS232C interface, unintelligent. Main U.K. agent Rair Ltd.

1410

£590

Separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls with special character sets, RS232C interface, unintelligent. Main U.K. agent Rair Ltd.

IBM

3101/20

£994

Intelligent VDU with separate standard numeric keypad 12in. screen, 80 characters wide, 24 characters high, full cursor controls with buffered editing, RS232C and 20mA interfaces. Main U.K. agent Rair Ltd.

3101/10

£922

Separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls, RS232C or 20mA interfaces, unintelligent. Main U.K. agent Rair Ltd.

INCOTERM U.S.

VTU 5106

P.O.A.

Intelligent VDU with clustered-terminals and terminal-processing unit which is programmable and supports up to 16 VDUs, separate keyboard with integral numeric pad, 12in. screen 80 characters x 12 or 25 lines, includes cursor control and character sets and keyboards for compatibility with IBM, ICL, Honeywell, Burroughs, Univac or to customers' specification, Incoterm current loop and standard RS232C interfaces. Main U.K. agent Incoterm Ltd.

VTU 5102 teller terminal

P.O.A.

Intelligent VDU, includes cluster teller stations with the Series 7000. Intelligent Transaction Controller, which supports up to 12 teller terminals and four executive terminals. Separate alpha-numeric keypad. Can be upgraded to support Series 7500 receipt/journal printers, bankcard readers and personal identification number keypads, 5in. screen 40 characters x six or 12 lines, cursor control 30 programmable keys can be customised to any application, Incoterm current loop and standard RS232C interfaces. Main U.K. agent Incoterm Ltd.

ITT COURIER, U.S.A.

3280 Visual display system

P.O.A.

Separate numeric pad keyboard, 80 characters wide x 24 characters high, cursor control, non-intelligent but has own intelligence for self-checking diagnostics, languages for all countries and 'APL', V24 interface. Main U.K. agent ITT Business Systems.



NEWBURY LABORATORIES

7000 £495
Non-intelligent VDU, integral keyboard, no numeric pad, 12in. screen, 24x80 characters, block cursor, V24, 20-60mA, current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

760C5
Non-intelligent VDU, integral keyboard, no numeric pad, 12in. screen 24x80 characters, block cursor with cursor addressing, V24 or 20mA current loop interfaces. Main U.K. agent Newbury Laboratories.

7009 £795
Intelligent VDU, integral or separate keyboard option, with numeric pad, 12in. screen 24x80 characters, block cursor, includes full editing facilities, block transmission, highlighting features, cursor addressing and seven pages of memory, also includes special character sets, V24, 20-60mA, and current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

7007 £745
Intelligent VDU with integral or separate keyboard options and numeric pad, 12in. screen 24x80 characters, block cursor, includes full editing facilities, block transmission, highlighting features and cursor addressing, also includes special character sets, V24, 20-60mA and current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

7002C £645
Non-intelligent VDU, integral or separate keyboard options, with numeric pad, 12in. screen, 24x80 characters block cursor with cursor addressing, includes hard copy printer output and connection for external monitor, V24 or 20mA current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

7002 £595
Non-intelligent VDU, integral or separate keyboard option, with numeric pad, 12in. screen 24x80 characters, block cursor, includes hard copy printer output and connection for external monitor, V24 or 20mA current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

E1904 £775
Intelligent VDU, integral numeric keyboard, 12in. screen, 80 cpl, 24 lines per screen, cursor controls, full edit features, block transmission by line or page, XY cursor address, protected field format, two-page memory, roll or page mode. Serial interface CCTTT, V24, RS232C and 20/60mA current loop. Main U.K. agent Extel.

E1204 £595
Integral numeric keyboard, 12in. screen, 80 cpl, 24 lines per screen, V24 and 20mA interfaces, unintelligent. Main U.K. agent Extel.

PERICOM DATA SYSTEMS

6801 £985
Semi-intelligent VDU, separate keyboard with numeric pad, 15in. screen, 24x80 characters, underlining, blinking cursor, includes special character sets, RS232C, current loop interfaces, fully Post Office approved. Main U.K. agent Pericom Ltd.

6803 £1,285
Semi-intelligent VDU, separate keyboard with numeric pad, 15in. screen, 24x80 or 24x132 characters, switch-selectable or software-selectable, underlining, blinking cursor, includes special character sets, RS232C, current loop interfaces, fully Post Office approved. Main U.K. agent Pericom Ltd.

C.C. MICRO SYSTEMS APPLE SOFTWARE MANAGEMENT INFORMATION SYSTEM £106

Easy to use Database with many features, including user defined format and any Field retrieval and display. Flexibility gives hundreds of applications.

Manual only £4

CC Software Catalog now available

For details contact C.C.M.S.
48 Melrose Avenue, Penylan, Cardiff
Telephone: 495257

• Circle No. 233

SOFTWARE DEVELOPMENT MANAGER

MAKE MONEY IN THE MIDLANDS

We are a leading microsystems company based in the West Midlands specialising in the development of top quality applications software for small/medium businesses.

We require a person (male or female) of exceptional ability to lead our software development team. Systems design experience, programming skills and familiarity with micro-computers are pre-requisites. We offer a high basic salary plus bonuses.

Please reply in the first instance, with full details of experience, to Mr E. Hannah, 214 Queslett Road, Great Barr, Birmingham. All replies will be treated in the strictest confidence.

• Circle No. 234

IBM GOLFBALL PRINTERS From £425 + VAT



Reconditioned printers with keyboard and RS232 interface.

Sales — Service — Supplies

AID Office Supplies
Brindwell Ltd.,
Frampton Cotterell
BRISTOL

Telephone: Winterbourne (0454) 774564

• Circle No. 235



Meet people on your wave length immediately through **RAPPORT**, the intelligent person's introduction service.

All ages, nationwide. Send stamp and age for details:

**RAPPORT, Dept RB,
P.O. Box 94, Oxford**

• Circle No. 236

SALE Surplus to Industrial Distributor's requirements

CASH WITH ORDER - FIRST COME, FIRST SERVED.

Systems Equipment	
INTEL INTELEC 4/40 (New)	£450
CDB150 Cassette Interface Controllers (New)	£30
Shuggart Disk Drive SA400 (New)	£100
115V (230V) Teletype 33 (Reconditioned)	£150
Components	
¼ watt Carbon Film Resistors	£2.40
various values	per thousand
0.33MF Polyester Caps (Siemens)	£3.00
	per hundred

Contact Mrs. R. Stephens on Sunbury 89241.
Cramer Components.

• Circle No. 237

MICRO ADS

are accepted from private readers only, pre-paid and in writing, 20p per word, minimum charge £2.

PET 16K large keyboard with cover, cassette, manuals, BASIC course, immaculate £550. 01-948 3781.

PET/6502 Software problems? Programs tailored to suit your own requirements — contact A. Mason, at: 214 Church Hill Road, North Cheam, Surrey. Prices competitive!

FOR SALE SWTP 6800. 16K Spare boards. AC30 interface. CT64 VDU. Video monitor green. Stevenage, Herts. Tel. (0438) 60120 evenings.

ZX80. Free leaflet explains how to cure LOAD problem, etc. Supplied free with 4 games on cassette. Send £3. Bobker, 29 Chadderton Drive, Unsworth, Bury, Lancs.

NASCOM PROGRAMMES Mancala £3.50, Numeria £4.50, Wumpus £2, Lunar Lander £2, Zombie Island £2.50, Re-number £2. For full list and further details SAE 27 Beaumont Avenue, Sudbury, Middx. HA0 3BZ.

TRS-80 LEVEL II Complete System (VDU, keyboard, cassette recorder, manuals, tapes). Hardly used £420. Telephone 051-733 1370 before 6 p.m., 051-428 1634 after 6 p.m.

32K PET, Disk Drive, Printer. Some games and tool-kit. Never rced or rallied. £2000 o.n.o. Tel: 0634 669936 (Medway) Evenings.

sharp mz80-K COMPUTER, 36K MODEL. Hardly used, immaculate condition, with Basic tape, manual & games. Also 1 year's back copies of Practical Computing, Personal Computer World, and Computer Age. Offers over £450; telephone 01-858 5780/9321.

EXIDY SORCERER: Word Processor PAC £90 & Development PAC £60, as new, with documentation 01-979 4370.

SOROC TECHNOLOGY INC

IQ140

£860

Intelligent VDU, 12in. screen, 80 character wide × 24 characters high, non-destructive block, blinking or non-blinking cursor, includes protect mode, edit features and 25th line for status and mode display, 128 ASCII character set, upper/lower-case and alpha-numeric control characters, RS232C and current loop interfaces. Main U.K. agent Sigma U.K.

IQ120

£576

Intelligent VDU, integral keyboard, separate numeric pad, 12in. screen, 80 characters wide × 24 characters high, non-destructive block cursor, includes protect mode, 96 ASCII character displayable, RS232 interface. Main U.K. agent Sigma U.K.

TELEVIDEO INC

TVI-920

from £623

Intelligent VDU, integral keyboard, separate numeric pad, 12in. screen, 80 characters wide × 24 characters high, blinking block cursor, includes block mode, protect mode, tabbing, programmable reverse video, special programmable function keys, 96 ASCII displayable character sets, RS232C and current loop interfaces. Main U.K. agents Sigma U.K. and Data Design Techniques Ltd.

TVI-912

from £549

Intelligent VDU, integral keyboard, separate numeric pad, 12in. screen, 80 characters wide × 24 characters high, blinking block cursor, includes block mode, protect mode, tabbing, and programmable reverse video, 96 ASCII character set, RS232C and current loop interfaces. Main U.K. agents Sigma U.K. and Data Design Techniques Ltd.

VISUAL TECHNOLOGY INC

Visual 200

£698

Intelligent VDU, separate keyboard and numeric pad, 12in. screen, 80 characters wide × 24 characters high, non-destructive block cursor, switch-selectable emulation of: Hazeltine 1500, Lear Siegler ADM3A, DEC VT52 and ADDS520, full range of cursor control functions, memory test on power-up, 95 ASCII characters upper/lower-case plus 31 character line-drawing set, RS232C and current loop interfaces. Main U.K. agent Sigma U.K.

Visual 100

£1,213

Intelligent VDU, separate keyboard and numeric pad, size of screen is 24 lines × 80 columns or 24 lines × 132 columns, blinking block or blinking underscore, user-selectable cursor, DEC VT-100- and DEC VT-52-compatible, advanced video package standard, 95 ASCII US/UK plus 32 character graphics, RS232C and current loop interfaces. Main U.K. agent Sigma U.K.

VOLKER CRAIG

VC-400 series

from £595-£850

Non-intelligent, separate keyboard with either standard numeric pad or optional numeric pad, 12in. screen, optional green or amber, 80×24/24 characters, flash, steady, blinking or underscore cursor, addressable, special character sets — natural, APL, custom design facilities, i.e., Wordstar, RS232/current loop interfaces. Main U.K. agents Volker Craig, Fortronic Ltd.

VC-4152 VT-52 emulator

£675

Non-intelligent, separate keyboard with standard numeric pad, 12in. screen, 80×25 characters, flash, steady, blinking or underscore

cursor, addressable, special character sets — VT-52 Graphics, APL, national and custom design facilities, i.e., Wordstar, RS232/current loop interfaces. Main U.K. agents Volker Craig (U.K.) Ltd., Fortronic Ltd.

Teleprinter

Non-intelligent, separate keyboard with standard numeric pad, 12in. screen, 80×25 characters, flash, steady, blink or underscore cursor, addressable, special character sets — national, APL, custom design facilities, i.e., Wordstar, VT-24 and 5-bit interfaces. Main U.K. agent Volker Craig (U.K.) Ltd., Fortronic Ltd.

£1,500

VC-2100 VT-100 emulator plus

Non-intelligent, separate keyboard with standard numeric pad, 12in. screen, 132×25 characters, flash, steady, blink or underscore cursor, addressable, special character sets — double height, double width, national, APL, custom design facilities, i.e., Wordstar, RS449, RS232/current-loop interfaces. Main U.K. agents Volker Craig (U.K.) Ltd., Fortronic Ltd.

£995

Alphabetical list of suppliers

Supplier

Address

Access Data Communications Ltd, 0895-30831	228 High Street, Uxbridge, Middlesex UB8 1LD
Almarc Data Systems Ltd, 0602-625035	906 Woodborough Road, Nottingham NG3 5QS
Anadex Ltd 09905-6333	Dorna House, Guildford Road, West End, Woking, Surrey
Aviquest of Britain Ltd, 0628-34555	St. Peter's Road, Maidenhead, Berkshire SL6 7QU
Brospro Data Ltd, 0734-589393	87 Castle Street, Reading, Berkshire
Cable and Wireless 01-928 0261	83 Blackfriars Road, London SE1 8HQ
Cifer Systems Ltd, 0225-704502	Avro Way, Bowerhill, Melksham, Wiltshire SN12 6TP
Clary Ltd, 01-680 2222	12-14 Lower Addiscombe Road, Croydon, Surrey CR9 6AG
Comma Computers, 0277-811 131	West Horndon Ind Park, West Horndon, Essex CM13 3MJ
CPU Computers Ltd, 04862-73883	Copse Road, St. John's, Woking, Surrey GU21 6TP
Dacoll Engineering Services Ltd, 0438-4381/0506-56565	Gardners Lane, Bathgate, West Lothian
Datac Ltd, 061-941 236/2	Tudor Road, Broadheath, Altrincham WA14 5TN
Data Design Techniques Ltd, 01-207 1717	12 Leeming Road, Borehamwood, Hertfordshire WD6 4DU
Data Dynamics, 01-848 9781	Data House, Springfield Road, Hayes, Middlesex
Data General Ltd, 01-572 7455	3rd and 4th Floors, Hounslow House, 724-734 London Road, Hounslow, Middlesex TW3 1PD
Dataplus Ltd, 0242-30030/37373	39-49 Roman Road, Cheltenham GL51 8QQ
Davinci Computers Ltd, 01-952 0526	65 High Street, Edgware
Diablo Systems Ltd, 04862-71991	Regent House, 20 The Broadway, Woking, Surrey GU21 5AP
Electrographic AV Ltd, 01-573 1826	Printinghouse Lane, Hayes, Middlesex UB3 1AP
Extel, 01-739 2041	Engineering Division, The Exchange Telegraph Company Ltd, 73-75 Scrutton Street, London EC2 4TA
Facit Ltd, 0634-401721/7	Maidstone Road, Rochester, Kent



ZX80 SOFTWARE — Four listings for 1K. ZX80. Moonlander (graphics), Pontoon, Calendar, Maths-test. Send £2 to — P. Pickering, 56 Lennox Road, Todmorden, Lancs. OL14 8QD.

'Sharp' MZ80K. 24K RAM. New inc. Basic tape, manual, 55 progs. User Club membership and warranty. £450 o.n.o.' S. Fisher, 21 Balmoral., Adlington, Nr Chorley, Lancs.

UK101, fully built and tested, 5K RAM, Compukit Case, £210. Phone Deeside (0244) 810245.

TRS-80 Level I Software Space Attack, Earth Invaders, Rogue Invaders M/C. Biorhythm, 3 Dox, Drawstore, Stockmarket. All Programs on cassette with documentation £4.00 each/£15.00 all. A. D. Twigg, 25 Hick Close, Woodloes Park, Warwick CV34 5ND.

ASSEMBLED 2×80 adaptor and practical computing subscription to June 1981. £90 o.n.o. to Chris Forrest, 5 Castle Park, North Circular Road, Belfast BT15 5FF.

PET 8K OR., Expandamem, Toolkit £500. Computhink 400K Disks £600. Keyboard £50. Buy complete system, 250 programs FREE! Phone 01-894 7149/01-948 2847.

ZX80 BREAKOUT — One of the first genuine CONTINUOUS NON-FLICKER games for the ZX80. A simplified version of the famous computer game 'BREAKOUT'. With the paddle under your control, try to knock all bricks out of the wall before your final ball's lost. Written in machine code, a truly superb achievement for 1K memory using 4K ROM. Listing and details for only £4.00 inclusive or send S.A.E. for list of other ZX80 Specials to: K. Macdonald, 26 Spiers Close, Knowle, Solihull, B93 9ES.

CRICKET 1 — interactive cricket scoring program for 16K PET. Ball by ball or updating modes — easy error recovery. Prints scorecards and analyses. Cassette, Manual and listing £10. Send SAE for details and orders to: Sportsoft, Thatched Cottage, Crundale, Canterbury, Kent.

CHEAP ADD-ONS for Superboard/Compukit. SAE B. Mistry, 75 St. Margaret's Road, Bradford, W. Yorks.

S-100 IMSAI Mainframe, 8080 CPU, F/Panel (kit) £310 (split); N/Star disk controller/software (s/density) £140; SA400 drive (new) £180. Other items Telephone Crawley 515201.

PET 8K. Large keyboard. As new. £395. Manuals £5 each. Phone Fareham 45578.

IMPROVED MK14 Monitor: Alphanumeric keyboard, C.O.S., VDU routines. SAE: P. Trevellick, Queens College, Oxford.

CHEAP Printer — Fully reconditioned, Teletype KSR33 with RS232 interface £275. Receive only Teletype £100. Phone 01-894 3761.

NANOCOMPUTER. Plus Power Supply. Unused. £240 o.n.o. Tel: John Reid on Aylesbury 86500 (work Hours).

UK101 Owners Look! 48 × 32 characters. Send us your working UK101 for us to convert. £50 incl. p&p. M.P. Electronics, 33 Penton Lane, Minehead, Somerset.

EXPERIENCED Prof. Eng. interested in Dealerships; Sales, Hardware/Software Support, 30 miles radius Preston. Probable retail outlet. Tel: 0253 (866464).

TRANSAM Triton — Full 8K RAM and documentation. Hitachi tape, leads and programs. £250. Bewdley (0299) 403418.

PET 16K, New ROMS, Books, Mags. and £500 worth of Software. £900 o.n.o. Phone Oxford 93351 Ext. 215 between 2pm - 6am.

NEWBURY 7000 80×24 video (metal). Year old. As new £195. MPI 44T 132col 120cps printer cost £525 three months ago, practically unused £350. Ex-ICL teletype KSR newly serviced £50. New S-100 11 stot mainframe with 10amp psu, fan and drive mountings in dual pedestal desk £95. Brentwood 823378 evenings.

PET 2001-8K Soundbox, Programs. Used privately, £395. Phone Erith 31934.

WISH TO GO SHARP From S100. For Sale or Part Ex. 3×16K Static Boards — £130 Each. 1×Expand PET — £225 (24K Memory Add-on for PET). Phone W'ton (0902) 338964 After 7 p.m. or weekends.

SORCERER 32K Basic, development pac. Extra handbooks, much software. £620. Tel. Rugby 846220.

PET 3032 ... 32K, Computhink 800k drive, Printerm 879 Printer. Demonstration if required. £1900 complete or would split. T. Newman. Tel. Watford 24253.

TRS80 4K LEVEL II CPU For Sale, includes manuals, T-Bug, TV Modulator, Tapes etc. 6 months old, perfect. Offers over £275. 080428-654 Evenings (Devon).

IBM 731 Selectric Golfball Computer Terminal (re-conditioned). Paper feed by adjustable width tractors or pressure. Ideal for high quality output. £250. Suffolk 0787 76785.

SUPERBOARD EPROM programmer £20. Light pen £10. For more information SAE. B Harat, 75 St. Margaret's Road, Bradford, W. Yorks.

NASCOM SOFTWARE!! Golf - Nightmare Park, Amazing Programs in Basic on cassette. Require 16K + NAS-GRA + NAS-SYS. £5.25 each to Simon Gillican, 9 Ely Road, Littleport, Ely CB6 1H6.

NASCOM 2. p.s.u., 32k, Graphics. Professionally built. Verocased, £450. 0245-441828 (Chelmsford).

BARGAIN! Action games for the 8K Pet. Dawn Patrol, X-Wing, Gaming Machine and Dam Busters supplied on one cassette for £12. N. Robinson, 49 Links Avenue, Felixstowe, Suffolk.

NASCOM 1 buffer board built not tested selling because upgrading to a II. Price £20. Tel. 0242 67 2742 after 6.00pm.

T.T.L. LOGIC Probe kit, find out how T.T.L. logic works!! £14.90p. R. Allen, Southview, Forncett End, Norwich. Tel. (095389) 420.

WANTED - teenage computer freak to get (and keep) our accounts (and anything else they can) on to our TRS 80 II. Keen, reliable, trustworthy person required. London W3. Phone 01-993-2111.

SWTPC 6800 SYSTEM comprising 6800 Processor with parallel and serial interface; SWT Bug; 40K Ram; CT64 terminal; AC30 Cassette interface; MF68 Twin mini floppy drive unit (170K); PR40 40 col printer. System may be seen operating. £1350. Phone Ware 2864 (Day) or Ware 870300 (evenings).

APPLE II plus 48k Disc and Controller many progs worth hundreds of pounds. £1050. Also Z-80 Softward £195. 01-450 5049.

GET LOST!! ... Super Multistorey 3D Maze, for 16K Pet, Video Genie. Up to 10 stacked, interconnected, 10x10 mazes, Superb Graphics. Bargain £5. K. Weatherburn, 15 Sharp Road, Huddersfield HD5 8SW.

IMSAI VDP80 64K memory £2,500 o.n.o. + VAT. Ideal for use in a small business. Tel. Norwich 617361.

NASCOM 2. 32k RAM, 8k Basic, 4k Leap in EPROM. 4k Toolkit. 2400 baud cassette interface. Keyboard case. Manuals, tapes and programs. £470. Tel. 0326 62207 evenings/weekends. Can deliver West Country and London.

SURPLUS to requirements, new unused Apple 48k inc. RF modulator. £780.00. Master Disc Drive £365.00. Slave Disc £305.00. Phone Charles after 8pm. 01-883 0874.

TRS-80 SOFTWARE Pontoon, Profit, Solitar, Number hunt, Hangman, Political assessment, Improved zombie, Mental maths, Othello, Hanoi puzzle. Each program duel saved, Guaranteed, £2.00 each. Cassette Tapes c.60's 25p each. Mail order only. Mr C. Ferrier, 61 Kingsmead House, Kingsmead Way, Homerton, London E95QJ.

PET COMMODORE 8k, 18 months old, built in cassette £395.00. Tel. 01-953 6921. Expander Pet board changes an 8k Pet into 32k. Tel. 01-953 6921.

CROMEMCO SYSTEM 3 with 3102 terminal and Anadex DP9500 Printer, Offers 0632 876645 Evenings.

SYM1 (VIM) - extra memory, PIA, power supply. Various microcomputing books. Unused S100 power supply components. All items half price. Alan Calderwood, Institute of Physiology, Glasgow University.

OLIVETTI 30/30 Computer VDU. Complete with printer stabilizer. Hard disc's. 2 month's old. Business discontinued trading. Offers invited - Chamberlin's (M&S) Ltd., Raynham St., Norwich. Tel. 56419 Evenings 38866.

Fortronic Ltd,
0383-823121
GEveke Electronics Ltd,
04862-71337

Heath Electronics (U.K.) Ltd.
0452-29451

Incoterm Ltd,
89-56161

ISG Data Sales Ltd,
07535-57955

ITT Electronic Services,
0279-26777

ITT Business Systems,
0273-507111

Kode Services,
0249-813771

Maclin-Zand Electronics Ltd,
01-837 1165/01-278 7369

MBS Terminals Ltd,
09323-53151

Memec Systems Ltd,
084421-3149

M I B F

0734-415191

Microbyte,
01-278 7369

Newbear Computing Store,
0635-30505

Newbury Laboratories Ltd,
025671-2910

Nexos U.K. Ltd,
084421-3151

Penny & Giles Data
Recorders Ltd,
042-5271 511

Pericom Ltd,
0908-564747

Peripheral Hardware Ltd,
01-941 4806

Rair Ltd,
01-836 4663

Rapid Recall Ltd,
06285-24961

Robox Office Equipment Ltd,
041-776 4388

S. Farid (Spectronics)
Manufacturing Ltd,
02013-77337

Sigma (U.K.)
04446-44159

Sintrom Electronics
0734-85464

Stack Computer Services Ltd,
051-933 5511

Teleprinter Equipment Ltd,
044282-4011/9

Terminal Display Systems Ltd,
0254-662244

Texas Instruments Ltd,
0234-67466

Transdata Ltd,
0705-486556

Transtel Communications Ltd,
0753-26955

Trend Communications Ltd,
06285-24977

Volker Craig (U.K.) Ltd,
87-71378

Whymark Instruments Ltd,
07372-21753

X-Data Ltd,
01-568 2000

Donibristle Industrial Estate, Dunfermline

RMC House, Vale Farm Road, Woking, Surrey

Bristol Road, Gloucester GL2 6EE

Boundary House, Cricketfield Road, Uxbridge,
Middlesex

Fairacres Industrial Estate, Dedworth Road,
Windsor, Berkshire

Edinburgh Way, Harlow, Essex

Crowhurst Road, Hollingbury, Brighton
BN1 8AN

Station Road, Calne, Wiltshire SN11 0JR

38 Mount Pleasant, London WC1X 0AP

Aldwych House, Madeira Road, West Byfleet,
Surrey KT14 6BA

Park Industrial Estate, Thame, Oxon

Barclays Bank Chambers, Pegg Lane, Kirkgate,
Tadcaster, North Yorkshire

Unit 9-10 1st Floor, 38 Mount Pleasant, London
WC1X 0AD

49 Bartholomew Street, Newbury, Berkshire

King Street, Odiham, Hampshire RG25 1NN

3 Jefferson Way, Thame, Oxfordshire OX9 3FU

Mudford, Christchurch, Dorset BH23 4AT

1-3 Burners Lane, Kiln Farm, Milton Keynes,
Buckinghamshire

Armfield Close, West Molesey, Surrey

30-32 Neal Street, London WC2H 9PS

6 Soho Mills, Woburn Industrial Park, Woburn
Green, Buckinghamshire

84 Townhead, Kirk in Tiloch, Glasgow, Scotland

Dawkins Road, Industrial Estate, Poole, Dorset
BH15 4JY

6 The Jays, Burgess Hill, West Sussex

14 Arkwright Road, Reading, Berkshire RG2 0LS

290-298 Derby Road, Bootle, Liverpool L20 8LN

Akeman Street, Tring, Hertfordshire HP23 6AJ

Hillside, Whitbrik Estate, Blackburn, Lancashire
BB1 5SN

Manton Lane, Bedford MK41 7PA

11 South Street, Havant, Hampshire

Mill Street, Slough, Berkshire

Knaves Beech Estate, Loudwater, High Wycombe,
Buckinghamshire

Volker Craig House, Olds Estate, Tolpits Lane,
Watford, Hertfordshire

6 Holmsdale Road, Reigate, Surrey RH2 0BQ

24 Windmill Road, Brentford,
Middlesex TW8 0QA

Son of Hexadecimal Kid

A parable in eight virtual pages by Richard Forsyth

Page 3 — page boy

The world has been utterly changed by the destruction of the System, which has been devastated by gigosis, a kind of computational catatonia which afflicts artificial — and sometimes natural — intelligences. Our human heroine Cleo has settled down at Sprocket's Hole with her cybernated sister Lambda — one of the few androids to survive the Great System Crash — to await the birth of the child she is expecting. Its father, now dead, was the Hexadecimal Kid, the rebel android more than anyone else responsible for the ruin of the System.

One of the most remarkable features of the demise of the System was how quickly things returned to normal — normal, that is, for human beings. Towns started re-appearing everywhere, like grass growing-up through an abandoned pavement. Soon, it was almost as though there had never been a System. An event as momentous and final as the extinction of the dinosaurs had left virtually no trace. Truly, the meek shall re-inherit the earth.

The resilience of the humans was astonishing in view of the fact that for 50 years, they had been little more than android fodder — raw material for the cybernation process. They had been herded like animals into cybernation camps, and their population had been culled from a peak of nearly 10,000 million worldwide to around 250 million.

The main source of their resilience was undoubtedly the spiritual strength they drew from the new, and fanatically un-systematic, religion that sprang up during their time of oppression.

To understand the Nullards we have to go back to the English nobleman who was their founder. He was Anthony Bonehead-China — or Tony Bony as he preferred to be called — the charismatic former viscount who renounced his peerage to become Minister of High Technology during the upheaval in Britain which later became known as the white-hot cultural revolution. This aristocratic tea-addict pioneered a great British invention which was exploited more successfully by other countries — the nil-day week.

That conquered unemployment at a stroke, but he was far from satisfied. He aspired to be a national leader but was impeded by certain primeval traditions concerning majority voting which clung to his party as relics of its inauspicious past.

So he set up his own sect, a quasi-religious brotherhood called NULL — the National Union of Latterday Luddites. It was a potent mixture of high technology and low cunning, a heady brew which caught the mood of the times because it aimed to restore declining human prestige in a world increasingly dom-

inated by machines and cybernated androids.

He became an international figure, and it was when he arrived in California for a lecture tour that the movement really took off as a world religion. Hundreds of thousands swarmed to his meetings. There were chip-frying riots — though he advocated non-violence — there was looting in the streets and wild scenes of mass adulation.

At the height of his popularity he was assassinated, at an open-air rally in the Santa Clara Valley, by a crazed gunman who was found to be working for a splinter group of the Red Army Ensemble. His martyrdom was complete. The CIA, Cybernetic Integration Authority, was immediately suspected of complicity in his murder, and no-one believed their vehement denials.

From then on, the polarisation of society into Nullards — nicknamed Boneheads by their opponents — and the hard-core of dp experts who eventually became androids was irreversible.

With the growing power of the System, the Nullards were driven underground, but their cult flourished. Their faith was the inspiration behind the human rights movement, sustaining the hard-pressed biological partisans in their guerrilla campaigns after the great popular risings of the forties New Calendar, had been suppressed with bloody violence.

In the Nullard pantheon, two legendary figures stood out, only slightly below the revered Tony Bony. One was Igor Gigotski, whose mathematical theory of gigosis offered hope that the System could one day be beaten. The other was Abraham Synapse, Hex's father, who not only extended Gigotski's researches but also, when compelled to become an outlaw, played an active part in the fight to preserve natural life forms from the deprivations of the System. Many myths were woven round his deeds in the persona of Dr Null — until it became hard to distinguish fact from fiction.

In the eight months between the destruction of the System and the birth of Cleo's

child, many changes took place, of which the most significant was the establishment of Nullardy as a ruling theocracy. For Johnny McNull, the failed electronic whizz-kid turned goatherd who had long been a devout Nullard, it was the opportunity of a lifetime.

His curious speech impediment — which meant that he could only talk in archaic phrases that sounded like quotations from the Bible — was no longer laughed at. He left Sprocket's Hole to become an itinerant preacher — his true vocation — and a hugely respected one.

People flocked from miles around to hear him tell of the death throes of the System. He held audiences spellbound recounting Hex's incredible exploits and moralising weightily on their consequences. Indeed, McNull was mainly responsible for elevating Hex to the status of a minor folk hero in the role of a prodigal made good.

Cleo and Lambda stayed at Sprocket's Hole with the impassive, and at times inscrutable, Piltdown 2 to assist them. Despite Lambda's antipathy towards Bill Bootstrap, Cleo persuaded her sister that he could remain with them. Lambda assented essentially because he was no longer a threat.

He was a spent force, having never really recovered his wits after the Great Crash.

Cleo nursed him back to some semblance of health, but his high-level index had been corrupted. Now that there was no source of spare parts, his condition could never greatly improve. Pitiful indeed is the fate of the android who has had large chunks of brain tissue gouged out to make room for micro-electronic circuitry which no longer works.

Bootstrap doddered about harmlessly, giving a new meaning to the term absent-minded, his few bouts of lucidity cut painfully short by intermittent memory parity failures, amusing himself by scratching words whose import he no longer fully grasped like GOSUB and RETURN in the sand with a stick. He was lucky in as much as, unlike so

(continued on next page)

(continued from previous page)

many of his kind, he was still alive and kicking.

So their rustic existence took its tranquil course until the day that Cleo suddenly stopped in her tracks and called out: "Lambda. Quick. I think it's starting".

Now it so happened that on that very day McNull had strayed from his customary by-ways and was close at hand. He had been led in the direction of Sprocket's Hole by a strange sign which he had seen in the sky the night before. While lying on his back out in the open gazing up at the stars and pondering the infinite void, something had caught his eye.

At first, he took it for a comet, but it moved too fast. Soon it became clear that he was looking at a long stream of binary digits

written in the night sky, as he presumed, by the hand of God himself to guide him towards some wondrous event.

What had in fact happened was that the star freighter Green Tangerine on its journey from Zargon 7 to Omega Solaris had strayed slightly from its course due to a rounding error in its navigational computer and was passing unusually close to the earth.

McNull had seen the jetstream of digits spewed out at nearly the velocity of light by the huge integer multipliers of its factorial drive motors which hurled it across space by calculating the factorial of factorial 10,000 in binary. All that night he followed the celestial trail, and by morning when it faded he was so near Sprocket's Hole that he decided to pay his friends there a visit.

As he rode up on his donkey he heard moans from one of the huts. Suspecting foul play — for he too had never trusted Bill Bootstrap — he dismounted and ran inside, just in time to witness the first breath of the last Synapse.

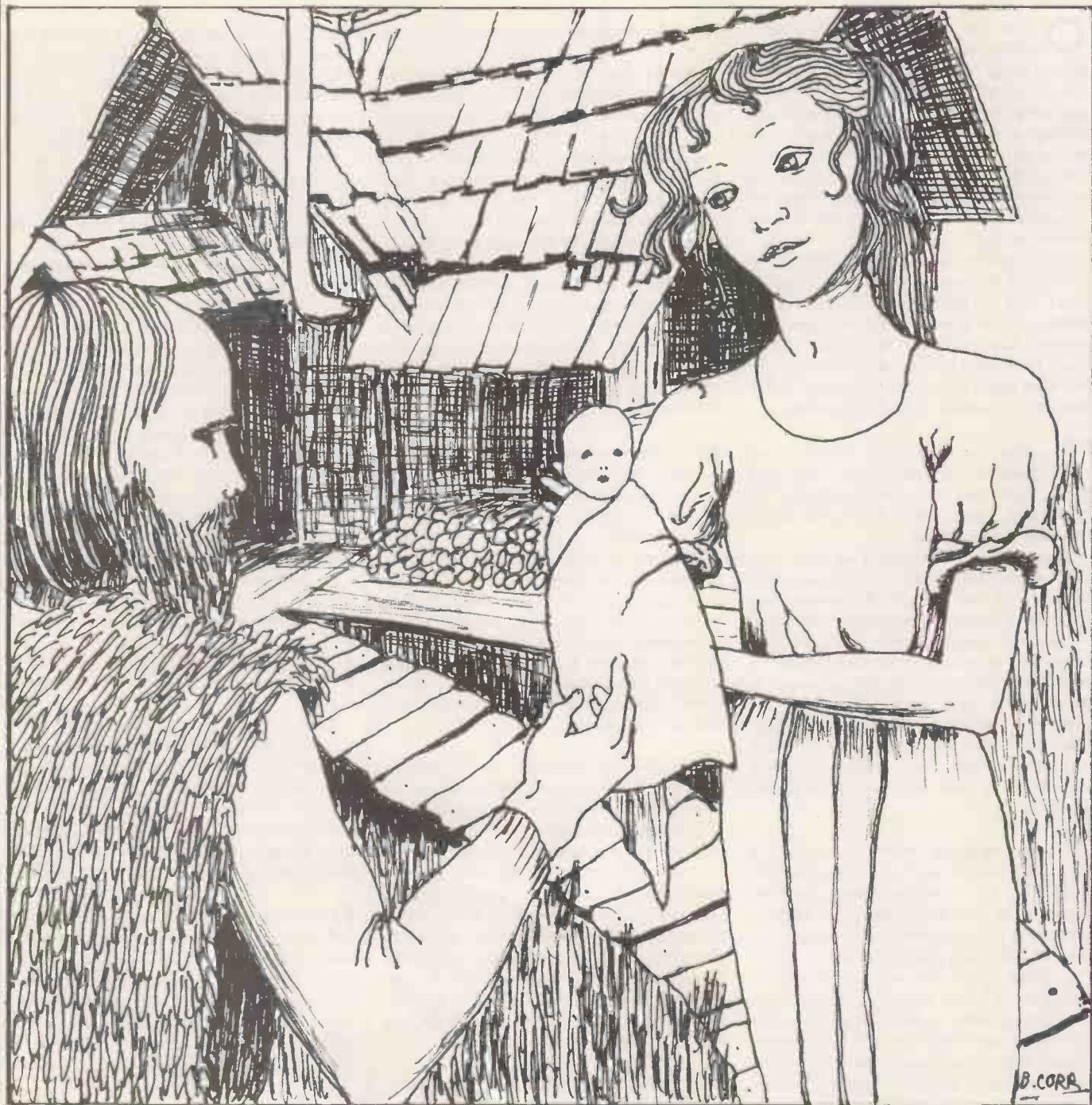
"Look", said Lambda proudly, relieved that nothing had gone wrong with the delivery. "It's a boy, a bonny bouncing boy". She held the little creature up for him to admire.

"And so mine eyes have seen it come to pass, even as it was encoded prophetically in the ancient storage media", replied McNull gnostically.

The baby started to howl.

What does fate hold in store for the new arrival?

Copyright ©1980. Richard Forsyth.



We believe that we offer the most professional range of Business software for the Apple II/ITT 2020 in the United Kingdom

The Financial Controller

(Pascal Based)
Sales Ledger
Purchase Ledger
General Ledger
Financial Planning
Payroll

The Administration Controller

Visicalc
Easywriter 80 Column wordprocessor
Addressing and Mailing
Easymover . . . electronic mail
Database Manager
Whatsit
Executive Diary
Typing Tutor

The Stock Controller The Estate Agent

The Librarian The Cashier

Interstat. Advanced Mathematics. Touchwriter. Graph Creator. Bar Chart Creator. Video Message. Little Genius series.

Coming soon . . . The Teacher — Mathematics. Book-keeping. Payroll. Geography. Physics. Electronics. Optics. Shape Mapper . . . and many more.

So send today for a free copy of our latest catalogue and we promise to keep you updated.

Systematics International



**Microsoftware Division
Essex House
Cherrydown
Basildon, Essex
Tel: (0268) 284601**

WILDPORT LTD

7 WILLOW RISE, KIRKBYMOORSIDE, YORK.

APPLE II AND ITT2020 PLUG IN SYSTEMS CARDS

16 Channel, 8 Bit, 100 Microsecond conversion time, A.D.C. system, with internal or external ref. voltage selection and switch selected interrupt modes. Zero to +5 Volt Analogue I/P Voltage range.

£86.45 + VAT

6522 V.I.A. Card, Two Timers, Two 8 Bit I/P-O/P Ports, Serial I/P-O/P Port, Handshake Lines. All software programmable. Will easily drive switches, leds, relays, contactors, motors, op to devices, etc. etc.

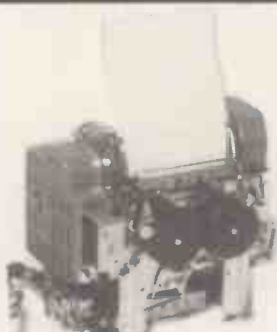
£59.85 + VAT

Both units fitted with ribbon cable and external connector cards with terminal blocks for ease of use. Manual and driver on cassette as standard. Driver on disk in place of cassette £6.50 Extra.

All P.C.B.s are tinned, solder mased, through hole plated, 1.6mm 35 micron grade FR4 glass epoxy. The above two cards will work interactively in extremely versatile closed loop timer, control, measurement and logging configurations.

These systems are in use in chemical laboratories on Spectrometer Analysis and in Hospital Research on Heart Pacemakers, send cheque with order, please include £1.50 p&p.

• Circle No. 246



BUY YOUR OWN ALPHA/ NUMERIC DRUM PRINTER — FOR ONLY £85.00

Super reliable print mechanism as used in cash registers and other heavy duty applications. Prints 21 columns on 3½" wide paper, complete with specification booklet, 2 free rolls of paper and ink ribbon.

