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Personal Computer World

PLUS GEMINI BENCHTEST

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February 1982 75p

~~not March
23/12/82~~

BRITAIN'S LARGEST SELLING MICRO MAGAZINE

FROM THE MAN WHO GAVE YOU PET...
Sirius: The 3rd Generation Micro


NEW MODEL
LOWER COST
CROMEMCO MODEL 3703 PRINTER
WRITEMASTER Word Processing System

MICRO TRAINING FOR COMPUTER USERS

6 Micro courses at Digitus

Which would you like to attend?

Digitus is running a number of courses to train users and potential users in the basic skills of microcomputing. Conducted at our Central London Workshop, the courses provide hands-on experience of microcomputers, demonstrations of working systems and tutorials on your particular needs.

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One day's concentrated information on microcomputing aimed at the potential user in small and large organisations. A practical course which includes business applications of micros, guidelines on selecting microcomputer systems and an introduction to programming.

WORDSTAR WORDPROCESSING

A one day course for people who want to learn the fundamentals of wordprocessing. Uses the popular Wordstar wordprocessing package available on most CP/M micros and teaches by hands-on use.

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In addition to Wordstar, Micro-Pro Inc have produced a variety of aids to improve productivity in offices and systems departments. This one day course includes: Mail-Merge linked to Wordstar • Supersort sorting utility • CalcStar rows and columns manipulation • DataStar information manager • harnessing the 'Star' products together.

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Note: Wordstar and DataStar are registered trademarks of Micro-Pro Inc.

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A two day course designed to teach the first principals of programming in BASIC. Aimed at those with some understanding of micros who want to learn how to instruct their computer to perform tasks.

DATASTAR INFORMATION MANAGEMENT

The DataStar data entry, retrieval and management system is a powerful aid which enables the educated user and computer professional to build information systems economically and rapidly.

IMPROVE YOUR BASIC

A two day course for those who have learned Basic from hands-on experience and want to brush up their BASIC techniques and learn some timesaving software tools.

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Course in: Micro Technology for Management • Local Area Networks • Micros for Computer Professionals.
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Booking and Fees The fee for all courses is £80 per day plus VAT, payable 14 days prior to starting date.

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☐ Please send me further information ☐ Reserve places as follows:

Name of delegate .... Date ....
Name of delegate .... Date ....
Name of delegate .... Date ....

Courses/dates

Introduction to Microcomputers	☐ Feb 8	☐ Apr 19
Fundamentals of Programming in Basic	☐ Feb 9/10	☐ Apr 20/21
Improve your Basic	☐ Feb 11/12	☐ Apr 22/23
Wordstar Wordprocessing	☐ Feb 23	☐ May 11
Micro-Pro Software Tools	☐ Feb 24	☐ May 12
DataStar Information Management	☐ Feb 25	☐ May 13

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PCW

PCW 1

INSIDE PCW

Volume 5 No 2 February 1982

Cover photography by Chris Stevens
Photographs of Chuck Peddle by Tony Sleep

60 NEWSPRINT

All the micro computing news thats fit to print plus some that isn't; brought to you by Guy Kewney.

74 BANKS' STATEMENT

A gripping tale of governmental tyranny and bureauctratic obfuscation as told to Martin Banks by the legendary 'Bumper' Harris.

77 CTUK! NEWS

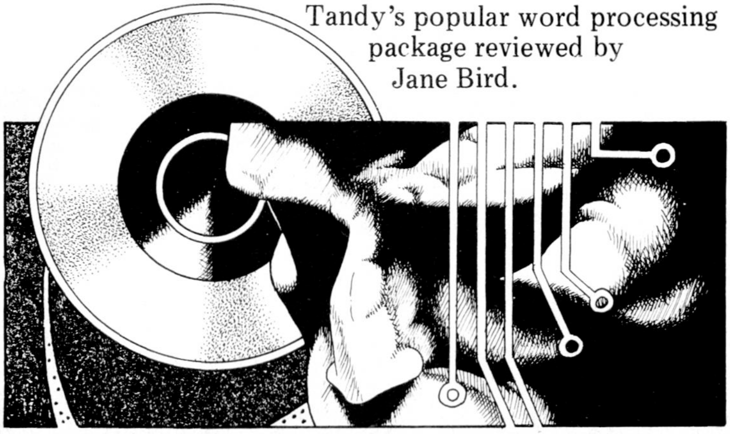
The latest news from Britain's own grass roots computer literacy movement — ComputerTown UK!

78 COMMUNICATIONS

Negative and positive feedback from *PCW*'s readers.

82 SCRIPSIT 2.0

Tandy's popular word processing package reviewed by Jane Bird.



See page 86

86 FRAMES OF REFERENCE

Continuing Alan Woods series on the implications of the personal computer for the traditional data processing industry. This month a look at the micro manufacturers and software suppliers.

93 WATANABE PLOTTER

Editor Rodwell checks out an expensive but tempting peripheral, Watanabe's intelligent plotter.

99 CALCULATOR CORNER

An airline pilot describes how, despite all his modern navigation aids, a programmable calculator finds a place on his flight deck.

100 PATTERNS

Alan Sutcliffe considers the place of mirror images in computer graphics, with programming examples to achieve image reversal.

104 SIRIUS BUSINESS

Chuck Peddle's new 16-bit business computer looks set to make massive waves in the marketplace offering exceptional value for money. We present Britains first Benchtest of the ACT Sirius-I.

109 BOOKFARE

Malcolm Peltu reviews books ranging from psycology to typography, but all with a computing angle.

117 GEMINI MULTIBOARD

Benchtesting a new low price modular micro computing system which will interest hobbyist and professional alike. Neil Cryer investigates.

122 CASIO fx - 9000p

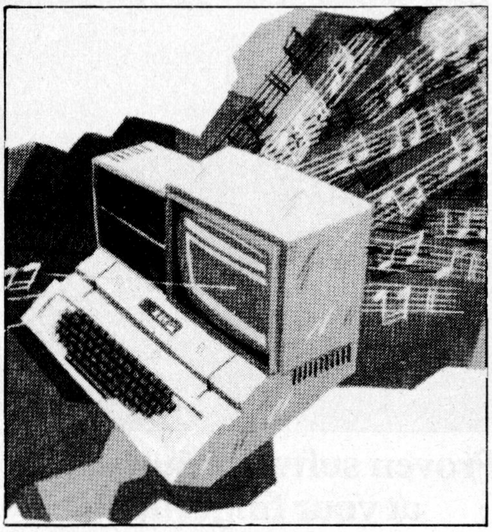
Dick Pountain tries out the first desk top computer from Casio; a powerful mathematics engine with some unusually hardware features.

131 HIGH DENSITY VDU CARD

Our hardware feature for this month; B J Hawkins tells how to design and build a display controller to give 80x24 character screens.

138 FREQOUT!

David Ellis checks out a sophisticated new music synthesiser package for Apple.



142 ANS BASIC

The American National Standard for the Basic language contains some powerful and, to those reared on Microsoft products, unfamiliar feature features. Mike Parr outlines them.

148 TJ'S WORKSHOP

Terminal Junkies get their monthly hardware and software fixes here.

154 THE MAN BEHIND THE WEST COAST FAIRE

A personality profile by Dave Tebbutt of one of the founders of personal computing; Jim Warren who gave the US Dr Dobbs, The West Coast Faire and Info World.

See page 75

157 PCW SUBSET

More useful assembler subroutines for popular processors.

162 COMPUTER ANSWERS

Readers' queries answered by Sheridan Williams and his band of experts.

164 NEWCOMERS START HERE

Our quick intro for those new to computing.

165 DIRECT ACCESS

In Store, Transaction File, User Groups Index Update, Network News Diary Data and CTUK! centres.

177 LEISURE LINES

J J Clessa's latest brain teasers.

177 PROGRAMS

More readers' programs for popular machines.

191 BLUNDERS

Everyone makes mistakes but only *PCW* publicises them!

192 BACK ISSUES

Catch up with what you missed (if we haven't sold out of it).