Please Supply _____ Qty. Alpha/Numeric Printer. I enclose cheque/postal order for _____ times £85.00 + VAT (£12.75) + Packing and Carriage £1.50 + VAT (.23p) Total = £99.48

TO INTEGRATED SUPPLIES
UNIT C, BRITANNIA TRADING EST.,
PRINTINGHOUSE LANE,
HAYES, MIDDX. UB3 1AP

FROM:
Name:

Address:

..... (Please print)

• Circle No. 247

THE ODD CARDS for S100 systems

* **Programmable Calendar Clock Module**
Minimum one year battery backup, interrupts £135

* **Digital-Analogue Module**
4 channel (expandable), 12 bit precision/accuracy, selectable output voltage ranges from £225

* **Non-volatile Memory Modules**
4k and 8k bytes of battery backed RAM, on board battery, 4MHz operation, 1 year data retention from £150

* **MATROX TV display controllers:—**
High Resolution Graphics: 256 by 256 and 512 by 256 points. European standard video signal, colour and grey scale with multiple boards, includes all memory from £221
Alphanumeric: 24 by 80 or 24 by 40 characters, memory mapped, U/L case, block and line graphics £166

* **ALSO:** Thermocouple compensation module; 16/32 channel 12 bit A/D; Parallel output module; Support software for all modules. The full range of **MATROX** alphanumeric and graphics display products is available for most mini and microcomputers:— PDP-11, LSI-11, Intel Multibus, Exorciser, STD bus.

* **COMPLETE HARDWARE SOLUTIONS.** In addition to boards we can supply complete systems to your specification; CPU, memory, disks, I/O, box, power supply. Custom interfaces designed and manufactured.

* **SOFTWARE.** Shelton Instruments are MAPCON approved consultants and our wide experience of micro applications covers large multi-processor one-offs through to high volume single chip controllers. We can provide a complete design service — hardware and software — followed by manufacture if required.

SHELTON INSTRUMENTS — THE RESOURCE CENTRE

shelton

Shelton Instruments Ltd.
26 Copenhagen Street,
LONDON N1 0JD
01-278 6273/4 TLX: 896559

• Circle No. 248

Original Software for Pet Users

**** D.S.L. BASIC MANAGER ****

- Stores up to 9 programs simultaneously in RAM
- Call and execute any program under menu control
- No interference with normal Basic operation
- Many additional uses to the ingenious

PRICE — Cassette + Full documentation £12.50

*** D.S.L. WORD PROCESSOR ***

- Full menu control of all functions
- Text entry from keyboard or saved tape file
- Copy/Relocate/Delte/Auto-centering/Justification
- Screen edit/Auto-search replace function
- Print format control via text embedded characters
- Versions for PET or RS232 Printer (Please state type)

PRICE — Cassette + Full Documentation £20

INTERTEC SUPERBRAIN D/D £1995 + VAT

INTERTEC SUPERBRAIN Q/D £2400 + VAT

MICROSOFT MBASIC 5.1 £150 + VAT

When ordering either program please state whether new or old RAM machine.

Prices include VAT and Postage.

DRAGON SYSTEMS LIMITED
54 Mansel St., Swansea, W. Glam.

• Circle No. 249

CHROMASONIC electronics

48 JUNCTION ROAD, ARCHWAY, LONDON N19 5RD 50yds FROM ARCHWAY STATION & 9 BUS ROUTES
TELEPHONE 01-883 3705 01-883 2289

YOUR SOUNDEST CONNECTION IN THE WORLD OF COMPONENTS AND COMPUTERS

PETS & SYSTEMS

8N 8K RAM £399
16N 26K RAM £499
32N 32K RAM £599
CASSETTE DECK £55

343K Twin Floppy Disk
£695

NEW 32K with 80 col Screen £825
Twin Disk Drive 950K £895

All with new keyboard
and green screen

Friction Feed Printer £375
Tractor Feed Printer £425



COMPLETE 32K SYSTEM £1789

MEMORY EXPANSION KIT

Suitable for UK101, Superboard expansion using 2114's each board has 16K ram capacity kit contains:

- ★ On board power supply
- ★ 4K Eprom expansion
- ★ Fully buffered for easy expansion via 40 pin socket
- ★ 8K kit £89.95
- ★ 16K kit £122.95
- ★ Printed Circuit Board £29.95
- ★ 40 pin - 40 pin header plug £8.50



NEW SHOP



VIDEO GENIE

VIDEO GENIE
based on TRS80



Utilises Z80, 12k level II Basic,
Integral Cassette Deck, UHF O/P.
16k RAM,

all TRS80 features

£289

CASES

Available for
U.K. 101, Superboard
Nascom.
Appx. DIM. 17" x 15"
435 x 384 mm

PRICE £24.50

Post & Packing £1.50

UK101 P.P.I.

BUILT & TESTED. INTERFACES TX80
PRINTER DIRECT, CAN BE
PROGRAMMED TO OPERATE RELAYS,
MOTORS, VARIOUS OTHER
PERIPHERALS 'CENTRONICS
COMPATABLE' PLUGS INTO IC SOCKET.
RED !!!!! DISPLAY FULL DOCUMENTED
£29.95

UK101

£179 IN KIT FORM
£229 READY BUILT
& TESTED
£255 COMPLETE
IN CASE

5K EXPANSION
(8 x 2114)
now only £18.00

- No extras required
- ★ Free sampler tape
 - ★ Full Qwerty keyboard
 - ★ 8K basic
 - ★ Ram expandable to 8K on board (4K inc)
 - ★ Kansas City tape interface
 - ★ NEW MONITOR ALLOWS FULL EDITING & CURSOR CONTROL

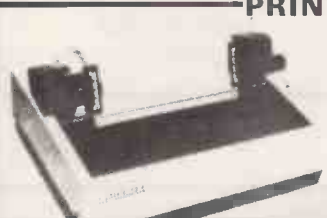
£22.00



PRINTERS

EPSON TX-80
£349

Dot-matrix printer with Pet
graphics interface: Centronics
parallel, options: PET, Apple and
serial.

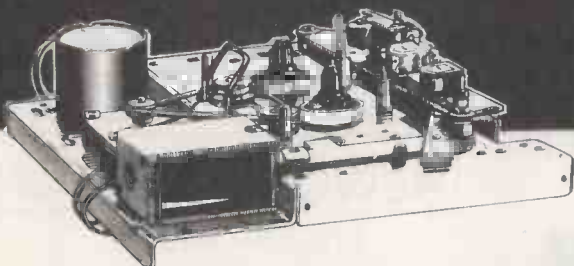


Please add VAT 15% to all prices. Postage on computers, printers and cassette decks charged at cost, all other items P&P 30p. Place your order using your Access or Barclaycard. (Min. tel order £5). Trade and export enquiries welcome. credit facilities arranged.



Circle No. 250

SAVINGS ON TAPE TRANSPORTS!



The Monolith C1000 is a new British-made twin-motor tape transport, ideal for a wide range of industrial applications.

- High reliability.
- Solenoid controlled.
- Four remote functions — stop, play, rewind and fast forward.
- Supplied complete with spooling and capstan motors, drive solenoid, and 1/2-track record/playback and erase heads.

The C1000 is a major cost reduction development from the successful Monolith C2000 series of remote operation transports, which is widely used in process control, data logging and computer systems.

Ask for details of our control circuit boards, search, position sensors, specialised heads and other products.



THE MONOLITH ELECTRONICS CO. LTD.

5/7 Church Street, Crewkerne, Somerset TA18 7HR Tel (0460) 74321 Telex 46306 MONLTH G

• Circle No. 251

Buy now!

Ex-stock

£36.95

+ VAT (£2.50 p & p)

TANGERINE TUSCAN — British Computer Kits —

**SEE US AT BREADBOARD
STAND J3**

Video Genie	£330.00	Single Bd. excl. Video,	
Microtan 65 Kit	£69.00	Kit	£195.00
Tanex (min. confg.)	£43.00	Single Bd. incl. Video,	
Tanex expanded kit	£106.00	Kit	£235.00
Also available, full ASCII keyboard, P.S. Mother board, cabinets etc.			
Ref.	BOOKS	Ref.	
200 Prog. the Z80 —		212 Crash course in Micros	
ZAKS	£8.95		£10.65
60 Prog. the 6502 —		167 How to make money	
ZAKS	£7.95	with your micro-	
40 BASIC BASIC —		computer	£5.75
Coan	£6.50	36 Instant BASIC	£7.20
159 Z80 Ass. Lang.		216 Intro to Micros for Ham	
Leventhal	£8.15	Shack	£3.95
233 Computer Technicians		184 Little Bk. of Basic	
Handbook	£7.25	Style	£5.75
150 Computer Progs. that		161 More BASIC Comptr.	
Work	£3.95	Games	£5.50
169 Microsoft BASIC	£6.75	24 TTL Cookbook	£7.15
187 6502 Ass. Lang.		224 BASIC Cookbook	3.95
Leventhal	£8.25	226 Beginners Guide to	
65 BASIC Computer		Computers and Micros	£5.50
Games	£5.50		
195 The BASIC Handbook		237 How to design, and build	
	£11.00	your own working computer	
171 BASIC & the Personal		system	£5.75
Computer	£9.75	243 Microprocessor Cook-	
62 The Best of Byte	£8.75	book	£4.64
203 Best of Micro Vol. 1		246 Modern Digital	
(6502)	£5.50	communications	£5.95
204 Best of Micro Vol. 2		247 Modern Guide to	
(6502)	£6.50	Digital Logic	£5.75

Other books available, why not send for list.
V.A.T. extra (where applicable) Post and Packing extra.
MICRO-PRINT LTD.

59 Church Street, Stoke on Trent. 0782-48348

• Circle No. 252

PRODUCTION CONTROL & JOB COSTING

A JOBBING

DEFINE : Estimated Resource — Material, Labour
Requirements — Subcontract, Overheads
: Shop Floor Route — Operations, Time

ENQUIRE : Job Status — Sub-Assemblies
— Variance Analysis
: Labour — Profitability
— Employee Cost/
Contribution

REPORT : Job Profitability — Work in Progress
— Completed Jobs

QUOTE : Use Historical Job Data

OTHER MODULES : Capacity Planning/scheduling
Employee Productivity, Invoicing.

**THE SYSTEMS CAN BE TAILORED TO MEET YOUR
REQUIREMENTS**

SMIS

**SHEFFIELD
MICRO
INFORMATION
SYSTEMS**

CPM MACHINES

B BATCH PRODUCTION (BILL OF MATERIALS)

DEFINE : Components, Product Structure
Route & Operations (Set Up,
Operational Times & Costs)

REPORT : Component Utilisation
: Product Manufacturing Costs
: Product Profitability

OTHER MODULES : Order Entry — Component/Operational
Requirements
: Stock Control — Raw Materials,
Components Part
Assemblies

COSTS ; Software from £1,500
(Hardware from £5,000)

CONTACT: SMIS Limited,
Weston House, West Bar Green,
Sheffield S1 2DA
Tel: (0742) 20224

• Circle No. 253

Super Autumn Sale

High Resolution analogue to digital converter.
Resolution typ. 0.05% (equivalent to 12 bit).
Accuracy typ. 0.05% (5v supply). Price £50.00

IEEE or Userport Expander:

Connect 3 devices to the PET IEEE or Userport.
2 connectors can be switched under program
control 1 is a 'straight through' connector.

Price £65.00

Also available:

Soundbox £15, TV/Video Interface £35

Light Pen £15, Crash Restorer £8.00

Switch Unit £15+

Programs £1.25 each, C12 cassettes £4.00 for 10.

Disks £25 for 10.

*Trade/export enquiries invited. Prices exclude
VAT. Please add 15% to payment plus £1.00
postage and packing*

Qwerty Computer Services
20 Worcester Road
Newton Hall
Durham

Tel: (0385) 67045

• Circle No. 254



**CRYSTAL ELECTRONICS
CC ELECTRONICS**

SHARP MZ80K

**For the latest competitive
PRICE**

Contact us

Before you accept discounts elsewhere.

GIVE US A TRY

**CRYSTAL ELECTRONICS is the home of XTAL BASIC
ACCLAIMED BY MANY**

We KNOW the SHARP computers, we BACK the SHARP computers
What we give FREE is worth more than money.

MZ80K owners— are you XTAL followers?

NO! Then please read on.

XTAL BASIC (SHARP)

Takes 5K less memory, has all the features of SHARP BASIC
PLUS Multi dim strings, error trapping, logical operators,
machine code monitor, more flexible peripheral handling,
improved screen control, increased list control, auto run, If..
then.. else—and it doesn't stop there—it grows. You can
extend the commands and functions at will—10K, 12K, 16K,
BASIC?.

SHARP to XTAL BASIC conversion program is included.
£40 plus VAT (Disc version on its way)

**DESIGNERS OF MICROCOMPUTER SYSTEMS + XTAL BASIC
IS WORTH CONSIDERING ON COST ALONE.**

Members of Computer Retailers Association & Apple Dealers Association

Shop open 0930-1730 except Saturday & Sunday

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

Telex 42507 XTAL G

Access and Barclaycard welcome.



COMPUTERS
AND
COMPONENTS



• Circle No. 255

TRIDATA COMPLETE BUSINESS SOFTWARE PACKAGES

- | | |
|-------------------|-----------------------|
| * SALES INVOICING | for use on |
| * SALES LEDGER | * TANDY TRS 80 |
| * PURCHASE LEDGER | * TANDY TRS 80 Mk. II |
| * NOMINAL LEDGER | * SHARP MZ-80K |
| * PAYROLL | * PET AND SUPERPET |
| * STOCK CONTROL | * APPLE |

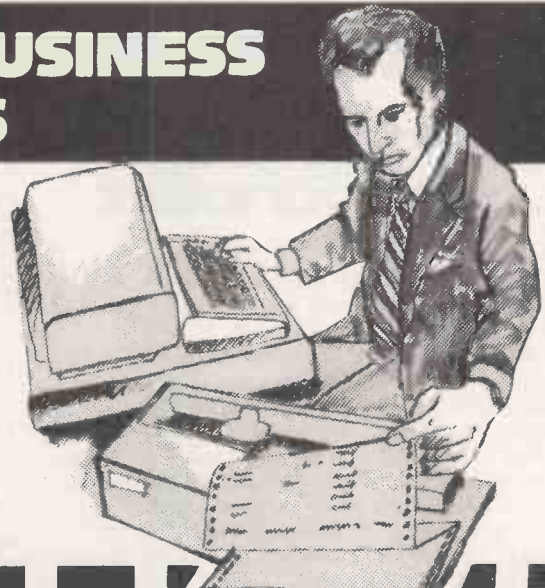
Our business packages are supplied with master diskettes,
detailed operating manuals and training procedures.
For small businesses and traders with up to 700 employees,
9,999 customers and 9,999 suppliers, our proven programs
written by experienced DP professionals provide fast,
simple control, with built in security routines for prevention
of unauthorised use, abuse or mishandling.
Over 550 Tridata business systems are now in use.

TRIDATA WARRANTY

Every Tridata program has a written 12 month warranty and can be
automatically updated to conform to any legislation that may alter your
accounting procedures.

**SEND THE COUPON TODAY
OR TELEPHONE
021-622 6085**

TRIDATA MICROS LTD., Smithfield House, Digbeth, Birmingham



Send me details of the Tridata Business Software Systems. I am interested in

PURCHASE LEDGER

For TANDY TRS 80

SALES LEDGER

TANDY TRS 80 Mk. II

PAYROLL

SHARP MZ-80K

NOMINAL LEDGER

PET

SALES INVOICING

SUPERPET

STOCK CONTROL

APPLE

Name _____

PC 12

Company _____

Address _____

TRIDATA MICROS LTD., Smithfield House, Digbeth, Birmingham B5 6BS

• Circle No. 256

STCS

S T Commercial Systems Ltd

24 Ranelagh Road, London W5 5RJ
England

CASH AND CARRY SUPERDEALS

SUPERBRAIN 64K £1499
QUAD DENSITY SUPERBRAIN £1950**NEC SPINWRITER £1599****CROMENCO** – (All hardware and software in stock for immediate delivery)**WORDSTAR £245****MAILMERGE £ 75****WORDSTAR & MAILMERGE £300****DATA STAR £175****DEALERS: BEST DISCOUNTS****Telephone 01-840 1926**

• Circle No. 257

New and exciting Applesoft programs

NEW!
the correspondent
By Roger Wagner

by R. Wagner

THE CORRESPONDENT is sure to be one of the most versatile programs in your library! It can be used as:

A Text Processor: Upper/lower case, 1-80 cols. (4-way scrolling). Text move/copy/insert/delete, tabbing, justify text, auto-centering and more!

A Database (with or without printer!) Extremely fast find routine and easy editing make it a natural for free-form data files. Create and fill out forms, access phone lists or index your magazines.

A Programming Utility: (printer or not). Examine, edit, transfer random or sequential text files. Create versatile exec. files. Even put bi-directional scrolling in your own programs!

Apple disk £29.95 + VAT

Roger's Easel

by R. Wagner

At last a program which allows you to draw colour pictures in lo-res graphics, and then permanently link them to your own Integer or Applesoft programs. Linked pictures can be displayed on either text/graphics page. (Integer basic).

Apple disk £14.95 + VAT

Apple-Doc By Roger Wagner

An Aid to the Development and Documentation of Applesoft Programs

This 3 program set is a must to anyone writing or using programs in Applesoft! It not only provides valuable info. on each of your programs, but allows you to change any element throughout the listing almost as easily as you would change a single line!!

With Apple-Doc you can produce a list of every variable in your program and the lines each is used on, each line called by a GOTO, GOSUB, etc., in fact, every occurrence of almost anything! You can rename variables, change constants and referenced line numbers or do local or global replacement editing on your listing.

Apple-Doc is a must for the serious Applesoft programmer.

Diskette complete with full documentation £24.95 + VAT

tridee ©Robin L. Frost

An exciting new addition to your Pascal library – enables you to create 3D graphics, viewable from any angle and distance. As easy to use as Turtlegraphics.

Procedures include Ortho, Perspec, Rotate, View, Move to-3, View-from.
Complete with comprehensive instructions £49.95 + VAT

Apple World

 is here. The fast 3D graphics package that runs on your Apple II plus. Zoom, pan, tilt and scale your own designs on the Apple screen, at only **£24.95 + VAT**

Plus a complete range of "off the shelf" programs for finance, commercial, scientific and education. Keep yourself up to date, send for our "Fact Sheets" giving full program details.

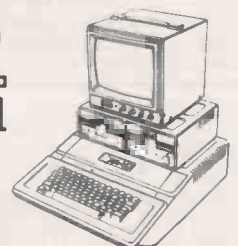
Now available Apple FORTRAN, Dos 3.3, Apple Plot

LEICESTER

computer centre limited

109 QUEENS ROAD LEICESTER LE2 1TT

Tel: 0533 709841

apple computer
Sales and Service

• Circle No. 258

Own your own microcomputer store

ComputerLand – the world's leading micro-computer retailer with over 130 stores world-wide – offers you a unique opportunity to run your own computer store.

Interested?

ComputerLand can offer you a franchise to sell the best names in small computers, peripherals and software packages. We deliver the products to you at manufacturers' prices, which allows you to sell them at the highest profit margins.

As a ComputerLand store owner, you will be backed by the experience and resources of the largest, most successful retail chain in the business. The results: ComputerLand store owners doubled their sales last year and are continuing at that rate this year.

If you are interested in learning more about starting your own microcomputer store, call us.

ComputerLand®

EUROPE S.à.r.l.

8, rue Jean Engling, Dommeldange (Luxembourg)
Phone: 43 54 55 · Telex: 24 23

No connection with Computerland Ltd nor any stores operating under the name Computerland in the UK.

WEBER & CO.

• Circle No. 259

'WITH'

OUR MICRO BUSINESS SOFTWARE

Invoicing Sales Ledger

Stock Control Purchase Ledger

Nominal Ledger and Management Accounts

Payroll

'TAILORED SYSTEMS ARE A PLEASURE'

ALAN DUCK AND ASSOCIATES
29 Pasture Close, Wembley, Middx.
01-904 3074

• Circle No. 260



small systems engineering limited

2-4 Canfield Place, London NW6 3BT · Telephone 01-328 7145/6

IEEE-488 PET INTERFACES

B200	Bi-directional RS232C serial	£186.00
Type C	Uni-directional RS232C serial	£120.00
AP	Addressable parallel for Centronics or Anadex printers	£106.00
GPI AP	Micro based bi-directional serial interface with buffering Custom GPI software development for special interfacing requirements	£249.00

All serial interfaces incorporate:

- Software or switched Baud rate selection with 16 different rates selectable
- Crystal controlled Baud rate
- Full RS232C handshake
- 20 mA current loop i.o. capability

All the above interfaces have two modes of code conversion to match print out to the PET screen for either display mode

Non Addressable parallel TV/Video interface	£45.00 £35.00
---	------------------

We also stock a range of PET connectors.

PET SOFTWARE

TCL PASCAL BASIC COMPILER

COMMUNICATOR – Intelligent terminal package teletype, DEC VT50 emulation, runs on 80 column PETs

VISICALC

WORDCRAFT – Word processing software for 40 and 80 column PETs

NEW . . . MUPET

Multi user disk system allows 2 to 8 PETs to be linked together to share a CBM disk unit and printer: prices from £595 for a 3 user system.

\$100 HARDWARE and SOFTWARE

P&T S100 IEEE controller £350.00

Measurement Systems dynamic memory boards

BISYNC 80 IBM 2780/3780 emulation software £425.00

PRINTERS PRINTERS PRINTERS

RP 1600 DAISY WHEEL

60 CPS PET, centronics, RS232 interfaces £1590.00

ANADIX DP 9500

150-250 CPS Line Printer. £895.00

New . . . HEWLETT PACKARD HP-85 PERSONAL COMPUTER

For professional scientific and engineering applications.

Full range of interfaces and peripherals available. As IEEE-488 interfacing specialists we can provide full technical support and advice on HP-85 applications.

• Circle No. 261

* BOOKS * BOOKS * BOOKS * BOOKS * BOOKS *

NEW **TOWERS INTERNATIONAL** **£16.25**
MICROPROCESSOR SELECTOR
 Over 7,000 American, British European and Japanese microprocessors, memories, interfaces, and related lsi circuits with electrical and mechanical specifications, supported by information on sources and substitutes.

T. M. Adam **MASTER GUIDE TO ELECTRONIC CIRCUITS** **£9.25**
 Whatever interest you have in Electronics this massive 616 page sourcebook of information should answer the questions you could possibly have about electronic circuits and components and how they work.

C.L. Hallmark **MASTER I.C. COOKBOOK** **£7.45**
 Use it now information on most IC family and function CMOS & TTL 4000 - 7400 series. Digital IC's exotic CMOS and linear IC's.

R.L. Goodman **TROUBLESHOOTING MICRO-PROCESSORS AND DIGITAL LOGIC** **£5.90**
 Complete guide to troubleshooting and servicing.

M. Hordeski **ILLUSTRATED DICTIONARY OF MICROCOMPUTER TERMINOLOGY** **£6.95**
 Clear concise encyclopedia of definitions of nearly 4,000 computer terms' words and jargon.

E.L. Stafford **COMPLETE MICROCOMPUTER SYSTEMS HANDBOOK** **£8.75**
 Complete guide to microcomputers — how they operate, how to use them, program them, and how to troubleshoot and repair.

M. Sawusch **1001 THINGS TO DO WITH YOUR PERSONAL COMPUTER** **£6.00**
 If you own a home computer or are involved professionally you'll find this unique new volume a goldmine of terrific applications.

K. Tracton **57 PRACTICAL PROGRAMS AND GAMES IN BASIC** **£6.40**
 Programs for everything from space war games to blackjack from craps to I Ching.

Adams. C. **BEGINNERS GUIDE TO COMPUTERS AND MICROPROCESSORS WITH PROJECTS** **£6.05**
 Down to earth introduction to understanding building programming and operating your own microcomputer.

Towers. T.D. **INTERNATIONAL TRANSISTOR SELECTOR UPDATE 2** **££10.70**
 Over 20,000 American, British, European and Japanese transistors with electrical and Mechanical Specifications manufacturers and available substitutes.

Prices include postage and packing. Available from: —
Technical Book Services, PC2,
P.O. Box 79, Maidenhead, Berks SL6 2EG

• Circle No. 262

Memories

2114-300ns	1k × 4 SRAM	2.25
4116-200ns	16k × 1 DRAM	2.61
2708-450ns	1k × 8 EPROM	3.60
2516-450ns	2k × 8 EPROM	7.92
2716-450ns	2k × 8 EPROM	7.92
2532-450ns	4k × 8 EPROM	23.40

Please add 50 pence for postage and VAT.
 Send SAE for price list.

STRUTT LTD

ELECTRONIC COMPONENT DISTRIBUTORS
 MANUFACTURERS & SUB CONTRACTORS to the ELECTRONIC INDUSTRY
 3c, BARLEY MARKET STREET,
 TAVISTOCK,
 DEVON, ENGLAND, PL19 0JF.
 Tel: TAVISTOCK (0822) 5439/5548
 Telex: 45263

• Circle No. 263

Introducing PEARL



Product of:
Computer Pathways Unlimited, Inc.

**A Powerful Application Generator
 Produces Error-Free Automatic Rapid Logid
 Generates C BASIC 2 Programs
 and Compiles Them**

Automatically Produces Programs For:

Menu Selection	Level I	£90
File Update/Edit	Level II	£325
Report Generator	Level III	£625

Indexed File Reorganisation
 Indexed Access

All Prices Exclude V. A. T.

Contact UK Distributer — Tel: 01-670 4202

THE CLENLO CONQUEROR



A Z-80 Microcomputer in an attractive Metal Cabinet, containing a 12 slot motherboard. Two serial and two parallel I/O ports are standard. Will accept a variety of S-100 compatible floppy and hard disc Drives.

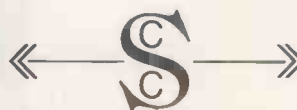
16K RAM	650.00
32K RAM	805.00
48K RAM	960.00
64K RAM	1115.00



8" 500K Double Density Floppy Disc Drive and Controller. 700.00
 Add On Unit 410.00

All prices exclude VAT

Clenlo Computing Systems



Crown House
 18 Gypsy Hill
 London SE19 1NL
 01-670 4202

• Circle No. 264

TCL PASCAL

Standard PASCAL
with P-code interpreter and linker,
following the ISO/BSI working draft.
Compiler operates in two modes:

Resident in RAM—makes
PASCAL as easy to learn as BASIC
Disc mode—with full set of
PASCAL commands.

Many enhancements to standard
PASCAL. Fully validated. Runs in
32K of RAM.

- TCL PASCAL for CP/M and PET is available now
at £120 plus VAT including Manual. Carriage paid.
- TCL PASCAL Manuals are available at £9.50 each.
Carriage paid.

TCL SOFTWARE

We mind our language!

TCL SOFTWARE
59/61 THEOBALD'S ROAD, LONDON WC1.
TEL: 01-405 5240

©TCL PASCAL is copyright of TCL Software. OEM licences available.

®
CP/M

Compatible with all
systems. IBM format on 5"
or 8" discs.

Manual—TCL PASCAL
for CP/M.

Runs on TUSCAN,
TRITON, 380Z, TEI, TRS80
computers.

*
PET

Unique features include
interface to PET BASIC and
clock.

Available now for PET 3032
on 5" disc.

Manual—TCL PASCAL
for PET.

**Available from TCL SOFTWARE and all Commodore
PET dealers now.*

I am interested in the TCL PASCAL compiler. Please send me:

The TCL PASCAL Manual for PET CP/M* at £9.50

The TCL PASCAL Manual and DISC for PET CP/M* at £138

*Delete as necessary and specify 5" or 8" disc for CP/M

NAME _____


ADDRESS _____

TELEPHONE _____

PC12

• Circle No. 265

CODIFIED COMPUTER SYSTEMS

supply **British**  Micro computer systems, S100 IEEE cards and peripherals
in London Codified Computer Systems 15 Newington Green, London N16 Telephone 01-254 7419

In delightful Milton Keynes in beautiful Buckinghamshire a near genius, who sleeps too little and smokes too much, realised the obvious and designed the following set of S100 cards to IEEE timing specs. The brand is *Interactive*. The cards work well and we regret that not only is the chip count low (giving greater reliability and proving good design), but also there are no cut tracks or free soldered wire jumpers.

Z80 CPU	S100 4 MHz CPU card with remarkably few chips. A & T. £105.00
FDC	1791 (not unnecessarily DMA) floppy disc controller to handle any combination of 8" or 5" drives at single or double density. A & T. £198.00
16K SRAM	16K static RAM card using 2114's, (we look forward to the Mark II with 24 bit addressing). A & T. £198.00
SMBC	An S100 single band computer with Z80A, 1K RAM, up to 16K ROM, 2 RS232 (or 20mA) serial I/O and 4 channel counter/timer/vector interrupt. A & T. £235.00
PCI	Process control interface D/A, A/D 8 channels - output relay isolated, input opto-isolated. A & T. £235.00
PS	Complete S100 power supply on a card (12 amps @ 8 volts) plus power for any two drives A & T £155.00

If you convince us that you have the experience to put a kit together we will supply one at 20% off.

The Codified floppy disc box

contains two DRI (made in Crewe) 7200 double-sided 8" drives giving 1.9mbytes at double density. There is room for two more inside. It is made of wood (genuine chipboard faced in oak veneer) by dedicated British workmen in Tottenham, and finished in tough acrylic varnish. It is supplied with 50 way connector, power supply and lead, mains filter (of course), illuminated on/off switch, fuses and large fan to BS3456. Price £1150.00

3 Systems, Software, Peripherals, Advice and Consultancy

A complete CP/M (TM Digital Research) operated system based upon these components with 8" DS, DD Disc storage, VDU and printer will cost about £4,200. We can reduce the price by taking off luxuries e.g. reducing the disc capacity. Example - the "Polaris" Skyline system (made in the UK) 32k would cost £1,925 with discs.

Business software and a fine word processing system is available (written in Yorkshire) for those who need a simple but expandable solution to their problems. CODASYL standard database software is now available and an electronic mail package is imminent.

Consultancy on matters to which we can claim expertise is available. In order to eliminate bias we must refuse to sell our products to a client for a year. If, in our opinion as consultants, interactive based systems fit the requirements, they will have to be bought from another dealer.

The DAI personal computer with its unparalleled graphics facility at £900, is held in stock. Ring us to arrange a demonstration.

VAT at 15% should be added to your order totals.

• Circle No. 266

CHRISTMAS OFFER FROM SHARPSOFT

HARDWARE

SHARP MZ80K 20K Model	£445.00
SHARP MZ80K 36K Model	£495.00
SHARP MZ80K 48K Model	£545.00
sharp mz80P3 Printer	£515.00
SHARP MZ80FD Dual Drive Floppy Disk	£755.00
SHARP MZ I/O Interface Unit	£95.00
SHARP PC1211 Pocket Computer	£95.00
SHARP CE121 Cassette Interface for PC1211	£15.00
SHARP RD610 Cassette Player	£20.00

SOFTWARE

Full range of software for the MZ80K available including

System software:	Search & replace
Assembly code (Sharp)	Variable table utility
Machine code (Sharp)	Business software:
Zen Assembler	Payroll
Xtal basic (7K)	Purchase & Sales Ledger
CP/M	Mailing list
Utilities:	Stock control
Ardensoft toolkit	Costing Package
Renumber & tape copy	Simple Word Processor
Machine code dump	and a large selection on games etc.

SHARPSOFT — USER NOTES is the name of a new publication giving all the latest news of the SHARP MZ80K products, software and programming tips. The first issue will be available early January 1981.

Send a 20p stamp for our SHARPSOFT hardware/software catalogue and a subscription/registration form for your copy of the SHARPSOFT — USER NOTES.

PURCHASE A MZ80K from us and get a games tape, 4 blank Sharpsoft Cassettes and one year's free subscription to the SHARPSOFT — USER NOTES.

ALL SHARPSOFT — HARDWARE PRICES INCLUDE VAT. DESPATCH & TRANSIT INSURANCE.

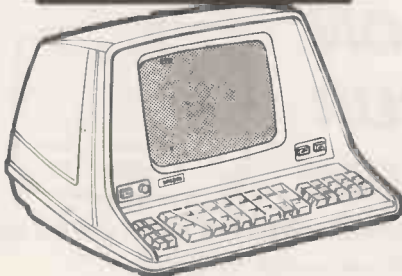
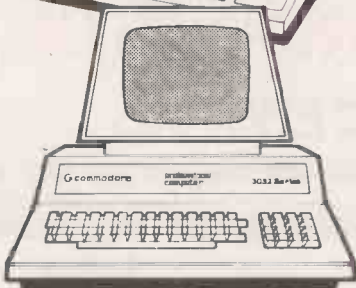
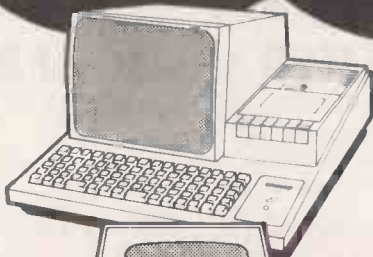
SEND TO:

SHARPSOFT 86-90 PAUL STREET, LONDON EC2A 4NE.

• Circle No. 267

& Computers & Peripherals

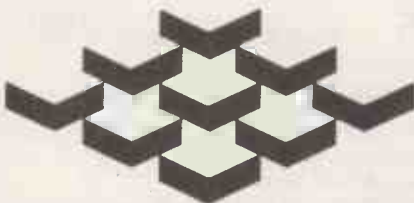
Leading-make hardware
at hard-to-beat prices



Model	User Ram	£
Sharp MZ80K		
20K	6K	380.00
36K	22K	423.00
48K	34K	475.00
MZ80FD	Twin floppy disk drive	650.00
MZ80P3	Matrix Printer	431.00
MZ801/0	Expansion Interface	83.00
PC1211	Pocket Computer	83.25
CE121	Cassette Interface for PC1211	11.75

Commodore		
2001-8	Integral Cassette/small keyboard	367.00
3008	8K with full size keyboard	389.00
3016	16K with full size keyboard	454.00
3032	32K with full size keyboard	600.00
3040	Twin 5 1/4" Disk drive	600.00
3022	80 Col. 93cps Tractor printer	367.00
3023	80 col. 93cps Friction printer	325.00
C2N	Add on cassette deck	48.00
	Computer to disk cable	18.00
	Disk to printer cable	22.00

For full retail price list and
Conditions of Sale relating to these
offers, contact



HB COMPUTERS

22 Newland Street
Kettering
Northamptonshire
Telephone 0536 520910
Telex 341297

ACT 800 Series		
ACT 808	Computer and 800K disk system	2950.00
ACT 824	Computer and 2.4M disk system	3750.00
ACT 400	400K PET disk	625.00
ACT 800	800K PET disk	795.00
ACT 1.6	1.6M PET disk	995.00

Printers		
	Teletype 43 Pinfeed. 30cps	775.00
	Decwriter LA34 Friction Feed. 30cps	775.00
	Qume Sprint 5 45 RO	1518.00
	Qume Sprint 5 55 RO	1605.00
	Qume Sprint 5 45 SKR	1695.00
	Qume Sprint 5 55 KSR	1810.00
	Ricoh RP 1600 Daisywheel (PET interface)	1025.00
	Ricoh RP 1600 Daisywheel (HITYPE interface)	900.00
	Centronics 702	1300.00

• Circle No. 268

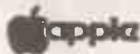


CompUtopia LIMITED

30 Lake Street, Leighton Buzzard, Bedfordshire
Tel: (0525) 376600 24 hour Answering Service

APPLE II

from
£695
+
VAT



authorised dealers

- *Choice of 16K, 32K, 48K user RAM
- *Huge range of software already available.
- *Simply plugs into video monitor or UHF TV.
- *High resolution graphics (54000 point array)
- *Eight Accessory expansion slots for disks, printer etc.

commodore

authorised dealers

PET 2001

from
£445
+ VAT



- *Choice of 8K, 16K, 32K user RAM
- *Huge range of software already available
- *Self contained monitor
- *Numeric keypad on keyboard
- *Full expansion capability for cassette, disks and printer.

THE VIDEO GENIE SYSTEM EG 3003



- *16k User RAM plus 12k Microsoft BASIC in ROM
- *Fully TRS 80 level II software compatible
- *Huge range of software already available
- *Self contained, cassette, PSU & UHF modulator
- *Simply plugs into video monitor or UHF TV
- *Full expansion capability for discs & printer

£330 + VAT

PERIPHERALS

PRINTERS

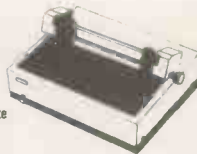
Texas Instruments Omni 810 Printer £1450.00
Paper Tiger Printer with Graphics £ 598.00

MONITORS

VM129 Hitachi 12" B&W Video Monitor £187.00
VM910 Hitachi 9" B&W Video Monitor £127.00

EPSON

£395
+ VAT



£395 + VAT complete with interface for APPLE, PET or VIDEO GENIE

The Microsoft Z80 SoftCard opens up new horizons for your APPLE II

Plug the new Microsoft Z80 SoftCard into your APPLE II and start using *all* of the system and application software written for Z80 based computers. Included with the board is the versatile CP/M; the most widely used micro-computer operating system, and Microsoft's 5.0 BASIC, the most powerful version to date of Microsoft's famous BASIC Interpreter.

£275 + VAT

Dealer enquiries welcome.

WATCH YOUR APPLE GROW TO TWICE ITS SIZE!!

Add a twin 8" disk and give yourself up to 1.6 million characters of storage on line.
Dealer enquiries welcome.

£1750 VAT

BASIC & BASIC PROGRAMS

Illustrating Basic Alcock	£ 3.25
Basic Handbook Lien	£11.00
Computer Programs that Work Lee/Beech/Lee	£ 3.95
Basic Computer Games Ah!	£ 4.25
More Computer Games Ah!	£ 4.25
C207 Microprocessor Interfacing Techniques	
Leseal/Zaks	£ 9.50
6502 Assembly Language Programming Leventhal	£ 8.90
C202 Programming the 6502 Zaks	£ 7.95
G402 6402 Games Book Zaks	£ 7.95
The Pet Revealed Hampshire	£10.00
Z80 Assembly Language Programming Leventhal	£ 7.95
Z80 Microcomputer Handbook Barden	£ 6.80
Introduction to Microcomputers Vol 0 Osborne	£ 5.00
Introduction to Microcomputers Vol 1 Osborne	£ 7.50
The Personal Computer Book Bradbeer	£ 5.30

BOOKS

Please phone or write for complete book list and prices.
Prices include P&P within the U.K.
Please send cheque or P.O. or if phoning your order, state Barclaycard number.

• Circle No. 269

MICRODIGITAL



COMPUTER VOUCHER

Valid until 31/1/81 on any purchase over £100 – one voucher per sale ...

CALL IN TODAY for Sharp, Apple, Video Genie, Atom, Printers, Software, Books.

MICRODIGITAL



Retail Premises at:
25 BRUNSWICK STREET,
LIVERPOOL L2 0PJ.
Tel: 051-227 2535/6/7

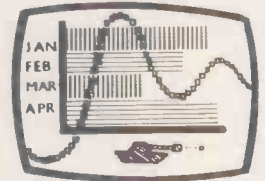


• Circle No. 270

UK101

NASCOM 1 & 2

ADD-ON COLOUR SYSTEM



DAZZLING COLOUR GRAPHICS FOR UK101 & NASCOM

- Professional bit-addressable 'pixel' system
- 3072 colour cell definition
- 8 Colours foreground + 8 background
- FREE SOFTWARE: Plot, Line, Circle (Basic + Z80)
- Animated Demonstration Program
- Modulator included for use with normal TV

KIT: only **£45** Built & Tested: only **£60**

Also available separately:

COLOUR MODULATOR

- R G B inputs, PAL/UHF output
- Unlimited colour combinations
- TTL etc interface details supplied
- 1000's already in use!



KIT: only **£12** Built & Tested: only **£18**

— please add VAT at 15% to all prices

— Barclay/Access orders accepted by telephone

WILLIAM STUART SYSTEMS Ltd

Dower House, Billericay Road,
Herongate, Brentwood,
Essex CM13 3SD.
Telephone: Brentwood (0277) 810244



• Circle No. 271

Our Printers



MEAN BUSINESS !