255 CHIPCHAT

Read how *PCW* publisher won a computer in an Asteroids tournament, plus the usual industry gossip, slander etc.

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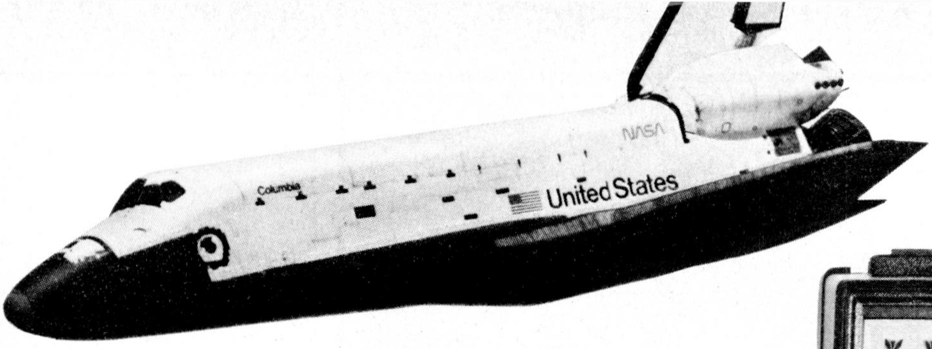
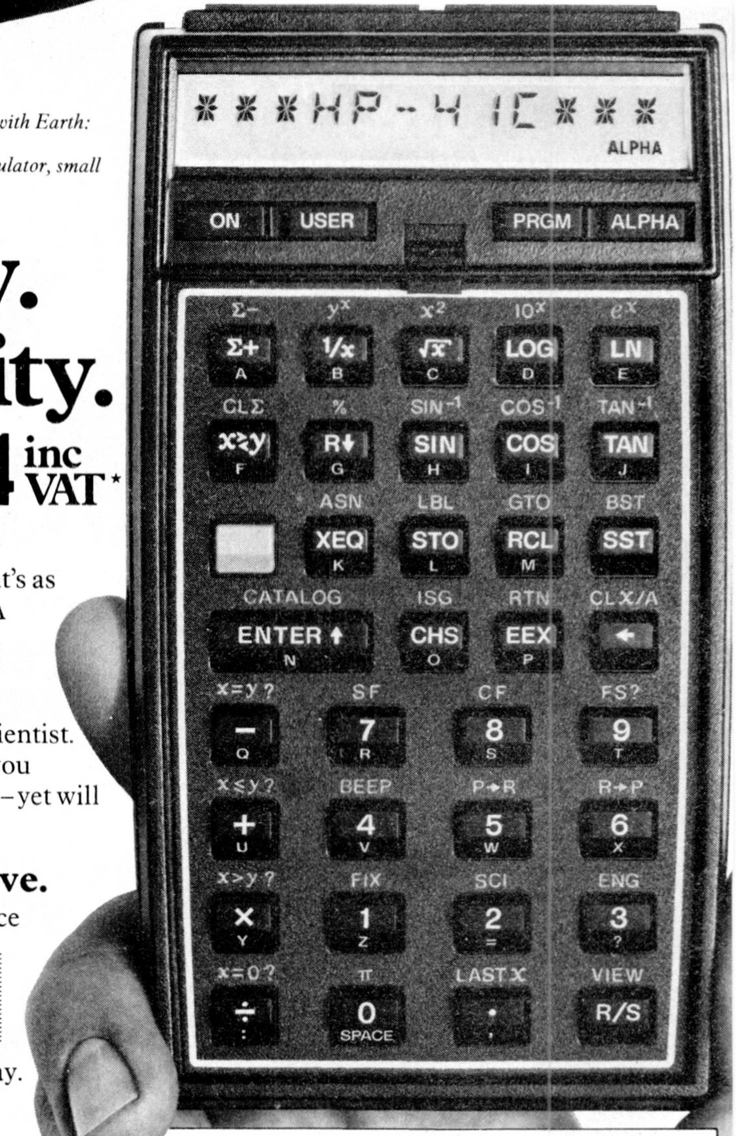


On the edge of the atmosphere, space shuttle Columbia was about to lose all contact with Earth: for 21 agonising minutes, touch-down would be touch-and-go.
As the world held its breath, the £4½ billion project relied on a £165 hand-held calculator, small enough to live in the pocket of Robert Crippen's flight suit.
The Hewlett-Packard HP-41C. Unmodified. Just as you buy it today. . .



Astronaut quality. Everyday simplicity. The HP-41C. £184 inc VAT*

Sooner or later, a basic calculator is too basic.

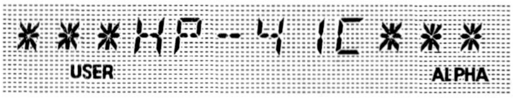
Suddenly you need to 'compute' – but with a 'computer' that's as simple and pocketable as a hand-held calculator. And, as NASA found, that means an HP-41C.

Today, a broad-ranging companion to an A-level course. Tomorrow, a fully-fledged, advanced programmable system for the businessman, analyst, researcher, technician, engineer or scientist.

Whatever your job, here's a calculator that will grow with you and your needs step-by-step into a complete calculating system – yet will always stay simple, manageable and portable.

The friendly calculator with power in reserve.

As a straightforward calculator, the HP-41C is a masterpiece of compact power.

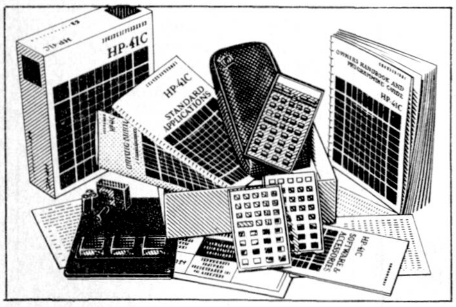


It gives you read-out in letters, as well as figures and symbols, so the display can talk to you in an easy, simple way.

Yet, inside, it has the effortless, problem-solving power normally associated with computers.

Among other things, that means the HP-41C is fully programmable. You can feed its built-in 400-line memory with ready-made programs or develop your own. Its friendly style makes it surprisingly easy. And, because the memory is continuous, what you put into it stays in – even when you switch off.

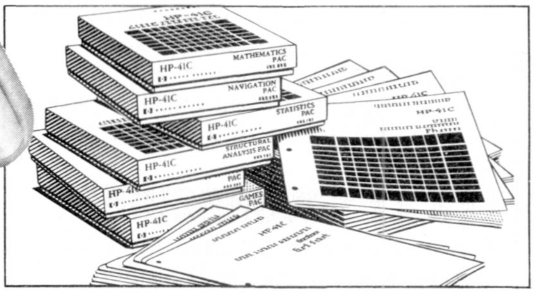
But that's not the end of the story by any means. Because, unlike any other advanced programmable calculator you are likely to see, the HP-41C has behind it a highly developed package of software support representing many years of heavy investment by Hewlett-Packard. So when you buy the HP-41C you don't just *own* a powerful system; you can put it powerfully to *work*.



The HP-41C hand-held 'computer' in a box. £184 brings you the calculator, a comprehensive 270-page manual, owner's handbook, and programming guide, a standard applications handbook, customising overlays. HP Users' Library membership reply card, free one year's subscription to HP's User's Newsletter, batteries, carrying pouch and 12 months' full guarantee.

Proven software support – at your fingertips.

Here, the HP-41C really comes into its own with an unrivalled range of software support.



17 Application Modules – miniature plug-in solutions: maths, electrical engineering, financial decisions, games . . .

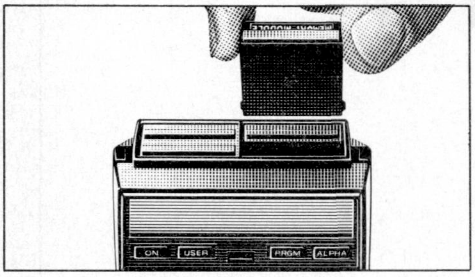
29 Solutions Books – each with up to 15 programs drawn from the best of 10,000 user-submitted programs. Each book provided with Bar Codes – for instant program entry with the HP wand.

11 Application Pacs – pre-recorded magnetic cards covering over 2,000 programs, entered through the card reader.

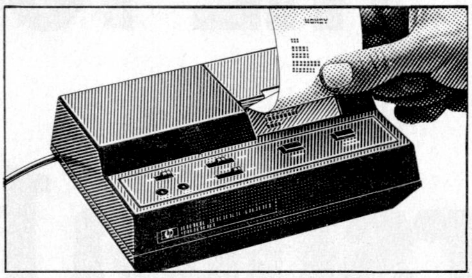
All software and peripherals are optional extras.

***Price correct at time of going to press.**

Two ways to make your system grow...

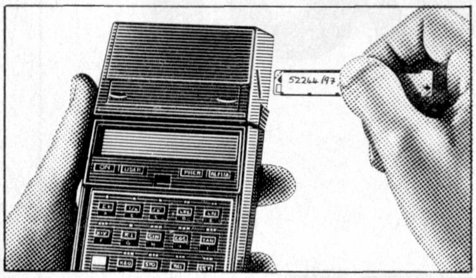


Snap-in more memory. *A single module will double the memory available. A quad module adds no fewer than 256 registers at once. Suddenly you've over 1800 lines of memory at your command.*

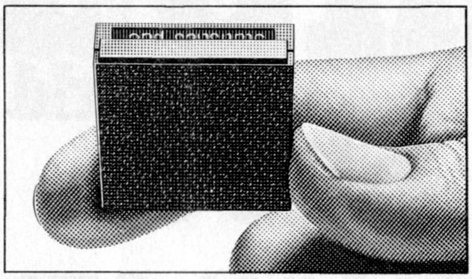


Plug-in a printer. *The HP-41C printer handles upper and lower case, in alpha, numeric and graph-plotting modes. Use it for final hard copy, or to follow program execution.*

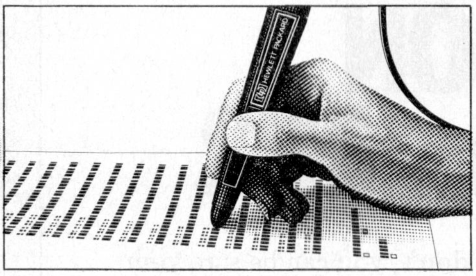
Four ways to program your HP-41C...



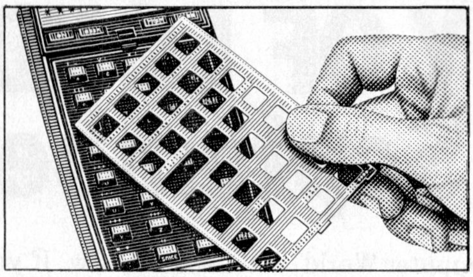
Card reader. *This reads pre-programmed magnetic cards. It can also record and read your own programs and data.*



Application modules. *These are plug-in modules each containing a whole range of ready-made programs on your chosen subject.*



Bar code reader. *A quick and easy way of loading any one of the software packages. The wand simply 'lifts' the coded program straight off the page of your HP-41C solution books.*



Keyboard customising. *Develop your own programs and enter them through the keyboard. You can assign any function or program to any key and mark them on your own customising overlay.*

Thousands of easy ways to solve problems.

Think of a problem! As an HP-41C owner you won't have far to look for the solution – or long to wait before it's locked in your system's memory. Any of HP's hundreds of pre-programmed solutions can be easily entered in any of the four ways we illustrate above. You'll certainly want to devise your own solutions, too. The guidance manual in your basic pack tells you how. If you develop an original one you could submit it to the HP-41C Users' Library. It already contains thousands of tested programs which 10,000 users world-wide are happy for you to share.

Quality from HP – the big computer manufacturer.

The HP-41C is made from the chip upwards by Hewlett-Packard, a world leader in computers. And you can tell! By the detail like the permanent inlaid key notations, tough ABS case, and gold-plated port contacts. By the elegant simplicity designed into the HP-41C's operating style. By the sort of software support only a computer giant would be capable of. By the utter reliability that is the HP hallmark throughout the world of computers.

HEWLETT
PACKARD

See the HP-41C at **Comet, Xerox Stores, Wilding, Sumlock-Bondain, Landau** or these other Appointed Dealers:

Aberdeen Tyseal Office Equipment.
Bath Wilding Office Equipment.
Belfast Cardiac Services Company.
Birmingham John Mabon Associates; Research Micro System.
Bolton Wilding Office Equipment.
Bournemouth South Coast Business Machines.
Brighton Office Machinery Engineering Co.
Bristol Decimal Business Machines; Wilding Office Equipment.
Bromley Wilding Office Equipment.
Cambridge W. Heffer & Sons; Wilding Office Equipment.
Canterbury R. E. Typewriters.
Cardiff Sigma Systems (Calculators).
Carlisle Thos. Hill International.
Colchester Wilding Office Equipment.
Croydon Wilding Office Equipment. **Derby** Office Machines.
Dundee Tayside Office Equipment.
Edinburgh Business & Electronic Machines; Holdene; Robox.
Folkestone R. E. Harding. **Glasgow** Robox.
Gloucester Wilding Office Equipment.
Gravesend Wilding Office Equipment.
Grimsby Teesdale Office Equipment.
High Wycombe Wilding Office Equipment.
Hornchurch Wilding Office Equipment.
Ilford Wilding Office Equipment.
Ipswich Anglia Business Machines; Wilding Office Equipment.
Kingston-upon-Thames Wilding Office Equipment.
Leeds Holdene; Wilding Office Equipment.
Leicester A. C. Barratt & Co.; Sumlock Services.
Lichfield Anglo American Computing.
Liverpool Rockliff Brothers.
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57 Houndsditch, Bethnal Green Road; Concept Business Systems;
Dixons Photographic – 123 Holborn, 64 New Bond Street;
Euro-Calc – 128-132 Curtain Road, 224 Tottenham Court Road,
55 High Holborn; Landau Calculators – Bourne's Oxford Street,
227 Tottenham Court Road; McDonald Stores –
78 Oxford Street; Metyclean – 137 The Strand, 92 Victoria Street;
Mountaindene – 22 Cowper Street; Sumlock-Bondain –
263-269 City Road, 360 Euston Road, Cannon Street Station;
Wallace-Heaton – 127 New Bond Street;
Wilding Office Equipment – 7 The Arcade Hoe Street,
21 Thomas Street, 120 The Broadway, Wimbledon;
199 Parrock Street, Gravesend. The Xerox Store Piccadilly –
76 High Holborn, 110 Moorgate.
Luton Wilding Office Equipment.
Maidstone Wilding Office Equipment.
Manchester Automated Business Equipment; Holdene;
Wilding Office Equipment. **Matlock** Derby Office Machines.
Middlesbrough Thos. Hill International.
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Northampton A. C. Barratt & Co.
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Nottingham Bennett's (Typewriter & Office Suppliers);
Trent Office Equipment. **Oxford** Reid's Office Equipment;
Science Studio. **Plymouth** JAD Integrated Services.
Reading Central Southern Equipment; Reid's Office Equipment;
Caversham, 38 Market Place, Reading.
Romford Wilding Office Equipment. **Royston** Herts Electroplan.
Sheffield Butlers Office Equipment.
Slough Wilding Office Equipment.
Southampton Leicester Typewriters.
Southend Wilding Office Equipment.
Sunderland Thos. Hill International.
Sutton Landau Calculators.
Swindon Wilding Office Equipment.
Waltham Cross Wilding Office Equipment.
Watford Automatic & Electronic Calculators;
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All UK Comet branches.

MORE ROOM AT THE TOP!

The 5th Personal Computer World Show

BARBICAN CENTRE
CITY OF LONDON
9 – 12 September 1982

If you came to the 4th Personal Computer World Show this year you'll know exactly what we mean.

If you didn't, then you missed the spectacle of over 16,000 people cramming themselves into two halls filled with the most up-to-date hardware, software and peripherals going.