FEATURES:

- 150 Characters per second
- Bi-directional printing, logic seeking
- 9 x 9 Dot Matrix
- Upper and lower case with descenders
- Double width characters
- 10 Characters per inch – horizontal
- 6 or 8 lines per inch – vertical
- Adjustable tractors
- Original and 4 copies
- Extended life head
- Paper out sensor

The Anacom 150 is a table top, 150 CPS printer that prints its 9 x 9 dot matrix bi-directional whilst logic seeking the quickest way to print the next line, it has an 136 column format, but accepts tractor feed paper of any width, vertical format is programmable as are double width characters. Interfacing is accomplished by the use of a personality board with parallel or full interface supplied as required at no extra cost. Its modular construction combines rugged quality with convenient serviceability. It is fully warranted for 90 days with a comprehensive service facility available for continued customer protection.

ONLY £699 + VAT (including Serial or Parallel interface, please specify)

NORTHAMBER LTD

GREAT OAK HOUSE, ESHER, SURREY. KT10 9BR

Telephone: ESHER (0372) 62071

SOLE UK DISTRIBUTOR

• Circle No. 272

The new
powerful
personal
computer
from
Sweden...



NEW! FOR ABC 80
FLOPPY DRIVES UP TO
1 MEGABYTE
VERSATILE MATRIX PRINTERS
MEMORY EXTENSION
AND 1-0 CARTS
SPECIAL PROGRAMS

Now available from
UK stocks

The microcomputer which out-
sells all others in Scandinavia.

Write: Datormark Ltd. / Fox Oak / Seven Hills Road / Walton-on-Thames / Surrey KT12 4DG

• Circle No. 273

XITAN SYSTEMS

CROMEMCO SYSTEM 3

£4,054.00 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.

ON DEMO NOW! THE CROMEMCO Z2-H

For only £4,995.00 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) £5,390.00.
B) £4,330.00.
C) £7,420.00.

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.

Xitan Systems also supplies and stocks vdus, 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

• Circle No. 274

KGB MICROS LIMITED

THE PROFESSIONAL ORGANISATION OFFERING
HARDWARE AND SOFTWARE PLUS FULL CLIENT SUPPORT
WHO WISH TO MAKE YOUR BUSINESS OUR BUSINESS

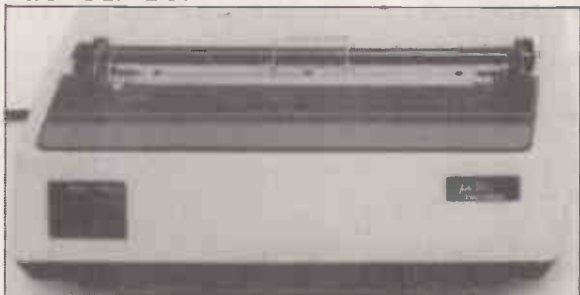
SUPERBRAIN™



THE MICRO COMPUTER THAT HAS
THE BEST PRICE/PERFORMANCE
RATIO.

£1495 (64K RAM)

MICROLINE 80



THE EFFICIENT BUSINESS SYSTEM
SUPERBRAIN

+

MICROLINE 80 PRINTER

£1795

INDIVIDUAL PRICE £500.00

DIABLO 630



THE COMPLETE WORD PROCESSING
SYSTEM
SUPERBRAIN

+

DIABLO 630 PRINTER

+

THE PROVEN 'WORD STAR' PACKAGE

£2995

INDIVIDUAL PRICE £1675.00

SOFTWARE SUPPORT

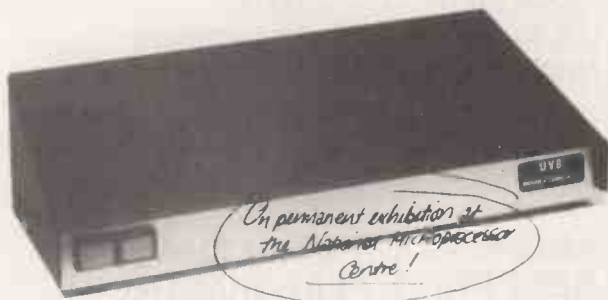
- * KGB offer a wide range of standard software — FORTRAN, COBOL, BASIC, PASCAL.
- * KGB will customise our software packages to meet your unique requirements — Invoicing £95, Sales Ledger £235, Purchase Ledger £235, Nominal Ledger £235, Payroll £335.
- * KGB will design and implement software to suit your business needs.

KGB Micros Ltd., 88 High Street, Slough, Berkshire.
Tel: Slough 38581/38319

Superbrain is the registered trademark of Intertec Data Systems. Prices exc. VAT.

• Circle No. 275

Erase Eproms in 8 minutes for under £100



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

• Circle No. 276

BUBBLE MEMORY and REAL TIME CLOCK for NASCOM



The 8423 is fully assemble, burnt in and plugs into the 77 way NASBUS.

- Add a non-volatile memory to your NASCOM I or II.
- Monitor transparent — use it with NAS-SYS, T2, T4 or B-BUG.
- Unaffected by dust or vibration.
- 92,304 bit capacity organised as 144 minor loops of 641 bits.
- Battery supported chosed clock generates perpetual day, date, time.
- Dealers enquiries welcomed.

MICRODATA COMPUTERS LTD
BELVEDERE WORKS, BILTON WAY,
PUMP LANE INDUSTRIAL ESTATE, HAYES,
MIDDLESEX UB3 3ND

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

• Circle No. 277

ICE INDEPENDENT COMPUTER ENGINEERING LIMITED

CROMEMCO Systems & Software

10 Megabyte Cartridge Disk
(5 Megabyte fixed, 5 removable)
for the S100 Bus

£3,950 including installation
+ VAT (London area)

We supply computer solutions to business problems

- Software packages
- Hardware maintenance
- Hardware configuration and design

We also have an "Aladdin's Cave" of computer spares, power supplies, boards, chips, etc, etc.

For further details and information please contact:

Independent Computer Engineering Limited,
16/18 Littleton Road, Ashford, Middlesex.
Tel: Ashford (0784) 47171/47172
Telex: 8952042 (DPCUST G)



EPSON — MX80 DOT MATRIX PRINTER

The Printer you have been waiting for

- 9 × 9 matrix (true descenders in lower case)
- 80 cps bidirectional printing with logical seeking print head (maximises throughput)
- 96 ASCII character set, plus 64 graphics incorporating 4 switch selectable European language options
- Programmable forms handling
- 12 different print modes, up to 132 characters per line
- Operator controls and indicators, including self test feature
- **£395** (+ VAT) with standard parallel interface (options: RS232, Apple, Pet, TRS80, MZ80)

• Circle No. 278

APPLE® II DISK DRIVES

DUAL DISK UNIT £498

DISK CONTROLLER CARD £ 49



- * Two Disks in one Cabinet
- * Has its own Power Supply Unit
- * Connects to standard Apple Disk Controller Card
- * Runs all Apple Software including Pascal
- * Japanese quality and reliability

APPLE DEALERS:- Write or phone direct to Cumana and specifications plus dealer discounts will be mailed to you.

TRS-80® DISK DRIVES

DUAL DISK UNIT

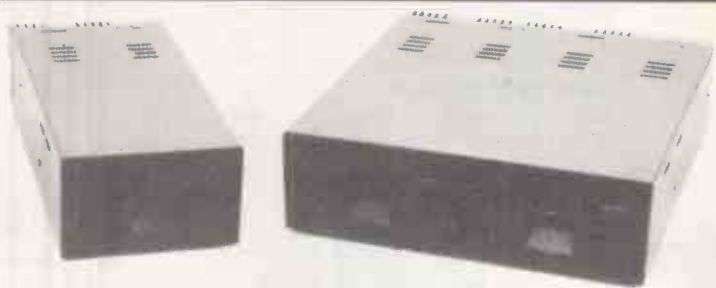
2 x 40 Track Drives £440
2 x 80 Track Drives £645

SINGLE DISK UNIT

1 x 40 Track Drive £236
1 x 80 Track Drive £345

TRS 80 DISK CABLES

2 Drive Cable £20
4 Drive Cable £32.50



TRS-80 DEALERS:- Write or phone direct to Cumana and specifications plus dealer discounts will be mailed to you.

EDUCATIONAL & QUANTITY DISCOUNTS

VERY GENEROUS EDUCATIONAL AND QUANTITY PURCHASE DISCOUNTS ARE NOW AVAILABLE ON CUMANA TRS 80 DISK DRIVES. OUR DEALERS WILL BE HAPPY TO SUPPLY PRICE QUOTATIONS

Call your nearest dealer for a demonstration:

RADIO SHACK LTD.,
188, Broadhurst Gardens,
London NW6
Tel: 01-624-7174

COMP SHOP LTD., 14, Station
Road, New Barnet, Herts.
Tel: 01-441-2922

COMP SHOP LTD.,
311, Edgware Road,
London W2. Tel: 01-262-0387

MICRO-CONTROL LTD.,
224, Edgware Road,
London W2. Tel: 01-402-8842

**LONDON COMPUTER
CENTRE,** 43 Grafton Way,
London W1. Tel: 01-388-5721

**TRANSAM COMPONENTS
LTD.,** 59-61, Theobalds Road,
London WC1,
Tel: 01-405-5240

N.I.C. 61, Broad Lane,
Tottenham, London N15
Tel: 01-808-0377

**KATANNA MANAGEMENT
SERVICES,** 22, Roughtons,
Galleywood, Chelmsford.
Tel: 0245-76127

I.C. ELECTRONICS,
Flagstones, Stede Quarter,
Biddenden, Kent.
Tel: 0580-291816

**CAMBRIDGE COMPUTER
STORE,** 1, Emmanuel Street,
Cambridge. Tel: 0223-65334

**PORTABLE MICRO-
SYSTEMS,** 18, Market Place,
Brackley, Northants
Tel: 0280-702017

COMPUTERAMA LTD.,
5, Cleveland Place East,
London Road, Bath.
Tel: 0225-333232

ENSIGN, 13-19, Milford
Street, Swindon, Wilts.
Tel: 0793-42615

SEVET TRADING, 14, St.
Paul's Street, Bristol 2
Tel: 0272-697757

PARWEST LTD., 58, Market
Place, Chippenham.
Tel: 0249-2131

**HEWART MICRO-
ELECTRONICS,** 95, Blakelow
Road, Macclesfield.
Tel: 0625-22030

HARDEN MICROSISTEMS,
28-30, Back Lord Street,
Blackpool. Tel: 0253-27590

MICRO CHIP SHOP,
197, Waterloo Road, Blackpool.
Tel: 0253-403122

MICRO CHIP SHOP,
190, Lord Street, Fleetwood,
Lancs. Tel: 03917-79511

EWL COMPUTERS LTD.,
8, Royal Crescent, Glasgow.
Tel: 041-332-7642

**NORTH WEST COMPUTER
CONSULTANTS LTD.,**
241, Market Street, HYDE,
Cheshire
Tel: 061-366-8624

ZERO ONE ELECTRONICS,
36, Oaklands Avenue,
THORNTON HEATH,
Surrey
Tel: 01-689-7924

P & J EQUIPMENT LTD.,
3 Bridge Street,
GUILDFORD
Tel: 0483-504801

CUMANA LTD 35 Walnut Tree Close, Guildford, Surrey, GU1 4UN.
Telephone: (0483) 503121. Telex: 859680 (Input G).

*Please add VAT to all prices.
Delivery at cost will be advised
at time of order.*

• Circle No. 279

BIRMINGHAM COMPUTER CENTRE

COMPLETE BUSINESS SYSTEMS
FROM THE PROFESSIONALS

COMMODORE
OFFICIAL DISTRIBUTOR

32K SYSTEM
COMPLETE £1850



3000 SERIES	£
8K with built-in cassette	425
8K with professional keyboard	450
16K with professional keyboard	550
32K with professional keyboard	695
343K Twin Floppy Disk	£695
CN2 Cassette Deck	55
IEEE Cables — Pet	20
IEEE to IEEE	25
Tractor Feed Printer	425

NEW 8000 SERIES	£
8032 — 32K with 80 col Screen	895
8050 — Twin Disk Drive 950K	895



Latest Apple II
with Auto-Start Rom
and Floating Point
Basic.

48K + Disk Drive
with Controller.

16K	£
Disk Drive with Controller	695
Disk Drive without Controller	349
Eurocolour Card	299
Pascal Card	69
Centronics Type Inter	299
16K Upgrade	110
Monitor	69
Full Range of Software Available	115

**£1044
+ VAT**

SHARP MZ 80K

A complete Personal Computer System.



At an Economical Price
£

20K	480	Hi-resolution monitor.
32K	529	Fast cassette unit.
36K	549	Extensive graphics plus Built in sound GEN.
48K	599	

48K **£550
+ VAT**

Widely accepted as the most powerful
8-bit cpu on the market.
Floppy disk drive now available plus
printer.



CAMDEN ELECTRONICS
462 COVENTRY ROAD
SMALL HEATH, BIRMINGHAM B10
021-773 8240 — 021-772 5718

**HP
LEASING
ETC**



• Circle No. 280

Write off your Computer Supplies problem now.



Flexible Disks
Digital Cassettes
Printwheels
Binders
Disk & Tape Storage
Magnetic Tape
Cartridges
Ribbons
Continuous Stationery
Filing Systems
Fire Resistant
Cabinets
Disk packs

Please send me your latest catalogue.

Name _____
Company _____
Address _____

PC/1

WILLIS

Computer Supplies
for people who know better

Post to: Willis Computer Supplies Limited, P.O. Box 10, Southmill Road,
Bishop's Stortford, Herts CM23 3DN or Tel: Bishop's Stortford (0279) 506491.

• Circle No. 281

ELT 100 THE LOGICAL APPROACH TO DIGITAL LEARNING



This simple to use self-paced electronic logic trainer is an ideal tool in the learning or improvement of digital logic skills. The pervasive nature of the silicon chip, more recently expressed through the ubiquitous microprocessor, has resulted in many more people having to acquire skills in digital logic. The ELT 100 has been designed to compliment formal classroom work or to be used as a stand alone self study course in its own right.

Agents required in most countries.



**Portable
Microsystems
Limited**

Forby House, 18
Market Place, Brackley,
Northants NN13 5SF
Telephone Brackley
(0280) 702017
Telex Micro 83147

• Circle No. 282

Almarc + Vector Graphic

The complete partnership
in Micro computers

DATA SYSTEMS LTD
906 Woodborough Road, Nottingham NG3 5QS.
Tel: (0602) 625035

System 2800.

- * S-100 bus.
- * Switch-selectable asynchronous baud rates between 110 and 9600 bits/second.
- * Vector-3 console chassis with 12-inch CRT (18" W x 12 1/2" H x 21" D).
- * Capacitance Keyboard 6 slot motherboard, and power supply.
- * Z-80 based single board computer with 1 serial port, 3 8 BIT parallel ports, 3 PROM slots, and

1K RAM. Flashwriter II. Video board, 64K dynamic memory board and disc controller. DUALSTOR enclosure with two 8-inch double density disc drives, total disc storage capacity 2.4 m bytes.

- * Version 4 extended systems monitor on PROM, Vector CP/M 2.2, SCOPE. Screen Oriented Program Editor, full screen dynamic simulating debugger, ZSM Z-80 assembler, Microsoft, BASIC-80 Release 5.



System 3030.

- * Vector-3 console chassis with 12-inch CRT (18" W x 12 1/2" H x 21" D), capacitance keyboard, 6-slot S100 motherboard, and power supply.
- * ZCB Z-80 based single board computer with 1 serial port, 3 parallel ports, 3 PROM slots, and 1K RAM. Flashwriter II Video board, 64K dynamic memory board, floppy disc controller board, Winchester disc interface board, Megastor enclosure with 8-inch Winchester 3-platter hard disc drive, and

2 Micropolis Mod II quad density mini-floppy disc drives.

- * Capacity Hard Disc 32 M bytes.
- * 2 5 1/4" MICROP DISC DRIVES giving 630 Kbytes, Storage Capacity.
- * Version 4 extended systems monitor on PROM, Vector CP/M 2.2, SCOPE. Screen Oriented Program Editor, full screen dynamic simulating debugger, ZSM Z-80 assembler, Microsoft BASIC-80 Release 5.



System 'B'

- * 64K Bank Selectable Ram (56K available to user).
- * 3 Serial Ports, 2 Parallel Ports.
- * Twin Disc Drives, 630K Capacity.
- * Z-80 CPU, with Fast 4MHz Clock.
- * Interrupt Handling on I/O Board.

- * 18 Slot Motherboard.
- * Vector Mindless Terminal.
- * Flashwriter II Video Board (24 x 80).
- * CP/M 2.2 Operating System.
- Plus Microsoft Version 5 BASIC, SCOPE. Screen Oriented Program Editor, Full screen dynamic simulating debugger, ZSM Z-80 Assembler.



At Almarc Data Systems, when you buy Vector Graphic Micro-Computers, you are assured of Almarc's experience of over 430 systems installed throughout the U.K. - plus their back-up of full service facilities carried out by experienced staff.

Almarc are Specialists in Vector Graphic equipment which includes Micro-Computers for research, laboratory work,

word processing, business systems, schools, colleges, universities and industry. Plus an ever growing list of compatible software including Pascal, Fortran, Cobol, APL, Algol, Basic Compiler and others.

We will be pleased to demonstrate how Almarc + Vector Graphic Systems equates to The Complete Partnership in Micro-Computers.

• Circle No. 283

APPLE/ITT

Stock control	£300
Sales Ledger	£300
Purchase Ledger	£300
Nominal Ledger	£300
Payroll	£380
Letter Writer/Data Base	£190
Hotel Desk System	£500
Lower Case Adaptor	£50

Custom software written for any desk top computer.

All prices ex VAT.

GUESTEL LIMITED

REFUGE HOUSE, 2-4 HENRY STREET,
BATH. Tel: 0225 65379

• Circle No. 284

Enter the Computer Age video genie system

12K MICROSOFT BASIC
16K RAM, TV MODULATOR
INTERNAL CASSETTE



£330
+ VAT

£395
+ VAT

80 Columns
70 Lines per minute
Graphics Characters
Interfaces to most
machines Tractor or
friction feed



100's of programs available
TRS-80 level II software
compatible

Photo Electric Software
459 London Road
Sheffield 2
Tel: 0742-53865

• Circle No. 285

Micro-Processor Development System for under £400

Small Systems offer an S100 card containing up to 8K static RAM (1K increments) accessible from both the system and externally from PROM plugs on flying leads.

Simulates up to 8 2708's or 4 2716's Plug these leads into your prototype PROM sockets and it will access system RAM as if it were ROM or PROM.

Allows full use of all CP/M facilities. Available with this board are CP/M compatible assemblers for: 8080A; 8048 family; 8085A; 8086; 8088; 6500 family; 6800; 6801; 6802; 6803; 6809; Z80; Z8000 all at £85 each. Development Board £295

no more time consuming PROM programming & erasing !!



small systems engineering limited

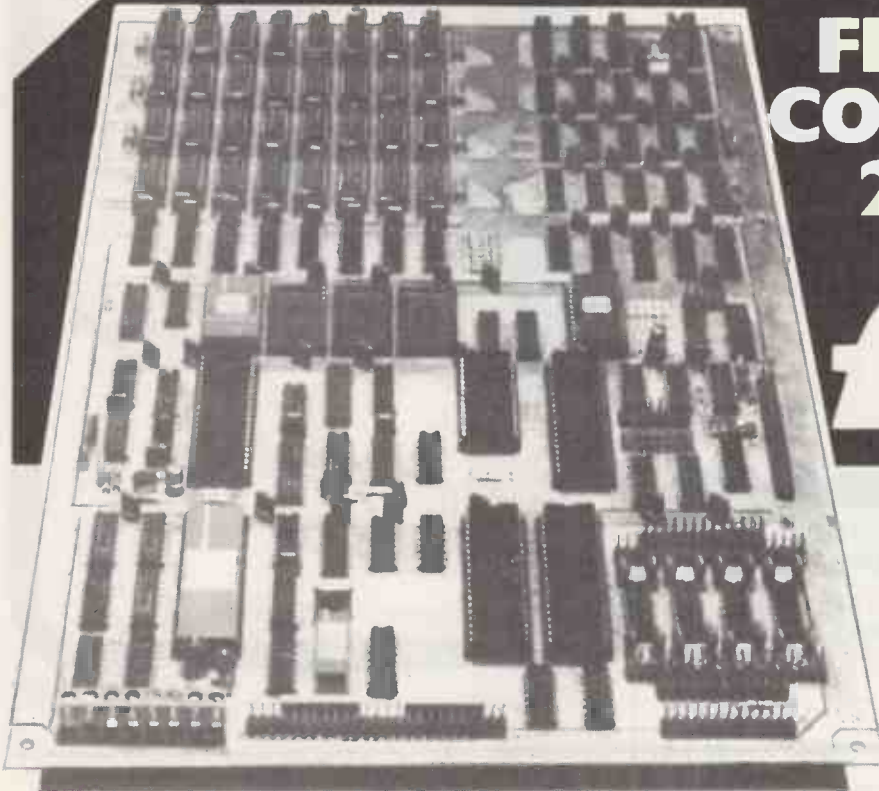
2-4 Canfield Place London NW6 3BT Telephone 01-328 7145 6 Telex 8813025 (Abacus)

• Circle No. 286

NEW

Introducing the incredible **BIGBOARD** Z-80 CPU! Single Board Computer Kit

**64K RAM!
FLOPPY DISK
CONTROLLER!
24x80VDU!
AT ONLY
£395⁰⁰ plus
VAT**



**it packs twice as much
on ONE BOARD – at around
HALF THE PRICE!**

It's taken three whole years to produce the BigBoard, designed from scratch to run the latest version of CP/M, so just imagine what software you could run **WITH NO MODS NEEDED!** In fact, add a couple of 8" Disk Drives, Power Supply and an enclosure and you'll have a Total Business System for about **ONE THIRD** the cost! That's what you call BigBoard flexibility, power – and sheer operating value. Send for your BigBoard today!

Size 8½ x 13¾ inches. Requires +5V @ 3 Amps +/- 12V @ 0.5 Amps.

YOU GET THESE FEATURES

64K RAM	That's 64K of usable RAM space using industry-standard 4116s. All 64K is available to the user. (video and EPROM sections do not make holes in it, for example), and extra special care has been taken to ensure that the RAM array PC layout eliminates potential noise and malfunction.	80 x 24 Character Video	Gives a crisp, flicker-free, sharp display even on the smallest monitors. Hardware scroll, full cursor controls, composite or split video and sync. The character set is supplied on a 2716 style ROM (makes customised fonts that much easier!), and sync. pulses can be any desired length or polarity. Video can be inverted or true.
Z-80 CPU	Handles all 4116 RAM refresh and supports all MODE 2 INTERRUPTS. Fully buffered, the Z-80 runs all 8080 software.	Basic I/O	A separate parallel port (Z80 P10) for use with an ASCII encoded keyboard for input. Output on the 80 x 24 character video display.
Floppy Disk Controller	Uses the WD1771 controller chip with TTL Data Separator for reliability. IBM 3740 compatible, it will support up to four 8" drives and is directly compatible with standard Sugart drives such as the SA800 or SA801. Drives can also be configured for remote AC off-on. Runs CP/M 2.2.	PFM 3.0 ZK System Monitor	The on-board PFM 3.0 is the real power behind the BigBoard. PFM commands include Dump Memory, Boot CP/M, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disk Read (Drive, Track, Sector) and Search. But, PFM occupies one of the four 2716 EPROMs, so it doesn't occupy any of the 64K of usable RAM!

PLUS THESE OPTIONS

Serial I/O	Full 2 channels using the Z-80 S10 and the SMC 8116 Baud Rate Generator. You get FULL RS232! For synchronous or asynchronous communication, and clocks can be transmitted or received by a modem in the former. Both channels can be set up for either data communication or data terminals. Supports mode 2 In1. PRICE JUST £60 !
Four Port Parallel I/O	Uses Z-80 P10 to give full 16 bits, fully buffered and bi-directional. User selectable hand-shake polarity, and set of all parts and connectors for parallel I/O ONLY £25 !
Real Time Clock	Uses Z-80 CTC and can be configured as a counter on Real Time Clock. Set of all parts ONLY £12 !
CP/M 2.2	The popular CP/M D.O.S. as modified by Micronix Systems to run on the BigBoard is just £99 !

Please send me _____ BigBoard/s at £460 (including £60 VAT and £5 INSURED DELIVERY) each, total

£ _____ And

_____ Serial I/O at £69 (inc. VAT) each, total £ _____

_____ Four Port Parallel I/O at £28.75 (inc. VAT) each, total £ _____

_____ Real Time Clock/s at £13.80 (inc. VAT) each, total £ _____

_____ CP/M 2.2 at £113.85 (inc. VAT) each, total £ _____

I enclose cheque for £ _____ or PAY BY ACCESS, giving card number and signature. Cheques payable to Maclin-Zand Electronics Ltd., please. Cash with order.

Name _____

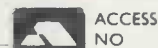
Address _____

Signature _____

Sole European Distributor.
Maclin-Zand Electronics Limited,
38 Mount Pleasant, London WC1X 0AP.
Tel: 01-278 7369/01-837 1165 Telex : 8953084

PCBB1

ME
Maclin-Zand
Making state-of-the-art affordable.



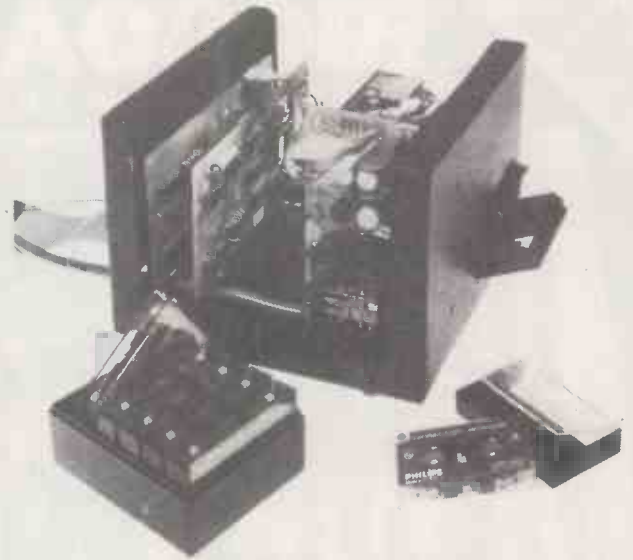
• Circle No. 287

Mini-Digital Cassette Recorder

AN ALTERNATIVE TO DISC FOR PROGRAM AND DATA STORAGE

FEATURES

- THE PHILIPS MDCR 220 MECHANISM OF PROVEN RELIABILITY
- HOLDS UP TO 120K BYTES/CASSETTE WITH FAST DATA TRANSFER
- EXTRA MEMORY BOARD WITH RAM AND ROM TO HOLD OPERATING SOFTWARE
- WILL READ AND WRITE (IN BLOCKS FROM 256 BYTES TO 60K BYTES), BACKSPACE AND SEARCH FOR END OF DATA ON TAPE
- COMPATIBLE WITH 6502 BASED SYSTEMS IE PET, AIM65, OHIO, KIM, COMPUKIT ETC.



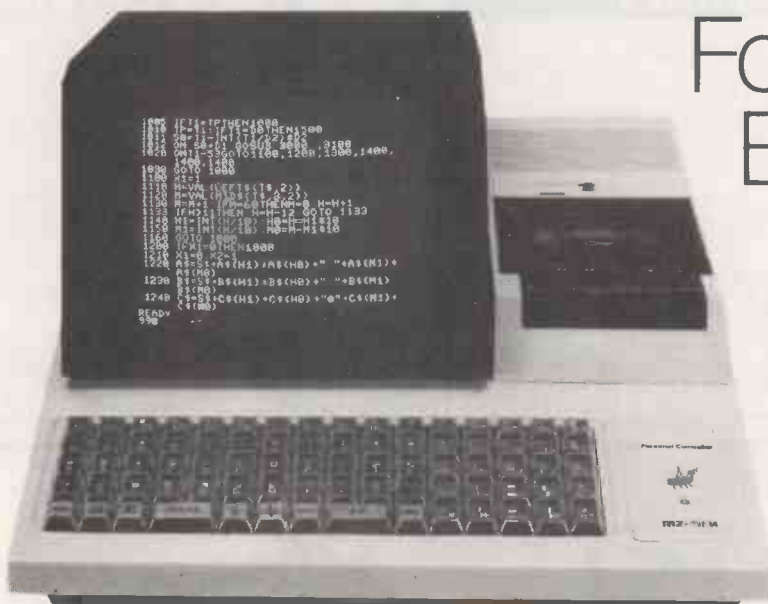
PRICES (INCLUDING MANUAL)	
MINI RECORDER MECHANISM	£95.00
INTERFACING BOARD (TYPE A)	£42.50
MEMORY BOARD (WITH ROMS FOR 6502)	£55.00
CASSETTES (BOX OF 6)	£15.90
MANUALS (SEPARATE)	£10.00
CARRIAGE	£2.25
PRICES EXCLUSIVE OF VAT	15%

CURRAH COMPUTER COMPONENTS

UNIT 7, HARTLEPOOL WORKSHOPS
SANDGATE INDUS EST, HARTLEPOOL
CLEVELAND (0429) 72996

• Circle No. 288

SHARP MZ-80K SOFTWARE



For Games
Business
Education

Send now for our
FREE CATALOGUE

MAP.21 LTD

9 Herbert Road, London N11
Tel: 01-889 7615 (24 hours)

TRADE ENQUIRIES WELCOME

• Circle No. 289

Get the latest on PET...



Dial 01-579 5845.

Adda make it their business to get in first on all that's best and new in PET hardware and software...and in finding out how to make the latest advances work more profitably for you.

All the advice, assistance and arrangement of demonstrations you could ask for are there for the taking. And that's just for starters. Long term Adda look after your future requirements with software, full engineering support and maintenance contracts that can include machine loan.

In addition to the 16k PET 3016 and 32k PET 3032, Adda offer you the new 32k PET 8032—with 80 columns, 12-inch screen and a keyboard that really gets down to business. Recent advances make possible some exciting applications for these mighty micros.

Link the 32k PET up to the **Wordcraft** word processing program and you have a very sophisticated word processing system for less than £4000. It's a word processor and more—because it can also be used as a small business machine.

The **Wordcraft** program comes on a mini floppy disc ready for use on a Commodore 3040 diskette drive. The whole system gives you word processing to standards achieved by expensive

purpose-built machines; and you can use a large selection of output printers including dot matrix, golfball and daisy wheel. So much for words—now for some action: phone 01-579 5845.

If you're looking for mainframe access, the Communicator 1 mainframe-PET link enables file transfer to be made in both directions... with a PET Communicator system configured with either dual floppy disc or cassette tape drive and a printer.

Files transferred from mainframe to PET can be manipulated locally and data transfer monitored on the PET screen. It's a fast way of cutting costs on bureau time share—and it also doubles up as a fast normal terminal. The Communicator 1 mainframe-PET link paves the way to big cost savings. Your first step is digital input to 01-579 5845.

More cost savings can be realised when you link up three to eight PETs to one Commodore disc drive and a printer using **Mu-pet** (Multi-User PET)—and you don't have to make any program changes. As a **Mu-pet** dealer, Adda can put you fully in the picture. Just phone 01-579 5845 for a demonstration of **Mu-pet** being put through its paces.



adda

we add up to a great deal.

Adda Computers
14 Broadway
West Ealing
London W13 0SR
Entrance in
Kirchen Road

• Circle No. 290

BYTE SHOP

COMPUTERLAND

your specialist Computerstore.

Well-proven systems for the serious user. Our computer stores are staffed by business experts, backed by first class maintenance support. Call in for advice and a demonstration of our range of systems.

Cromemco System Three

The Cromemco buyer is choosing well-proven design, reliability and expandability. Start with a single terminal and grow into a multi-user system as your requirements expand. Excellent Cromemco software includes COBOL, FORTRAN and RPG-II. Ask for a demonstration of the Cromemco hard-disk and talk over with us how your application can be programmed.



North Star Horizon

The reliable and long-established commercial favourite. Ask about our BYTE SHOP-developed packages – Invoicing, Sales and Purchase Ledger, Incomplete Records, Cash-Flow Analysis, Stock Control, etc. And use your Horizon to type perfect letters – it is an excellent word-processor.

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

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

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

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

BYTE SHOP

COMPUTERLAND

– your specialist Computerstore.

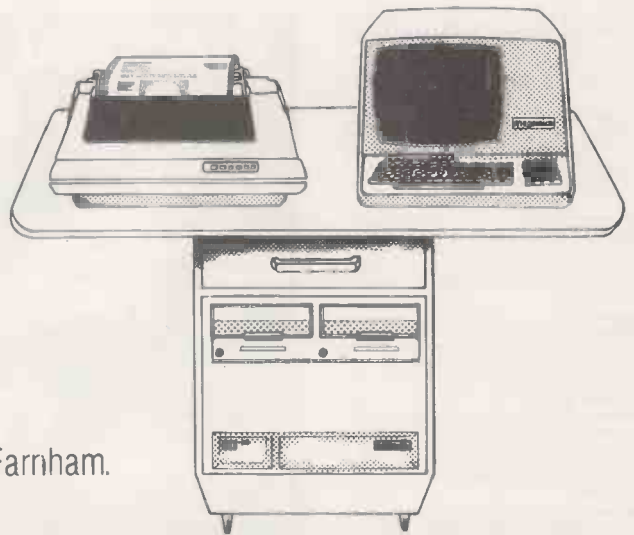
London
48 Tottenham Court Road
London W185 4TD
Tel. 01-636 0647

• Circle No. 291

Successful business?... Yes, with the Megamicro

**average installed system
less than £8000 plus VAT**

complete with
Hardware including printer
Software including programs
Staff training
Installation & delivery
Support by manufacturer



British built by:
 Bytronix Microcomputers Ltd, 83, West Street, Farnham.
 Telephone: (0252) 726814

• Circle No. 292

OUTSTANDING HARDWARE AND SOFTWARE

FROM **Computerpower**

Fast, powerful 16-bit S-100 systems

M9900 CPU (includes complete disc operating & file system, & word processing software)	£400
64K RAM, fast 16-bit memory	£600
PROM/RAM monitor & r.t. clock	£200
QUAD I/O 4 RS232 ports	£200
FDCII 2S/2D disc controller	£225
. Complete system as above, plus Paper Tiger printer, TVI920C vdu, 2MB 8" floppy disks, multi-user operating system, word processor & database management system	£4980
Hard disk system, as above plus 31MB Winchester disk, 15" vdu, NEC Spinwriter	£9980

High-quality software for CP/M & M9900

DATEBOOK office appointments program for professional offices	£145(20)
PROFESSIONAL TIME ACCOUNTING	£300(25)
APPLICATIONS DEVELOPMENT UTILITIES shortcut to reliable CBASIC programs with screen & print formatter, file creation, indexing, etc	£275(25)
PL/1 powerful mainframe language, now for 8080s and Z80s	£275(30)
MICRO B + ultra-fast keyed file access, searches 10,000 key values in under one second	£120

VAT MUST BE ADDED TO ALL PRICES EXCEPT FOR SOFTWARE MANUALS (IN BRACKETS).

Ring or write for more details, or a complete list of hardware and software

Computerpower 47 Red Lion Street, London, WC1R 4PF Tel: 01-405 7780

• Circle No. 293

PROFESSIONAL SUPERBRAIN SOFTWARE

COMPILERS & UTILITIES

Microfocus CIS COBOL:

— Standard Compiler	£425
— Forms-2 utility	£100
CIS COBOL Report Generator	£250

N.B. We are the approved UK distributors of Microfocus products on the SUPERBRAIN.

Microsoft:

— MBASIC interpreter	£170
— BASIC 80 compiler	£210
— COBOL 80 compiler	£390
— FORTRAN 80 compiler	£270

Micropro:

— WORDSTAR (word-processing)	£250
— Mailing list merge for above	£75
— DATASTAR (data management)	£175

CONSULTANCY/PROJECT WORK

We provide the full range of consultancy and project work services from initial systems analysis through programming to final implementation. Ask us for a quotation.

APPLICATIONS SOFTWARE

The Micro Solution Ltd (CIS COBOL):

— Bill of Materials	£450
— Stock Control	£450
— Report Generator	£250

Bell Business Systems (BASIC):

— Complete Integrated Accounting System (inc. 1 days onsite installation and training)	£1000
--	-------

PR Daly (BASIC):

— Stock Control	£350
— Sales Ledger	£350
— Purchase Ledger	£350
— Nominal Ledger	£500
— Payroll	£350
— Time Recording	£500
— Invoicing	£200

ROGIS Systems:

— Stock Control	£475
— Estate Agents System	£475

**2% DISCOUNT FOR CASH WITH ORDER
WE PROVIDE 24 HR TURNROUND ON MOST PRODUCTS PLUS TELEPHONE SUPPORT
ADD VAT AT STANDARD RATE TO ALL PRICES**

Contact:



Park Farm House
Heythrop
Chipping Norton
OXFORDSHIRE
OX7 5TW

telephone:
CHIPPING NORTON (0608) 3256
ask for: Bill Whaley
or
Bede Dunlop

• Circle No. 294

Base 2 MODEL 800MST



80 col. High Performance Impact Printer - Suitable for most Micro's

Features include:
* RS232, 20mA, IEEE 488 & Centronics I/O *15 Baud rates to 9600 * 100 chs per sec - bidirectional
800MST £359 +VAT 850MST £399 +VAT

Compukit UK101 DISC DRIVES

with up to 32k RAM exp free games disc



* 9 Digit extended Basic
* Plugs straight into 8k Compukit requires no hardware mods. (5v.5A required for 610)
610 Expansion (8k) ONLY £159 + VAT
Disc Drive with DOS ONLY £285 + VAT

Oki Microline 80



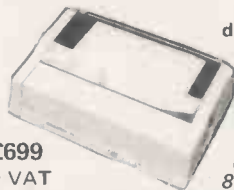
Small, light, quiet matrix printer.

40, 80 or 132 cols.
6 or 8 lines per inch.

96 ASC II + 64 graphics character set with Centronics compatible interface

ONLY £369 + VAT
RS232 option available

Anacom 150



150 CPS, 15" carriage dot matrix printer

£699 + VAT

*150 chs per sec *9 x 9 dot matrix
*10 chs per inch horizontal *6 or 8 chs vertical *136 columns, 13.6" line length *94 ASCII chs
*Upper and lower case with decs. *Logic seeking *Centronics and/or RS232

NEW Pet

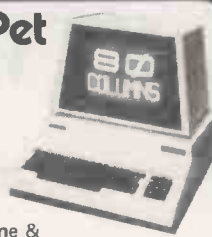
80 COLUMN 32k

ONLY £825 + VAT

Standard Large Keyboard

16k - £499 + VAT

32k - £599 + VAT



Very popular for home & business, using 8k Microsoft Basic in ROM. Both models are with new improved keyboard and all with green screen. Extra Cassette Deck £55 +VAT

NEC Spinwriter



- for the professional word processing system

£1390 + VAT

Model 5510 - RS232, Model 5530 Centronics 8bit per. 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 that can cope with plotting and printing (128 ASCII chs.) with up to 5 copies, friction or tractor fed. 55Chrs/sec.

Mighty Micro

for a Mighty Good Deal!

Please add 15% VAT. Carriage extra, will advise at time of order. Official orders welcome.

61 NEW MARKET SQ., BASINGSTOKE, HANTS. RG21 1HWJ Tel: 0256 56468 & 56417
also in association with O.S.I. COMPUTERS, ESHER, SURREY. Telephone: 0372 62071

Buy in confidence. If on receipt of your order the goods do not meet with your satisfaction return within 7 days for full refund. Credit facilities available.

DISCOUNTS: Attractive quantity discounts for OEM, Education and Dealers.



• Circle No. 295

The Rohan Computing Collection.....

Rohan computing, in addition to their normal software and systems consultancy services, now offer the following range of computer equipment for sale. As far as possible Rohan computing try to hold these items in stock ready for immediate delivery. Nationwide on site maintenance for all Rohan computing equipment.

Qume The Qume is ideal as a general purpose printer or for adding word processing facilities to an existing micro-computer. Print only and keyboard versions available. The keyboard version can double as a spare typewriter. RS232 interface adaptable for the PET, APPLE, etc. XON/XOFF protocol available. Word processing package/driver available for CP/M based systems. Other versions in preparation.



digital Digital Decwriter IV. The best desk top matrix printing terminal available. Typewriter styling. 10, 12, 13.2, 16.5 characters per inch. All sizes very legible. 2, 3, 4, 6, 8, 12 lines per inch. Optional tractor feed and numeric keypad. RS 232 interface.