But we won't be caught again. For 1982 we are moving to the Barbican Centre in the City of London — *the* new exhibition venue with everything going for it. Excellent location, superb facilities, and lots of room for more exhibitors and more visitors.

Just like this year there will be one floor devoted to business and professional microcomputing and one devoted to home and hobbyist applications. But overall there will be almost twice as much exhibition space. And we're opening for four days instead of three.

Judging by the level of advance reservations from the 1981 Show, space is still going to be in short supply. So phone or return the coupon to Timothy Collins now. If you don't, you can be sure your competitors will.

Tim Collins Montbuild Ltd, 11 Manchester Square
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Please rush me details of exhibiting at the
5th Personal Computer World Show

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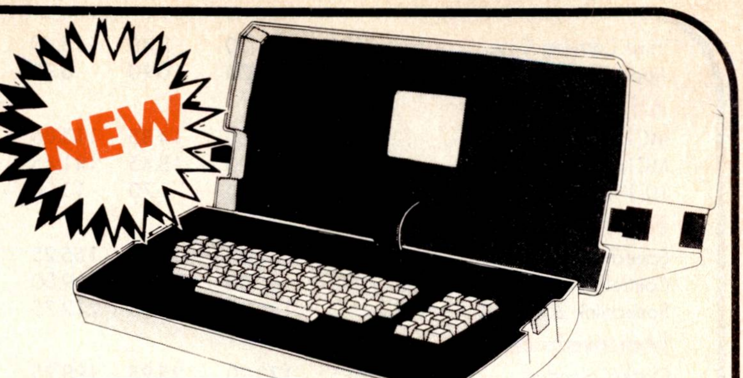
10 Shops Nationwide



OSBORNE

The Osborne 1 is a new concept in microcomputing – selling at a price of £1,250. This includes £800 worth of software, comprising CP/M, MBASIC, CBASIC, Supercalc and Wordstar/Mailmerge. The machine itself is based on a Z80 microprocessor with 64 KBytes of RAM as standard. The twin built-in floppy disk drives afford 100K of storage each. RS232 and IEEE ports are both incorporated. The 5" screen acts as a window of 52 x 24 characters onto a background of 128 x 32. An external full size monitor may be plugged in.

	NETT	V.A.T.	TOTAL
Osborne 1 Computer	1250.00	187.50	1437.50

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Tel: 021-632 6303. Manager: Peter Stallard.
300 yards from Bullring Centre.

Manchester

12/14 St. Mary's Gate, Market Street,
Manchester, M1 1PX. Tel: 061-832 6087.
Manager: Lesly Jacobs. Corner of Deansgate.

Bristol

16/20 Penn Street, Bristol, BS1 3AN.
Tel: 0272 20421. Manager: Steve Heynes.
Between Holiday Inn and C & A.

Glasgow

22/24 West Nile Street, Glasgow, G7 2PF.
Tel: 041-226 3349. Manager: David Livingstone.
Between Buchannan Street and Central Station.

Chester

The Forum, Northgate Street, Chester, CH1 2BZ.
Tel: 0244 317667.
Manager: Jeremy Ashcroft. Next to the Town Hall.

Sheffield

58 Leopold Street, Sheffield, S1 2GZ.
Tel: 0742 750971. Manager: Justin Rowles.
Top of the Moor, opposite Town Hall.

Edinburgh

4 St. James Centre, Edinburgh, EH1 3SR.
Tel: 031-556 6217. Manager: Colin Draper.
East end of Princes Street, St. James Centre.

Liverpool

33 Dale Street, Liverpool, L2 2HF.
Tel: 051-236 2828. Manager: Mark Butler.
Between the Town Hall and Magistrates Courts.

Preston

1/4 Guildhall Arcade, Preston, PR1 1HR.
Tel: 0772 59264.
Manager: Jim Comisky. Directly under Guild Hall.

London

42 Tottenham Court Road, London, W1 9RD.
Tel: 01-636 0845.
Manager: Vass Demosthenis.

Terms & Conditions

Our Conditions of Business

In addition to cash we accept Access, Barclaycard, Stereo Club, American Express, Diners Club and cheques covered by a bankers card.

Official orders over £50 are welcome, with normal 30 days credit extended to bona-fida commercial and government organisations. All prices, specifications and terms are subject to change without notice at the discretion of the management. Offers subject to availability.

All previous **Laskys** Advertisements are superseded by this. Not all stores carry every advertised item.

Prices correct at time of going to press. E. & O.E.

Computer Retailers Association

We are founder members of the Computer Retailers Association a voluntary organisation of leading micro-computer dealers and service organisations.

The purpose of this Association is to maintain and improve standards of trading and customer support within the industry and to present the industry's case to the outside world. The Association also acts as a forum where members can discuss common problems.

A Better Guarantee

The products are warranted against defects in material and workmanship for a period of one year from the date of purchase, two years for Apple and Sharp products.

During the warranty period, the company will repair (or at its own option, replace) at no charge, components that prove defective. This is provided the product is returned, shipping prepaid, or by person, stating when it was bought and enclosing proof of purchase.

This warranty does not apply if, in the opinion of the company, the product has been damaged by accident, misuse or misapplication.

Laskys Stereoclub

– the handy way to buy, from Laskys. Multiply your monthly payment by 24 to find out your credit limit. For instance, for the minimum monthly payment of £5 you would get credit up to £120. In some cases you may be able to get instant credit by paying a deposit of 10% of a purchase price. Current Stereoclub interest rate is 2.75% monthly – equivalent to an APR of **38.5%.** Rates may vary.

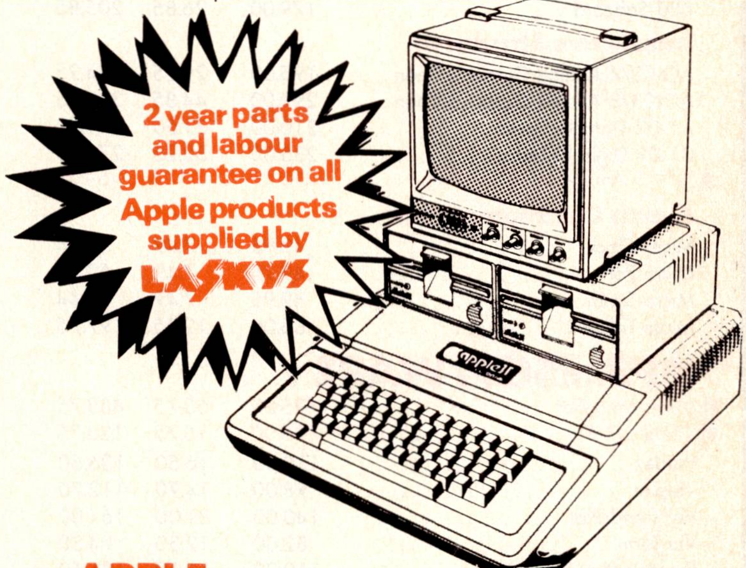
If you pay by Bankers' Order, apart from the extra convenience, you'll enjoy a LOWER INTEREST RATE – currently 2.45% monthly, equivalent to an APR of **33.7%.**

As a Stereoclub member we'll send you regular news and literature from Laskys. Laskys Stereoclub is probably the best thing that's happened to Microcomputers since the invention of the chip!

Head Office

Accounts administration and engineering are at:
Microcomputers at Laskys, 14 Castle Street, Liverpool L2 0TA. Telephone 051-227 2535.
General Manager: Bruce Everiss, Operations Manager: Graham Jones.