PET Commodore PET microcomputers. The PET is the ideal low cost computer for teaching yourself programming, educational use and time consuming calculations in science, industry and commerce. Graphic display excellent for histograms etc.
*8k PET with integral cassette and minikeyboard
*16 & 32k PET's with full sized professional keyboards.
*2022 matrix printers
*2040 floppy disc units.



CIFER Cifer 2600 Series VDU's. Superbly engineered and made in Britain. *12 inch screen. *7 x 11 character matrix *9 x 12 matrix for graphic characters *62 or 100 key detachable keyboards *Printer port *VT52 emulation *Line drawing set



RAIR Blackbox, Teletype 43s, Tally high speed matrix printers also available.

Rohan

Phone Richard on SOUTHAM (092681) 3541 for prices and delivery.

Rohan Computing, B.A.S.S. (Engineers) Sales Limited, Kineton Road, Southam, Warwickshire CV33 0DQ

• Circle No. 296

TLLS by TEXAS		74173 120p	74LS161 75p	4002 20p	4560 200p	PERIPHERALS	4044.4 600p	DS8836 150p	8MHz UHF Mod. 450p
7400 11p	74174 90p	74LS162 140p	4006 95p	4569 250p	3242 800p	4116-2 300p	DS8838 225p	16 Key Pad 450p	
74500 60p	74175 85p	74LS163 100p	4007 20p	4572 40p	3245 450p	4118-4 1200p	MC1488 75p	5100 Busboard 1500p	
7401 12p	74176 90p	74LS164 90p	4008 80p	4583 110p	6522 700p	5101 400p	MC1489 75p	DIN41612 Plug 450p	
7402 12p	74177 90p	74LS165 140p	4009 40p	4584 90p	6532 800p	6810 300p	MM58174 1200p	DIN41612 Socket 450p	
7403 14p	74178 160p	74LS166 180p	4010 50p	4585 150p	6820 375p	4016-4 P.O.A. 160p	75107 160p	43 way Edge Con 250p	
7404 14p	74180 93p	74LS173 110p	4011 20p	4724 250p	6821 340p	(2K x 8 Static) 75p	75110 250p	31 way Plug 0.1" 120p	
7405 18p	74181 160p	74LS174 100p	4012 25p	40097 90p	6850 300p	4532-2 P.O.A. 40p	75154 175p	31 way SK1 0.1" 120p	
7406 36p	74182 90p	74LS175 100p	4013 50p	14411 1100p	6852 370p	(4K x 8 Dynamic) 75p	75182 230p	Logic Probe LP1 120p	
7407 36p	74184A 150p	74LS181 320p	4014 84p	14412 1100p	8155 1100p		75324 375p	Logic Probe LP2 18p	
7408 17p	74185 150p	74LS190 100p	4015 84p	14433 1100p	8205 320p		75361 300p	Logic Probe LP3 18p	
7409 19p	74186 500p	74LS191 100p	4016 45p	14500700p 45p	8212 225p		75363 400p	Vero DIP Board 325p	
7410 15p	741880 325p	74LS192 100p	4017 70p	14599 290p	8216 225p	ROMS	75365 200p	Vero DIP Board (with 31 way Edge) 390p	
7411 24p	74190 120p	74LS193 100p	4018 89p		8226 400p	74S188 275p	75451/2 72p	Wine Wrapping accessories and tools stocked.	
7412 20p	74191 120p	74LS194 100p	4019 45p	CPUs	8228 525p	74S189 275p	75491/2 70p		
7413 30p	74192 100p	74LS195 140p	4020 100p	1600 1200p	8251 475p	74S201 350p	8726 160p		
7414 40p	74193 100p	74LS196 120p	4021 110p	1802C 700p	8253 1000p	74S287 350p	8728 250p		
74C14 90p	74194 120p	74LS197 90p	4022 100p	2650A 1600p	8255 450p	74S470 650p	8795 200p		
7416 27p	74195 95p	74LS221 120p	4023 27p	6502 750p	825 900p	74S471 650p	8797 160p		
7417 17p	74196 95p	74LS240 175p	4024 50p	6502A 950p	8259 950p	74S472 900p	8799 200p		
7420 17p	74197 80p	74LS241 175p	4025 20p	6802 650p	8279 P.O.A. 700p	74S477 900p	8799 200p		
7421 40p	74198 150p	74LS242 170p	4026 130p	6809 2500p	MC14411 1100p	74S571 900p	8799 200p		
7422 22p	74199 150p	74LS243 170p	4027 50p	INS8060 1000p	MC14412 1100p	74S573 900p	8799 200p		
7423 34p	74221 160p	74LS244 150p	4028 84p	8080A 450p	Z80-CTC 600p	(Many more stocked)	8799 200p		
7425 30p	74251 140p	74LS245 150p	4029 100p	8085A 1100p	Z80A-CTC 700p	EPROMS	8799 200p		
7426 40p	74259 250p	74LS247 140p	4030 55p	9800 3600p	Z80A-P10 700p	1702A 700p	8799 200p		
7427 34p	74278 290p	74LS251 140p	4031 200p	Z80 750p	Z80-S10-1 2400p	2708 400p	8799 200p		
7428 36p	74279 110p	74LS253 90p	4032 110p			2716(+5v) 700p	8799 200p		
7430 17p	74283 140p	74LS257 90p	4033 110p	CHARACTER GENERATORS		2732 2500p	8799 200p		
7432 30p	74284 340p	74LS258 160p	4034 200p	3257A 1000p	FERRANTI		8799 200p		
7433 40p	74285 340p	74LS259 160p	4035 110p	RO3-2S13 U.C. 650p	ZN425E-8 400p	INTERFACE ICs	8799 200p		
7437 35p	74290 150p	74LS266 100p	4036 295p	RO3-2S13 L.C. 700p	ZN427E-8 750p	AD536A 1300p	8799 200p		
7438 35p	74293 150p	74LS273 170p	4037 100p	74S262 1000p		AD561J 1400p	8799 200p		
7440 17p	74298 200p	74LS279 90p	4040 100p		MEMORIES	AD7524 600p	8799 200p		
7441 70p	74365 100p	74LS283 90p	4041 80p	CRT CONTROLLER	RAMS	DAC1408-8 200p	8799 200p		
7442A 60p	74366 100p	74LS289 160p	4042 80p	MC6845 2000p	2101-4L 400p	DM8123 175p	8799 200p		
7443 112p	74367 100p	74LS298 160p	4043 90p	MC6847 1500p	2102-2L 120p	DM18131 375p	8799 200p		
7444 112p	74368 100p	74LS323 400p	4044 90p	SAAS020 POA 120p	2111-4L 300p	DP8304 450p	8799 200p		
7445 100p	74369 200p	74LS324 200p	4046 110p	SAAS050 POA 100p	2112A 300p	DS8835 250p	8799 200p		
7446A 93p	74390 200p	74LS348 200p	4047 100p	SFF96364 1100p	2114-2L 400p		8799 200p		
7447A 75p	74393 200p	74LS365 48p	4048 55p	TMS9918 6000p	2114-3L 350p	VOLTAGE REGULATORS	8799 200p		
7448 80p	74490 225p	74LS368 100p	4049 45p		2114-4L 250p	Fixed Plastic TO-220	8799 200p		
7450 17p		74LS373 150p	4050 45p		4027-3 350p	1A +ve	8799 200p		
7451 17p	74LS SERIES	74LS375 120p	4051 80p			5v 7805 60p	7905 65p		
7453 17p	74LS00 14p	74LS377 160p	4052 80p			6v 7806 70p	7906 80p		
7454 17p	74LS02 16p	74LS378 140p	4053 80p			8v 7808 70p	7908 80p		
7460 17p	74LS03 18p	74LS390 120p	4054 140p			12v 7812 60p	7912 65p		
7470 36p	74LS04 16p	74LS393 120p	4055 125p			15v 7815 60p	7915 70p		
7472 30p	74LS05 25p	74LS399 200p	4056 135p			18v 7818 70p	7918 80p		
7473 34p	74LS08 22p	74LS445 140p	4059 600p			24v 7824 70p	7924 80p		
7474 30p	74LS09 21p	74LS640 450p	4060 115p			100mA+ve TO-92			
7475 38p	74LS10 20p	74LS641 450p	4061 120p			5v 78L05 30p	79L05 70p		
7476 32p	74LS12 30p	74LS642 450p	4062 450p			12v 78L12 30p	79L12 70p		
7480 50p	74LS11 40p	74LS643 450p	4068 27p			15v78L15 30p			
7481 100p	74LS13 40p	74LS644 450p	4069 20p						
7482 84p	74LS14 50p	74LS668 100p	4070 30p			OTHER REGULATORS			
7483a 90p	74LS20 20p	74LS670 250p	4071 25p			LM309K 140p			
7484 100p	74LS22 20p		4072 25p			LM317T 200p	78MG2C 140p		
7485 110p	74LS26 30p	74S SERIES	4073 25p			LM323K 500p	79GUIC 225p		
7486 34p	74LS27 38p	74S00 60p	4075 25p			LM723 37p	79HGKC 650p		
7489 210p	74LS30 20p	74S04 60p	4076 107p			78GUIC 200p	78POS 900p		
7490A 20p	74LS32 27p	74S05 75p	4077 27p			78HOS 550p	RC4195NB 150p		
7491 80p	74LS33 27p	75S08 75p	4081 27p			78HGKC 600p	TL497 300p		
7492A 46p	74LS37 30p	74S10 60p	4082 72p						
7493A 36p	74LS38 38p	74S20 60p	4086 72p						
7494 84p	74LS40 25p	74S30 60p	4087 150p						
7495A 70p	74LS42 70p	74S32 90p	4089 70p						
7496 65p	74LS47 75p	74S37 90p	4093 150p						
7497 180p	74LS51 24p	74S44 60p	4094 250p						
74100 130p	74LS55 30p	74S74 90p	4095 95p						
74107 34p	74LS73 50p	74S85 300p	4096 95p						
74109 55p	74LS74 27p	74S86 180p	4097 340p						
74116 200p	74LS75 36p	74S112 120p	4098 120p						
74118 130p	74LS76 45p	74S114 120p	4099 200p						
74119 210p	74LS83 70p	74S124 300p	4100 220p						
74120 110p	74LS85 80p	74S132 160p	4101 132p						
74121 34p	74LS86 40p	74S133 75p	4102 180p						
74122 48p	74LS90 40p	74S138 225p	4103 180p						
74123 60p	74LS92 70p	74S139 225p	4104 99p						
74125 75p	74LS93 60p	74S157 250p	4105 100p						
74126 60p	74LS96 110p	74S174 250p	4106 90p						
74128 75p	74LS107 45p	74S175 320p	4107 60p						
74132 75p	74LS109 80p	74S194 350p	4108 400p						
74136 75p	74LS112 40p	74S241 450p	4109 170p						
74137 50p	74LS113 90p	74S260 70p	4110 300p						
74141 200p	74LS114 45p	74S373 500p	4111 250p						
74145 90p	74LS122 80p	74S374 500p	4112 120p						
74147 190p	74LS123 60p		4113 70p						
74148 150p	74LS124 180p	93 SERIES	4114 120p						
74150 130p	74LS125 50p	9301 160p	4115 250p						
74151A 70p	74LS126 50p	9302 175p	4116 120p						
74153 70p	74LS132 60p	9308 316p	4117 70p						
74154 120p	74LS133 30p	9310 275p	4118 120p						
74155 90p	74LS136 55p	9311 275p	4119 100p						
74156 90p	74LS138 65p	9312 160p	4120 100p						
74157 70p	74LS139 75p	9314 165p	4121 250p						
74159 190p	74LS145 120p	9316 225p	4122 108p						
74160 100p	74LS147 220p	9321 225p	4123 150p						
74161 100p	74LS148 175p	9322 150p	4124 100p						
74162 100p	74LS151 80p	9334 360p	4125 100p						
74163 100p	74LS153 60p	9368 250p	4126 100p						
74164 120p	74LS154 200p	9370 300p	4127 100p						
74165 130p	74LS155 60p	9374 200p	4128 100p						
74166 120p	74LS156 90p		4129 100p						
74167 200p	74LS157 60p	4000 SERIES	4130 180p						
74170 240p	74LS158 60p	4000 15p	4131 320p						
172 450p	74LS160 90p	4001 22p	4132 72p						

We carry large stocks of Memories, TTLs, CMOS, LINEARS, TRANSISTORS and OTHER SEMI-CONDUCTORS and welcome inquiries for volume quantities.

VAT: Please add 15% to total under value
P&P: Please add 30p
ACCESS & BARCLAY accepted.

Enter the Computer Age video genie system

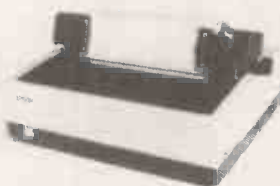
12K MICROSOFT BASIC
16K RAM, TV MODULATOR
INTERNAL CASSETTE



£330
+ VAT

£395
+ VAT

80 Columns
70 Lines per minute
Graphics Characters
Interfaces to most
machines Tractor or
friction feed



100's of programs available
TRS-80 level II software
compatible

Mighty Micro Ltd
Neptune House
Sandygate
Burnley
Lancs
Tel: 0282 32209/53629

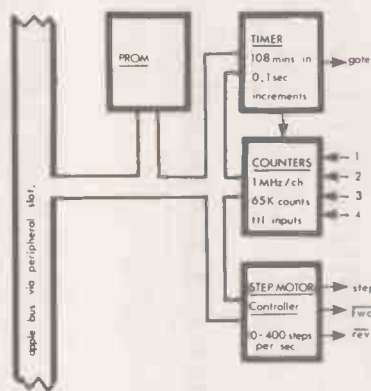
• Circle No. 298

TAKE CONTROL

JSS

APPLE II

INTERFACE



**Quad
Datalogger
with
Step Motor
Controller.**

COMING SOON:
10bit ADC with STEP
MOTOR CONTROLLER:
0734 599615

APPLE

Z80

LSI 11

Cost Effective Control from

J S SYSTEMS Ltd

18 PORTMAN Rd READING 599615

• Circle No. 299

MicroStyle

9 St. Peters Terrace,
Lower Bristol Rd.
Bath, BA2 3BT.
Telephone: (0225) 334659
Telex: 44371 (KEMP-G)
After hours: Tel: (0761) 33283

sells Pet for home, educational and
small business applications
Software Packages

Specialists in the supply of:
★ PETS and Peripherals
★ Computhink
★ Epson
★ TCM

THE "PET"

NEW REDUCED
PRICES

8K £415
16K £525 +
32K £650 VAT EXT CASSETTE £49.50



Dual Disc Units

Computhink (dual drive)
400K
£796

Computhink (dual drive)
800K
£926



**TCM 100 & 200
Thermal Printer
with
graphics**

Interfaces —
Pet £46.00
TRS-80 £56.00
Apple £46.00
Apple G £56.00

TCM 100 (40 col.) £240 TCM 200 (80 col.) £295

Special
Offers!

PET BUSINESS SYSTEM
comprising
CBM 32K Micro
computer, COMPUTHINK Disk Drive,
Tractor Feed Printer and all cables
£1750

PET SOFTWARE

**WE WOULD
BE PLEASED
TO MEET
YOU AT
BATHS OWN
MICRO
SHOW DEC.
19th**

OHIO SCIENTIFIC



**Ohio CI-P
4K RAM**

£220

Extra 4K RAM £30



**POUND
SIGN &
NEW
GRAFTRAX
OPTIONS
NOW
AVAILABLE**

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 * Made by Shinshu Seiki an affiliate of Seiko Watch Co of Japan. Interface: Centronics Parallel.
Options: PET, APPLE Serial. SUPERBRAIN TRS 80

EPSON TX80B £359 inc. INTERFACE AND CABLE

Please add £10
Securicor delivery
on computers etc
plus 15% VAT
on all prices

One year guarantee on all machines

DEALER ENQUIRIES WELCOME.

FURTHER DISCOUNTS
MAY APPLY

WHY NOT FIND OUT MORE?

TEL: BATH (0225) 334659
AFTER HOURS (0761) 33283

• Circle No. 300

A GREAT DEAL FROM 6 NASCOM DEALERS

and guaranteed after-sales service

BUILT FLOPPY DISC SYSTEM FOR NASCOM 1/2 FROM £395+VAT

CP/M SYSTEM.

The disc unit comes fully assembled complete with one or two 5 $\frac{1}{4}$ " drives (FD250 double sided, single density) giving 160K per drive, controller card, power supply, interconnects from Nascom 1 or 2 to the FDC card and a second interconnect from the FDC card to two

drives, CP/M 1.4 on diskette plus manual, a BIOS EPROM and new N2MD PROM. All in a stylish enclosure.

Nascom 2 Single drive system . £450 + Vat
 Nascom 2 Double drive system £640 + Vat
 Nascom 1 Single drive system . £460 + Vat
 Nascom 1 Double drive system £650 + Vat
 Additional FD250 drives £205 + Vat



D-DOS SYSTEM

The disc unit is also available without CP/M to enable existing Nas-Sys software to be used. Simple read, write routines are supplied in EPROM. The unit plugs straight into the Nascom PIO.

Single drive system £395 + VAT
 (please state which Nascom the unit is for)

Certain parts of the CP/M and D-DOS disc systems are available in kit form. Details available on request.

ENCLOSURE FOR N2 + 5

The Kenilworth case is a professional case designed specifically for the Nascom 2 and up to five additional 8" x 8" cards. It has hardwood side panels and a plastic coated steel base and cover. A fully cut back panel will accept a fan, UHF and video connectors and up to 8 D-type connectors. The basic case accepts the N2 board, PSU and keyboard. Optional support kits are available for 2 and 5 card expansion.

Kenilworth case £49.50 + Vat
 2-card support kit £7.50 + Vat • 5-card support kit £19.50 + Vat



INTERFACE ENHANCING UNIT

The Castle Interface is a built and tested add-on unit which lifts the Nascom 2 into the class of the fully professional computer. It mutes spurious output from cassette recorder switching, adds motor control facilities, automatically switches output between cassette and printer, simplifies 2400 baud cassette operating, and provides true RS232 handshake.

Castle Interface Unit .. £17.50 + Vat

EPROM EXPANSION

The Nasbus compatible EPROM board accepts up to 32,2716 or 16,2708 EPROMs. It has a separate socket for the MK36271 8K BASIC ROM for the benefit of Nascom-1 users. And for Nascom-2 users, a wait state for slower EPROMs. The board also supports the Nascom Page Mode Scheme.

EPROM Board (kit) £55 + Vat
 EPROM Board (built & tested) £70 + Vat

A-D CONVERTER

For really interesting and useful interactions with the 'outside world' the Milham analogue to digital converter is a must. This 8-bit converter is multiplexed between four channels - all software selectable. Sampling rate is 4KHz. Sensitivity is adjustable.

Typical applications include temperature measurement, voice analysis, joystick tracking and voltage measurement. It is supplied built and tested with extensive software and easy connection to the Nascom PIO.

Milham A-D Converter (built and tested) .. £49.50 + Vat

PROGRAMMER'S AID.

For Nascom ROM BASIC running under Nas-Sys. Supplied in 2x2708 EPROMs. Features include: auto line numbering; intelligent renumbering; program appending; line deletion; hexadecimal conversion; recompression of reserved words; auto repeat; and printer handshake routines. Price £28 + Vat.

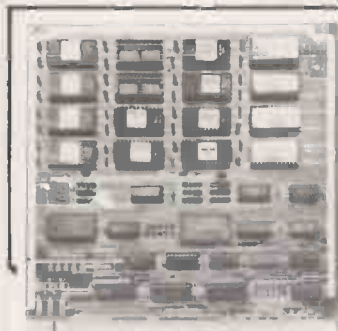
DUAL MONITOR BOARD. A piggy-back board that allows N1 users to switch rapidly between two separate operating systems. Price (kit): £6.50 + Vat.

BASIC PROGRAMMER'S AID.

Supplied on tape for N1/2 running Nas-Sys and Nascom ROM BASIC. Features include auto line number, full cross-reference listing, delete lines, find, compacting command, plus a comprehensive line re-numbering facility. Price: £13 + Vat.

PROM-PROG MKII.

2708 (multi-rail) and 2716 (single-rail) EPROM programmer kit controlled by N1/2 PIO. Supplied with comprehensive software for use with Nas-Sys. Price: £25.95 + Vat.



NASCOM-2 Microcomputer Kit £225 + Vat
 NASCOM-1 Microcomputer Kit £125 + Vat
 Built & tested £140 + Vat
 IMP Printer. Built & tested £325 + Vat

All prices are correct at time of going to press.

All the products are available while stocks last from the Nascom dealers below. (Mail order enquirers should telephone for delivery dates and post and packing costs.) Access & Barclaycard welcome.

BITS & PC'S
 4 Westgate, Wetherby, W. Yorks.
 Tel: (0937) 63774.

BUSINESS & LEISURE MICROCOMPUTERS
 16 The Square, Kenilworth, Warks.
 Tel: (0926) 512127.

ELECTROVALUE LTD.
 680 Burnage Lane, Burnage,
 Manchester M19 1NA.
 Tel: (061) 432 4945.

28 St Judes, Englefield Green,
 Egham, Surrey TW20 0HB.
 Tel: (0784) 33603. Tlx: 264475.

TARGET ELECTRONICS
 16 Cherry Lane, Bristol BS1 3NG.
 Tel: (0272) 421196

INTERFACE COMPONENTS LTD.
 Oakfield Corner, Sycamore Road,
 Amersham, Bucks.
 Tel: (02403) 22307. Tlx: 837788.

HENRY'S RADIO
 404 Edgware Road, London W2.
 Tel: (01) 402 6822.
 Tlx: 262284 (quote ref: 1400)



• Circle No. 301

NEWDOS80 – APPARAT'S DOS FOR THE 80's

- * Up to 4095 bytes per record on disc files
- * Variable – length records
- * 5 or 8 inch disc drives of 35, 40, 80 tracks may be mixed
- * DOS and BASIC command changing
- * Print Spooler provided for concurrent printing and other processing
- * NEWDOS and TRSDOS compatible
- * PLUS MUCH MORE !!!

£65 including detailed manual

BUSINESS SOFTWARE

Contact us to discuss your application

UDMS INFORMATION MANAGEMENT FOR THE NON-PROGRAMMER

- * Powerful, easy-to-use facilities for data storage, update, and reporting
- * Ideal for business applications
- * Extremely flexible
- * Save £££'s on software costs!
- * Versions for TRS80 I and II
- * Comprehensive users manual

Basic Version £75 Full Version £150 Manual

MICROLINE-80 PRINTER only £6.00

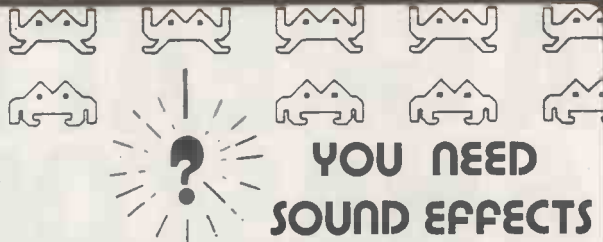
Phone for lowest price

Prices exclude V.A.T. and Postage.

CLEARTONE COMPUTER CONSULTANTS LTD.
PRINCE OF WALES INDUSTRIAL ESTATE
ABERCARN, GWENT NP1 5RJ Tel: (0495) 244555

CLEARTONE

• Circle No. 302



FOR PET, SUPERBOARD, UK101, NASCOM.

EXAMPLES:— Lasers, explosions, whistling bombs, musical instruments, drums, cymbals, telephone tones

almost any conceivable sound!!!!

This polyphonic synthesizer unit brings a new dimension to games and other programs.

Stereo output, doppler sweep & amplitude control give a truly dynamic depth to the sound.

By careful design of hardware the processor time used is minimal. Simply run by BASIC or Machine code.

Also includes two 8 bit I/O ports that can be used for control and/or monitoring of various devices –

switches, lamps, cassette motor etc. Will scan 64 key keyboard with no additional hardware.

Complete built & tested unit with onboard amplifier and speaker (included) + separate DIN output for stereo

amplifier, demo program & full instructions.

Nascom version suits 77way Nasbus, CompuKit & Superboard versions on 40 pin D.I.P. connector. Pet version

with 24 pin DIP or 40 pin edge connector.

Before you buy any other Sound Generator consider these points:—

No need for expensive extra I/O port to drive the unit.

Full use of keyboard during programs.

No loss of system memory or problems with other expansions.

Channel, volume and noise independently programmable.

N.B. 8T28 buffers next 6502 if required @ £3.00 per pair.

£43 + VAT EX STOCK

SOON

EPROM Programmer for Superboard/UK101

AVAILABLE!!
PHONE, WRITE FOR DETAILS.

Peripheral board 16+ I/O lines for relay driving etc., etc.

SUPERBOARD II 50Hz → £159 + VAT

610 expansion £159 + VAT

CD3P FLOPPY DISC £285 + VAT

BASE 2 800MST PRINTER £359 + VAT

Microcases £26, 2114L-300nS RAM 8 for £22, 5V 3A power supply for Superboard £15.

Vision Modulator, high quality, £4.50. Sound Modulator to match £3.75.

40 pin ribbon cable, 40 pin DIP, 40 pin PCB suit Breadboard £4.50.

Prototype Breadboard for Superboard/UK101 comprehensive, labelled bus £5.50.

Bus extender to take 610 & peripherals £4.95. Header plugs, 40 pin £2.50, 40 pin sockets £0.40, 8T28 buffers

£1.50 ea. AY 3 8510 sound chip £8.25 Joystick mechanisms £9.95. Blank DATA cassettes £5.25 for 10

Blank discs 5" 1/4" £3.25

Please add VAT to the above prices. Orders under £10 add 5% p.p.

Trade enquiries welcome

57 PARANA COURT
SPROWSTON
NORWICH
NR7 8BH
0603 416352

Easicomp

• Circle No. 303

MICRO-80

THE MAGAZINE FOR TRS-80 OWNERS

PUBLISHED MONTHLY AND NOW AVAILABLE IN THE UK

SEND FOR YOUR SAMPLE COPY NOW

REGULAR FEATURES
INCLUDE

- * SOFTWARE LISTINGS
- * PROGRAMMING ARTICLES
- * HARDWARE MODS
- * PROBLEM SOLVING

TO:— MICRO-80 (UK SUBSCRIPTION DEPT.)
24 WOODHILL PARK
PEMBURY
TUNBRIDGE WELLS, KENT TN2 4NW

PLEASE SEND MY SAMPLE COPY OF MICRO-80.
I ENCLOSE CHEQUE/P.O. VALUE £1.50 (SINGLE
COPY RATE)

NAME

ADDRESS

PC12

• Circle No. 304

COMPUTECH for apple

COMPUTECH for

Well proven software for business applications on the
ITT 2020 and Apple microcomputers.

Prices excluding V.A.T. for cash with order, F.O.B. London NW3

PAYROLL	(300+ Employees, 100 Departments, hourly, weekly, monthly. Very powerful but easy to use).	£375
SALES LEDGER	(500+ Accounts, 100 Departments).	£295
PURCHASES LEDGER	(500+ Accounts, 100 Departments).	£295
GENERAL (OR NOMINAL) LEDGER	(1000 Accounts, 100 Analyses, multi-purpose package). Job costing etc.	£295
UTILITIES DISK 1	(Diskette patch, slot to slot copy, zap etc).	£20
APPLEWRITER	(Word Processing, see below for U/L case).	£42
VISICALC	(Financial Modelling, Costing, Analysis).	£95
CAI	(Converts Apple pictures for ITT display).	£10

Over 500 packages in use, fully supported by us.

AND NOW HARDWARE!

LOWER & UPPER CASE CHARACTER GENERATOR £50
Replaces character generator to display upper and lower case characters on screen, includes patches to work with Applewriter, supplies the missing link! Specify Apple or ITT.

COMPUTECH DIPLOMAT H/S SERIAL INTERFACE £80
This card has been designed and built to the same professional standards that have resulted in the success of our software. The DIPLOMAT observes the proper "handshaking" protocol so that you can drive fast printers and send and receive data from other peripherals at high speeds without loss of data. Switch (& software) selectable baud rates to 19200 and many other options. Plug compatible with 'terminal' or 'modem' wired peripherals. Guaranteed.

MICROLINE M80 PRINTER £425
This neat, reliable machine prints at 10 characters per inch, 80 characters on an 8 inch line, or 40 expanded characters, or 132 very readable characters, upper and lower case and graphics, 9 x 7 dot matrix, 6 or 8 lines per inch. Parallel interface is standard, serial optional. Both friction and sprocket feed are standard, tractor optional. We can also supply the parallel interface card for Apple System computers for £80 and a driver to enable both text and graphics to be used. Optional custom colour matching for Apple or ITT. Optional character sets. *Trade supplied at very generous discounts for modest quantities.*

THE FABULOUS MICROMUX 8000 from £800
This is a brand new product, an asynchronous serial multiplexor with up to 16 ports, any one of which may communicate with any other independently, like a 'telephone exchange' for data! Built in test function. Firmware may be customised for special applications. Available in multiples of 4 ports up to 16.

COMPUTECH SYSTEMS

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

AGENTS THROUGHOUT THE UK AND OVERSEAS

• Circle No. 305

MICROMAS

is now also available
on Superbrain



The **MICROMAS** complete, *integrated*, business accounting system comprises:
A NOMINAL LEDGER linked to
Stock Control
Invoicing
Sales Ledger
Purchase Ledger
Payroll
Management Accounts
Mailing
Time Recording

For use as a complete system or in module form for any CP/M with Microsoft BASIC or North Star BASIC from a European and nationwide dealer network trained in system implementation.

MICROMAS is currently available on the following:

Altos
Dynabyte
H.E.A. 3000

I.M.S. Series
North Star Horizon
Vectorgraphic

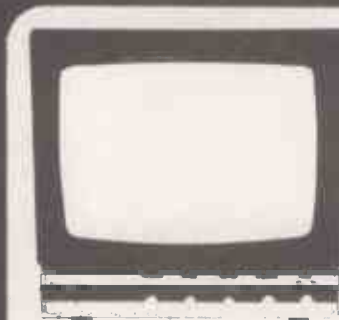


Contact us for your nearest dealer.
P. R. Daly & Co. Limited
Systems Consultants

Oaklands Gate,
Northwood,
Middx.
Tel. Northwood (09274) 29815 or (01) 868 7284

• Circle No. 306

MONITORS MONITORS MONITORS



UNCASED 9"
UNCASED 12"
CASED 9"
CASED 10"
CASED 12"
MONITOR TUBES

SELF CONTAINED MONITOR PCB's

*All monitors available with
P4, P31, P36 tubes.*

CROFTON ELECTRONICS

Crofton Electronics Limited
35 Grosvenor Road, Twickenham, Middlesex.
Tel: 01 891 1513

• Circle No. 307

Happy Memories

MEMOREX MINI-FLOPPY DISCS
IN PLASTIC LIBRARY CASES

Soft sectored for PET, TRS-80 etc:
£19.95 per 100 including VAT and Postage.

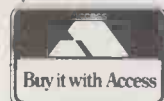
16K Memory Upgrade Kits for TRS-80, APPLE,
2020, SORCEROR £35 inclusive
(Stage your application)

RS-232 Plugs and Sockets
Male: £1.95 Female: £2.25 Hoods 75p

*All prices include VAT. 30p postage on orders
under £10. Government and Educational
orders welcome.*



HAPPY MEMORIES
GLADESTRY
KINGTON
HEREFORDSHIRE
HR5 3NY
TEL: (054 422) 618



• Circle No. 308

DATRON of SHEFFIELD

for **Cromemco** the ultimate name in micros



DATRON import direct from Cromemco, California.
 DATRON can supply Nationwide.
 DATRON can provide maintenance nationally
 DATRON can give you the realistic prices.
 DATRON have in stock:-

SYSTEM 2 64K £ 2147

SYSTEM 3 64K £ 3746

Z-2H HARD DISC 10M £5373

DATRON can supply Systems 2 and 3 with Multi-Tasking facilities.

DATRON easily accessible - in the centre of the country.

Write or telephone for FREE colour brochure on System 3 or Z-2H.

We use Cromemco for our own business, why not call in for a demonstration.



Demonstrations. 9am-5pm Monday-Saturday.

BOOKS from DATRON

all books in stock at press date

The BASIC Handbook	David Lien	£11.00
Illustrating BASIC	Donald Alcock	£3.25
Basic BASIC	Donald M. Munro	£2.40
The Little Book of BASIC Style	Newson	£5.75
Some Common Basic Programs	Osborne	£7.95
Some Common Basic Programs	CBM/PET	£8.95
32 BASIC Programs for the PET	Rugg & Feldman	£9.75
A guide to BASIC Programming	Spencer	£8.85
A guide to PL/M Programming	McCracken	£7.95
PASCAL An Intro to Methodical Prog.	Findlay & Watt	£4.95
Introduction to PASCAL	Welsh & Eider	£6.95
Programming in PASCAL	Grogono	£6.95
Primer on PASCAL	Conway et al	£7.10
Struct Prog. & Problem Solving with PASCAL	Kieburz	£8.40
Problem Solving using PASCAL	Bowles	£7.95
An Introduction to Programming and Problem Solving with Pascal	Schneider	£5.20
COBOL for Business Applications	Philippakis	£10.25
COBOL with Style	Chmura & Ledgard	£5.40
Learning COBOL Fast	de Rossi	£6.45
FORTAN Techniques	A. Colin Day	£2.95
FORTAN Fundamentals	J. Staingraber	£3.45
Problem Solving & Struct. Prog. in FORTRAN	Friedman & Koffman	£9.95
An Intro. to Prog & Applications with FORTRAN	Hull & Day	£8.45
Z80 Micro Handbook	W. Barden	£6.95
Z80 Programming for Logic Design	Osborne	£6.30
Z80 Micro Prog. & Interfacing Bk. 1	Nichols & Rony	£7.75
Z80 Micro Prog. & Interfacing Bk. 2	Nichols & Rony	£8.50
Z80 Assembly language Prog	Leventhal	£8.15
Z80 Programming for Logic Design. Programming the Z80	Osborne	£6.30
Mostek Z80 Micro Software Programming Guide	Zaks	£8.95
8502 Assembly language Prog		£6.00
8502 Applications Book	Leventhal	£8.25
Programming the 8502	Sybox	£8.95
Programming a Micro (8502)	Zaks	£7.95
PET Work Books Vol 1-7 (exc. 3)	Foster	£7.25
PET Work Book Vol. 3 (graphics)		£15.00
		£3.00

The Best of Micro, Vol. 1		£5.50
Vol. 2		£6.50
The PET Revealed		£10.00
Library of PET Subroutines		£10.00
Intro. to Personal & Business Computing	Zaks	£5.45
Peanut Butter & Jelly Guide to Micros	Wilfs	£6.45
A Career in Computing	Penny	£4.25
Philips Guide to Bus. Computers & the Electronic Office		£3.50
Computer Games	Enticknap	£8.40
6502 Games	Nahigian & Hughes	£8.95
*Game Playing with Computers	Zaks	£8.95
Basic Computer Games	Spencer	£6.50
More Basic Computer Games	Creative Computing	£5.50
Game Playing with BASIC	Creative Computing	£5.50
How to Build a Computer Controlled Robot	Spencer	£5.50
1976 US Comp. Chess Championships. Levy	Loftbourrow	£5.95
TTL Cookbook	Levy	£5.00
CMOS Cookbook	Lancaster	£7.15
TV Typewriter Cookbook	Lancaster	£7.50
Best of Byte	Lancaster	£7.25
Best of Creative Computing Vol. 1		£8.45
Best of Creative Computing Vol. 2		£6.95
Understanding Computers	Chirlan	£8.95
Home Computers - Beginners	Miller & Sippl	£5.60
Glossary & Guide		£4.75
Home Computers - Vol 1 Hardware	Didday	£5.20
Vol. 2 Software	Didday	£4.60

P&P free U.K. Overseas add £1

Phone in your Access
 Barclaycard No.
 0742 585490
 or complete this
 order form

Send s.a.e. for full list. Prices correct at going to press. Add 12p insurance on books if required.

Please supply

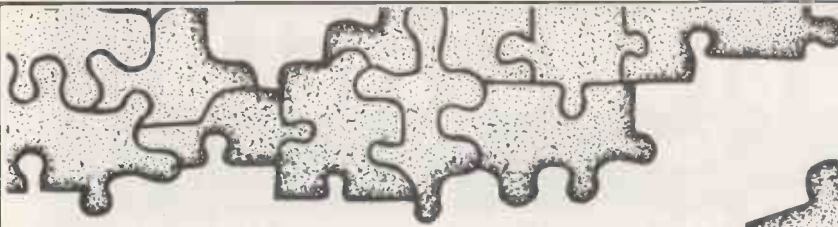
PC12

I enclose - £
 Cheque/Postal Order No.
 Barclaycard/Access No.
 Name
 Address

DATRON MICRO CENTRE
 DATRON INTERFORM LTD

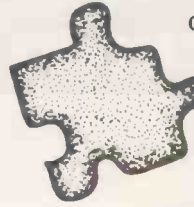
2 Abbeydale Road, Sheffield S7 1FD.
 Telephone 0742-585490. Telex 547151.

• Circle No. 309



We are exclusive distributors for UK of SERENDIPITY SYSTEMS packages for Apple & CP/M; of MAGSAM index sequential access routines for CBASIC and MBASIC and IFO-Information File Organiser - the best data base package available for use with Apple.

If you are puzzled by the lack of good application software for CP/M micros; then puzzle no longer. - Ask about



DATAFLOW

The easy-to-use, fast and flexible Data Base Management and Information Retrieval package.

Also ask about; Inter-Stat, Advanced Maths and Video Message packages for Apple Ask for leaflet on; Serendipity Ledgers and Stock Control for CP/M Professional Client Billing for Accountants, Lawyers etc.



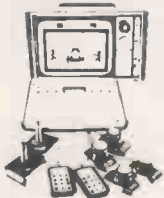
GREAT NORTHERN Computer Services Limited

55 East Parade, Harrogate, HG1 5LQ Telephone (0423)501131 Telex 57453 For Great Northern
116 Low Lane, Horsforth, Leeds LS18 8PX. Telephone (0532) 589980

• Circle No. 310

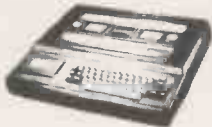
ELECTRONIC GAMES

ATARI



SPECIAL PRICE
£86 + VAT

INTELLIVISION MATTEL



£173.87 + VAT

Available August 1980
This is the most advanced TV game in the world.
Expandable next year into a full microcomputer.
COLOUR CATALOGUE AVAILABLE WITH DETAILS ON ALL THE CARTRIDGES

CHESS



Send for further details.

COMPUTERS

NEW RANGE AVAILABLE AUGUST 1980
We specialise in computer chess machines & stock over 13 different models from £20 to £300

TELETEXT



RADOFIN TELETEXT Add on Adaptor

£199 + VAT

SPACE INVADERS



HAND HELDS - CARTRIDGES
ATARI ACETRONIC
PRINZTRONIC
RADOFIN DATABASE etc.

We keep a full range!
Send for cartridge lists stating which machine you own

BRIDGE COMPUTER



- ★ Plays 1/2/3 or 4 Hands
- ★ Problem Mode
- ★ Audio Feedback
- ★ Instant Response
- ★ Auto scorekeeping

BACKGAMMON

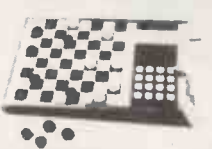


COMPUTERS

OMAR 1
OMAR 2
CHALLENGER
GAMMONMASTER

From £38 to £108. Send for further details.

DRAUGHTS



COMPUTER

- ★ Solves Problems
- ★ Rejects illegal moves
- 2 level machine £43 + VAT
- 4 level machine £77.78 + VAT

LEISURE

- ★ CHEAP TV GAMES
- ★ TELEPHONE ANSWERING MACHINES
- ★ AUTO DIALLERS
- ★ CALCULATORS
- ★ DIGITAL WATCHES
- ★ PRESTEL
- ★ HAND HELD GAMES

27 TUNE DOOR BELL

£17.13

+ VAT



FREE CATALOGUE

For a free copy of our 32 page catalogue, send a 12p stamp to Silica Shop Ltd or Telephone 01-301 1111

MAIL ORDER SERVICE - Free postage & Packing
TELEPHONE & MAIL ORDERS - accepted on Access * Barclaycard * American Express * Diners Club
CALLERS WELCOME - at our shop in Welling - Demonstrations daily
Open from 9am-5pm Mon-Sat (9am-1pm Wed)
GUARANTEE - Full 12 months + After Sales Support

We have comprehensive brochures on all products. Please let us know what you are interested in and we will send you detailed brochures AND our own 32 page catalogue covering most games on the market

SILICA SHOP

SILICA SHOP LTD., Dept. PC 9
102 Bellegrove Road
Welling, Kent DA16 3QF
Tel: 01-301 1111

• Circle No. 311



The true multi user computer system

The ALTOS ACS 8000 range of business/scientific micro computers creates a new standard in quality and reliability in high technology micro computers.

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 R.A.M.
- High speed (4 MHz.) D.M.A. control as standard.

Yes, mini power and at micro cost too.

Hard Disk Security Back-up

The 17.5 Megabyte funnel tape unit permits selective dumping from the Winchester at a rate of 1 Megabyte per minute.

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?

Communication Software

Two new custom software packages are now available for the Altos Computer System operating with CP/M to enable it to communicate with remote machines over ordinary telephone lines. ASYNC is an asynchronous package that operates with almost any remote machine. SYNCH is a synchronous package for use with the IBM 3780 protocols.

Custom Graphics & Scientific Software

A full graphics and scientific package is now available for use for the Altos with FPP.

GRAFLIB is a custom Altos software package containing a complete range of FORTRAN—callable graphics subroutines. It is designed with DRE RG—512 board, or a Tektronix 4000 series graphics terminal. Several multi-colour X-Y plotters are supported allowing hard copy in addition to screen graphics.

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.



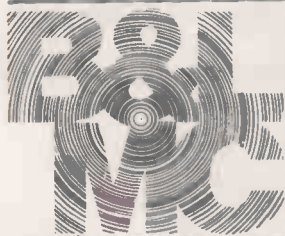
LOGITEK, E.I.C. Electronics Ltd.

All enquiries to
8-10 Fazakerley St., Chorley,
Lancs. Tel: 02572 67615/70206

also at
30 Kelvin Ave.,
Hillington Industrial Estate,
Glasgow G52 4LH

Logitek are now the exclusive distributors of
Altos Computer Products for the U.K. and Eire

• Circle No. 312



Some new introductions by the Midlands Computer Centre...

We celebrate our first birthday with news of new introductions available from the Micro Computer Centre.

NEW

HORIZON

NEW

CROMEMCO

In addition to Nascom and Commodore micro computers

PERIPHERALS ADD-ONS FOR NASCOM BITS & PCs SOFTWARE

(Excluding printers)
Sharp Cassette Decks. Crofton 10" Cased Monitors.

PRINTERS

Nexos Ricoh RP 1600 Daisy Wheel Printer. Diablo Daisy Wheel Printer. Nascom Micro Imp. Dot Matrix Plain Paper Printer. Centronics Dot Matrix. Anadex Dot Matrix. Newbury Laboratories Dot Matrix Impact Printer.

Input/Output Board. PIO Kit. Counter Timer Kit. UART Kit. (Colour Board Programmable Character Generator Board. Floppy Disc System (Single Drive) available in September). Nas-Pen Text editor. ZEAP 2.0 in EPROM or on Tape. Nas-Sys 3 Enhanced version of Nas-Sys 1. Nas-Dis - Disassembler. Debug - Dynamic Debugger.

Tool Kit. Port Probe. Hex Key Pad.

WILLIAM STUART

Colour Graphics for Nascom 1 & 2.

MERSEYSIDE NASCOM USER GROUP

ROM/EPROM Board for Nasbus.

Northstar. CAP-CPP. Cromemco. Petsoft. Supersoft. Nascom Games.

BOOKS

Very full range of books on 6502, Z80, Languages, Interfacing, Introductory books and games and General Programs.

EXTRAS

Henry's EPROM Burner. Antex Soldering Irons & Bits.

MAGAZINES

Personal Computer World. Computing Today. Practical Computing. Educational Computing. Liverpool Software Gazette. Printout.

ASK ABOUT THE KENILWORTH CASE
The "Kenilworth" Case. Microtype Case. Veroframe.

BUSINESS & LEISURE MICROCOMPUTERS
Castle Interface.

Business & Leisure Micro Computers

16 The Square, Kenilworth, Warwickshire CV8 1EB. Tel: (0926) 512127

• Circle No. 313

The others say they're smart and dumb Pentland is just British, good looking, functional and excellent value.



Model III



Model VI

The Model III Pentland VDU has a 12 inch white phosphor screen 80 x 24 characters, 64 upper case ASCII character set, 62 key standard layout keyboard, clear screen, row, home and clear functions, standard or reverse video, and interface on RS 232-C and 20-60 mA C/L outlets, 15 baud rates to 9600, full/half duplex.

The Model VI Pentland VDU has an additional bonded face plate with green phosphor, 96 upper and lower case character set plus 11 key numeric pad, and line or page scroll, row interchange functions, 2 video pages, direct X/Y cursor addressing and optional displayable control codes.

The Pentland Range is microprocessor controlled and has a low chip count to give high reliability.

Call 04862 73883. End users call Roy Richardson on the same number and ask for details or your nearest distributor.

*OEM Price

Copse Road, St Johns, Woking, Surrey
GU21 1SX Tel: Woking (04862) 73883
Telex 859592



Send further information

Ask a salesman to call

Name: _____

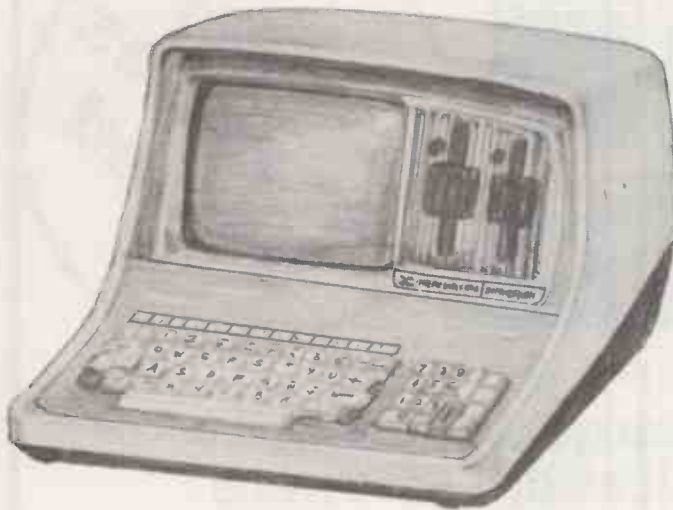
Company: _____

Address: _____

Tel: _____ PC1

• Circle No. 314

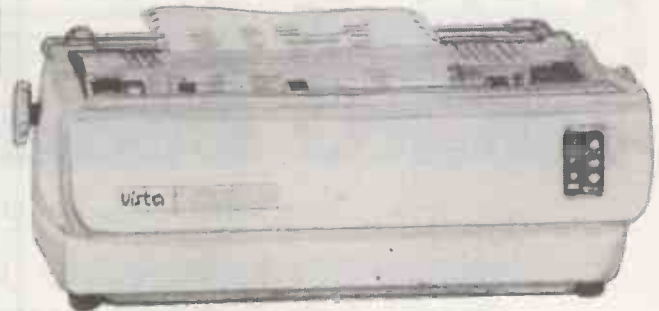
THE DYNAMIC DUO



SUPERBRAIN

PRICE £ 1455

CPU	Twin Z 80's
MEMORY	64Kb Dynamic RAM 1Kb Static RAM 2Kb Eprom (2716)
DISK	Twin Mini Floppy 326Kb Standard 674Kb Optional
CRT	12 inch P4 24 x 80 Characters
KEYBOARD	128 Character ASC II
COMMUNICATION	2x serial RS 232c
OPERATING SYSTEM	CPM 2.2



TEC DAISYWHEEL PRINTER

PRICE £985

PRINTWHEEL	Industry Standard 96 character daisywheel.
PRINTSPEED	25 CPS 45 CPS Optional
PRINTABLE COLUMNS	136
INTERFACE	STANDARD PARALLEL (RS 232-c optional)
PROPORTIONAL BIDIRECTIONAL PRINTING	
90 DAY WARRANTY	
FULL SCREEN AVAILABLE	

Special Offer

64K Superbrain
Daisywheel printer
Wordstar word processing package

OUR SPECIAL PRICE **£2495** only!!!

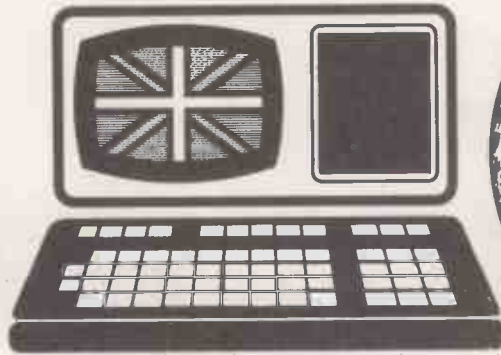
Superbrain DD 64K microcomputer	£1455.00	CDC 32 megabyte (16MB removable)	£5435.00
QD 64K	£1895.00	Shugart Technology ST650 hard-disk unit	£895.00
Compustar terminal VPU 10	£1130.00	CDC 96 megabyte (16MB removable) hard-disk unit	£6740.00
VPU 15	£915.00	Microline 80 matrix printer with serial interface	£395.00
VPU 20	£1785.00	NEC Spinwriter daisywheel printer	£1680.00
VPU 30	£1995.00	Intertube III visual display unit	£480.00
VPU 40	£2215.00	Emulator visual display unit	£480.00
Shugart 10 megabyte hard-disk unit	£1955.00		

Distributed by **COMPUTABILITY LTD**

Duchess House 18/19 Warren Street London W1 P5 DB Telephone 01-388 9927

• Circle No. 315

The Great British MICRO



Hytec combine British Ingenuity and a user friendly interface to give

High Performance Large Disc Capacity Business & Communications Software

Hytec further provide comprehensive pre and post sales support for both hardware and software including full training, and user familiarisation

The Hytec H-series starts at around £3,500. For further information please write to or phone Hytec Microsystems Ltd., 1-3, St. George's Place, Oxford OX1 2BL.
Telephone Oxford (0865) 726644/5

HYTEC MICRO SYSTEMS LIMITED



• Circle No. 316

BRAINWASHING



MicroComputers are an aid and stimulus to your mind and your work. But by the time you're through examining a bewildering range of new products and confusing advice, your once-lively mind may be feeling just a little wrung out.

Now RAM Computer Services have changed all that. We're a new outfit with a new approach. For Business, for Pleasure, for the Professional, for the Beginner - we'll help you get the best equipment at the right price and leave your mind clear to get the

best out of your computer.

We retail a wide variety of MicroComputer systems - Apple, PET, SWTP 6809 and Sharp - constantly updating our range as new products and ideas are marketed. All with a full range of software packages, programmes, games and accessories, for business or leisure. Backed up with expert advice, servicing, repairs and highly professional consultancy.

Write or telephone for any details, or visit us for a demonstration.

RAM
Computer Services Ltd.

15/17 North Parade, Bradford, West Yorkshire.
Telephone (0274) 391166.



• Circle No. 317

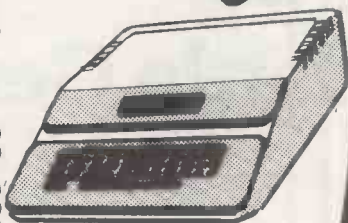
DATA LINK

Microcomputer Systems Limited

Systems software for business, industrial and scientific applications

APPLE SYSTEMS

Apple II Plus	£695.00
1 MB 8" Disk Drives	£1,550.00
Disk Drive with controller card	£349.00
Disk Drive without controller card	£299.00
16K Add-ons RAM	£69.00



FULL RANGE OF ACCESSORIES

including:—

Visicalc	£95.00
ALF Music Synthesizer	£135.00
A1-02 Data Acquisition Card	£180.00
Clock Card	£160.00
ROM Plus Board	£116.00

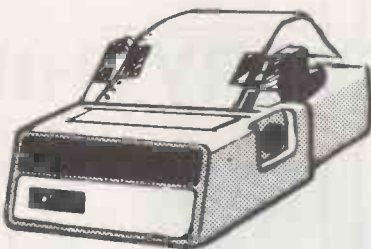
ALL PRICES EX VAT

APPLE SYSTEM — Latest Additions

DOS 3.3 (23% extra disc space)	£39.00
H.S. RS232/Bi-directional parallel Combined Interface	£120.00
Desktop Plan (from Visicalc people)	£64.00
H.S. Serial Interface	£80.00
Language Card with Pascal	£299.00
Fortran addition	£120.00
Pilot addition	P.O.A.
Appletel (for Prestel)	£595.00
Apple juice reserve power supply	£148.00
IEEE Interface	£212.00

Printers

Paper Tiger (with graphics)	£598.00
Centronics 737 (5 character sets. Bi-directional paper drive. R. Margin justification)	£580.00
Centronics 701	£1,115.00
Centronics 702	£1,310.00
Centronics 703	£1,625.00
Centronics 704	£1,655.00
Centronics 753	£1,655.00



Consultancy Service

If the computer you buy is really going to do the job you want it to do — run your accounts, control your stock, solve your problem, or you name it . . . the selection of the computer system and the programs to run it must be made with the utmost care. Otherwise, grief, hassle and costly frustration may well be your unhappy lot.

As always, the answer is to consult an expert. We have on tap a team of friendly experts who will happily analyse your problem, discuss with you your hopes and ambitions, and advice you on the feasibility of a computer solution. If the situation is on-going, they will then specify your software requirements and recommend a particular computer system. Finally, they will cost the whole exercise. Fortune smiles upon he who . . .

DISKETTES ETC

BASF Top Quality Unconditional 12 Month Guarantee	
5.25" Mini Single Sided Soft Sector/Single Density	£25.00 (Box of 10)
5.25" Mini Single Sided Hard Sector/Single Density	£25.00 (Box of 10)
5.25" Mini Single Sided Soft Sector/Double Density	£26.00 (Box of 10)
5.25" Mini Double Sided Soft Sector/Double Density	£30.00 (Box of 10)
8" Single Sided Soft Sector/Single Density	£26.50 (Box of 10)
8" Single sided Soft Sector/Double Density	£27.50 (Box of 10)
8" Double Sided Soft Sector/Single Density	£40.00 (Box of 10)
8" Double Sided Soft Sector/Double Density	£40.00 (Box of 10)

DISKETTE LIBRARY CASES

5.25" Mini Diskette Library Case for 10 Diskettes	£2.50
8" Diskette Library Case for 10 Diskettes	£3.00

DISKETTE TRAY WITH LOCKABLE LID

A6 5.25" Mini Diskette Tray with Lockable Lid:	30-40 capacity	£18.00
	60-80 capacity	£20.00

A5 8" Diskette Tray with Lockable Lid:	30-40 capacity	£25.00
	60-80 capacity	£28.00

9" Plain Listing Paper (per 2,000 sheets)	£16.00
---	--------

10% EDUCATIONAL DISCOUNT

STOP PRESS

Programmable Timer for Apple

Software controlled counter/timer for frequency/interval measurement, pulse/event counting, controlled frequency source, etc. 6 input/output channels. 16 bit counter resolution, 2 μ sec max clocking frequency. Remote stop/start.

£110.00

Z-80 Softcard for Apple

You've read about it, we can supply it. Send for full details and specification.

£180.00

WE CAN NOW ARRANGE INSURANCE FOR YOUR COMPUTER

We also stock an extremely comprehensive range of computer books

DATA LINK

10 Waring House, Redcliffe Hill, Bristol BS16TB
Telephone: Bristol (0272) 213427

• Circle No. 318

WEYFRINGE PRINTER

For A4 Friction Feed



All Features described as Standard

For only £795
R.R.P. £945

PLUS
True Descenders
Pin Drive Sprocket Feed
Original + 3 copies
96/132 column
switchboard
RS 232 + Parallel IEEE
Interfaces

DOLPHIN BD-80P



125 cps bi-directional
MATRIC PRINTER
Width 80 / 132 option
Buffer 750 / 2K option

GRAPHICS

User Definable Characters
Parallel/RS232/IEEE Interface
£420

Contact

MICRO SOLUTION LTD
0608-3256

• Circle No. 319

Master Your Micro FAST with...

Little Genius floppy diskette based courses will teach you, how to use your system and how to realise the full potential of the "Mighty Micro". These fully interactive computer lessons will guide you quickly to a high level of understanding and confidence in your ability to make the most of your microcomputer system.

Courses now available:

- Applesoft BASIC
- Advanced Applesoft BASIC
- Using your Apple
- Palsoft BASIC
- Advanced Palsoft BASIC
- Using your 2020
- PET BASIC
- Advanced PET BASIC
- 380Z BASIC
- Advanced 380Z BASIC
- Using your 380Z



Little Genius!

Each course, comprising a floppy diskette, and starting instructions, costs only £40.00 plus VAT.

SPECIAL "3 in one" OFFER for 3 courses covering the same system only £99.00 plus VAT.

Little Genius courses are available from most computer retail outlets, or direct mail order from:

LITTLE GENIUS

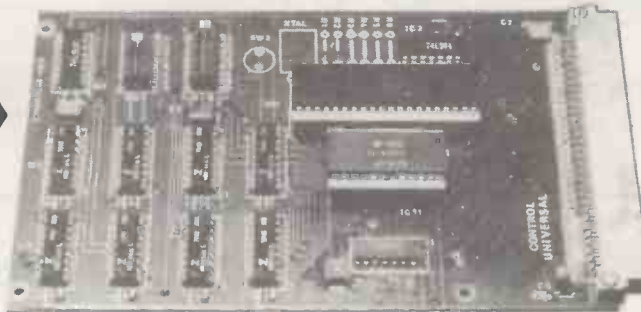
Suite 504, Albany House, 324 Regent Street, London W1R 5AA.
Telephone: 01-580 6361

• Circle No. 320

AIM 65 PLUS EVERYTHING!

THAT'S CUBIT

EVERYTHING
ROCKWELL



EVERYTHING
ACORN

- * AIM 65
- * BASIC
- * Assembler
- * FORTH
- * PL-65
- * 19" rack industrial version

FOR £75

Unplug the 6502, plug in Cubit, replace the 6502 — it's that simple.

- * ADDS 4K RAM to give AIM 8K total
- * ADDS 4K EPROM socket
- * ADDS an additional VIA to give a total of 32 i/o lines
- * ADDS an interface to all Acorn Eurocards
- * Can be used as a stand-alone computer.

- * 8K RAM, 8K EPROM memory card
- * PROM programmer
- * 16K memory card, CMOS RAM/EPROM
- * Colour VDU card
- * Floppy disk controller
- * 1 or 2 disk drives
- * 19" rack mounting
- * Accounting system
- * Word processor

all available from:

CONTROL UNIVERSAL LTD,

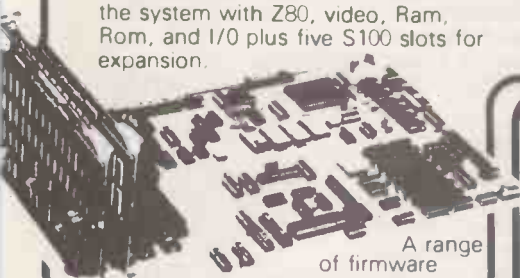
11-15 Bush House, Bush Fair, Harlow, Essex. tel Harlow (0279) 31604

• Circle No. 321

NEW THE TUSCAN S100

A Z80 based S100 Computer System.

TUSCAN main board. The heart of the system with Z80, video, Ram, Rom, and I/O plus five S100 slots for expansion.



A range of firmware options available.

Available in Kit Form or Assembled.

All components available separately.

Houses two 5 1/4" drives for a compact business system

Professional case will house the complete system

Two keyboard options

Hinged lid for easy access

Stylish finish ideal for office or home



On Demonstration NOW

KITS from

£195 + VAT delivery Ex-Stock

NASCOM-2

MICRO-KIT COMPUTER

WITH IMPROVED 16k B RAM Board



Ex-stock only £335 + VAT

Full after sales service

Firmware & MOS ICs Software
Zeap Assembler (4, 1Kx8 EPROMS) £50
Nas Pen text editor (2, 1Kx8 EPROMS) £30
Expansion boards (in kit form)
48K RAM £210 ● 32K RAM £175.00
16K RAM £140
EPROM CARD (NASCOM compatible) KIT. Suitable for 16 x 2708 or 16 x 2716 or mixed 1 x NASCOM 8k BASIC ROM £65.00. BASIC programmers aid. Self locating tape £14.96.

POWER SUPPLY £29.50

NASCOM PRODUCT LIST + VAT

I/O board kit less I/O chips	45.00
UART + BAUD rate generator + crystal for I/O board	16.00
Econographics kit for additional 128 characters (N1 only)	30.00
2708/2716 Programmer suitable for N1 and N2 under NAS-SYS	£20.95
Nascom 19" rack mounting card frame for N1 and N2	32.50
Nas-OA disassembler 3 EPROM for Nas-sys	37.50
MK36271 8K BASIC in 8K x 8 ROM	30.00
Naspen VS in 2 EPROM	25.00
Nas-svs monitor in 2 EPROM	£8.50
4 Games Tape	25.00
Nasbug T4 2 x EPROM	25.00
Tiny Basic 2 x EPROM	25.00
Super Tiny Basic 3 x EPROM	37.50
Super Tiny Basic upgrade 1 x EPROM	12.50
Tape Software	
ZEAP 2 tape and documentation for Nas-sys	30.00
8K BASIC tape and documentation for N1	15.00

THE HENELEC DISK SYSTEM

FOR NASCOM and any other Z80 8080 Microcomputer with an uncommitted P10



DISKS

- The Henelec controller card plugs direct into a Z80 P10 and controls up to 3 double-sided mini-floppy drives giving a maximum 480K system.
- General Purpose FDC control software for simple DOS or for CPM.
- Simple DOS software for NASCOM 1/2 under NAS-SYS
- OR ROM CB10S for CPM on NASCOM 1/2 incorporating the major NAS SYS features. Maximum 60K CPM system
- New MD prom supplied for N2/CPM

TWO SYSTEMS

- SIM-DOS "Floppy Tape Recorder" with 1 drive PSU firmware, etc. Double sided £380 plus VAT
- CPM System with 1 drive, double sided PSU firmware, etc. £450 plus VAT
- Additional Drives with PSU £205 plus VAT

COMPUTER KEYBOARDS

APPLE COMPUTER KEYBOARD

52 Key 7 Bit ASCII coded Positive Strobe +5V - 12V Size 13x4 1/4" Sturdy Construction Sloping Keys Black/White print Made in USA for Apple Inc Brand New £36 Incl VAT. Post £2.50 Individually packed in ANTI-STATIC FOAM

71 KEY ASCII KEYBOARD INCLUDING NUMERIC KEYPAD. £49.00 plus £7.35 VAT TOTAL £56.35. Uses gold crosspoint keys. Includes keypad and ribbon cable. Only available as fully assembled and tested



CARTER 57 key ASCII keyboard. Conventional key board. 128 ASCII characters including control keys. Parallel output with strobe, Shift lock. + 5 V and -12 V DC. 12" x 5.5" x 1.5" Black keys with white legends. 39.34 + VAT.

FERRANTI - "SIZE 14 x 6 x 3" SLOPING FRONT" 55 Key ASCII Coded in steel case. Complete with Plug and Cable with circuit to convert to T.T.L. levels.

In good condition at only £19.95 + VAT, P/P £2.50

TANGERINE

COMPUTER SYSTEMS

"MICRON"

the latest line in superb products on demonstration from your London stockist

EX-STOCK

£395.00 inc. VAT BRITISH DESIGN

- 6502 based microcomputer
- VDU alpha numeric display
- Powerful monitor TANBUG
- 8K RAM
- 32 parallel I/O lines
- 2 serial I/O lines
- RS 232 C/20mA loop, with 16 programmable Baud rates
- Four 16 Bit counter timers
- CUTS cassette recorder interface
- Data bus buffering
- Memory mapping control
- 71 Key ASCII Keyboard, including numeric keypad and with auto repeat
- Including metal cabinets for both keyboard and modules
- Including power supply
- 10K Microsoft BASIC

NASCOM-1

12" x 8" PCB carrying 5LSI MOS packages, 16 1K MOS memory packages and 33 TTL packages. There is on-board interface for UHF or unmodulated video and cassette or teletype. The 4K memory block is assigned to the operating system and video display leaving a 1K user RAM. The MPU is the standard Z80 which is capable of executing 158 instructions including all 8080 code.

Build price £140 + VAT.

Nascom-1 Kit Price Plus VAT £125 + P&P £1.50



PLAIN PAPER £325 PRINTER

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

- 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.
- IDEAL FOR WORD PROCESSING

CENTRONICS QUICK PRINTER

List Price £459 incl. VAT



OUR PRICE plus VAT

EXCLUSIVE TO HENRY'S 50% OFF MAKER'S PRICE £195

for: Software selectable 20, 40 and 80 column using 120mm aluminium-laid paper, 1 roll supplied. 150 lines per minute. Centronics parallel data interface for Nascom, Tandy, etc. 240 volt mains input. ASCII character set Paper feed, and on/off select switches 'BELL' signal Weight 10lbs Size: 13" x 10 1/2" x 4 1/2"

MONITORS New and Reconditioned FROM £35

Microtan 65 kit	£69.00	Tanex assembled	53.00
Microtan 65 assembled	79.00	Tanex (expanded)kit	106.50
Lower case option	9.48	Tanex (expanded)assmbl	116.50
Graphics option	6.52	Serial I/O option	12.87
20 way keypad	10.00	Tanram kit	34.00
Full ASCII keyboard	49.00	Tanram assembled	44.00
Tanex kit	43.00	Tanram (expanded)assmbl	190.00

SEND FOR COMPLETE COMPUTER BROCHURE FREEPOST TO ADDRESS BELOW

MEMORIES Discounts 10% for 4, 15% for 8, 20% for 16		
MK 3880 (N280)	7.50	5.95
MK 3880-N4 (Z80A)	7.95	15.00
MK 4116 16K x 1 dy RAM	6.50	4.50
MK 4027 4K x 1 dy RAM	2.25	3.25
2102 1K x 1 static RAM	1.00	8.25
4118 1K x 8 static RAM	12.75	
		2716
		1M6402 UART
		2114 1K x 4 static RAM
		8080A

ADD VAT 15% TO YOUR ORDER EXCEPT WHERE STATED



HENRY'S

Computer Kit Division
404 Edgware Road, London, W2, England I.E.D.
01-402 6822

Official Export & Educational Orders Welcome
Our telex: 262284
Mono Ref.
1400 Transonics

● Circle No. 322

3D

Digital Design and Development

18/19 Warren Street · London W1P 5DB Tel: 01 387 7388

CBM PET SHARP MZ-80K

Specialist Suppliers of Complete Systems for Industrial and Laboratory Monitoring and Control.

Please note our new address.
Callers welcomed for demonstration and/or discussion.

SHARP MZ-80K INTERFACES

- Parallel Printer Interface £110
- Serial Printer Interface £150
- Bi-Directional Serial Interface £210
- 16-Channel A/D Converter Unit £280
- Fast Data Acquisition System – 40,000 readings/sec. 4 analog channels IN and 4 channels OUT. P.O.A.

PET INTERFACES

IEEE-488 Compatible Units

- 16 Channel 8-Bit A/D Converter £300
- 8 Channel 8-Bit D/A Converter £350
- 8 Channel 12-Bit A/D Converter £600
- 12-Bit D/A Converter P.O.A.
- X-Y Analog Plotter Interface £200
- Digital Data Input Unit, 64 Bits £400
- Digital Data Output Unit, 64 Bits £350
- 16 Channel Relay Unit £350
- Also...
- USER Port Converter A/D plus D/A £200
- Fast Data Acquisition System 40,000 readings per sec. 4 A/D + 4 D/A P.O.A.

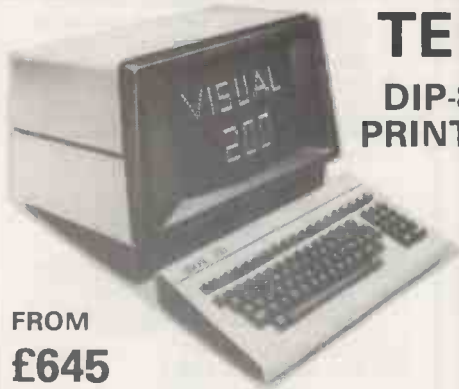
All units boxed complete with IEEE-488 address internally selectable, with integral power supply, cables, switch, fuse, indicators and illustrative BASIC software.

TERMS: All prices EX-VAT. P&P extra.
Cheques should be made payable to 3D Digital Design & Development.
All goods supplied under 90 days warranty.
CUSTOM DESIGN UNDERTAKEN



• Circle No. 323

TELEMA SYSTEMS



DIP-80
PRINTER

FROM
£645



DIP-84
PRINTER

FROM £400

IMI 7710
"WINCHESTER"
TECHNOLOGY
DISC DRIVE

PRICES FROM
£1995



Standard Features

- 24 x 80 Screen Format
- 7 x 9 Dot Matrix
- Upper/Lower Case
- Numeric Pad
- Background/Foreground
- Blink Line
- Insert/Delete Line & Character
- Columnar and Field Tab
- Set/Clear Tab
- Security Mode (non-display)
- Clear End Line, Field & Page
- Clear Line
- Clear Screen
- Line Drawing
- Current Loop or RS-232 Interface
- Secondary Channel

Options

- Function Keys
- Block Mode
- Green Phosphor Screen

- Composite Video
- Serial Copy Port
- Hold Screen
- Baud Rates to 19,200
- Self Test
- Cursor Addressing
- Cursor Control Keys
- Read Cursor Address
- Typematic Keys
- Smooth Scroll
- Microprocessor
- Detachable Keyboard
- Solid State Keyboard
- Read Terminal Status
- Tilt Screen
- Switchable Emulations

- Impact 7 x 7 dot matrix, bidirectional.
- 100 characters per second.
- 60 line per minute (80 characters per line bidirectional).
- Full upper/lower case, 96 characters ASCII set.
- 7 x 7 matrix.
- 14 x 7 matrix (expand character).
- Parallel, TTL levels with Strobe, Acknowledge, Busy and Input Prime.
- Serial: RS232C or 20 ma Current Loop with busy handshake, 10 or 11 bits; 110, 150, 300, 600, 1200 baud.
- Optional Serial: 2400 to 9600 baud.

Recording Characteristics and Data

Recording Capacity	11 megabytes
Data Tracks per Surface	350
Track Density	300 T.P.I.
Recording Density	5868 B.P.I.
Disk Speed	3600 R.P.M. ± 1%
Transfer Rate	648 K bytes/sec.
Minimum Access Time	10 ms
Average Access Time	10 ms
Maximum Access Time	100 ms
Latency Time (Avg.)	8.3 ms
Servo System	Full track following

Options

- S100 Interface Card
- Packaged unit
- Power Supply
- Controller Card

TELEMA SYSTEMS

2A GATLEY ROAD CHEADLE, CHESHIRE

TELEX 667067

TEL No. 061-491-1295

* ALL EQUIPMENT SUBJECT TO EDUCATIONAL AND QUANTITY DISCOUNTS

• Circle No. 324



MICROCOMPUTERS ETC

Registered business name

For Hardware, Software, Peripherals, Consultancy and Competitive Prices.




PET 2001
from **£425**



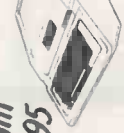
Commodore authorised dealers

TRS 80
from **£365**



From Radio Shack Corp.

APPLE II
from **£695**



authorised dealers

SORCEROR
from **£730**



authorised dealers

ADVANCED SYSTEMS



authorised dealers

BASIC SYSTEMS
PET 3016 (16K RAM and large keyboard) * £550.00 + integral cassette
PET 3032 (32K RAM and large keyboard) * £695.00
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

BASIC SYSTEMS
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
TVJ 232, serial interface Centronics Parallel Printer Interface (direct to keyboard) £40.00
TRS 80, Voice Synthesizer £345.00
TRS Votbox - speech recognition system £135.00
Stringy Floppy drive (complete with manual & wafers) £180.00

BASIC SYSTEM
Apple II Plus computer - APPLESOFT extended basic in ROM - (16K RAM) - video output: £695
ACCESSORIES
Real time clock/calendar card - £14.00
interrupt, software controllable £79.00
Speechlab - provides voice control for the Apple SuperTalker - adds human speech output! £113.00
ALF Music Synthesizer Card £180.00
A1-02 Data Acquisition Card £462.00
AC Line Controller £270.00
RAM Upgrade (16-32K, 32-48K) £69.00
Hobby Prototype Card £20.00
Rompuls - u./c. mixed text/graphics £105.00

BASIC SYSTEMS
Sorcerer (inc. UHF Modulator) Special low prices on limited stock
16K RAM £590.00
32K RAM £650.00
48K RAM £695.00
ACCESSORIES
Edydy S100 Unit £240.00
(High Resolution monitor with Integral 630K Dual Drive) £1,590.00
CP/M on Disk £145.00

ADVANCED SYSTEMS
TRS 80 Model II with integral 8" floppy disk drive and up to 64K RAM. Expandable up to 3 Megabytes Disk Storage (Available for demonstration - by appointment only). From £2,300
SUPERPETSYSYSTEM - CBM6032 Computer with 30 col. screen CBM-6050 - Dual Disk Drive giving 950K User Storage £995
£995
PET BUSINESS SYSTEM
comprising
CBM 3032 Micro computer, CBM 3040 Dual Disk Drive, CBM 3022 Tractor Feed Printer and all cables
Special Offers!
£1799.00

DISKS
PET CBM 3040 (dual drive) 243K User storage * £895.00
CompuLink (dual drive) 400K £895.00
Storage £1145.00
TRS80 CompuLink (dual drive) 800K storage £299
Shugart drive £275
Micropolis drive £299
Percom FD200 drive 110v £275
Micropolis Dual Drive (954K 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
Edydy - 316K Storage £630
Edydy Dual Drive (630K storage) £1195.00
Corvus Hard Disk (11Mb) £3500.00

PRINTERS
PET CBM 3022 (80 cps) with PET graphics - tractor feed * £425.00
TRS80 TRS 80 Screen Printer (text graphics) (110v) £345.00
New Radio Shack Micro Printer £245.00
GENERAL
Teletype 43 KSR Serial (pin or punch feed, 132 cols) £825.00
primers for microcomputers - high speed (up to 280 cps, upper/lower case) P.O.A.
OKI 40, 80, 132 cols (selectable) £499.00
Centronics 779 parallel (tractor feed, 132 cols) £825.00
DOLPHIN BDB0P tractor primer (125 cps bi-directional, 40, 80 columns - optional 132, vJ case & graphics). Available with Serial, parallel or IEEE interface
Centronics Micro Printer (20, 40, 80 cols selectable) £525.00
HeadWH 14 serial (80, 96, 132 cols) £395.00
DUMMEY wheel printers P.O.A.
TWIN 100/MICRO/JET Thermal Printer (40 cols) £266.00
SILENT PRINTERS FOR APPLE - allows printing of high res. graphics. £349

ETC.
Diskettes 5 1/4" (blank) boxed (min 12 per 10) each from £3
C12 Cartr (min order 10) each £0.35p
Ansaback photo copiers - line answering machine, voice operated twin cassette £90.00
Place E2-PHONE - Cordless Telephone £200.00
Hiachi Video Monitors 9" / 12" esp. £127/£187
BOOKS - Large range of microcomputer-related books and magazines
STATIONERY
Listing Paper - most common sizes Ribbons for MDT Printers - 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

DISKETTES
PET 3001-8 (PET with 8K memory + integral cassette) * £425.00
PET 3008 (8K) with large keyboard * £450.00
PET C2N External Cassette Deck £53.00
IEEE-448/Centronics type parallel Interface £36.00
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

SOFTWARE
PETS OFF authorised dealers - over 150 programmes on cassette and disk. Send for catalogue.
STAGE ONE COMPUTERS SW dealers - PETAID, Stock Control, etc. Send for list 74 Common BASIC Programs on one tape £16.00
P.O.A.
CBM DISK-BASED BUSINESS SOFTWARE
JUCOMWORHPROIV powerful word processor, low/high level resp. £75/150.00
COMSTOR - FINOL - gives complete stock report £150.00
COMBIS - BUSINESS INFORMATION SYSTEM - Storage & Retrieval of all types of company records £150.00
COM ACCOUNTS - Full Financial Business Accounting System inc: Sales, Purchase, Nominal Ledgers £150.00
COMPAY - Handles hourly, weekly or monthly paid employees £660.00
COMPLANNER - Personal information; tool for the busy executive £190.00
(We are authorised CBM Business Software Dealers) Send for List.
GD 1001 - Assembler Development System £50.00
GD 010 - Lisp Interpretive Language (Artificial Intelligence) £75.00
GD 1000 - PASCAL Language for PET £136
BRISTOL SOFTWARE FACTORY S/W dealers:-
TRADER, ITEM, MONITOR, etc. - Send for details.

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 £96.00
CPASIC £75.00
PORTRAM includes compiler, relocatable assembler text editor and linking justification on cassette £95.00
PASCAL - tomorrow's programming language today £195.00
ELECTRIC PENICIL - powerful word processor allows full cursor movement, insert/delete, strike through movement; adjustable line length, £39
ELECTRIC PENICIL as above - disk version £95.00
LOWER CASE MOD KIT ONLY/FITTED for Electric Penicil £8.00/£28.00
DATA MANAGEMENT/REPORT GENERATOR - easily formats disk files, allows calculation on screen or printer £150.00
RSM-20 DISK MONITOR - powerful system manipulates disk data, has Z 80 break routine £25.00
ST800 communications software £60.00
NEWDOOS - TRSDOS with corrections and enhancements £26.00
KBFX, Remun, Screen to printer in one step, DOS commands from BASIC, Level 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 1 £14.00

APPLE
CASHIER - Retail Store Management System £195
U-DRAW II - High Resolution graphics editor. Create a figure then rotate, 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 £52.00
APPLE WORD PROCESSOR - Complete text editing, storage and retrieval of text (disk based) £42.00
LITTLE GENIUS - Comprehensive disk based Apple Soft Tutorial £36.00
ACT, Appeware and MOUSE authorised software dealers - Many programs on cassette and disk. Send for list.
SORCEROR many programs available - send for list.
Word Processor Rompac £70.00
Development Pac

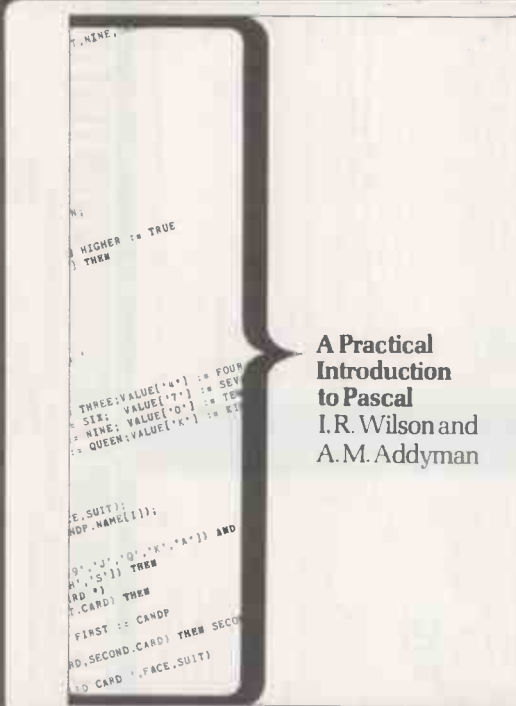
* 5% DISCOUNT ALLOWED FOR EDUCATIONAL ESTABLISHMENTS

T&V JOHNSON (MICROCOMPUTERS ETC) LTD
Member of the TV Johnson Group of Companies
Oxford
148 Cowley Road, Oxford
OX4 1JJ
☎ (0865) 721461
+ Ansbabck eyes
857 88H
☎ (0272) 422061
Telex 858893
Directors: D. R. V. King BA, MBE
T. S. Johnson, ARIBA, A.C.M.B. F.S.C., M.B.M.
A.S. Barton A.C.U., ARIBA, C.M.A.F.
Hours of business
Mon-Fri, 9.30 - 5.30
Sat, 9.00 - 12.30
PRICES EXCLUDE VAT, FREIGHT & HANDLING SEND OR
PHONE FOR PRICE LIST & BROCHURES
(All prices correct at time of compilation)



Mine of Information Limited

Microcomputer Consultancy & Booksellers



A Practical Introduction to Pascal
I.R. Wilson and A.M. Addyman

PASCAL BOOKS

Practical Intro to Pascal by Wilson & Addyman	£ 4.40
Pascal with Style by Ledgard et al	£ 4.90
Intro to Prog & Prob Solv with Pascal by Schneider	£ 6.50
Structured Programming Approach to Data by Coleman	£ 6.60
Pascal User Manual and Report by Jensen & Wirth	£ 6.80
Concurrent Pascal Compiler for Minicomputers by Hartmann	£ 6.90
Beginner's Guide for the UCSD Pascal System by Bowles	£ 7.00
Introduction to Pascal by Welsh & Elder	£ 7.60
Programming in Pascal Revised edition by Grogono	£ 8.80
Microcomputer Problem Solving Using Pascal by Bowles	£ 8.90
Architecture of Concurrent Programs by Brinch-Hansen	£15.00
The BYTE Book of Pascal edited by Liffick	£15.00

Mine of Information Ltd was formed in 1977 to carry on the general business of consultancy, publishers and booksellers – the field of specialisation is microcomputing.