Laskys, the retail division of the Ladbroke Group of Companies



APPLE

	NETT	V.A.T.	TOTAL
Apple III Information Analyst	2695.00	404.25	3099.25
Disk III	385.00	57.75	442.75
Silentype III	222.00	33.30	255.30
● Apple II + 48K	675.00	101.25	776.25
● Disk Drive Plus Controller (3.3)	375.00	56.25	431.25
● Disk Drive	295.00	44.25	339.25
Programmer's Aid	26.00	3.90	29.90
Autostart Rom Pack	33.00	4.95	37.95
Graphics Tablet	485.00	72.75	557.75
● Silentype	195.00	29.25	224.25
Apple Tel System	575.00	86.25	661.25
Black and White Modulator	14.00	2.10	16.10
Pascal Language System	245.00	36.75	281.75
Applesoft Firmware Card	95.00	14.25	109.25
Integer Card	95.00	14.25	109.25
● 16K Ram Card (48K – 64K)	60.00	9.00	69.00
Language Card	97.50	14.63	112.13
Apple Pilot	79.00	11.85	90.85
Apple Fortran	105.00	15.75	120.75
Apple Prototype/Hobby Card	12.00	1.80	13.80
Vero Prototype/Hobby Card	10.00	1.50	11.50
Parallel Printer Interface Card	87.50	13.13	100.63
Communications Card	103.00	15.45	118.45
High Speed Serial Interface Card	94.75	14.21	108.96
Centronics Card	103.00	15.45	118.45
Controller Card	100.00	15.00	115.00
● Eurocolour Card	69.00	10.35	79.35
B/W Modulator	14.00	2.10	16.10
IEEE 488 Interface	230.00	34.50	264.50
Thermal Paper for Silentype	2.75	0.41	3.16

MICROCOMPUTERS AT LASKYS

Vinyl Carrying Case	16.00	2.40	18.40
Apple Ties	6.00	0.90	6.90

Alf

MC1 – 9 Voice	99.00	14.85	113.85
MC16 – 3 Voice	123.00	18.45	141.45
10-1-17 Timing Mode Input	11.30	1.70	13.00

Heuristics

Speech Lab	135.00	20.25	155.25
Controller 70	60.00	9.00	69.00
Speechlink 2000	185.00	27.75	212.75

Mountain Hardware

Clock/Calendar	173.00	25.95	198.95
Supertalker	185.00	27.75	212.75
Romplus + Keyboard Filter	127.00	19.05	146.05
Rom Writer	105.00	15.75	120.75
Music System Complete	330.00	49.50	379.50
Copyplus Rom	34.00	5.10	39.10
AD + DA 16 Channel	210.00	31.50	241.50
● CPS Card	160.00	24.00	184.00

Other Items

● Omnivision	185.00	27.75	212.75
Numeric Keypad	85.00	12.75	97.75
Sup 'R' Terminal	195.00	29.25	224.25
Z80 Softcard	179.00	26.85	205.85

Interactive Structures

AO-03/4 Analog Output 4 Chan	195.00	29.25	224.25
AO-03/8 Analog Output 8 Chan	299.00	44.85	343.85
A1-02 Data Aquisition	210.00	31.50	241.50
D1-09 Digital Interface	235.00	32.25	270.25
● A1-13 Analog Input 16 Chan	395.00	59.25	454.25

March Communications

Micro Clock	49.95	7.49	57.44
Micro-Port	49.95	7.49	57.44
Micro-Synth.	49.95	7.49	57.44
Micro-Talker 1	85.00	12.75	97.75

APPLESOFTWARE

● Micro Modeller	425.00	63.75	488.75
● Visicalc (3-3)	105.00	15.75	120.75
Visidex	110.00	16.50	126.50
Visiplot	98.00	14.70	112.70
Visi Trend/Plot	140.00	21.00	161.00
Visi Term	82.00	12.30	94.30
Desktop Plan II	110.00	16.50	126.50
CCA Datamanagement	56.00	8.40	64.40
● D.B. Master V.2.4.	105.00	15.75	120.75

Word Processing

Apple Writer	39.00	5.85	44.85
Magic Window Text Editor	49.00	7.35	56.35
Easywriter (80 Col.)	155.00	23.25	178.25
Mailmerge (80 Col.)	68.50	10.28	78.78
Easywriter (40 Col.)	51.30	7.70	59.00
The Address Book	27.00	4.05	31.05

Games/Aids

Animation Pac	31.00	4.65	35.65
Saturn Navigator	15.00	2.25	17.25
Higher Graphics II	20.50	3.08	23.58
Higher Text	20.50	3.08	23.58
3D Super Graphics	22.25	3.34	25.59
Apple World	33.00	4.95	37.95
Memory Management System	25.25	3.79	29.04
Alien Rain/Typhoon	15.43	2.32	17.75
Sneakers	16.30	2.45	18.75
● Gorgon	16.30	2.45	18.75
Galaxy Wars	14.28	2.14	16.42
Raster Blaster	16.30	2.45	18.75
A.B.M.	15.22	2.28	17.50
Falcons	16.30	2.45	18.75
Pegasus II	17.17	2.58	19.75
Space Raiders	16.30	2.45	18.75
Mychess	23.00	3.45	26.45

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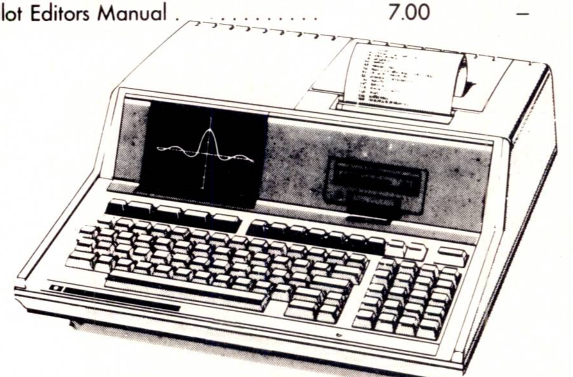
APPLE BOOKS

	NETT	V.A.T.	TOTAL
Apple II Reference Manual	11.00	–	11.00
6502 Hardware Manual	9.00	–	9.00
6502 Software Manual	9.00	–	9.00
Apple II Basic Program Manual	6.00	–	6.00
Applesoft II Reference Manual	6.00	–	6.00
DOS 3.2 Manual	6.00	–	6.00
Apple II Basic Tutorial Manual	6.00	–	6.00
Pascal Reference Manual	8.50	–	8.50
Autostart ROM Manual	4.50	–	4.50
Fortran Reference Manual	12.00	–	12.00
Pascal Reference Manual	9.00	–	9.00
Pascal Operating Manual	11.50	–	11.50
Graphics Tablet Manual	5.00	–	5.00
Silentype Manual	3.00	–	3.00
DOS 3.3 Manual	5.00	–	5.00
Pilot Language Reference Manual	9.00	–	9.00
Pilot Editors Manual	7.00	–	7.00



HEWLETT PACKARD

HP-80 Series Mainframes	NETT	V.A.T.	TOTAL
HP-83 Computer	1486.35	222.95	1709.30
HP-85 Computer	2146.95	322.04	2468.99
16K Memory Module	194.88	29.23	224.11
ROM Drawer	29.73	4.46	34.19
ROMS			
Mass Storage ROM	98.19	14.73	112.92
Plotter/Printer ROM	98.19	14.73	112.92
Input/Output ROM	199.77	29.97	229.74
Matrix ROM	98.19	14.73	112.92
● New Advanced Programming ROM	98.19	14.73	112.92
Assembler ROM	199.77	29.97	229.74
Interfaces & Accessories			
HP-IB	260.94	39.14	300.08
RS232 Serial Int.	260.94	39.14	300.08
GP-IO	335.21	50.28	385.49
BCD	335.21	50.28	385.49
Parallel Printer Int.	199.77	29.97	229.74
HP-IB 1/2 metre cable	47.00	7.05	54.05
HP-IB 1 metre cable	47.00	7.05	54.05
HP-IB 2 metre cable	50.00	7.50	57.50
HP-IB 4 metre cable	57.00	8.55	65.55
Plotter & Accessories			
Plotter	1619.00	242.85	1861.85
Personality Module	496.00	74.40	570.40
Overhead Transp. Kit	83.00	12.45	95.45
Digitizing Sight	27.60	4.14	31.74
Vinyl Carrying Case	151.80	22.77	174.57
100 sheets Engl.	4.83	0.72	5.55

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100 sheets Metric	4.83	0.72	5.55
50 sheets blank (E.F.)	2.76	0.41	3.17
50 sheets blank (A4)	2.76	0.41	3.17
4 Colour pen pack	4.49	0.67	5.16
5 red pens	4.49	0.67	5.16
5 blue pens	4.49	0.67	5.16
5 green pens	4.49	0.67	5.16
5 black pens	4.49	0.67	5.16
100 Transp. films	18.48	2.77	21.25
Transp. Solvent	2.76	0.41	3.17
Transp. Pens (B,R,B,G,)	5.87	0.88	6.75
Transp. Pens (B,O,B,V,)	5.87	0.88	6.75
Transp. Pens wide (B,R,B,G)	5.87	0.88	6.75
Transp. Pens wide (B,O,B,V)	5.87	0.88	6.75

Printers & Accessories

Printer Line	2611.00	391.65	3002.65
Printer Stand	227.00	34.05	261.05
Sound Abatement Cover	69.00	10.35	79.35
Wire Paper Basket	35.00	5.25	40.25
Printer Ribbon – Pack of 2	43.00	6.45	49.45
Printer Impact	637.81	95.67	733.48
Printer Ribbon – Pack of 2	26.00	3.90	29.90
Print Head	37.50	5.63	43.13

Additional Accessories

Tape Cartridge (Pack of 5)	64.50	9.68	74.18
Thermal Paper Blue (Box of 2)	20.32	3.05	23.37
Thermal Paper Black (Box of 6)	60.95	9.14	70.09
Cartridges and Manual holder	6.77	1.02	7.79
HP83/85 Carrying Case	81.26	12.19	93.45
3-ring lit. binder	6.77	1.02	7.79
Dust Cover	10.16	1.52	11.68

Manuals

Owners Manual HP83/85	17.25	–	17.25
Pocket Guide	3.45	–	3.45
Mass Storage ROM Manual	6.90	–	6.90
Plotter/Printer ROM Manual	6.90	–	6.90
I/O ROM Manual	20.70	–	20.70
Matrix ROM Manual	6.90	–	6.90
Assembler ROM Manual	13.80	–	13.80
Flexible Disc Operating Manual	3.45	–	3.45
HP-IB	6.90	–	6.90
Serial Installation Manual	6.90	–	6.90
GP/IO Manual	6.90	–	6.90
B.C.D. Manual	6.90	–	6.90
Parallel Printer Manual	6.90	–	6.90

Application packs

Standard Pack	64.33	9.65	73.98
Basic Training	64.33	9.65	73.98
General Statistics	64.33	9.65	73.98
Finance	64.33	9.65	73.98
Math	64.33	9.65	73.98
Circuit Analysis	64.33	9.65	73.98
Games	64.33	9.65	73.98
Linear Programming	64.33	9.65	73.98
Text Editing	64.33	9.65	73.98
Wave Form Analysis	64.33	9.65	73.98
Basic Stat. & Data	64.33	9.65	73.98
Regression Analysis	64.33	9.65	73.98
Graphics Presentation	135.44	20.31	155.75
VisiCalc Plus	135.44	20.31	155.75
Surveying	135.44	20.31	155.75

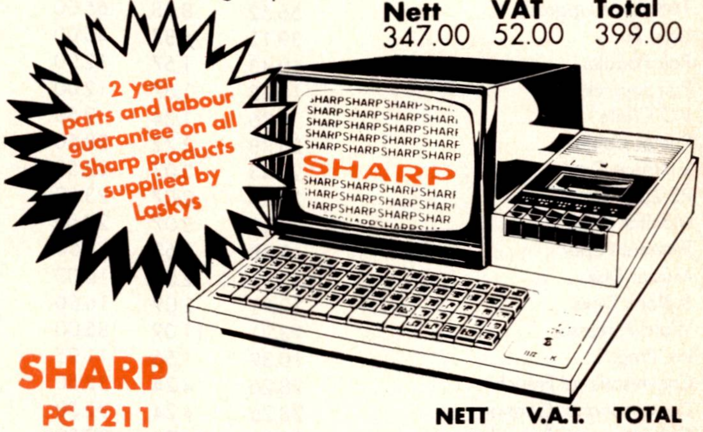
Flexible Disc Unit

Dual Master (540K Bytes) 5¼ Disk	1693.00	253.95	1946.95
Dual Add-On (540K bytes) 5¼ Disk	1489.84	223.48	1713.32
Single Master (270K bytes) 5¼ Disk	1015.80	152.37	1168.17
Single Add-On (270K bytes) 5¼" Disk	858.78	128.82	987.60
Dual Master (2400K bytes) 8" Disk	4515.00	677.25	5192.25
Dual Add-On (2400K bytes) 8" Disk	3821.00	573.15	4394.15
Single Master (1200K bytes) 8" Disk	3299.00	494.85	3793.85
Single Add-On (1200K bytes) 8" Disk	2605.00	390.75	2995.75
Flexible Disk 5¼ (Pack of 10)	50.50	7.76	58.08
Flexible Disk 8" (Pack of 10)	71.50	10.73	82.23
Graphics Tablet	1355.00	203.25	1558.25

MZ-80K SPECIAL OFFER!

A proper full size microcomputer for less than the real cost of a toy microcomputer. The Sharp comes with **48k** of RAM and the screen and cassette are built in, instead of being expensive extras.

Nett	VAT	Total
347.00	52.00	399.00



SHARP

PC 1211

	NETT	V.A.T.	TOTAL
PC1211 Pocket Computer	69.52	10.43	79.95
CE121 Cassette Interface	11.00	1.65	12.65
CE122 Printer/Cassette Interface	52.13	7.82	59.95
CSR 700 Paper Rolls (40)	5.00	0.75	5.75
EA 800R Ink Ribbons	1.80	0.27	2.07

MZ 80K

MZ 80K Computer 48K	347.00	52.00	399.00
MZ 80FD Dual Disks	560.00	84.00	644.00
MZ 80P3 Dot Matrix Printer	365.00	54.75	419.75
MZ 80F I/O Disk Interface	52.00	7.80	59.80
MZ 80 FMD Master Disk and Manual	20.00	3.00	23.00
MZ 80 F15 Disk Cable	8.00	1.20	9.20
MZ 80 FO5 Extra Disk Cable	7.00	1.05	8.05
MZ 80 I/O Expansion Box	96.00	14.40	110.40
MZ 80 BM Basic Manual	6.60	–	6.60
MZ 80 TIOB Basic Tape	9.50	1.43	10.93
MZ 80 T20C Machine Language	18.00	2.70	20.70
MZ 80 TU Assembler	36.00	5.40	41.40
MZ 80 I/O – 1 Universal Interface Card	40.00	6.00	46.00
MZ 8T70 AE FDOS for MZ 80K	67.00	10.05	77.05
MZ 8T70BE Basic Compiler for MZ80k	40.00	6.00	46.00
MZ 8T40E Pascal for MZ80K	40.00	6.00	46.00

MZ 80B

MZ 80B Computer 64K	1095.00	164.25	1259.25
MZ 80 FD Dual Disks	560.00	84.00	644.00
MZ 80 P5 Dot Matrix Printer	387.00	58.05	445.05
MZ 80 P6 Dot Matrix Printer	440.00	66.00	506.00
MZ 80 FI Disk Interface	94.00	14.10	108.10
MZ 80 MDB Master Disk and Manual	30.00	4.50	34.50
MZ 80 F15 Disk Cable	8.00	1.20	9.20
MZ 80 F05 Extra Disk Cable	7.00	1.05	8.05
MZ 80 BJC Disk Cable Jointer	15.00	2.25	17.25
MZ 80 EU Expansion Box	47.00	7.05	54.05
MZ 80 GMK Graphics Option	112.00	16.80	128.80
MZ 80 I/O-2 Universal Interface Card	40.00	6.00	46.00
MZ 80 T10C K — B Converter	7.00	1.05	8.05
MZ 8 BD02 FDOS for MZ 80B	67.00	10.05	77.05
MZ 8 BT03 Basic Compiler for MZ80B	40.00	6.00	46.00
MZ 8 BT02 Pascal for MZ 80B	40.00	6.00	46.00