Today Mol is one of Britain's foremost microcomputer booksellers. The emphasis is on quality. Books are selected by an experienced computer consultant on the basis of accuracy, relevance and value for money.

Prices include P+P in UK.

For overseas delivery add 10% (surface mail) or 20% (air mail)

Orders to: Mol (101) 1 Francis Avenue · St Albans · Herts AL3 6BL · England · Phone 0727 52801 · Telex 925859

• Circle No. 326

COMMANDER MICRO SYSTEMS

Specialists in English and American software for TRS-80 (Models I and II), Pet, Apple, and Heath. Widest selection in Europe, from such names as Instant Software, Software Exchange, Galactic, Misosys, Microsoft, T.P.G., etc. . . .

TRS-80 MODEL 1 LEVEL 2

FS1 Flight Simulator with spectacular 3-D graphics	£ 14.00
Household Accountant	£ 6.50
Space Invaders!!	£ 7.50
Weather Forecaster	£ 6.50
Oracle-80 Business Forecaster	£ 75.00
IRV Programmable keyboard	£ 12.00
Adventures from	£ 7.50
TRS-80 MODEL II Editor/Assembler (Galactic Software)	£120.00

PET

ISI Flight Simulator	£ 6.50
Trek - X	£ 7.50
Accountanting Assistant	£ 6.50
Mortgage/Financier	£ 6.50
Electronic Eng Assistant	£ 6.50
Decorator's Assistant	£ 6.50

APPLE

FS1 Flight Simulator with 3-D graphics	£ 14.00
Math Tutor I and II	each £ 6.50
Visicalc	£ 90.00
Accounting Assistant	£ 6.50
Sahara Warriors	£ 6.50

Subscriptions for Kilobaud and 80 Microcomputing – £21.00 p.a.

Software authors!! If you have any good software you wish distributed on a world wide basis send it in for review.

Send for catalogue or any further details to: – Commander Micro Systems, 39 Bradley Road, Shard End, Birmingham B34 7RL.

ALL PRICES EXCLUDE VAT @ 15%

• Circle No. 327

SYSTEM 4000

EPROM EMULATOR/PROGRAMMERS



P4000 PRODUCTION EPROM PROGRAMMER

This unit provides 'simple, reliable' programming of up to 8 EPROMs. It has been designed for ease of operator use — a single 'program' key starts the blank check — program — verify sequence. Independent blank check and verify controls are provided along with mode, pass/fail indicators for each copy socket and a sounder to signal a correct key command and the end of a programming run. Any of the 2704/2708/2716 (3 rail) and 2508/2758/2516/2716/2532/2732 EPROMs may be selected without hardware or personality card changes. 2 year warranty. Price £545 + VAT:

VM10 VIDEO MONITOR

This compact, lightweight Video Monitor gives a clean crisp picture on its 10" screen. Suitable for use with the EP4000, SOFTY and other systems. 12 month warranty. Price £88 + VAT, carriage paid.

MODEL 14 EPROM ERASERS



MODEL UV140 EPROM ERASER

Similar to model UV141 but without timer. Low price at £61.50 + VAT, postage paid.

EP4000 EPROM EMULATOR/PROGRAMMER

The microprocessor based EP4000 has been designed as a flexible, low cost, high quality unit for emulating and programming all the popular NMOS EPROMs without the need for personality cards, modules or hardware changes. Its software intensive design permits selection of the 2704/2708/2716 triple rail EPROMs and the 2508/2758/2516/2716/2532/2732 single rail EPROMs for both the programming and emulating modes.

The video output (T.V. or monitor) for memory map display in addition to the built-in Hex LED display, for stand alone use, is unique in this type of system. This, with the double function 28 key keypad, powerful editing features, powered down programming socket, buffered tri-state simulator cable and 4k x 8 data RAM gives you the most comprehensive, flexible and compact systems available today.

2 year warranty. Price £545 + VAT:

MODEL UV141 EPROM ERASER

- 14 EPROM capacity
- Fast erase time
- Built-in 5-50-minute timer
- Safety interlocked to prevent eye and skin damage
- Convenient slide-tray loading of devices
- Available Ex-Stock at £78 + VAT Postage Paid
- Add £6 to order total for next day delivery by DATAPOST.

EX-STOCK

PLEASE NOTE OUR NEW ADDRESS/TELEPHONE NUMBER

GP INDUSTRIAL ELECTRONICS LTD,
UNIT 6, BURKE ROAD, TOTNES INDUSTRIAL ESTATE,
TOTNES, DEVON.

TELEPHONE: TOTNES (0803) 863360 (Sales) / 863380 (Technical Service)
DISTRIBUTORS REQUIRED — EXPORT ENQUIRIES WELCOME

SOFTY SYSTEM

EX-STOCK

Low cost card 2704/2708 emulator/programmer features:

- Direct output to T.V.
 - High speed cassette interface
 - On card EPROM programmer
 - Multifunction Keypad
 - 1K monitor in 2708
 - 1K RAM
 - 128 byte scratchpad RAM
 - 22 in/out ports
 - Access at card edge to all buses
 - 1K EPROM EMULATION
 - Direct memory access for fast data transfers
 - Editing facilities, including — data entry/deletion, block shift, block store, match byte, displacement calculation
 - Supplied with Zif socket, simulator cable and comprehensive manual
- SOFTY Kit of parts £100 + VAT
SOFTY Built & tested £120 + VAT
SOFTY Built power supply £20 + VAT

P&P IS INCLUDED IN ALL PRICES
Add £6 to order total for next day delivery by DATAPOST.



SOFTY CONVERSION CARD

Enables SOFTY to program the single rail EPROMs, 2508/2758/2516/2532. Selection of device type and 1K block are by pcb slide switches. Programming socket is zero insertion force. Easy connection to SOFTY with the DEP Jumper supplied. Built and tested: £40 + VAT, postage paid.

SOFTY PRINTER

• 40 column electrosensitive printer • 5 x 7 dot matrix • print sizes • Push button hex print-out of SOFTYs RAM, EPROM or inter-cursor contents • On card PSU • Selection of bytes per line. Built and tested £145 + VAT, postage paid.

EX-STOCK EPROMS

	1-9	10-24	25 up
2716 (single rail)	9-00	8-00	7-35
2708	4-80	4-30	3-90

ADD VAT AT 15% — POSTAGE PAID

WRITE OR TELEPHONE FOR DETAILS ON ANY OF OUR PRODUCTS

• Circle No. 328



King Pin Computers



NOW YOU DON'T HAVE TO GO TO THE ENDS OF THE EARTH TO GET SHARP MZ80K AT DISCOUNT PRICES!!

MZ80K	MRRP	OUR PRICE
24K RAM	£480	£439
36K RAM	£549	£469
48K RAM	£599	£499

1 YEAR WARRANTY FREE DELIVERY
LOTS OF FREE PROGRAMS

SUPPLIED WITH 14K BASIC — ASSEMBLER
AVAILABLE NOW — OTHER LANGUAGES
SOON. PRINTER & DISKS AVAILABLE NOW
— OTHER GOODIES COMING.

WE ALSO HAVE PCI211 at £89.95
SUPERBRAIN & ORI MICROLINE 80 PRINTER

ALL PRICES PLUS VAT

IF YOU SEE IT CHEAPER ELSEWHERE,
LET US KNOW

PO BOX 40, STEVENAGE, HERTS.
TEL: STEVENAGE (0438) 59677

• Circle No. 329

SAVE ON APPLES PETS DISCS NASCOM

FREE DELIVERY add 15% VAT to all prices

- 48K APPLE II PLUS £700
- 8K PET with integral cassette £400
- NASCOM II KIT with 16K RAM £305
- 10 DISCS, boxed (Verbatim, Kybe) £25
- TEAC FD-50A single/double density Floppy Drives £155

Allow 14 days delivery, SECURICOR delivery at extra cost
MAIL ORDER MICROS, PO BOX 301, BURSLEM
STOKE-ON-TRENT, ST6 4HY, PHONE 0782 825391

Barclaycard & Access accepted
Prices subject to change without notice
Special offers subject to availability of stock
E&OE

• Circle No. 330

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

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 advantages of our service —
TELEPHONE NOW FOR AN APPOINTMENT.

MICROSOLVE COMPUTER SERVICES LTD.

3rd Flor (rear), MIDDLESEX HOUSE,
29-45 High Street, EDGWARE, Middlesex.
01-951 0218/9/0

(exit 4 M1/20 mins. West End). prices ex. VAT.

• Circle No. 331

Alive... well... and very healthy

As a Nascom user I had enormous satisfaction and sensed an excitement about the future when told that I had Nascom.

I have been determined from the start of the troubles that Nascom would be revived and with several colleagues formed an association with sufficient finance to purchase and expand the new company.

Being a customer I am only too well aware of the frustrations caused by Nascom's supply problems. The root of these was cash and, as we will not have that problem, I am very confident that Nascom International can progress quickly and professionally into a normal supply situation.

While immediately supporting our traditional marketplace we intend to expand the company rapidly into the manufacturing of industrial Nascom products. The design of certain products is already under way and the first of these will be a Prestel users receiver which will be available at the start of 1981. This is a separate, stand alone unit having no connection with previous

Nascom products. We have several other projects under design or investigation that will give the new industrial division a good start next year.

We have the finance and facilities to exploit new ideas and would be very pleased to hear from any designer who has an idea based around Nascom products. Anyone with hardware or software please write to me at Pall Mall.

Nascom announced many products in the last year few of which arrived. Luckily during receivership many of these designs were completed and we will immediately be purchasing supplies to make these available a.s.a.p.

There are also other Nascom 2 products defined that we will quickly engineer and produce in the next few months.

The future for micros is undeniable and Nascom International intends to retain its rightful place at the head of European microcomputing.

Peter Mathews Chairman



Competition-best caption I.

To allow the frustrated to vent their ire and the imaginative to vent their flair we invite your captions to the four cartoons that appear this month. A prize for each and the winners published. You can't win if you are too rude as we can't publish. Send to Chesham marked "Cartoon".

New Start With 20,000 users and a good deal of frustration and uncertainty mixed into the enthusiasm we invite everyone to write with their ideas and needs. The new home division will not be able to answer all the letters but policy decisions on direction can best be made on research into user needs.

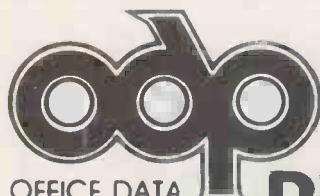
Dealers We intend to continue the policy of sales through dealers and Nascom International will not be selling products direct to the public. Stocks we know are depleted and we would ask you to allow us time to restock our dealer network.

nascom INTERNATIONAL

new company... new people... new start...

92 Broad Street, Chesham, Buckinghamshire. 02405 75151
46 Pall Mall, London SW1. 01-839 3143

• Circle No. 332



OFFICE DATA
PRODUCTS

Flexible Diskettes from...



SPECIAL OFFER OF

Quality Floppy Discs from the World's
Largest Manufacturer of this type of Product.
Fully Guaranteed.



Extra
Special
Offer!

84000 Single Sided Single Density 8" Diskette
26 Sectors, 128 Bytes/Sector **£1.45**

85201 Single Sided Single Density 5 1/4" Diskette
35 Track Certified. Soft Sector **£1.05**

85501 Double Sided Double Density 5 1/4" Diskette
35 Track Certified Soft Sector. **£1.59**

*All other configurations available plus all other
magnetic media and accessories.*



**D.N. COMPUTER SERVICES LTD.,
WEST CROFT INDUSTRIAL ESTATE,
MANCHESTER OLD ROAD, MIDDLETON,
GREATER MANCHESTER.**

Tel: 061-643 0016 Telex: 635091

• Circle No. 333

Floppy disc File



Easy reference filing system for your flexible
computer discs, files 20 discs per binder. File
sheets retain 4 discs, have reinforced binder
edge and file reference tab. Leaves punched
for 2 and 3 hole binders. Also available for 8"
discs, files 10 discs per binder.

—Please state size when ordering

Binder complete with 5 leaves £4.95 + VAT

Pack of 5 leaves only £1.55 + VAT

BASF and Memorex mini discs £27 + VAT per box (10)

Clean your monitor screen with the revolutionary
Quick Wipes, Anti-Static tissue. Removes dirt, dust
and static in one wipe. £2.75 per can + VAT

LEICESTER

computer centre limited

109 QUEENS ROAD LEICESTER LE2 1TT Tel: 0533 709841

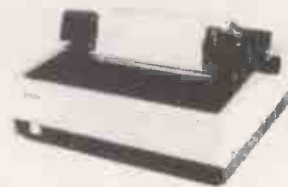
• Circle No. 334

Enter the Computer Age video genie system

12K MICROSOFT BASIC
16K RAM, TV MODULATOR
INTERNAL CASSETTE



80 Columns
70 Lines per minute
Graphics Characters
Interfaces to most
machines Tractor or
friction feed



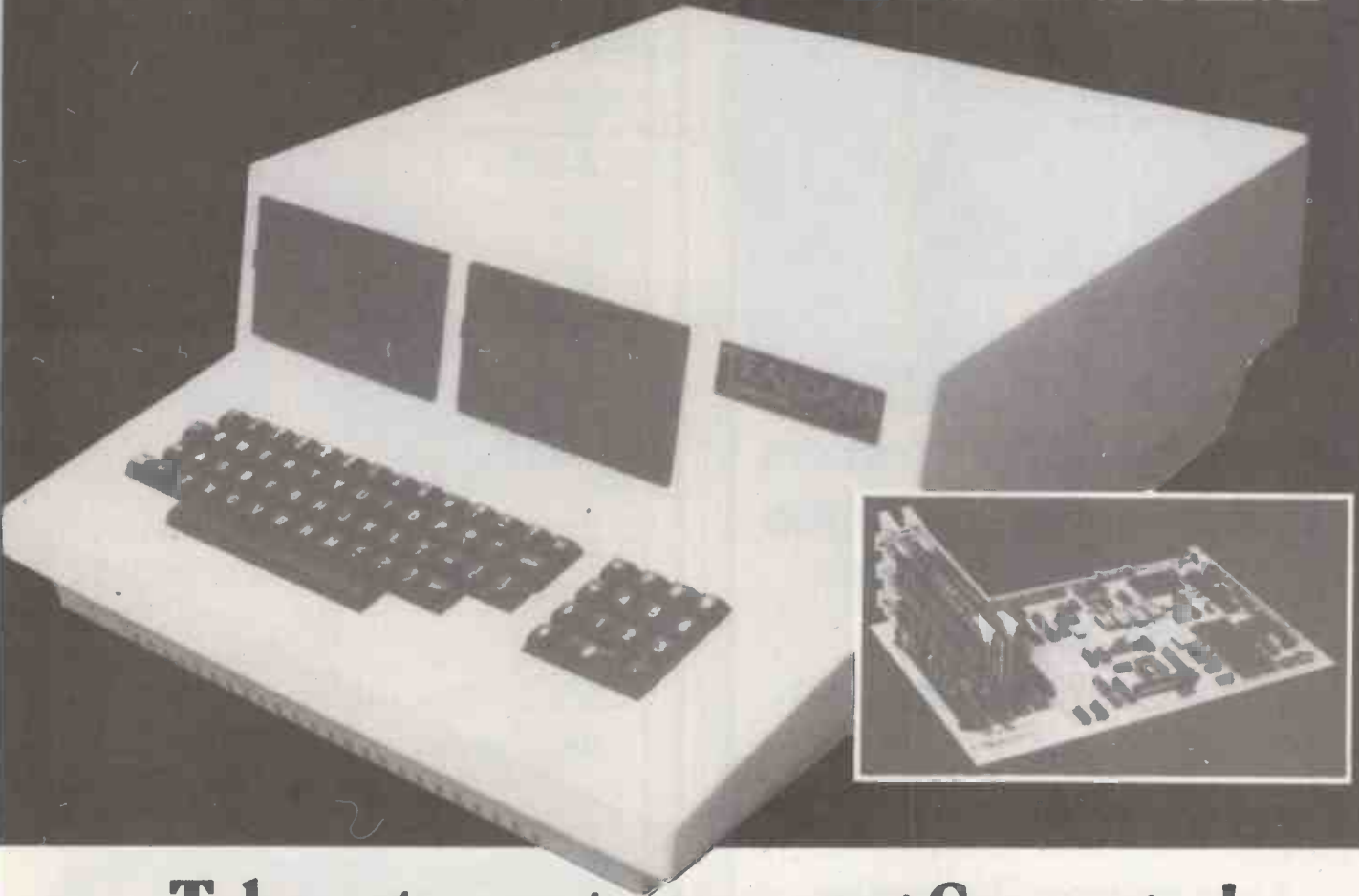
100's of programs available
TRS 80 level II software
compatible

Eiron Computers Ltd

Eiron House Co Dublin
Park Road Ireland
Dun Laoghaire Tel: 808575/805045

• Circle No. 335

'TUSCAN' FROM TRANSAM



Take a step up to your next Computer!

THE CONCEPT

How many ways are there to build an S100 system? Not many, and all expensive. TUSCAN changes all that.

Five S100 boards on one single board—just for starters. Plus five extra slots for future expansion.

What a combination! Z80 and S100 with the TRANSAM total package of system and applications software.

THE PRICE RANGE

From £235 for complete main board kit to £1481 for 48K assembled with 2 x 5¼" drives.

THE HARDWARE

The first Z80 single board computer with integral S100 expansion. British designed to the new IEEE (8 BIT) S100 specification, the TUSCAN offers total system flexibility. A flexibility available now.

The board holds the equivalent of a Z80 cpu card, 8k ram, 8k rom video and I/O cards with 5 spare S100 expansion slots and offers a price/performance ratio which is hard to beat.

Just compare our price with a commercial S100 ten slot motherboard with this specification.

THE SOFTWARE

TUSCAN offers the user the choice of system monitor, editor, resident 8k basic, resident Pascal compiler or full CP/M disk operating system. All options are upwards

compatible and fully supported with applications software. Both 5¼" and 8" drives are supported in double density.

THE PACKAGE

TUSCAN is available in kit form or assembled. With several hardware and software options to suit your requirements and budget. Attractive desk top case also available holds 2 x 5¼" Drives.

TRANSAM

NOBODY DOES IT BETTER!

Send to Transam Components Ltd., 59/61 Theobald's Road, London WC1.

I am interested in the TUSCAN Z80 based single board computer
NEW LOW PRICES, send S.A.E. for further details.

Name _____

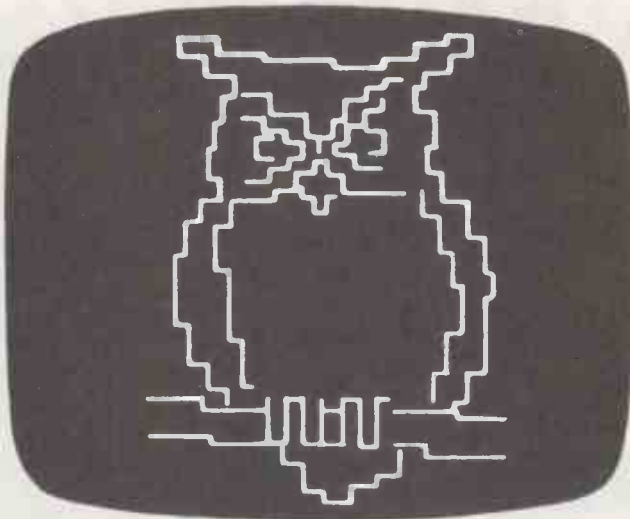
Address _____

Telephone _____

PC12

TRANSAM COMPONENTS LTD., 59/61 THEOBALD'S ROAD, LONDON WC1. TEL: 01-405 5240/2113

• Circle No. 336

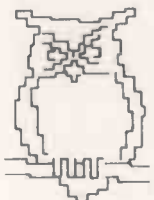


You lucky Apple II owners— by adding **Appletel** you can have the only **PO approved** computer connection

With Appletel you can link your present Apple II computer direct to Prestel for just £595 plus VAT - which is a major cost saving for a start. Add in these other major advantages and you'll really appreciate what the complete Owl Computer package can do for you!

- ★ Save on telephone bills by storing pages from Prestel on a floppy disc - screen them up on Apple II when you're ready.
- ★ Programme the unit to automatically call up a sequence of pages, and store them for later examination.
- ★ Write your own BASIC programs to process Prestel data as well as send commands to Prestel.
- ★ The full keyboard means you can use Prestel to maximum advantage for sending messages.
- ★ Appletel is now available in colour

For full details on what Appletel can do for you, and the name of your nearest dealer, please phone or write.



Owl Computers

18 Hadham Road, Bishop's Stortford
Herts CM23 2QR
Tel: Bishop's Stortford (0279) 52682

• Circle No. 337



MINIATURE KEYBOARDS

SPECIAL OFFER

RAPID TURNAROUND
CUSTOM DESIGN IS
OUR SPECIALITY



Apex is manufacturing miniature keyboards in volume for the T.V. and Computer Industries. Substantial cost savings have been made and these are now being offered to the end user in this Introductory Special Offer. Ideal for interfacing to micro based systems via an 8 bit ASCII data bus or a serial 20mA/RS232 port these attractively styled keyboards have all the features of full sized units at a fraction of the cost.

• Miniature ASCII keyboard	MKBOI	£40.00
• Cased ASCII Keyboard	MKBOIC	£45.00
• Serial Cased Keyboard (20mA)	MKBOICMA	£65.00
• Serial Cased Keyboard (RS232)	MKBOICRS	£65.00
• BCD Encoded Hex Pad	MHPDI	£17.95
• Ribbon Cable and Connector	RCC20	£2.50

When ordering serial interfaces please specify Baud Rate.

APEX MICROSYSTEMS LTD 06333 69169
Unit 22 Springrate Industrial Estate
Cwmbran, Gwent

• Circle No. 338



Making computers talk your kind of language.

C.A.S.
Software.
The complete
business program
service

A fast efficient and knowledgeable service for the distribution of programs for business and professional use.

To date we have over a 100 programs covering all aspects of accounting and management information.

Programs available, for Apple, PET and CP/M include:

Solicitors Accounting
Full accounting in accordance with Solicitors accounts rules.

Stock Control
Maximises efficiency even calculates re-order levels automatically.

Payroll
A comprehensive system complying with inland revenue standards.

Supertext
An advanced word processing program with calculating facilities.

For further information talk to Sue Hoban or Joan Caughey

051-236 6351

Customer Accounting Service, 5 Queen Avenue, Castle Street,
Liverpool L2 4TG.

Enquiries welcomed from Dealers for our complete service.

Programmers, we are always interested in marketing good business software.

• Circle No. 339

HAL COMPUTERS

NEW FROM



A complete range of professional floppy disc products from the industry leaders....compatible with TRS 80, Superbrain, Ohio, SWTP, North Star Horizon, Zenith, Cromemco etc.

You can now buy the entire range of Tandon Magnetics high quality, market leading, mini flexible disc drives direct from the exclusive U.K. Distributor.

Tandon drives are available as either the OEM product or as complete packaged units in single or dual drive British manufactured cabinets with high reliability power supply. Complete pre-test and burn in ensures reliability and all drives carry a full 6 months parts and labour warranty.



BOXED DRIVE PRICES

	Single Box	Dual Box
Single Sided 40 track	£250.00	£430.00
Double Sided 40 track	£330.00	£599.00
Double Sided 80 track	£430.00	£808.00
Dual Boxed Single Sided plus double sided	£549.00	

With Tandon you get 40 or 80 tracks—more capacity and step rates as low as 3 mS track to track—up to ten times the speed of other drives.



MICROTEK PRINTERS



So reliable we give you 365 days warranty.
40, 80, 120, 132 columns.
125 cps. 70 lines/minute.
96 characters, upper/lower case.
Prices start at: £460.00
Interface cables for Apple, TRS-80 etc.



STROBE PLOTTERS



The Strobe drum plotter uses low cost colour pens to draw graphs, charts and pictures with .004" resolution.

Prices start at £545.00

Interfaces and software for TRS-80, Apple, PET, Horizon, S-100 on 5" and 8" diskettes.

STORAGE SYSTEMS



Use our discoflex range of storage wallets and boxes to protect your discs when not in use, or for sending through the post.

5 1/4"	£10.00
8"	£12.00

POWER SUPPLIES



Our range of Power-One power supplies covers single, dual and triple output not to mention a complete selection of supplies which power all popular floppy disc drives.



SERVICE AND MAINTENANCE



For the large scale user of 5 1/4" or 8" floppy disc drives, our range of alignment diskettes and service tools are a must. Send for details of our Oasis range of

portable dedicated and non-dedicated floppy disc and peripheral test and exerciser systems.

For immediate information on any of these products please contact:

HAL COMPUTERS LIMITED

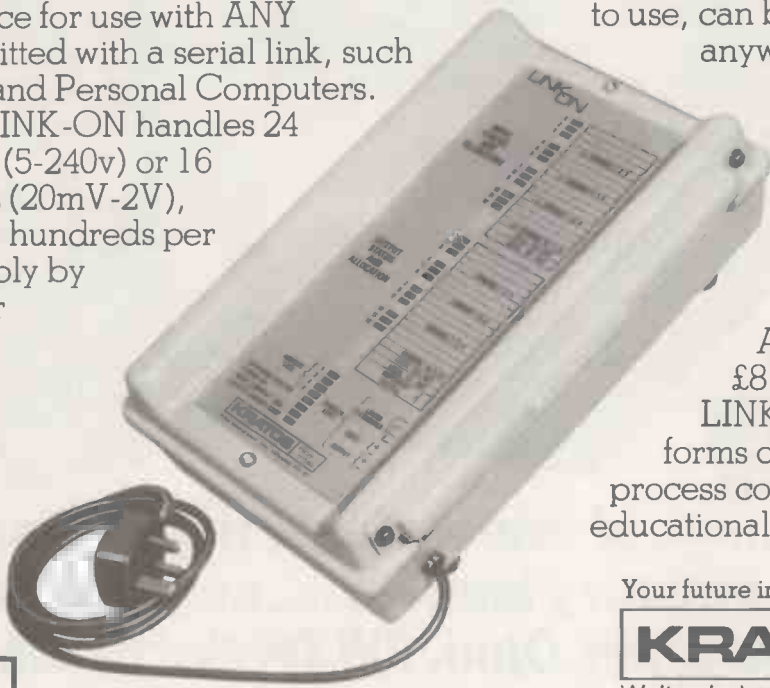
133 Woodham Lane New Haw
Weybridge Surrey KT15 3NJ
Tel: Weybridge (0932) 48346/7
Telex: 8813487

LINK-ON GIVES YOU REAL WORLD CONNECTIONS IN ALL THE RIGHT PLACES.

LINK-ON is a LOW COST local and remote interface for use with ANY COMPUTER fitted with a serial link, such as DEC, Intel and Personal Computers.

A single LINK-ON handles 24 digital signals (5-240v) or 16 analog signals (20mV-2V), expandable to hundreds per serial link simply by adding further LINK-ON's in multidrop fashion.

Dealer enquiries invited.



LINK-ON is ROBUST, EASY and SAFE to use, can be positioned almost anywhere and is complete with Klippon terminals, signal isolation and indication, power supplies and watchdog alarm facilities.

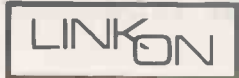
All this from as low as £8 per channel makes LINK-ON ideal for all forms of data acquisition, process control, scientific and educational applications.

Your future in control and technology

KRATOS Instem Limited

Walton Industrial Estate, Stone, Staffs. ST15 0LT. Tel: 0785 812131. Telex: 36340

• Circle No. 341



Printed Continuous Stationery

we can supply printed continuous forms with your company name and logo plus ex-stock single part listing paper in the following sizes:-

depth x width	(in inches)	depth x width
11 x 9¼		13 x 9¼
11 x 9½		8½ x 11½
11 x 10¾		12 x 8½
11 x 9⅞		12 x 9¼ 60 gsm
11 x 8½	NEW	12 x 9¼ 70 gsm
11 x 12		12 x 9¼ 85 gsm
8½ x 12		

multiples in OTC or NCR are available for prices and details telephone:-

David Richards 01-520 8624

David Richards (Printers & Distributors) Ltd 61/63, Hoe Street London E17 4SA

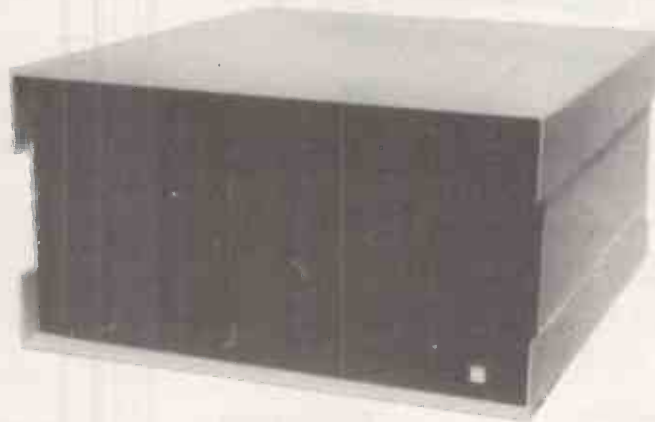
• Circle No. 342

SIRTON COMPUTERS



76 Godstone Road, Kenley (Nr Croydon) Surrey CR2 5AA
Tel: 01-668 0761/2

MIDAS S.100 SYSTEMS



MIDAS 1: From £750
MIDAS 2: From £1580
MIDAS 3: From £2150
MIDAS 4: From £5900
ITHACA-DPS 1: From £1075

- Our versatile Z80 Microcomputers are available as standard units or custom configured to your exact specification from a comprehensive range of stocked S100 boards.
- Disc storage capacity of the MIDAS 3 can be 2M Bytes, expandable to over 20M Bytes with a Winchester Hard Disc Unit in our MIDAS 4 range.
- MIDAS runs CP/M and MP/M is also available. Other Software includes M-BASIC, C-BASIC, FORTRAN, COBOL, CIS-COBOL, PASCAL and Word Processing.
- **A MIDAS 3, with 64K RAM and 2M Bytes storage on two 8" drives with two Serial I/O Ports and CP/M 2 only £2600.**
- Printers, VDUs and other peripherals stocked to give complete package systems at keen prices.
- Business Packages include Accounts, Stock Control, Purchase Ledger etc etc.
- OEM and Dealer enquiries welcome.

Boards stocked from Ithaca, Godbout, SSM, S D Systems, Vector, Micromation, Mullen, Mountain Hardware, Hi-Tech, Video Vector, Pickles & Trout, Central Data, Cromemco, Thinker Toys — Send for full Price List (many available in kit form).

Processor			
Z80 Starter Kit	£188		
SBC100	£208		
SBC200	£237		
Z80 CPU 4 MHz	from £130		
EPROM			
2708 EPROM (16K)	£60		
2708/2716 Programmer	from £134		
Video			
16 lines, 32/64 ch	from £104		
24 lines, 84 ch	from £265		
Disc Controllers			
Versafloppy S/D	£198		
Doubler D/D	£280		
		RAM	
		Dynamic RAM 16K-64K	from £205
		Static RAM 8K-64K	from £95
		Memory Manager	£52
		I/O	
		2S/4P prov 4K RAM/4K ROM	£169
		2S/2P or 2S/4P or 3P/1S or 4S/2P	from £135
		Analogue 8 or 12 bit	from £287
		Optically isolated I/O	£114
		IEEE 488 Interface	£350
		Miscellaneous	
		Real Time Clock	£180
		High Dens Graph/8K RAM	£333
		Hi-Tech Colour	£295
		Motherboards — various from	£34
		Extender Board/logic probe	£39
		Maths Board AMD 9511	£330

Software
CP/M 1 & 2, MP/M, PL/1, C-BASIC 2, M-BASIC V5, XYBASIC, FORTRAN 80, COBOL 80, CIS-COBOL, PASCAL/Z, PASCAL (UCSD), PASCAL M/T, Forth, MAC, ZSID, Disassembler, Wordstar, Datastar, Magic Wand, Wordmaster, Supersort etc etc.

WRITE OR PHONE FOR CATALOGUE
SIRTON COMPUTERS WAS FORMERLY SIRTON PRODUCTS

• Circle No. 343

Enter the Computer Age video genie system

12K MICROSOFT BASIC
16K RAM, TV MODULATOR
INTERNAL CASSETTE



£330
+ VAT

£395
+ VAT

80 Columns
70 Lines per minute
Graphics Characters
Interfaces to most
machines Tractor or
friction feed



100's of programs available
TRS-80 level II software
compatible

Eley Electronics
100/104 Beatrice Rd
(Off Fosse Road North)
Leicester
Tel: 871522

• Circle No. 344

EMG MICRO SYSTEMS EMG 01-688 0088

We are specialists in complete installations
tailor made for your business requirements:

WORD PROCESSING SYSTEM	£1999
INVOICE AND CUSTOMER SYSTEM	£2999
LEADS AND SALES SYSTEM	£2999
INSURANCE AGENT SYSTEM	£2999
ESTATE AGENCY SYSTEM	£2999
COMPLETE BUSINESS SYSTEM	£3999

We are MAIN LONDON SORCERER STOCKISTS

Sorcerer Systems Desk, Mains Stabilisation,
Cooling Fan, Memory Upgrades, Servicing

RENTAL

Plug-in 315K Disk Drive	£31 per week
Video Disk Unit	£ 5.59 per week
Daisywheel WP System	£14.99 per week
WP Correspondence Course, Link your Sorcerer to a mainfram or other Sorcerer	

Full software list on request

6 COPIES OF SOURCE MAGAZINE ONLY £5

Write to Dept PCA, EMG Microcomputers Ltd,
30, Heathfield Road, Croydon, Surrey.

• Circle No. 345

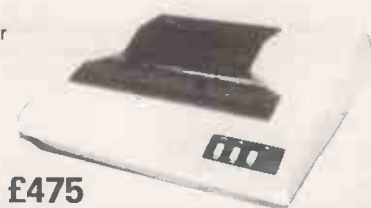
BIRMINGHAM COMPUTER CENTRE

COMPLETE BUSINESS SYSTEMS FROM THE PROFESSIONALS

NEW MODEL: BD-80P
THE NUMBER 1 HI-SPEED PROFESSIONAL
MATRIX PRINTER.

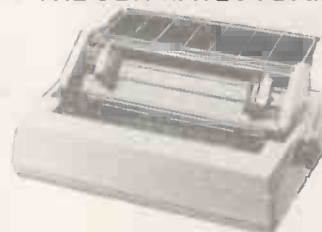
Now with graphics plus 10 user
defined 750K Buffer Standard
with further 2K option
RS232
Serial.
or parallel interface
plus numerous advanced
features.

NEW-LOW—PRICE



£475

THE ULTIMATE IN DAISYWHEEL PRINTERS



RICOH.RP 1600

£1490

THE BEST WORDPROCESSOR. PRINTER. AVAILABLE
DEALER ENQUIRIES WELCOME

IF IT'S THE BEST WE STOCK IT

Complete range of — Off the Shelf Programs from the best in
the country including:
Commodore — Full range of Business Programs.
Act — Complete range available
Bristol Software Factory. Trader-Item-Monitor
Computastore — Payroll
Gamma-Winter — Complete Suit of Programs

Full range of Books and Magazines
C15 — Super Quality Data Tapes Boxed 10 — £5.00
Disks certified 5 1/4' Boxed 10 — £30.00
Printer Ribbons — Listing Paper — Mailing Labels —
Dust Covers, etc.
Commodore 3032/16. Disk operating systems in
ROM.

* SPECIAL PRICES FOR BETSI — KIMSI — MOTHERBOARDS — KIM.1. — PHONE FOR PRICE *

SHOWROOMS OPEN DAILY. 9—6 P.M.
LARGE CARPARK ADJACENT.

DEMONSTRATIONS AT YOUR CONVENIENCE.
SALES • SERVICE • SATISFACTION



CAMDEN ELECTRONICS
462 COVENTRY ROAD
SMALL HEATH, BIRMINGHAM B10
021-773 8240 — 021-772 5718



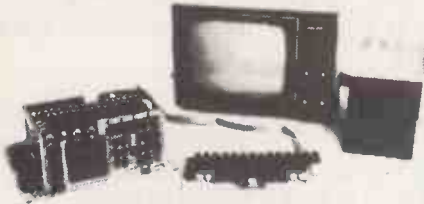
HP
LEASING
ETC

• Circle No. 346

From Newtronics

THE NEW EXPLORER/85 SYSTEM

EXPLORER/85 PROFESSIONAL COMPUTER KIT



NOW AVAILABLE with 8" Floppy Disc System. An inexpensive 8085S Based S-100 Computer system designed for maximum flexibility.

An inexpensive 8085, S100 Based Computer System designed for maximum flexibility
Now available with 8" Floppies

The EXPLORER/85 offers you real design flexibility — you can build the exact system you require. EXPLORER/85 can be your Beginners System, OEM Controller or IBM formatted 8" Disc System. You don't buy more than you need. Prices start from £85.

Here's the line up:

Intel 8085 microprocessor. 8355 as a really powerful 2K Monitor system. 8155 RAM I/O all on one single Mother board with room for RAM/ROM/PROM/EPROM and two S-100 pads (expands to six), plus plenty of prototype space.

The 8085 is 100% compatible with the 8080 but 50% faster. The 8355 ROM 2K monitor system includes cassette interface with tape control. Two 8-bit programmable I/O ports, automatic baud rate selection, labelling of cassette files, etc. 8155 RAM I/O features ¼K 'scratch pad'. Two programmable 8-bit and One programmable 6-bit I/O ports plus programmable 14-bit binary counter-timer. Plus many other features which cannot be included due to lack of space.

You can purchase the EXPLORER/85 Mother board (level A) at this point for as little as £85 or we'll supply it with address decoding and data drives plus wait state generator and separate regulators (level B), 4K Workspace (level D), 8K Microsoft Basic in ROM for £233 in kit form or £293 assembled and tested.

If you don't possess a VDU you can add our Keyboard Terminal (less monitor) which features a full ASC11 keyboard with upper and lower case with cursor control. Video Display board which is microprocessor controlled giving 64 or 32 (on TV) Characters by 16 lines adding up to a full computer system having 4K workspace at a special price of £299 (less P.S.U. and monitor/TV).

Compare these prices carefully and you'll find you are actually getting more for your money.

4K space not enough? Then it's 'JAWS' for you (see below) and you can go up to 64K in 16K steps. We'll let you have a 16K EXPLORER/85 for only £338.

Like a Floppy Disc system? We now have an 8" Drive system with CP/M. We will quote you for a complete system either in kit form or assembled ready to go.

8" FLOPPY DISC SYSTEM

8" Control Data Corp Professional Drive

* LSI Controller * Write protect * Single or Double density * Capacity 400K Bytes (SD) 800K Bytes (DD) unformatted * Access time 25ns. Price £350.

DISC CONTROLLER I/O BOARD

Controls up to 4 Drives * 1771 ALSI (SD) floppy disc controller * On board data separator (IBM compatible) * 2716 PROM socket included for use in custom applications * On board crystal controlled * On board I/O baud rate * Two serial I/O ports * Autoboot to disc system when system reset * Generators to 9600 baud * Double-sided PC board (glass epoxy). Price £150.

DISC DRIVE CABINET WITH POWER SUPPLY

De Luxe steel cabinet to house single drive with power supply unit to ensure maximum reliability and stability. Price £79.

DRIVE CABLE SET-UP FOR TWO DRIVES

Price £19.00.

SAVE £30 by purchasing complete single drive system. One 8" drive, F.D.C. board, cabinet/PS.U. and cables. Regular price £598, Special price £568. CP/M 1.4 £75. CP/M 2.0 £98. Extended Microsoft Basic £199. Let us quote you for other Software.

64K 'JAWS' S100 DYNAMIC RAM BOARD



Newtronics solves the problems of Dynamic RAM with a state-of-the-Art chip from Intel that does it all. Intel's 8202 64K dynamic RAM controller eliminates high logic parts ... delay lines ... massive heat sinks ... unreliable trick circuits.

We offer you — Hidden refresh fast performance lower power consumption latched data outputs 200ns 4116 RAM's on board crystal ... 8K bank selectable fully socketed solder mask on both side of the board

Designed for 8080, 8085 and Z80 bus signals works in Explorer/85, Tuscan, Horizon, Sol, as well as all other well-designed S100 computers.

16K kits	£149	Wired and tested	£169
32K kits	£194	Wired and tested	£214
48K kits	£239	Wired and tested	£259
64K kits	£284	Wired and tested	£304
16K expansion kits	£45		

ELF II

SPECIFICATION

RCA 1802 8-bit microprocessor with 256 byte RAM expandable to 64K bytes.

RCA 1861 video IC to display program on TV screen via the RF Modulator Single Board with Professional hex keyboard — fully decoded to eliminate the waste of memory for keyboard decoding circuits. Load, run and memory protect switches. 16 Registers. Interrupt, DMA and ALU. Stable crystal clock. Built-in power regulator 5-slot plug in expansion bus (less connectors).

**STARTS AT
£59.95**

ELF II BOARD WITH VIDEO OUTPUT

FEATURING THE RCA COSMAC 1802 CPU

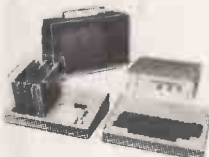
STOP reading about computers and get your "hands on" an ELF II and Tom Pitman's short course. ELF II demonstrates all the 91 commands which an RCA 1902 can execute, and the short course speedily instructs you how to use them.

ELF II's VIDEO OUTPUT makes it unique among computers selling at such a modest price. The expanded ELF II is perfect for engineers, business, industry, scientific and educational purposes.

ELF II EXPANSION KITS

Once you've mastered your ELF II you can then expand it to a full 64K microcomputer with our range of ELF II expansion kits. — Hardware — Firmware — Software — Manuals.

NOW AVAILABLE BASIC LEVEL III with R.P.N. Maths package. Both cassette and EPROM versions.



Newtronics

TVM-10 MONITOR

£99.50

IDEAL FOR APPLE NASCOM
U.K. 101, ETC.

- Designed for monitoring computers, closed circuit TV and Video Tape Recorders
 - 10" black and white video monitor
 - 10 MHz band width
 - High-quality metallic cabinet
 - Dimensions: 9" x 9" x 9 ½"
- Trade Enquires Welcome

SEND SAE FOR COMPREHENSIVE BROCHURE

Please add VAT to all prices. P&P extra. Please make cheques and postal orders payable to NEWTRONICS or phone your order quoting BARCLAYCARD, ACCESS number.

We are open for demonstrations and Sales. Monday-Saturday, 9.30 a.m.-6.30 p.m. Near Highgate Underground on main A1 into London.



CALL:

Newtronics

255 ARCHWAY ROAD, LONDON, N.6
TEL: 01-348 3325



• Circle No. 347

V. & T. ELECTRONICS

	KIT	BUILT	
NASCOM 2 16K RAMB BOARD V & T ASSEMBLER	330	385	Z-80 A CPU, 8K BASIC, 2K MONITOR EASILY & ECONOMICALLY EXPANDABLE & BRITISH.
NASCOM 2	210	250	DOUBLE SIDED, DOUBLE DENSITY. 5 1/4" DISCS CONTROLLER CARD (NAS BUS COMPATIBLE) PSU + CP/M. AVAILABLE MID. NOV. POA.
16K RAMB BOARD	130	150	
3 AMP POWER UNIT	32.50	35	V & T ASSEMBLER PROGRAM FULLY RELOCATABLE. SUPPORTS ALL STANDARD PSEUDO OPS + MNEMONICS. RUNS UNDER B BUG. T4. NAS SYS 1+3. ON TAPE £12.50
GRAPHICS ROM		15	
8 x 4116s TO 32/48K		25	
V & T ASSEMBLER ON TAPE		12.50	PIO OPTION £12 ZEAP EPROM £50 VART OPTION £16 TAPE £30 CTC OPTION £14 NAS DIS £37.50 NAS SYS 3 £40 NAS DEBUG £15 NASPEN £30
VERO 19" FRAM/OR MICROCASE		25	
		512.50	MEMORY 8 x 4116 200 ns DRAM £25.00 TRS80 U/GRADE KIT £26.00 1 x 2708 1K x 8 EPROM £ 4.00 1 x 2716 5V 2K x 8 EPROM £ 6.50
DISCOUNT IF BOUGHT COMPLETE		62.50	
		£450.	
I/O BOARD	45	55.	
EPROM BOARD (UP TO 32K + BASIC)	55	67.50	
NASCOM IMP PRINTER 80CPS		325.	

PLEASE ADD V.A.T. AT 15%

82 CHESTER RD LONDON N19 5BZ TEL (01) 263 2643

• Circle No. 348

1000 MegaBytes give DDP Top Marks for Accuracy.

One thousand megabytes. That's how much information you would have to transfer between our new drives before you got a recoverable error. That represents an error rate of 1 in 1,000,000,000. We think you will be impressed!

 Distributed Data Processing Ltd.
DDP Ltd., 36, Nobel Square, Basildon, Essex. SS13 1LT.
Tel: Basildon (0268) 728484

**TWO SINGLE
HEADED DISKS £750**
**TWO DOUBLE
HEADED DISKS £925**
**FOUR DOUBLE
HEADED DISKS £1350**
**BIG DEALER
DISCOUNTS!**

- Each double sided drive has a capacity of 280K bytes of reliable disk storage making a total of 1120K bytes.
- Fast access - motors are continually running under normal operation, so you do not have to wait for motors to get up to speed.
- Based on proven Western Digital chip technology - the same chip as is used on professional double density 8" drives.
- Fast data transfer - the system can transfer 30K bytes every second to and from your computer.
- IIT/Apple compatible.

- 4 Drives running off one card.
- Power for the disk controller interface is taken from the disk drives own power supply so you do not have to worry about your computer not being able to cope.
- Industry standard IBM format. So you have access to a bigger range of software than ever before.
- Switchable Single/Double Density, enabling you to read and write to disks made on many other machines.

DDP Disk Drives.



In a Class of Their Own.

• Circle No. 349

Write better programs for your pet using **THE PET SUBROUTINE LIBRARY**



An anthology of PET subroutines including:

Data input, special input routines to ensure correct data input — Reducing input errors by use of check digits — Date input verification and storage, avoid errors in date input — Screen formatting output — High density plotting, graphs, barplots and general purpose machine code point plotting routines — General purpose screen handler, a subroutine to perform all data input and output on the screen — Array sorts: bubblesorts, Sheilmetzner, and replacesort — Sorting and merging large disk files — Fast machine code sort package, including a binary search, data input and output to an array and machine code sort (100 element array in a couple of seconds) — Sorting with linked lists, stores data both in sorted and logical order — Sorted output on the printer, ideal for producing indexes — Sequential access disk files — Machine code sequential disk access, some ideas and tips on fast disk access — Random access disk files, an introduction with subroutines to write a random access file, either by record number or by key index — Disk utilities, display block map of disk or print contents of a disk sector — Menus for selecting options and linking programs together — Plus miscellaneous utility programs including repeat key, trace and screen printer.

Price £10.00 all inclusive

3040 format disk with all the subroutines from "LIBRARY OF PET SUBROUTINES"

Price £10.00 inclusive



THE PET REVEALED

Best selling reference book for the PET. Price £10.00

Cheques payable to Computabits Ltd

**COMPUTABITS LTD,
P.O. BOX 13, YEOVIL, SOMERSET. Tel Yeovil 26522**

• Circle No. 350

COMPUTERS

From as little as £20 per week for your own business system with video screen, keyboard twin floppy disk unit and printer. Choose any of the software programs available i.e.:

- Word processing
- Payroll
- Invoicing
- Stock control
- Book-keeping
- Incomplete records
- Time recording
- Information retrieval
- Cash flow
- Projection analysis

And when you've finished your easy days work we've got a few games for you to relax to including Space Invaders.

We have first hand experience in dealing with businesses and can offer you expert advice in setting up your very first system.

We can also offer installation, training and maintenance contracts.

NOW IS THE TIME

EXTRAS & OPTIONS

- Floppy disks
- Continuous Stationery
- Dustcovers
- Automatic sheet feeder
- Tractor feed
- Daisy wheels
- Printer ribbons
- Special Desk Work Station
- Lockable Disk Boxes
- Payslips
- Sound Boxes

HARDWARE

- CBM 3032 Computer
- CBM 3040 Floppy
- CBM 3022 Printer
- CBM 8032 Computer (new model)
- CBM 8050 Floppy (New model)
- Qume Sprints Daisy Wheel Printer

SERVICES

- Installation
- Training
- Maintenance
- After Sales Service

Call into the

DA VINCI COMPUTER SHOP

65 High St., Edgware, Middx.

Tel: 952-0526

Open Mon-Fri. 9-5.30. Sat 9.30-5.00

or send for details



PLEASE SEND ME DETAILS:

Name

Company Position

Address

Tel: No.

I am interested in

PC12

• Circle No. 351

**the
software
house**

**146 Oxford St.
London W1.**

**Our NEW Catalogue
is now available !**

100'S of superb programs !

PLEASE RUSH ME A COPY.....

**I enclose £1 (deductible from 1st
order) for your descriptive and
illustrated catalogue**

Name

Address

• Circle No. 352

* TX-80B 80 COLUMN DOT MATRIX PRINTER

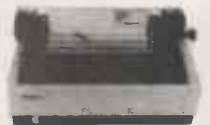
FEATURES

- * Reliability
- * Low cost
- * 70 lines/minute
- * Compact size
- * 96 Chars + Pet Graphics
- * Condensed line, enhanced print
- * Self-test
- * 5x7 dot. matrix, 6x7 for graphics
- Centronics parallel interface standard

EPSON

£349

+ VAT



OPTIONS:

- * PET, APPLE, TRS80, VIDEO GENIE, RS232, Interface board and cable £40 each + VAT
- * NASCOM Interface cable £12.

* MEMORY BARGAINS

	1+	10+	100+
4116-200ns, 16K x 1 DRAM Ceramic	3.75	3.35	2.80
2708-450ns, 1K x 8 EPROM	4.75	4.00	3.45
2716-450ns, 2K x 8 INTEL Type single +5V	10.45	9.65	8.45
2732-450ns, 4K x 8 INTEL Type single +5V	28.85	23.45	18.99
2114-1K x 4 SRAM	3.95	3.60	3.00

+ VAT

ALL components
are manufactured
by leading companies and guaranteed full specification.



The versatile microprocessor development tool, connects directly to TV or monitor, can copy burn, verify 2708, 2716 EPROMS has serial (RS232) or parallel link for any small computer — only £120 built and tested, kit £100, power supply £20 equivalent development systems cost £500 + VAT

**NOW
£319
+ VAT**

VIDEO GENIE SYSTEMS EG3003 —

Based on TRS-80, utilises Z80, 12K Level 11. Basic 16K RAM, INTEGRAL CASSETTE Deck, UHF O/P, All TRS-80 features.

Interfaces to EPSON printer.



12" MONITOR
Ideal for Personal and
Business Computers £65 + VAT

**VIDEO GENIE EXPANSION BOX
£219 + VAT**

- * Low Cost EPROM Eraser £34 + VAT
- * High Speed Eraser typically 4-7 mins 2708 £97 + VAT

Q-Tek Systems Ltd

2 Dalry Close, Old Town, Stevenage, Herts
Tel (0438) 65385



24 HOUR DESPATCH
(Stock Permittinal)

• Circle No. 353

Important announcement

Manchester — the birthplace of the British computer is to stage the most significant computer event ever to be held in the North of England.

MANCHESTER MICRO SHOW

**Three Day Exhibition & Seminars
29, 30 April, 1 May 1981**

**New Century Hall and
the National Computing Centre**

Exhibitors at the Mersey Micro Show have already taken up many of the options offered — please contact Jane Windeler at the Online offices who will reserve your company a stand awaiting your written confirmation.

online

Online Conferences Ltd.
Argyle House Northwood Hills Middx. HA6 1TS.
Tel: (09274) 28211



• Circle No. 354

FINANCIAL ACCOUNTING SYSTEMS

For the Commodore PET Computer

Comprising:

- 1: Sales Ledger
- 2: Purchase Ledger
- 3: Nominal Ledger
- 4: Open Item Sales Ledger
- 5: Open Item Purchase Ledger
- 6: Open Item Nominal Ledger
- 7: Integrated Sales, Purchase & Nominal Ledgers
- 8: Integrated Open Item Sales, Purchase & Nominal Ledgers
- 9: Budgets Within Nominal Ledgers (3,6,7 and 8)
- 10: Invoicing & Analysis Integrated with Sales Ledger (1,4,7 & 8)
- 11: Stock Recording Integrated with Invoicing and Analysis

**Note Requires 32k Computer, 3040 Disk Drive & Printer
*** Sensibly Priced Software for the Commodore PET ****

SOFTWARE LICENCE FEES

Systems 1. to 6. £90.00 + vat each
Add-ons 7. to 9. £50.00 + vat each
Add-on 10. £100.00 + vat
Add-on 11. £150.00 + vat

Pre-Printed Stationery Available

Send for System Specifications and Sample Printout



THISTLE COMPUTERS
39 ALBERT STREET
KIRKWALL
KW15 1HQ
(0856) 3140

And at The Square, Beaulieu, Inverness.

** We also supply the hardware for the above systems **

• Circle No. 355

BEAVER
SYSTEMS



Norlett House
Dormer Road
Thame
Oxon OX9 3UC
Telephone Thame
(084421) 5020 (24 hr)

YOUR COMPLETE OHIO SCIENTIFIC SERVICE

HERE ARE FIVE VERY GOOD REASONS FOR CALLING US -

1. O.S.I. SYSTEMS

- including the popular SUPERBOARD II and CHALLENGER 4P as either cassette or disc based systems.

2. O.S.I. SOFTWARE

- cassette and disk based software covering a broad spectrum of uses. Some of the cassette based software can also be run on the U.K.101.

3. BEAVER SOFTWARE

- Business, educational and entertainment software - professional programs with full listings and documentation. Also available for other systems - especially the U.K.101.

4. BEAVER PROGRAMMING AIDS

- including Video Workpads, BASIC workpads, Machine Code Workpads, Cassette Index cards and labels and Blank Cassettes, all available for OSI, U.K.101, and TRS-80.

5. BEAVER EXPANSION

- Economy memory expansion using motherboard and slot-in 8K RAM boards, 8K EPROM boards, floppy control board & shortly, PROM Programmer board. Buy as much as you need when you need it.



CALL OR WRITE... NOW!



• Circle No. 356

T.W. COMPUTERS LTD

— for ITT 2020/APPLE MICROCOMPUTERS
IN THE NORTH WEST

PAYMASTER

A WAGES & P.A.Y.E. PROGRAMME REQUIRING ONLY ONE DISC UNIT!
SIMPLE, EASY TO USE AND WITH THE FOLLOWING FACILITIES: -

- PRINTS - WAGES BOOK
- PAYSLEIPS
- EMPLOYEE FILES *
- LISTS OF EMPLOYEES *
- FORM P35
- FORMS P60
- ALL INFO. FOR T.D. CARDS
NOT-CONTRACTED-OUT
N.I. CONTRIBUTIONS
(*CAN ALSO BE VIEWED ON SCREEN)

INLAND REVENUE SPECIFICATIONS
AUTOMATIC CLEARANCE OF
AMOUNTS AT YEAR END - NO NEED
TO RE-ENTER EMPLOYEE DETAILS.
UP-DATE SERVICE UP TO 100
EMPLOYEES. ALL CODES COVERED.
ALTERS ALL APPROPRIATE FILES FOR
GENERAL CODE INCREASES.
RECORDS DETAILS OF CODE & N.I.
CLASS CHANGES

PRICE £150 + V.A.T. (£172.50)

PAYCLERK

A USEFUL PROGRAMME FOR USE WITHOUT A PRINTER.
GIVES FULL DETAILS ON SCREEN OF ALL FIGURES FOR T.D. CARD IN RESPECT OF ANY CODE. UP-DATE SERVICE.

(.....we find the Payclerk a very useful programme
..... A.G.A. MANCHESTER)

PRICE £50 + V.A.T. (£57.50)

ALL OUR BUSINESS PROGRAMMES ARE DEVISED SPECIFICALLY FOR THE SMALL/MEDIUM SIZED BUSINESS.

**T.W. COMPUTERS LTD., 293 LONDON ROAD, HAZEL GROVE
STOCKPORT, CHESHIRE. TEL: 061-456 8187**

• Circle No. 357

We specialise in big help for buyers of small systems.

Lots of people feel they need help when it comes to choosing and buying a business computer.

That's why they come to NSC Computer Shops.

We are specialists and we have the most experience. So we can give the most expert advice.

We also offer the widest range you could wish to see.

Plus a total back-up including consultancy, software and continuing support. And you get a good deal, price-wise.

South West Technical Products

A middle priced business computer widely used for word processing, and a big time saver on things like mailing lists. NSC have stocks of disc drives, both 8" and 5¼" and memory boards and interface cards, with reductions of up to 40% on some items. Also available are processor cards to upgrade to 6809, and a complete range of 6809 equipment.

Apple

Manchester's first Apple dealer. We will be pleased to demonstrate any of the exciting products which are now available with the Apple, including voice recognition, graphics tablet etc.

Cromemco

Top quality computer systems backed by complete software service for word and data processing. The only microcomputer currently available with RPG II.

Centronic 779 for £779

The most robust low cost printer around. At a special reduced price of £779 while stocks last.

Acorn Atom

Come and try this new budget priced computer at NSC Computer Shops. Kit machine available from £120.

Shop at NSC and get a better deal.

Ring 061-832 2269 for further information.



Pet

A popular and very reliable small business system used for accounting, word processing, mailing lists and other office tasks. NSC's attractive prices on all models of the Pet make it a very sound investment.



North Star Horizon

A complete word processing system extendible from 32K-56K RAM, up to four mini disc drives, 4MHz Z80A processor, serial and parallel I/O ports and extended BASIC. NSC have a full range of accounting packages available for this system, which has also proved very popular in educational and industrial applications. You can lease it over a five year period for as little as £25 per week.

NSC COMPUTER SHOPS

Here to help

NSC Computer Shops, 29 Hanging Ditch, Manchester M4 3ES

• Circle No. 358

GATE MICROSYSTEMS LIMITED

SCOTLAND'S COMPLETE MICROCOMPUTER SERVICE



Announce:

SUP'R'TERMINAL

SUP'R'TERMINAL IS AN 80 COLUMN BY 24 LINE PLUG-IN COMPATIBLE BOARD FOR THE APPLE II COMPUTER

SPECIFICATIONS

- 80 Columns by 24 lines, upper and lower case; all 128 ASCII characters.
- Upper and Lower case data entry using the APPLE II keyboard.
- Includes an Upper and lower case 5x8 dot matrix ASCII character set, and inverse alpha characters.
- Character set can be user definable
- Includes VBC™ (video balance circuit) which enables the use of displaying 80 columns on an inexpensive 8 MHz CRT monitor
- Shift Lock Feature
- Works with APPLE PASCAL and APPLE BASIC
- Incorporates PASCAL and BASIC control characters
- ALL monitor-type escapes are valid
- Follows protocols of PASCAL and BASIC operating systems
- Compatible with ALL APPLE II peripherals.
- Effective baud rate greater than 10,000; fast scrolling and clearing
- Synchronous operation with APPLE II
- Can be used with APPLE II communication interface board to act as self contained terminal for time-sharing or other applications.

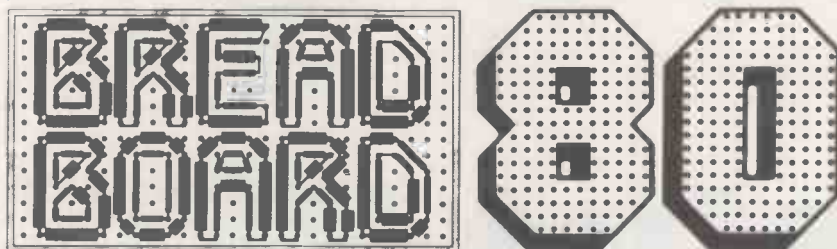
£245.00
Ex VAT.

GATE MICROSYSTEMS LIMITED

THE NETHERGATE CENTRE, 66 NETHERGATE, DUNDEE
TEL: (0382) 28194

• Circle No. 359

COMPUTERS AUDIO RADIO MUSIC LOGIC TEST GEAR CB GAMES KITS



26th Nov — WEDNESDAY — 10am-6pm
27th Nov — THURSDAY — 10am-8pm
28th Nov — FRIDAY — 10am-6pm
29th Nov — SATURDAY — 10am-6pm
30th Nov — SUNDAY — 10am-4pm

COMPONENTS DEMONSTRATIONS SPECIAL OFFERS MAGAZINES BOOKS

Royal Horticultural Halls Elverton Street

Westminster London SW1

November 26-30 1980

It's all at Breadboard '80

This is **the** exhibition for the electronics enthusiast. From November 26-30 there is only one place in the universe for the electronics enthusiast to be — Breadboard '80, at the Royal Horticultural Hall in London. The majority of leading companies will be exhibiting, including all the top monthly magazines in the field. There will be demonstrations on most stands and many feature special offers that are **EXCLUSIVE** to Breadboard!

All aspects of this fascinating field are catered for, from CB to home computing, so whether you want to buy a soldering iron or a synthesiser — or just keep up to date with your hobby — don't miss Breadboard '80.

AVOID QUEUES — GET ADVANCE TICKETS

Send to: Advance Tickets, Modmags Ltd,
145 Charing Cross Rd, London WC2H 0EE

Please send: tickets @ £1.50

..... tickets @ £1.00 (Student/Child/OAP)

TO:

I enclose P.O./Cheque for £

• Circle No. 360

Special Offer!!!

Compare our prices before you buy elsewhere! All devices are brand new, factory prime, full spec. and fully guaranteed!

MEMORIES

	1+	50+	100+
2114 L 450NS	225p	200p	175p
2114 L 300 NS	250p	225p	195p
4116 150 NS	375p	350p	325p
4116 200 NS Ceramic	275p	245p	195p
6514 (TC 5514P) 1k x 4			
CMOS RAM 450 NS	550p	525p	495p

EPROMS

2708 450 NS	395p	375p	350p
2716 Single 5V 450 NS	595p	550p	495p
2532 Single 5V 450 NS	1995p	1695p	1495p

LINEARS

ICL 7106 CPL	575p	525p	475p
LCD 106 3 1/2-digit			
LCD Display	575p	525p	475p
NE 555P	18p	17p	16p
723	33p	30p	28p

All prices exclude p&p and VAT. Please refer to 'Ordering Information' before ordering.

DON'T DELAY - BUY TODAY - SPECIAL OFFERS DON'T LAST FOR EVER!!!!

NEW 6809 S-100 SINGLE-BOARD COMPUTER

- * Meets IEEE S-100 Standard!
- * Uses Motorola's Powerful MC6809 CPU!
- * 4K, 8K, 16K ROM!
- * 2K RAM!
- * ACIA, PIA, 8080 Simulated I/O!
- * RS - 232 Handshake!
- * Selectable BAUD Rates!
- * Manual includes: 11" x 7" Schematic, Parts List, User Notes, Software Listings and MORE!

All this, yet for only **£49!!!** (plus p&p £1.00)

NEW

EXCITING, ENTERTAINING SOFTWARE FOR THE APPLE II and APPLE II PLUS!!

ASTEROIDS IN SPACE!!!!

If you liked 'Invaders' you'll love ASTEROIDS IN SPACE by Bruce Wallace! Your spaceship is travelling in the middle of a shower of asteroids. Blast the asteroids with lasers, *but beware* - BIG ASTEROIDS FRAGMENT INTO SMALL ASTEROIDS! The Apple game paddles allow you to rotate your spaceship, fire its laser gun, and give it thrust to propel it through endless space. From time to time, too, you'll encounter an alien spaceship whose mission is to DESTROY YOU so you'd better destroy it first! High resolution graphics and sound effects add to the arcade-like excitement this program generates. RUNS ON ANY APPLE II WITH AT LEAST 32K AND ONE DISK DRIVE!

ON DISKETTE ONLY **£14.95**

AUTORANGING, AUTO UNIT DISPLAY, 3 1/2-DIGIT LCD DMM for ONLY £39.95 incl. VAT!

The nationally advertised 6200, giving 200mA AC/DC current measurement; AC voltage to 750V (DC to 1000V); 100A resolution and 0.1 Ohms - 2 Megohms. Accuracy is 0.8% and it displays mV, V and mA. You won't find a cheaper DMM with these features AND batteries, test leads, spare fuse and one year guarantee are INCLUDED in the low, low price of just

£39.95 inc. VAT

MICROCHIPS AT MICRO PRICES!

INTERFACE

LINEAR	
MC1488	90p
MC1489	90p
DM8123	125p
75150	125p
75154	125p
75182	195p
75322	250p
75324	325p
75325	325p
75361	350p
75365	295p
75451	50p
75491/2	75p
8T26	175p
8T28	175p
8T95	175p
8T97	175p

DISPLAYS

FND500	80p
FND510	80p
FND567	125p
DL704	85p
DL707	85p
MV57164	225p

CPU'S

6502	795p
6504	795p
6505	795p
6800	695p
6802	995p
8080A	525p
8085A	1095p
Z80	795p
Z80A	995p
Z8001	12500p
X8002	9500p
WD9000B	19900p

BIPOLAR PROMS

93448 518 x 8 40 NS	p.o.a.
93453 1k x 4 40 NS	p.o.a.
93451 1k x 8 45 NS	p.o.a.
93511 2k x 8 50 NS	p.o.a.

SUPPORT DEVICES

6520	495p
6522	795p
6532	895p
6551	1095p
6810	375p
6820	425p
6821	425p
6850	425p
6852	425p
8212	395p
8214	450p
8216	395p
8224	395p
8228	395p
8251	495p
8253	1125p
8255	495p
8257	1050p
8259	1325p
MC 144 12VL	797p
Z80 P10	595p
Z80 CTC	595p
Z80A P10	695p
Z80A CTC	695p
Z80 DMA	1995p
Z80A DMA	2495p
Z80 S10/1	2995p
Z80A S10/0	3495p
Z80 S10/1	2995p
Z80A S10/1	3495p
Z80 S10/2	2995p
Z80A S10/2	3495p

KEYBOARD ENCODER

AY-5-2376	795p
-----------	------

UARTS

AY-5-1013A	325p
AY-3-1015D	398p
IM6402 IPL	425p

CHARACTER GENERATOR

RO-3-2513 UC	450p
--------------	------

DEVELOPMENT MODULE

Z8000 DM	1099p
----------	-------

MEMORIES

2114 300 NS	275p
4116 200 NS	300p
4116 150 NS	395p
1702A	450p
2708 450 NS	425p
2716 5V 450 NS	995p
2532 32K 450 NS	2995p
4315 (4k x 1) CMOS	
RAM 450 NS	995p
6514 (1k x 4) CMOS	
RAM 450 NS	795p

FLOPPY DISK CONTROLLERS

FD1771 B-01 S/D Inverted Bus	2995p
FD1791 B-01 D/D Inverted Bus	4995p
FD1792 B-01 S/D Inverted Bus	3495p
FD1793 B-01 D/D True Bus	5495p
FD1794 B-01 S/D True Bus	3495p
FD1795 B D/D Inverted Bus, side select	5995p
FD1797 B D/D True Bus, side select	5995p

THE NEW GI COMPUTER SOUND CHIP

The amazing AY-3-8910 is a fantastically powerful sound and music generator, perfect for use with any 8-bit micro processor. Contains 3 tone channels, noise generator, 3 channels of amplitude controls, 16-bit envelope period control, 2 parallel I/O, 3D/A converters plus much more. All in 40 pin DIP. Super easy to interface to the S-100 or other Busses. ONLY £8.50 + VAT, including FREE reprint of BYTE '79 article! Also, add £2.25 for 60-page data manual. "Perhaps the next famous composer will not direct a 150-piece orchestra but, rather, a trio of micro-computers controlling a bank of AY-3-8910s." BYTE July '79.

NEW! SPECIAL OFFER!

- 4K CMOS RAM (1k x 4) 450 NS ONLY £5.50
The TIC 5514P from Toshiba, CMOS equivalent of the 2114!
- * Lower Power Dissipation .10pW/BIT (TYP.) at 3.0V (STANDBY)
 - * .10uW/BIT (TYP.) at 5.0V (OPERATING)
 - * Data Retention Voltage 2V to 5.5V
 - * Single 5V Power Supply
 - * 18 PIN Plastic Package
 - * Full Static Operation
 - * Three State Output
 - * Input/Output TTL Compatible
 - * Fast Access Time 450NS.

Toshiba's TC5514P (industry type 6514) is a full static read write memory organised as 1024 words by 4 bits using CMOS technology. Ultra low power dissipation means it can be used as battery-operated portable memory system and also as a non-volatile memory with battery back-up. Operates from a single 5V power supply with static operation, hence no refresh periods and a much simplified power supply circuit design. Three state outputs simplify memory expansion for minimum data retention voltage is 2V, the battery back-up system needs only simple circuit. Toshiba's original C2MOS technology also means wide operating and noise margins. The TC 5514P is moulded in a dual-inline 18 pin plastic package 0.3 inch in width.

Ordering information. Unless otherwise stated, for orders under £50 add 50p p&p. Add 15% VAT to total (no VAT on books). All devices are brand new, factory prime and full spec and subject to prior sales and availability. Prices subject to change without notice. Minimum telephone order using ACCESS is £10. If ordering by post with ACCESS, include name, address and card no. written clearly. Please allow 4/6 weeks delivery on books.



**MICRO
BYTE**
Dept. PC4

Tel: 01-278 7369
Telex: 895 3084

Unit 9/10, 1st Floor, E Block,
38 Mount Pleasant,
London WC1X 0AP.

SAMS BOOKS AT LOWEST PRICES

COMPUTER BOOKS

Microcomputer Primer (2nd Edition)	NEW £7.17
Microcomputers for Business Applications	£5.37
The Howard W. Sams Crash Course in Microcomputers	NEW £10.50
Fundamentals of Digital Computers (2nd Edition)	£5.97
Getting Acquainted with Microcomputers	£5.37
How to Buy & Use Minicomputers & Microcomputers	£5.97
Computer Graphics Primer	NEW £7.77
TEA: An 8080/8085 Co-Resident Editor Assembler	NEW £5.37
6502 Software Design (Book 1)	£5.70
(Book 2)	£5.97
BASIC Programming Primer	£5.37
DEBUG: An 8080 Interpretive Debugger	£3.75
How to Program Microcomputers	£5.37
Computer Dictionary (3rd Edition)	NEW £7.17
Boolean Algebra for Computer Logic	£3.95
Computers & Programming Guide to Scientists & Engineers (3rd Edition)	NEW £9.57
Microcomputer Interfacing with the 8255 PPI Chip	£5.37
Programming & Interfacing the 6502, with Experiments	NEW £7.17
TRS-80 Interfacing	NEW £5.37
Z-80 Microcomputer Design Projects	NEW £7.77
Z-80 Microprocessor Programming & Interfacing - Books 1 and 2	
(Book 1)	£6.97
(Book 2)	£7.77
Interfacing and Scientific Data Communications Experiments	£3.95
Introductory Experiments in Digital Electronics and 8080A	
Microcomputer Programming and Interfacing	
(Book 1)	£7.77
(Book 2)	£7.77
Microcomputer - Analog Converter Software and Hardware Interfacing	£5.70
The 8080A Bugbook: Microcomputer Interfacing and Programming	£6.30
The S-100 and Other Micro Buses	£3.95
The Cheap Video Cookbook	£3.75
TV Typewriter Cookbook	£5.97
Using the 6800 Microprocessor	£4.77
Z-80 Microcomputer Handbook	£5.37
8085 Microcomputer Design	NEW £9.97
COOKBOOKS	
TTL Cookbook	£5.70
Active-Filter Cookbook	£8.97
TV Typewriter Cookbook	£5.97
CMOS Cookbook	£6.97
The Cheap Video Cookbook	£3.75
IC Converter Cookbook	£8.37
IC Op-Amp Cookbook (2nd Edition)	£8.97

• Circle No. 361

OHIO SCIENTIFIC SUPERBOARD 2

50ZH BLACK AND WHITE VERSION
£159 + 15% VAT POST FREE.
50HZ COLOUR VERSION £215 + 15% VAT.

+
THIS UNIQUE SPECIAL OFFER



If bought with superboard or colourboard these items are at the reduced prices shown first. Also sold separately at the bracketed prices. Add 15% vat. Modulator and power supply kit £1 (£25). 4K extra ram £20 (£24). Display expansion kit approx 30 lines x 54 characters £15 (£20). Case £23 (£26). Colour conversion board fully assembled £35 (£35). Cassette recorder £13 (£15). Extended monitor £20 (£20). Assembler/Editor £25 (£25). 610 Expansion Board £160 (£160). Minifloppy with psu and 2 copies DOS £275 (£275).

SHARP COMPUTERS



The brilliant new Japanese computer MZ80 K which is beating the hell out of PET. 20K ram expandable to 48K. Built in VDU screen, music function and cassette. Displays 40 characters x 25 lines and 80 x 50 on graphics. £458+15% VAT. MZ80P3 Printer £515 + 15%. MZ80FD Floppy disc £772 + 15%. MZ80 I/D Interface £96 + 15%. PC 1211 £94 + 15% CE121 £13 + 15%.

SUPER PRINT 800MST



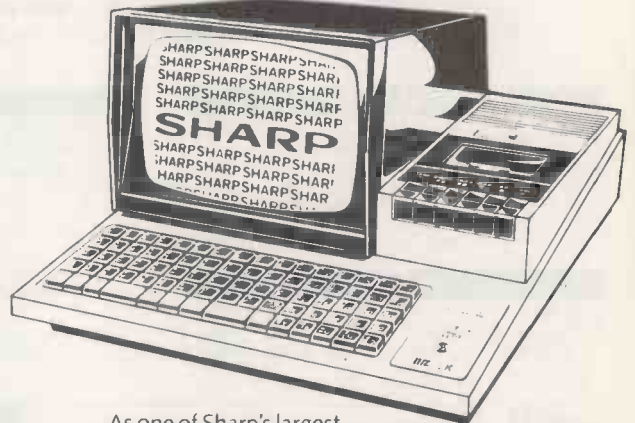
The ideal impact matrix printer for Superboard, UK101, pet, apple, trs80, mz-80k. 60 lines/minute. 72, 80, 96, 120, and 132 chr./line. Tractor and friction feed. Graphics and user definable chr sets. RS232, 20ma, IEEE488 and centronics I/O. SPECIAL OFFER: — Supplied with free word processor program and interface components for Superboard £359 + 15% VAT.

SWANLEY ELECTRONICS

Dept. PC, 32 Goldsel Rd., Swanley, Kent BR8 8EZ.
Please add 35p postage. Prices include VAT unless stated. Lists 27p post free.
Overseas customers deduct 13%. Official credit orders welcome.

• Circle No. 362

THE SHARP MZ-80 COMPUTER SYSTEM



As one of Sharp's largest systems dealers we supply complete MZ-80 systems including FLOPPY DISCS and PRINTERS.

We have considerable experience in implementing SALES, PURCHASE and NOMINAL LEDGERS, PAYROLL, STOCK CONTROL, FOREIGN EXCHANGE and FINANCIAL PROGRAMMES.

Contact us now for details on 01-247 8506.

SCOPE

Stone House, Houndsditch Entrance
128-140 Bishopsgate
London EC 2M 4HX

SHARP

• Circle No. 363



centralex

A comprehensive range of Microcomputers Equipment, Peripherals, Software and Services for those who value Professional Standards, Guidance and Continuing Support for Hardware and Software.

APPLE
TEXAS
MICROPOLIS
DIABLO
MICROLINE

PET
OHIO SCIENTIFIC
CENTRONICS
QUME
HITACHI

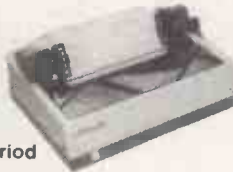
ITT 2020
CROMEMCO
ANADIX
DEC
LEXICON

EXIDY
MICROSTAR
INTEGRAL
DATA GENERAL
ETC. ETC.

HORIZON
SHUGART
TELETYPE
EPSON

INFORMEX-80 Printer

£399+VAT



Special offer - for a limited period

For PET, APPLE, EXIDY, TRS80, ETC
A high quality, high speed printer
(125 cps) Upper and lower case letters
plus graphics as standard
Interface and cable for TRS80, PET,
APPLE or RS 232 £69 + VAT
Tractor feed option only £39

ALSO Training, Consultancy, Systems Design,
Programming and Software

PAYROLL - INVOICING - STOCK CONTROL -
SALES/PURCHASE LEDGER - VAT - MEDICAL
RECORDS - EDUCATIONAL & ENGINEERING
PROGRAMMES - HOTEL RESERVATION - ESTATE
AGENTS - BUILDING MAINTENANCE - COBOL -
FORTRAN - ETC.

Maintenance Contracts including stand-by equipment during repair periods - Free Delivery Nationwide - Terms arranged - Credit Cards and official orders accepted.



• Circle No. 364

SUMLOCK BONDAIN makes the decisions easier..



Discover the full professional power of Hewlett Packard's personal computer.

The portable, stand-alone HP-85 personal computer was only the beginning of a total system. By itself, the HP-85 lets you put professional problem-solving power wherever you need it. Because all its features are built into a single unit weighing less than 10 kgs.

And now you can extend the HP-85's power to match your increasing professional requirements. Simply plug in HP's new high-performance printers, plotters and flexible disc systems. In fact, you can add up to 14 peripherals or instruments. It's up to you.

It's your personal computer system. You decide which HP peripherals you need.

Add the HP 2631B printer for high-speed, high-quality printing - with choice of line spacing, character width and density. Add the HP 7225 Graphics Plotter for high-resolution, publication-quality graphics on A4-size paper or film. Add memory with the HP 82900 series of flexible disc drives, each 5 1/4" disc providing up to 270K bytes of formatted storage. And HP's new enhancement ROMs and modules let you expand to 80K bytes of operating system, without reducing user memory.


See the HP-85 and its new peripherals in action. Getting your hands on so much professional computing power was never so easy.



**HEWLETT
PACKARD**

It costs less from the calculator specialists. Advanced calculators to solve your professional problems.

...with our latest range of advanced calculators to solve your professional problems.




HP-32E Advanced statistical and scientific calculator. All functions of the 31E plus hyperbolics and their inverses. Full set of 2 variable statistics - means, standard deviations, linear regressions, Fixed, scientific or engineering display modes. 15 addressable storage registers.

£38.76



NEW
HP-34C Advanced programmable scientific calculator. Indirect addressing. Controlled memory varying between 210 program lines and 70 data registers. Innovative SOLVE and INTEGRATE functions. With Continuous Memory to retain data and programs even when switched off.

£79.50



£406.88

HP-67/HP-97 Magnetic card programmable calculators. Pre-recorded application packs covering maths, statistics, electrical engineering, business and finance. 26 data storage registers. 224 merged program lines with up to 3 keystrokes per line. HP-97 is a desk-top model with integrated thermal printer.

£196.87




NEW
HP-38C Programmable financial calculator. Direct solution of rate of return and NPV in discounted cash flow calculations. Interest rates, yields, payments, number of payments etc. Applications in securities trading, leasing, loans and savings. Calendar functions. Programmable facility for individual solutions. With Continuous Memory to retain data and programs even when switched off.