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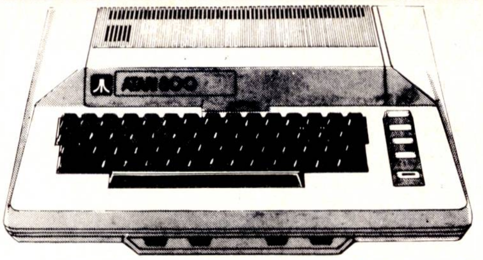


ATARI

400 16K Computer	300.00	45.00	345.00
800 16K Computer	560.87	84.13	645.00
410 Tape Recorder	43.48	6.52	50.00
810 Disk Drive	300.00	45.00	345.00
822 Thermal Printer	230.43	34.57	265.00
825 80 Column Printer	478.26	71.74	550.00
850 RS 232 Interface	117.39	17.61	135.00
16K RAM Upgrade	56.52	8.48	65.00
Light Pen	39.13	5.87	45.00
Pair Paddles	10.43	1.57	12.00
Pair Joysticks	10.43	1.57	12.00
I/O Cable	8.26	1.24	9.50
Printer Cable	24.78	3.72	28.50
Interface Cable	20.43	3.07	23.50
RS 232 Cable	20.43	3.07	23.50
Monitor Cable	20.43	3.07	23.50
Thermal Paper	3.48	0.52	4.00
Master Disk	13.91	2.09	16.00
5 Blank Disks	13.91	2.09	16.00
Word Processor	73.91	11.09	85.00
Inv. Prog. 1	10.39	1.56	11.95
Conversational French	28.26	4.24	32.50
Conversational German	28.26	4.24	32.50
Conversational Spanish	28.26	4.24	32.50
Conversational Italian	28.26	4.24	32.50
Music Composer ROM	28.26	4.24	32.50
Touchtype	13.00	1.95	14.95
Calc/Tor	14.74	2.21	16.95
Graphit	10.39	1.56	11.95
Statistics	10.39	1.56	11.95
Eng. Czar	7.78	1.17	8.95
Hangman	7.78	1.17	8.95
Kingdom	7.78	1.17	8.95
States and Capitals	7.78	1.17	8.95
States Europe	7.78	1.17	8.95
Scram	11.26	1.69	12.95
Telelink ROM	13.00	1.95	14.95
Asteroids ROM	26.04	3.91	29.95
Bask/Ball ROM	21.30	3.20	24.50
Blackjack	7.78	1.17	8.95
Chess ROM	21.30	3.20	24.50
Missile Command ROM	26.04	3.91	29.95
Space Invaders ROM	21.30	3.20	24.50
Space Invaders	11.26	1.69	12.95
● Star Raiders ROM	26.04	3.91	29.9.
Super Breakout ROM	21.30	3.20	24.50
Assembler Editor ROM	30.00	4.50	34.50
Pilot ROM	43.04	6.46	49.50
Microsoft Basic	43.04	6.46	49.50
Technical Notes	14.74	–	14.74
Operating System Lists	9.52	–	9.52
DOS Lists	2.61	–	2.61
DOS 2 Manual	6.04	–	6.04

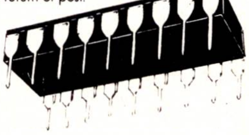
The Memory

PRICE WAR

Guaranteed quality – thousands already supplied. Any faulty chips should be returned to us within 12 months of purchase with proof of purchase for replacement by return of post.

4116 66p + VAT 200 nanoseconds

2114 Low power 300 nanoseconds 100p + VAT.



PRINTERS

● **Microline 80**	270.00	40.50	310.50
● **New Microline 82A**	395.00	59.25	454.25
Microline 80 Tractor	45.00	6.75	51.75
Diplomat Card (Apple-Microline)	85.00	12.75	97.75
Microline Ribbons	2.25	0.34	2.59

Epson

MX80 T Newtype 2	415.00	62.25	477.25
MX80 FT/1	399.00	59.85	458.85
MX80 FT Newtype 2	465.00	69.75	534.75
MX100	575.00	86.25	661.25

Epson Interfaces

Epson/Sharp Cassette	65.00	9.75	74.75
Epson/Sharp Disk	120.00	18.00	138.00
Epson/Apple	85.00	12.75	97.75
Epson/TRS 80 Bus	59.00	8.85	67.85
Epson/TRS 80 Expansion	25.00	3.75	28.75
Epson Ribbons	7.00	1.05	8.05
Epson MX100 Ribbons	8.50	1.28	9.78

Seikosha

● **Seikosha GP80A**	195.00	29.25	224.25
● **Seikosha GP80D (for MZ-80)**	245.00	36.75	281.75

Seikosha Interfaces

Seiko/Apple	59.00	8.85	67.85
Seiko/Pet	59.00	8.85	67.85
Seiko/Video Genie (EG3016)	33.00	4.95	37.95
Seiko/RS232	79.00	11.85	90.85
Seiko/TTL Serial	43.00	6.45	49.45
Seiko/IEEE 488	59.00	8.85	67.85
Seiko/Sharp (Disk)	59.00	8.85	67.85
Seiko/Ribbons	4.00	0.60	4.60
Seiko Paper 8½" x 11" 2000 Sheets	12.00	1.80	13.80
Paper 9½" x 11" 2000 Sheets	12.00	1.80	13.80
Paper Delivery	3.00	0.45	3.45

VIDEO MONITORS

New 12" Green Screen	125.00	18.75	143.75
● BM12E 12" Green	150.00	22.50	172.50
VM129 12" B/W	183.00	27.45	210.45
VM906 9" HI-RES B/W	150.00	22.50	172.50
VM910 9" B/W	125.00	18.75	143.75
9" B/W Monitor	85.00	12.75	97.75
Cables	5.00	0.75	5.75

Colour Monitors 14" New!

● MP 14N (NTSC) TTL, RGB	285.00	42.75	327.75
● MP 14P (PAL) TTL, RGB	285.00	42.75	327.75

SUNDRIES

QED Mains Suppressor 3 amp	12.80	1.92	14.72
QED Mains Suppressor 6 amp	17.30	2.60	19.90
Mini Floppy Head Cleaning Kit	19.50	2.93	22.43
C15 Cassette	0.80	0.12	0.92
C15 Cassettes Box 10	5.20	0.78	5.98
C15 Cassettes Box 50	25.00	3.75	28.75
C15 Cassettes box 100	45.00	6.75	51.75
● C15 Cassettes Box 1000	370.00	55.50	425.50
Mini Floppy SS/DD	2.50	0.38	2.88
Mini Floppy SS/DD x 10	20.00	3.00	23.00
Mini Floppy SS/DD x 50	87.50	13.13	100.63
Mini Floppy SS/DD x 100	150.00	22.50	172.50
Mini Floppy DS/DD	4.00	0.60	4.60
Mini Floppy DS/DD x 10	33.00	4.95	37.95
Mini Floppy DS/DD x 50	150.00	22.50	172.50
Mini Floppy DS/DD x 100	275.00	41.25	316.25
● 4116, 200 N.S.	0.66	0.10	0.76
● 2114, 300 N.S.	1.00	0.15	1.15
TI Programmer Calc.	45.00	6.75	51.75
Paper 8½" x 11" 2000 Sheets	12.00	1.80	13.80
Paper 9½" x 11" 2000 Sheets	12.00	1.80	13.80
Paper Delivery	3.00	0.45	3.45

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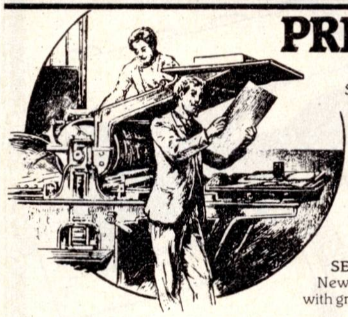
New-fangled hardware old-fashioned value at NSC Computer Shops!!!