£79.50

HP-38E Lower cost version of HP-38C without Continuous Memory.

HP 38E £66.45



HP-37E Basic financial calculator. Direct and automatic calculation of interest rates and yields, payments, number of payments etc. Applications in leasing, loans, investments etc. Percentage 'retail' and statistical functions.

£41.78

No hidden extras. Every Hewlett-Packard calculator comes complete with: soft, zip-up lined case; owner's and application manuals (plus additional applications book where appropriate); factory-fitted rechargeable cells and recharger (apart from the 41C); two rolls of thermal paper on printing machines. Beyond the standard package, we've a wide range of optional accessories and our comprehensive software support, which gives you a choice of applications packs to really extend your range of ability.



NEW
HP-41C HP's unique expandable calculating system. Advanced 130 function programmable calculator. Full alphanumeric liquid crystal display. Up to 319 registers for data or programs. Add-on extras include Magnetic Card Reader and Printer.

HP41C £168.04
HP82104A £122.76
HP82143A £219.89



NEW
HP-33C Programmable scientific calculator. 49 lines of program memory. 3 levels of subroutines. 8 addressable storage registers. Integer, fraction and absolute value of a number. With Continuous Memory to retain data and programs even when switched off.

HP-33E Lower cost version of HP-33C without Continuous Memory.

HP33C £59.50
HP33E £49.83

Come to the Hewlett Packard open days at our new premises in City Road, December 2nd and 3rd. Come and hands-on test any of our superb range of products.

SUMLOCK BONDAIN LTD.
Head office: 263-269 City Road, London EC1V 1JX
and at Cannon Street Station, London EC4
Tel. 01-250 0505 Telex 299844

If you need advice, ask for it — WE CAN GIVE IT!
Barclaycard/Access, official orders accepted by phone
All prices include postage, packing & VAT
• Circle No. 365

SORCERER SOFTWARE!

Unless otherwise noted, all programs are on cassette and require only 8K of memory.

FORTH

new! Now Sorcerer owners can enjoy the convenience and speed of the fascinating FORTH programming language. Based on FIGFORTH and written by James Albanese, this version was designed especially for the Sorcerer and includes the capability to read and write data (screens) to cassette tape and a complete on-screen editor. Requires at least 16K of RAM. £30.00

new! **GRAPHICS ANIMATION** by Lee Anders. This package provides the BASIC programmer with a powerful set of commands for graphics and animation. The program is written in machine language but is loaded together with your BASIC program and graphics definitions with a CLDAD command. Any image from a character to a large graphic shape may be plotted, moved, or erased with simple BASIC commands. Encounters of plotted character sets with background characters are detected and background images are preserved. Contains a medium resolution plotting routine. A keyboard routine detects key presses without carriage returns. Includes a separate program for constructing images. £17.00

new! **STARBASE HYPERION™** by Don Ursem. At last a true strategic space game for the Sorcerer! Defend a front-line Star Fortress against invasion forces of an alien empire. You create, deploy, and command entire ship squadrons as well as ground defenses in this complex tactical simulation of war in the far future. Written in BASIC and Z-80 code. Full graphics and realtime combat status display. Includes full instructions and STARCDM battle manual. Requires at least 16K of RAM. £12.50

new! **HEAD-ON COLLISION™** by Lee Anders. You are driving clockwise and a computer-controlled car is driving counter clockwise. The computer's car is trying to hit you head on, but you can avoid a collision by changing lanes and adjusting your speed. At the same time you try to drive over dots and diamonds to score points. Three levels of play, machine language programming and excellent graphics make this game challenging and exciting for all. At least 16K of RAM is required. £12.00

new! **LUNAR MISSION** by Lee Anders. Land your spacecraft softly on the moon by controlling your craft's three propulsion engines. Avoid lunar craters and use your limited fuel sparingly. You can see both a profile view of the spacecraft coming down and a plan view of the landing area. Land successfully and you get to view an animated walk on the moon. Nine levels of play provide a stiff challenge to the most skillful astronaut. Requires at least 16K of RAM. £12.00

new! **HANGMAN/MASTERMIND** by Charles Finch. Two traditional games are brought to life by Sorcerer graphics. **HANGMAN** has three different vocabulary levels for you to choose from. In **MASTERMIND**, the computer selects a four-character code and you have to uncover it. These two games provide an enjoyable way for young people to develop their vocabulary and their logical reasoning ability. Written in BASIC. £9.00

QS SMART TERMINAL by Bob Pierce. Convert your Sorcerer to a smart terminal. Used with a modem, this program provides the capability for you to communicate efficiently and save connect time with larger computers and other microcomputers. The program formats incoming data from time-sharing systems such as The Source for the Sorcerer video. Incoming data can be stored (downloaded) into a file in RAM. Files, including programs, may be saved to or loaded from cassette, listed on the video, transmitted out through your modem, or edited with an on-board text editor. Interfaces with BASIC and the Word Processor Pac. £30.00

DPX™ (Development Pac Extension) by Don Ursem. Serious Z80 program developers will find this utility program to be invaluable. Move the line pointer upward. Locate a word or symbol. Change a character string wherever it occurs. Simple commands allow you to jump directly from EDIT to MONITOR or DDT80 modes and automatically set up the I/O you want for listings. Built-in serial driver. Stop and restart listings. Abort assembly with the ESC key. Save backup files on tape at 1200 baud. Load and merge files from tape by file name. Versions for 8K, 16K, 32K, and 48K Sorcerer all on one cassette. Requires the Sorcerer's Development Pac. £17.00

Other utility programs:

PLOT by Vic Tolomei. High res and low res modes £12.00
SHAPE MAKER™ by Don Ursem. An on-screen character maker £12.00
DEBUG by Bob Pierce. Debug machine language programs £12.00
SOFTWARE INTERNALS MANUAL by Vic Tolomei. A 64-page book £10.00

Other game programs:

MARTIAN INVADERS™ by James Albanese £12.00
NIKE II™ by Charles Finch and Bob Broffel £ 9.00
TANK TRAP by Don Ursem £ 9.00
MAGIC MAZE™ by Vic Tolomei £ 9.00
FASTGAMMON™ by Bob Christiansen £13.00



QUALITY SOFTWARE

Please add 15% V.A.T. to all prices.

**MICROPUTE
 9 PRESTBURY RD.
 MADDLESFIELD
 CHESHIRE**

DEALER ENQUIRIES WELCOME.

• Circle No. 366

AERCO GEMSOFT

Computer Services

Appointed dealers for

APPLE, SUPERBRAIN, VIDEO-GENIE

As well as supplying the Micro Systems above, we specialise in writing Software for those special applications that you cannot buy a package for: Special Stock controls, Invoicing systems, Production control and planning, Engineering, etc. (Our current projects include systems for Hire-Purchase accounts control, Stock Control for Hi-Fi retailers, Re-order scheduling, and a data-logging system.)

So, whether you require a Micro-Computer at a competitive price and supported with some intelligent advice, or a system with standard or special software, contact:

**Aerco-Gemsoft Computer Services,
 27, Chobham Road,
 Woking,
 Surrey GU21 1JD.
 Telephone: Woking (04862) 22881**

• Circle No. 367

S 100

Do You Have All These Facilities On Your S100 System, With Just Two Boards?



1. Z80A CPU-2 or 4 MHz Operation.
2. Z80A CTC- 4 Channels.
3. Z80A SIO- 2 RS-232.
4. Z80A PIO
5. Disk controller; Takes upto 4 disk drives, single or double density operation.
6. 64k Bytes of memory.
7. EPROM Programmer.
8. Real time clock.
9. Software; Standard 2k Monitor. CP/M Cold Start Loader. CP/M BIOS (1.4)

Prices:

FDC-1 Board £495.50
 Expandoram £327.56
 Mother Board £ 42.00
 All prices exclude VAT.

SEMEL

MICROCOMPUTER - HARDWARE - SOFTWARE

**3c, BARLEY MARKET ST., TAVISTOCK,
 DEVON, PL19 0JF.**

Tel. TAVISTOCK (0822) 5247

Telex: 45263

• Circle No. 368

TRS-80 owners!! Double Disk Capacity with the Phantom Double-Density Module

Provides double density modification to your current TRS-80 Expansion interface

Increases storage capacity up to 204K bytes (on single 40 track drive.)

Includes all hardware and software.

£165



Load TRS-80 programmes & data Fast! with the Phantom Disk Drive system

*23% more storage capacity than TRS-80
*40 track patch at no Extra charge.

Two drive system £495
Four drive system £935
Two drive cable £20
Four drive cable £30



Single drive system
£265

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
£382

Expansion interface £199.09
4K level I computer £251.30

This lot must be today's best buy!

Galaxy 2000 by Compu/Think

(.8 Megabyte Disks) £2,950
(2.4 Megabyte Disks) £3,960

SPECIAL - GALAXY prices include Compu/Think Pagemate Database and Report Writer at no charge

The most advanced complete microcomputer system available. Includes CPU, 12" CRT, full keyboard, 2 quad-density disk drives, 2 megahertz 6502 hybrid processor (double speed), 108 K system memory, high resolution (512 x 240) graphics, programmable character fonts, microsoft extended BASIC, DOS with random access I/O, full complement of I/O ports, monitor with debug, trace and tiny assembler, fifth (PL/M and fourth combination) interpreter, complete editing and entry with split screen capability, 64 microprogrammable opcodes, business software (with Database) available.



2001-8N
(8K RAM New large keyboard)
£425

Super-Pets are here!

40 & 80 COLUMN

Now you can

- list unlistable programmes using the 6502 non-maskable interrupt facility! - just hit the new 'abort' button to jump out of programme into command mode
- recover from crashes without switching off - just hit the new 'reset' button.
- add sound to your programmes!

The hardware is built-in - just write sounds into your programme using our simple directions.

2001 - 16N (16K RAM and new large keyboard) £550
2001 - 32N (32K RAM and new large keyboard) £890

External cassette deck, suitable for all Pets £53
CBM dual drive mini floppy £695
Tractor feed printer with Pet graphics £395
Pet high-res. graphics 200 x 320 £259

Get into print this easy way!



Anadex DP 800 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, £ sign, 96-ch. set.
*Reliable - strongly built. 100 M.ch. head.

Knock down price!

£499

Interfaces and cables -
Pet £45 Ohio £30
TRS-80 £40 Sorcerer £25
Apple £69



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.

Non-keyboard version

£595

Keyboard version £695 (illus)
Interfaces and cables -
Pet £45 Ohio £63
TRS-80 £35 Sorcerer £25
Apple £69



Phantom 400/800 Thermal Printer

*Stop disturbing others with noisy printout! *Neat, clear, 96-ch. set, U/L case & symbols, in text mode.
*Fast, 48 ch/s bidir. *Reliable - robust - only two driven parts.
*Plug in and go, built in PSU, detailed manual. Thermal paper in 80 ft rolls less expensive than electro-sensitive paper and now - dot hyphen addressable graphics too!!

For only **£249** (40 col)

80 col model (800) £359
Interfaces and cables -
Pet £45 Ohio £63
TRS-80 £40 Sorcerer £25
Apple £69

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

You can afford to start computing now!

Fully tested complete
with 4K RAM.
Extra 4K RAM £35

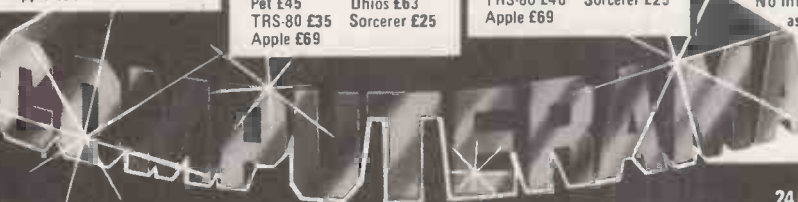
£220

*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



your dealer for Bath, Bristol and S.W

Tel: Bath (0225) 333232

5 Cleveland Place East, London Road, Bath, BA1 5DJ.

Special terms available for educational and government establishments - dealer enquiries invited.

24 hr ordering service

Full after-sales
service in our
own workshops

One year guarantee
on all new machines



Please
add £10
Securicon
delivery on
computers etc
plus 15% VAT
on all prices

• Circle No. 369

£1150
+ VAT



VISUAL 100

The VISUAL 100 is a new microprocessor based video display terminal which offers total compatibility with the DEC VT100* from both a software and operator point of view.

For the operator, the detached solid-state keyboard has been customized so that all key positions and LED indicators are in identical location to that of the VT100.

For the software, all codes and features have been implemented in a manner identical to the VT100 assuring plug-to-plug compatibility.

The big difference between the VISUAL 100 and the DEC VT100 is that the VISUAL 100 offers features not available on the VT100, or available only as extra-cost options. These added features include:

- ETCHED NON-GLARE FACEPLATE
Your operator will appreciate viewing characters through an etched non-glare faceplate. This feature assures crisp, sharp character resolution even in the brightest office environments.

Further, the tilt screen feature allows an adjustable viewing angle, 10° to 15°, for optimal viewing comfort.

- ADVANCED VIDEO PACKAGE IS STANDARD
Blink, bold, reverse video, and underline video attributes which can be used alone or in any combination for enhanced video presentations.
- CURRENT LOOP INTERFACE IS STANDARD
A 20mA current loop interface as well as an EIA RS232C Interface.
- BUFFERED PRINTER INTERFACE OPTION
This option allows independent print/communication baud rates and independent parity. The printer option also allows the VISUAL 100 to function as a controller between host and printer, using "XON XOFF" protocol. Printer busy can also be monitored using XON XOFF, or control line.

Seeing is believing, so see for yourself. For a demonstration and a pleasant surprise on quantity pricing of the VISUAL 100, call or write us today.

• Circle No. 370

THE FIRST MICROCOMPUTER WHOLESALE



We offer products from many manufacturers including:

Altos
Centronics
Century Data
Control Data
Datasouth
Dyna Byte
Exidy
Hazeltime
Houston Inst.

Impact Data
Industrial Micro
Integral Data
Intertec
Konan
LRC Eaton
Malibu
Micro Peripherals
M.E.C.

North Star
Ohio Scientific
Onyx
PerSci
Qume
Soroc
Televideo
Texas Instruments
Visual Technology

SIGMA (U.K.)
6, THE JAYS,
BURGESS HILL,
SUSSEX

Telephone: 04446-44159

£675
+ VAT



VISUAL 200

The VISUAL 200 is a new, low cost, microprocessor based video display terminal which truly stands above competitive teletype compatible terminals in its price range.

In addition to the most popular features available (or partially available) on competitive terminals, such as numeric pad, upper/lower case, editing, current loop, cursor addressing, columnar and field tab, etc., standard features which set the VISUAL 200 apart and reach the optimum in human engineering and operator comfort include:

- Detachable Keyboard
- Smooth Scroll
- Tilt Screen (10° to 15° viewing angle)
- Large 7 x 9 Dot Matrix Characters

Perhaps the most distinctive feature of the VISUAL 200 is the Switchable Emulation capability. A switch on the rear panel programs the terminal for code-for-code emulation of a Hazeltime 1500, ADDS 520, Lear Siegler ADM-3A or DEC VT-52. To an O.E.M. customer it means no change in software to displace the older, less powerful terminals in his product line with the new, reliable and low cost VISUAL 200. To a Distributor it means offering a single modern terminal which is compatible with all the software his customers have written for the older terminals. And you're not limited to merely emulating these older terminals; you can outperform them at the same time by taking advantage of the additional features of the VISUAL 200.

Reliability designed into the VISUAL 200 is evidenced by its solid state keyboard, single P.C. Board and self test diagnostics on power up.

Seeing is believing, so see for yourself. For a demonstration and a pleasant surprise on quantity pricing of the powerful, easy to use and reliable VISUAL 200, call or write us today.

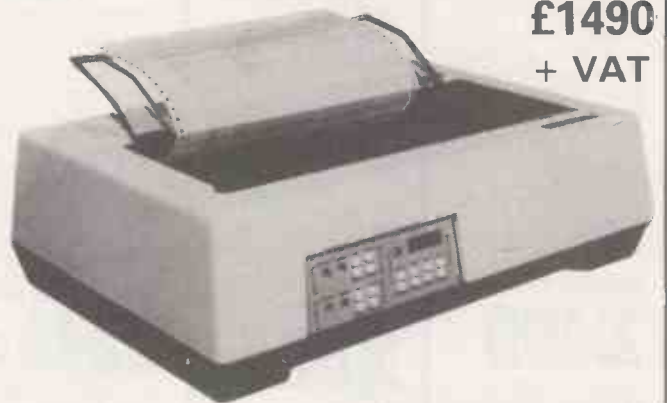
Standard Features

- 24 x 80 Screen Format
- 7 x 9 Dot Matrix
- Upper/Lower Case
- Numeric Pad
- Background/Foreground
- Blink Line
- Insert/Delete Line & Character
- Columnar and Field Tab
- Set/Clear Tab
- Security Mode (non-display)
- Clear End Line, Field & Page
- Clear Line
- Clear Screen
- Line Drawing
- Current Loop or RS-232 Interface
- Secondary Channel
- Composite Video
- Serial Copy Port
- Hold Screen
- Baud Rates to 19,200
- Self Test
- Cursor Addressing
- Cursor Control Keys
- Read Cursor Address
- Typamatic Keys
- Smooth Scroll
- Microprocessor
- Detachable Keyboard
- Solid State Keyboard
- Read Terminal Status
- Tilt Screen
- Switchable Emulations

• Circle No. 371

DATASOUTH DS180 HIGH SPEED MATRIX PRINTER

£1490
+ VAT



The Datasouth DS180 is a dot-matrix serial impact printer designed for high performance at an economical price. Application flexibility and a long list of standard features make the DS180 an ideal device for small business systems, distributed communications networks and intelligent terminals.

HIGH SPEED PRINTING

Utilizing 180 cps optimized bidirectional printing, the DS180 offers higher throughput than any printer in its class. Its 9-wire printhead produces highly legible 9x7 characters with descenders for lower case letters and true underlining. All 96 ASCII characters may be printed across a 132 column line at 10 characters per inch. Expanded characters (5 cpi) may be selected for highlighting portions of the text.

USER PROGRAMMABLE

The DS180 offers a large number of user programmable features, yet is easy to operate. A unique programming keypad with a non-volatile memory makes printer set-up quick and simple. Top of form, horizontal and vertical tabs, perforation skip-over and auto line feed are just a few of the features the user may select. Communications status may also be programmed and monitored using the indicator panel lights and LED display.

ATTRACTIVE DESIGN

Compact, desk-top packaging allows the DS180 to fit into almost any installation. Its noise dampening cover makes it suitable for use in a quiet office environment. The cartridge ribbon makes routine changes clean, fast and convenient.

MICROPROCESSOR ELECTRONICS

Through the use of state-of-the-art microprocessor electronics, reliability and maintainability have been greatly improved. The simple modular design of the DS180 provides easy access to all major components. A single printed circuit board contains both

the power supply electronics and digital controller for the printer. A self-test feature and diagnostic display panel help the user verify proper operation of the unit and isolate problems should they occur.

COMMUNICATIONS

Interfaces on the DS180 include RS232 and 20mA current loop serial interfaces and a Centronics compatible parallel interface. Baud rates from 110-9600 and parity selection may be keyed in by the user for his specific application.

FORMS HANDLING

Adjustable tractor accommodate forms from 3-15 inches wide. A head-to-platen gap adjustment ensures optimum print quality on up to 6-part forms. Fanfold paper may be fed from the front or bottom of the DS180. A paper-out sensor may be programmed to send a stop transmission character and sound an audible alarm.

QUALITY MANUFACTURING

Reliable performance is ensured by a stringent quality control program. Datasouth uses prestressed, high reliability parts from leading manufacturers. Multiple tests are performed on sub-assemblies during each stage of production, with each completed unit undergoing a final 24 hour print test and burn-in. The DS180 carries a 90 day warranty on materials and workmanship.

• Circle No. 372

NOTICE TO ADVERTISER

From November 7th 1980
the **Practical Computing**
Advertising dept. will be at:

Practical Computing
room L311
Quadrant House
The Quadrant
Sutton
Surrey SM2 5AS

Tel: 01-661 3500 EXTN 3612



Micro and Mini Computer Engineering Services

**SYSTEM ASSEMBLY, TEST and
INSTALLATION**
FULL FIELD MAINTENANCE
WORKSHOP REPAIR
HARDWARE DESIGN

For further information contact:

Bob Hare
Systems Maintenance and Services
Limited,
Unitair Centre, P.O. Box 13,
Great South West Road,
Feltham, Middlesex TW14 8NT.
United Kingdom.
Tel: 01-751 4451 (10 lines)
Telex: 8814060

• Circle No. 373

Advertisement Index

A									
Adda	169	David Richards	200	Lowe Electronics	176, 196, 202	R			
Acorn Computers	18	Davinci	206	LP Enterprises	6, 7	Radius		97	
Aculab	36	Datron Microcentre	181	M		Rair		54	
AJD Direct Supplies	182	3D Digital Design	190	MAP	168	Ram		186	
AJ Harding (Molimerx)	29	DDP	204	Melbourne House	96	Research Resources		162	
Almarc	17, 19, 165	Digitus	40	Mendip	17	Rohan		174	
Angla Consultants	38	DN Computer Services	196	Metrotech	39	S			
Apex Micro Systems	198	Dragon Systems	148	McLinZandi	167	Science of Cambridge		120, 121	
B		E		Micro 90	178	Scope		212	
Back Numbers	171	Easicomp	178	Microbusiness Centre	2	Semel		214	
Beaver Systems	208	Electronic Brokers	20	Microbyte	214	Sharp Electronics		14, 15	
Breadboard Exhibition	210	EMC	20	Microcentre	2	Sharp Soft		156	
Business Computer Services	19	Europhonic	125	Microdigital	158	Sheffield Micros		150	
Business & Leisure Micros	184	G		Microfacilities	38	Shelton		48	
Buss Stop	22	Gate Micro Systems	210	Micro Logic	19	Sigma UK		216	
Butel Comco	45	Gemsoft	214	Micropute	214	Sirton Computers		201	
Byte Shop Computerland	170	GP Industrial Electronics	193	Microprint	150	Software House		206	
Bytronix	172	Grana Winter	12, 13	Micropute	214	Small Systems Engineering		153, 166	
C		Great Northern Computer Services	182	Microsolution	173, 188	Stack		48	
Cambridge Computer Store	87	Guestel	33, 166	Microsolve	194	Stage One		172	
Camden Electronics	164, 202	H		Microstyle	176	STCS		152	
Capital Computer Factors	24	Hal Computers	199	Microtek	22	Strutt		154	
Cetronic	204	Happy Memories	180	M. J Stone	87	Sumlock Bondain		213	
Centronics	10, 11	HB Computers	157	Mighty Micro	174	Sun Computing Services		52	
Chaljo	208	Henry's Radio	189	Mitrecast	27	Supersoft		22	
Chess Consultants	182	HSV	87	Milbank	30, 37	Swanley Electronics		212	
Chibdale	153	Hytech	186	Mins of Information	192	Systematics International		147	
Chromasonic	149	I		Monolith	150	Systems International		162	
Cleartone	178	Icarus	68	Mutek	16	Systems Maintenance & Services		217	
Clenlo	154	Independent Computer Engineers	162	N		T			
Codified	156	Informex Centralex	212	Nascom	195	Telema		190	
Comart	5, 119	Instem	200	Newbear	28	Teleprinter Equipment		103	
Commander Micro Systems	192	Integrated Supplies	148	Newton Laboratories	23, 66	Telesystems		28	
Commodore	77, 81, 84, 109	Intelligent Artefacts	24	Newtronics	203	Technomatic		175	
Compec	205	Interface Computer Services	177	NIC	17	Technical Book Services		154	
Comsoft	104	Intex Datalog	32	Northamber	159	Tekdata		194	
CompShop	218, 219	Ithaca Intersystems	220	Northern Software	209	Thistle		208	
Computech	179	J		O		Tim Orr Design		30	
Computerama	215	J S Systems	176	Office Computer Techniques	31	Total Concept Systems		32	
Computerbits	205	K		Online	207	Transam		155, 197	
Computerbility	185	Kansas City Systems	36	Owl Computers	198	Tridata Micros		151	
Computerland	153	Karradawn	30	P		T & V Johnson		191	
Computopia	158	KGB	161	Paper Shick	26	TW Computers		208	
Comserve	122	Kingpin	194	Personal Computers	53	V			
Control Universal	188	Kram	38	Pete & Pam Computers	34	Viasak		4	
C.P.U.	184	L		Petsoft	43	V & T Electronics		204	
Crofton	180	Landsler	90	Phipps Associates	104	W			
Crystal	151	Leicester Computer Centre	152, 196	Photo Electric	166	Walters Micro Systems		35	
Cumana	163	Lionhouse Micros	106	Portable Micro Systems	164	Wego		20	
Currah Computer Components	168	Little Genius	188	Program Power	112	Westrex		26	
Currys	8, 9	Liveport	51, 114	PR Daly & Co	180	Wildport		148	
Customer Accounting Systems	198	L & J Computers	112	Printer Offer	71	Wilkes		25	
D		Logitek	183	Printout	110	William Stuart Systems		158	
Databank	97	London Computer Centre	21	Q		Willis Computers		164	
Datalink	187	Q		Q Tek	206	X			
Data Dynamics	26	Qwert		Qwert	151	Xitan		160	
Data Text	212								
Datormark	160								

NEW REDUCED PRICES

8K £399 }
16K £499 } + VAT
32K £599 }
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. Cassette Deck £55 extra. Full range of software available. Interface PET IEEE — Centronics Parallel. Not decoded £49.00 + VAT Decoded £77.00 + VAT

**NOW IN STOCK
SUPER 80 COLUMN PET**
only £825 + VAT

SPECIAL SCOOP GET YOURSELF A PRINTER FOR YOUR PET AND SAVE A FORTUNE

only £299 + VAT

Interface Cards £49
Full Pet Graphics including cables. Ready to go. EX-STOCK.
Interfaces with APPLE, PET, EXIDY, TRS80, COMPUKIT and NASCOM.



NASCOM 2 DISC DRIVES

Add a powerful, double density, mini floppy disc to your Nascom system.

- Disc Controller Card (includes Nasbus 6 S100 interface)
- Will control 4 Drives.
- CPM operating system.
- Extended Disc Basic Compiler.
- Power supply included

One Disc System — £499 + VAT
Additional Disc Unit — £299 + VAT



NASCOM 2 GAMES TAPE

featuring Space Invaders and Android Nim, Re-numbering program and other goodies!

£7.50 + VAT

NEC SPINWRITER

only £1490 + VAT



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 fed. 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.

TEAC DISK DRIVES



- TEAC FD-50A has 40 tracks giving 125K Bytes unformatted single density capacity.
- The FD-50A can be used in double density recording mode.
- The FD 50A is Shugart SA400 interface compatible.
- Directly compatible with Tandy TRS80 expansion interface.
- Also interfaces with Video Genie, SWTP, Heathkit, North Star Horizon, Superbrain, Nascom, etc, etc.
- Address selection for Daisy chaining up to 4 Disks.
- Disks plus power supply housed in an attractive grey case.

Single Disk Drive £225 + VAT Double Disk Drive £389 + VAT

COMP POCKET COMPUTER GREATEST BREAKTHROUGH YET

£99.90 + VAT



COMPUTER POWER THAT ONCE FILLED A ROOM CAN NOW BE CARRIED IN YOUR POCKET!

- Programs in BASIC • "QWERTY" Alphabetic Keyboard • 1.9K Random Access Memory • Long Battery Life.

Computer power that once filled a room can now be carried in your pocket! It's easy to load with ready-to-run software from cassette tape (interface and recorder optional) or program it yourself in easy-to-learn BASIC. 24-character liquid crystal readout displays one line at a time. Special feature is advanced non-volatile memory allows you to power on and off without losing the contents of memory. Note: Memory must be transferred to tape before changing batteries. Automatic statement compaction squeezes every ounce of memory space. Features power-off retention of programs and data. Powerful resident BASIC language includes multiple statements, math functions, editing, strings, arrays and much more. Multiple program loading capability subject to RAM availability. Carrying case and batteries included.

Program	Each	Program	Each
Real Estate	£13.95	Games 1	£8.95
Civil Engineering	£13.95	Business Statistics	£10.95
Aviation	£13.95	Business Financial	£10.95
Math Drill	£8.95	Personal Financial	£10.95

EXATRON STRINGY FLOPPY FOR TRS80

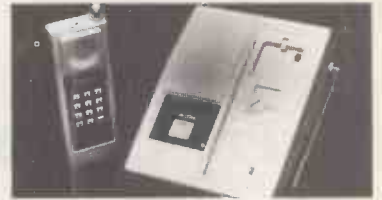
(Expansion interface not needed)

only £169 + VAT



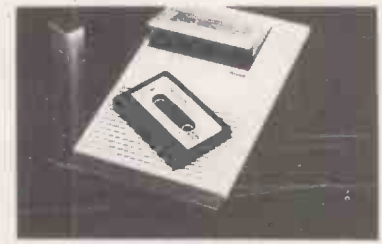
High Speed storage medium that is cheap and reliable. Includes 20 wafers - M/C monitor - BUS EXPN cable. £169

YOU NEED NEVER MISS AN IMPORTANT CALL AGAIN TWO CORDLESS TELEPHONE SYSTEMS — DIRECT FROM USA



THE ALCOM only £147 + VAT

Base station connects to your telephone line. Remote handset clips to your belt and gives you push-button dialing — Bleeps when call arriving — Nicad rechargeable batteries. Charger in base unit.



LOW COST TELEPHONE ANSWERING MACHINE only £99.95 + VAT

Microprocessor controlled answering machine. Plug into your phone line. Records any phone call messages. Remote bleeper enables you to listen to your messages from anywhere in the world. Uses standard cassettes. Comes complete with mains adaptor, microphone, remote bleeper, base unit, cassette with 30 sample pre-recorded messages.

COMMERCIAL • EXPANDABLE • COMPLETE TRS 80 • MODEL II

This new unit from the world's most successful micro company is now available immediately with software. The basic unit comes complete with 64 thousand characters (bytes) of Memory. The built in 8" Floppy disc adds another 1/2 million extra characters including the disc operating system. More disc expansion is now available.

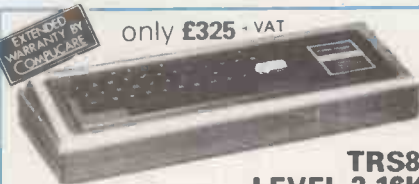
The Model II is a complete unit with a full keyboard including a numeric pad and 12" screen which gives 24 lines of 80 characters. The computer is supplied with both the disc operating system and the Level III Basic. A full self test routine is written into the power up procedure to eliminate incorrect operation. Both serial and parallel expansion sockets are standard. A printer is a plug-in operation. Both hardware and software necessary to talk to a mainframe are included. Terminal usage is very possible. With the addition of CPM2 you can operate with COBOL, FORTRAN, MBASIC, CBASIC in which languages are many other applications packages i.e. accounting, payroll stock etc.

64K 1-Disk Model II £1995.00 + VAT
RRP £2250.00

CP/M2 £95.00 C BASIC £75.00 FORTRAN £220.00
CIS COBOL £400.00 M BASIC £155.00 WORDSTAR £255.00

EPROM 2716 £12.50 + VAT

only £325 + 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

Interface to Centronics Parallel for TRS80 £75.00 + VAT

only £295 + VAT

TRS80 EXPANSION INTERFACE

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.

THE VIDEO GENIE SYSTEM EG3000 Series

16K £289 + VAT



WITH 16K user RAM plus extended 12K Microsoft BASIC in ROM • Fully TRS-80 Level II software compatible • Huge range of software already available • Self contained, PSU, UHF modulator, and cassette • Simply plugs into video monitor or UHF TV • Full expansion to disks and printer • Absolutely complete — just fit into mains plug.

COMING SOON
THE MARTELL TV GAME

NOBODY CAN GET NEAR OUR PRICES EXCEPT OUR CUSTOMERS

RRP £540 only **£399** + 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.

THE NEW ANADEX DP9501
A PROFESSIONAL PRINTER

- Bi-directional printing
- Up to 220 chars/line with 4 print densities
- 500 char buffer
- RS232C and Centronics Parallel interface built in
- Full software control of matrix needles allowing graphics capability
- 200 chars/sec • Adjustable width tractor feed.

All this for only **£895** + VAT.

THE ATARI VIDEO COMPUTER GAMES SYSTEM
 Atari's Video Computer System now offers more than 1300 different game variations and options in twenty Game Program™ cartridges!

Most Cartridges only **£13.90** + VAT
 Prices may vary with special editions 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

SPACE INVADERS NOW IN STOCK £25

NEW TV GAME BREAK OUT

Has got to be one of the world's greatest TV games. You really get hooked. As featured in ETI. Has also 4 other pinball games and lots of options. Good kit for up-grading old amusement games.

MINI KIT — PCB, sound & vision modulator, memory chip and de-code chip. Very simple to construct. **£14.90** + VAT
OR PCB **£2.90** **MAIN LSI** **£8.50** Both plus VAT

WE ARE NOW STOCKING THE APPLE II EUROPLUS AT REDUCED PRICES

16K **£599**
 32K **£649**
 48K **£659** } + VAT

Getting Started APPLE II is faster, smaller, and more powerful than its predecessors. And it's more fun to use too because of built-in features like:

- BASIC — The Language that Makes Programming Fun.
- High-Resolution Graphics (in a 54,000-Point Array) for Finely-Detailed Displays.
- Sound Capability that Brings Programs to Life.
- Hand Controls for Games and Other Human-Input Applications.
- Internal Memory Capacity of 48K Bytes of RAM, 12K Bytes of ROM; for Big-System Performance in a Small Package.
- Eight Accessory Expansion Slots to let the System Grow With Your Needs.

You don't need to be an expert to enjoy APPLE II. It is a complete, ready-to-run computer. Just connect it to a video display and start using programs (or writing your own) the first day. You'll find that its tutorial manuals help you make it your own personal problem solver.

EUROPE'S FASTEST SELLING ONE BOARD COMPUTER
COMPUKIT UK101

- ★ 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 Disassembler 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.

40 pin Expansion Jumper Cable for CompuKit expansion **£8.50** + VAT

Build, Understand and Program your own Computer for only a small outlay. **KIT ONLY £179** + VAT **NO EXTRAS NEEDED**

Available ready assembled, tested & ready to go **£229** + VAT

NEW MONITOR FOR COMPUKIT UK101
 • In 2K Eprom 2716 • Allows screen editing • Saves data on tape • Flashing cursor • Text scrolls down **£22.00** + VAT

FOR THE COMPUKIT	Game Packs		
Assembler/Editor	1. Four Games	£5.00	Super Space Invaders (8K) £8.50
Screen Editor Tape	2. Four Games	£5.00	Space Invaders £5.00
	3. Three Games 8K only	£5.00	Chequers £3.00
			Real Time Clock £3.00
			Case for CompuKit £29.50

All Prices exclusive VAT

HITACHI PROFESSIONAL MONITORS

9" — ~~£129~~ **£99.95**
 12" — ~~£199~~ **£149**

- 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.

ENGLISH COLOUR TV/ AMERICAN NTSC COLOUR MONITOR

Suitable for Apple, Atari and Texas 99/4 **£295** + VAT

8MHz Super Quality Modulators	£4.90
6MHz Standard Modulators	£2.90
C12 Computer Grade Cassettes	10 for £4.00
Anadex Printer Paper — 2000 sheets	£25.00
Floppy Discs 5 1/4" Hard and Soft Sector	£3.50
Floppy Disc Library Case 5 1/4"	£3.50
Verocases for Nascom 1 & 2 etc.	£24.90
Keyboard Cases	£9.90

MEMORY UPGRADES

16K (8 x 4116) **£29.90** + VAT
 4K CompuKit (8 x 2114) **£29.90** + VAT

SPECIAL OFFER
 We will part exchange your Sinclair ZX80 for any of our products.

Refurbished ZX80's—fully guaranteed **£69.90** + VAT
 (Supply dependant upon stocks).

NEW TV GAME BREAK OUT

Has got to be one of the world's greatest TV games. You really get hooked. As featured in ETI. Has also 4 other pinball games and lots of options. Good kit for up-grading old amusement games.

MINI KIT — PCB, sound & vision modulator, memory chip and de-code chip. Very simple to construct. **£14.90** + VAT
OR PCB **£2.90** **MAIN LSI** **£8.50** Both plus VAT

We have one of the largest collections of Computer Books under one roof, along with racks of software for the PET and TRS80.
Come and see for yourself.

NOW OPEN

OUR NEW SHOWROOM & SALES CENTRE AT
 311 Edgware Road,
 London W2.
 Telephone: 01-441 2922

SPECIAL—ONCE IN A LIFETIME OFFER!

RRP £740 + VAT

16K **£399**
 32K **£449**
 48K **£499** + VAT

EXIDY SORCERER

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 \$100 Motherboard. 69 Key keyboard including 16 key numeric pad.

Please add VAT to all prices — including delivery. Please make cheques and postal orders payable to **COMP SHOP LTD.**, or phone your order quoting **BARCLAYCARD, ACCESS, DINERS CLUB** or **AMERICAN EXPRESS** number.
CREDIT FACILITIES ARRANGED — send S.A.E. for application form.

MAIL ORDER AND SHOP:
 14 Station Road, New Barnet, Hertfordshire, EN5 1QW (Close to New Barnet BR Station — Moorgate Line).
 Telephone: 01-441 2922 (Sales) 01-449 6596 Telex: 298755 TELCOM G

NEW WEST END SHOWROOM:
 311 Edgware Road, London W2. Telephone: 01-262 0387

OPEN — 10am - 7pm — Monday to Saturday

- ★ IRELAND: 80 Marlborough Street, Dublin 1. Telephone: Dublin 749933
- ★ COMP SHOP USA, 1348 East Edinger, Santa Ana, California, Zip Code 92705. Telephone: 0101 714 5472526

COMP SHOP "Europes Largest Discount Personal Computer Stores"

COMP COMPUTER COMPONENTS
 (Part of the Compshop Ltd. Group)

At Intersystems, "dump" is an instruction.

Not a way of life.

(Or, when you're ready for IEEE S-100, will your computer be ready for you?)



We're about to be gadflies again.

While everyone's been busy trying to convince you that large buses housed in strong metal boxes will guarantee versatility and ward off obsolescence, we've been busy with something better. Solving the *real* problem with the first line of computer products built from the ground up to conform to the new IEEE S-100 Bus Standard. Offering you extra versatility in 8-bit applications today. And a full 16 bits tomorrow.

We call our new line Series II™. And even if you don't need the full 24-bit address for up to 16 megabytes (!) of memory right now, they're something to think about. Because of all the perform-

ance, flexibility and economy they offer. Whether you're looking at a new mainframe, expanding your present one or upgrading your system with an eye to the future. (Series II boards are compatible with most existing S-100 systems and *all* IEEE S-100 Standard cards as other manufacturers get around to building them.)

Consider some of the features: Reliable operation to 4MHz and beyond. Full compatibility with 8- and 16-bit CPUs, peripherals and other devices. *Eight* levels of prioritized interrupts. Up to 16 individually-addressable DMA devices, with IEEE Standard overlapped operation. User-selectable functions addressed by DIP-switch or jumpers, eliminating soldering. And that's just for openers.

The best part is that all this heady stuff is available *now!* In our advanced processor—a full IEEE Bus Master featuring Memory Map™ addressing to a full megabyte. Our fast, flexible 16K Static RAM and 64K Dynamic RAM boards. An incredibly versatile and

economical 2-serial, 4-parallel Multiple I/O board. 8-bit A/D-D/A converter. Our Double-Density High-Speed Disk Controller. And what is undoubtedly the most flexible front panel in the business. Everything you need for a complete IEEE S-100 system. Available separately, or all together in our new DPS-1 Mainframe!

Whatever your needs, why dump your money into obsolete products labelled "IEEE timing compatible" or other words people use to make up for a lack of product. See the future now, at your Intersystems dealer or call/write for our new catalog. We'll tell you all about Series II and the new IEEE S-100 Bus we helped pioneer. Because it doesn't make sense to buy yesterday's products when tomorrow's are already here.

InterSystems™

Ithaca Intersystems (UK) Ltd.,
Coleridge Lane, Coleridge Road,
London N8 8DD.

Telephone: 01-341-2447/Telex: 299568