PRINTERS



SEIKOSHA GP80A Cheapest dot matrix printer. Recommended by Acorn and Commodore. New low price.	£179.00
SEIKOSHA GP100A Wider version of GP80A	£199.00
SEIKOSHA 8510 New friction/tractor printer with graphics	£475.00
OKI MICROLINE 80 Low cost, 80 column, upper lower case with pin and friction feed.	£275.00
OKI MICROLINE 82 Bi-directional printing, programmable form length, serial and parallel.	£399.00
OKI MICROLINE 83 120 cps bi-directional on 15 inch paper.	£759.00
SERIAL INTERFACE RS-232 interface for M 80	£105.00
HI-SPEED INTERFACE High Speed RS-232 interface for M 80/82	£185.00
TRACTOR Tractor for M 80/82	£55.00
TYMAC INTERFACE Apple interface and cable for M 80 series	£89.00
EPSON MX 80 80 column tractor fed printer	£358.00
EPSON MX 80FT As MX 80 but with friction and tractor	£399.00
EPSON MX 80FT II As MX 80FT but with hi-res dot graphics	£449.00
EPSON MX 82 Friction and tractor feed	£399.00
EPSON MX 82FT Graphics, friction and tractor feed	£449.00
EPSON MX 100 As MX 80FT but with full 15 inch platen	£575.00
APPLE INTERFACE Apple interface and cable for MX series	£89.00
SERIAL INTERFACE Serial interface and RS-232 cable for MX	£59.00
BUFFERED INT. As above with 2K buffer	£79.00
RIBBONS Ribbons MX 80/82	£9.00
RIBBONS Ribbons MX 100	£13.00
CENTRONICS 737-2 Letter quality printing – parallel version	£425.00
CENTRONICS 737-4 Serial version	£475.00
CENTRONICS 737P Pet version	£485.00
CENTRONICS 739-2 As 737-2 but with high res graphics	£495.00
CENTRONICS 739-4 Serial version	£544.00
CENTRONICS 150-2 150 cps, bi-directional, logic seeking	£499.00
CENTRONICS 150-4 Serial version	£544.00
CENTRONICS 779 Due to a bulk purchase, NSC are able to offer you this DP quality, upper case only printer with infinitely variable print size (10 to 16.5 cpi) and full logic seeking head at less than half the normal trade price	£295.00
INTEGREX CX80 Full colour printer for Apple, VIC etc.	£895.00
COLOUR INTERFACE Apple colour dump card for above	£125.00
RIBBONS Tricolour ribbons for above	£5.00
QUANTEX 6000 150 cps matrix printer	£875.00
ANADEX DP 9500L 150 cps, 15 inch platen, serial and parallel	£895.00
ANADEX DP9501 As DP9500 with graphics and other features	£1045.00
RIBBONS Ribbons for Anadex DP9000 series	£14.00
TEXAS 820 RO High quality for 150 cps programmable printer	£1300.00
OLYMPIA EK100KSR A typewriter and letter quality printer all in one package at the amazing price of	£995.00
DIABLO 630 RO High quality daisy wheel printer capable of using metal or plastic daisy wheels	P.O.A.
B.D.T. Cut sheet feeder for Diablo and other daisy wheel printers	from £650.00
FUJITSU SP830 80 cps daisy wheel – the fastest around!	£1995.00

On all printers please add £6.00 for carriage.
All other items please add 50p for p&p.

COMPUTERS

ACORN ATOM
Available ex stock in any configuration – 8K+2K kit or assembled in any size up to 12K+12K. New ROM enables compatibility with BBC machine.

PRICES INCLUDING VAT & P&P

8K+2K Kit **£140.00** 8K+2K Assembled **£174.50**
Colour Atom inc PSU **£204.00**
12K+12K Assembled **£289.50** Power Supply **£10.20**

VIC 20
Fast becoming the most popular home computer. Price including VAT **£189.95 (p&p £3.00 extra).**

PET
Britain's best known micro computer. Our prices start from **£375.00**

APPLE II
Our best selling medium priced computer. Start with the basic unit and build up your system with disk drives, Pascal system, graphics tablet, voice recognition card, Visicalc, etc. Phone for our latest prices on all these items.

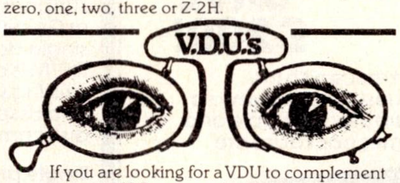
APPLE III
128K computer + Monitor III and Apple III Software comprising Business BASIC, Sophisticated Operating System (SOS) and Apple II emulation. **£2545.00.**

COMART COMMUNICATOR
4MHz, Z80A, S100 Computer with choice of twin 170K, 390K or 720K floppy disk drives or one floppy and one 5Mb Winchester hard disk. Also available 20Mb hard disk which can be added to any of the above. This computer has been designed with communications in mind and we can offer an interface to Prestel as well as the usual accounting packages. Prices start at **£1750.00.**

NORTH STAR
Come and see the Advantage, a major new system from a well established manufacturer. **£2195.00.** We can also supply the Evergreen Horizon.

RAIR (THE ICL PERSONAL COMPUTER)
The D.P. Manager's favourite micro. The 3/20 machine has twin 250K floppy disk drives and the 3/30 has one floppy and one 5Mb Winchester hard disk.
Also available is a 10Mb hard disk drive which can be added at the time of purchase or at a later date. M/PM for multi user environments. Programming languages available include basic Fortran, Pascal, Cobol and Assembler. Prices start from **£2,750** and rental terms are available.

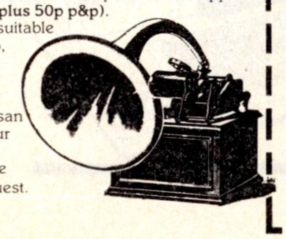
CROMEMCO
If you're looking for a 'Unix' like operating system, look no further. Cromemco's Cromix offers you up to 63K memory space per user with the ability to run C/PM programmes if required. Choose from System zero, one, two, three or Z-2H.

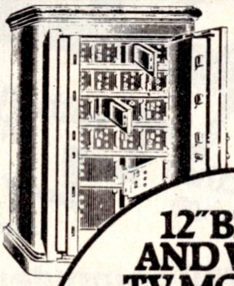


If you are looking for a VDU to complement your system, NSC can supply any one from a variety of manufacturers at prices ranging from £400–£2,500.
LEAR SIEGLER, TELEVIDEO, VOLKER CRAIG, BEEHIVE, DEC, IBM.

FLOPPY DISCS

Most manufacturers now recommend Dysan floppy disks with their computers. We stock Dysan at the following prices: S/Sided S/Density suitable for Apple etc. **£25.00 per 10 (plus 50p p&p).**
D/Sided D/Density suitable for Rair, Cromemco, Comart, North Star **£40.00 per 10 (plus 50p p&p)**
We recommend Dysan floppy disks to all our customers. Other brands and sizes are available upon request.





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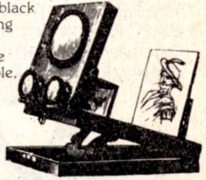

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MicroValue

MONEY SAVERS

with the exclusive MicroValue 12 Months Warranty*

MicroValue Exclusive

MV1 - a Z80 computer

SAVE £107.50

The MV1 computer kit uses the ubiquitous Nascom 1 Pcb and the Z80 CPU. Interfaces are included for television, printer and cassette. 2K memory, Gemini power supply (drives up to 3 extra boards). Cherry full ASCII keyboard and Quantum Graphics are also included. Available with either an ASCII version of the Nas-Sys 3 monitor, or a Tiny BASIC. MV1 is expandable to Gemini 80-BUS specification.

MicroValue price

£105 +VAT

MicroValue Exclusive

MicroValue's 'Nascom Special'

SAVE OVER £65

We've put together a microcomputer kit containing the Nascom 2, Nas-Sys 3, Graphics ROM, Bits & P.C.'s programmers aid, Gemini 3 APSU, 16K RAM Board and mini motherboard. The result is a powerful micro using market proven boards and components.

RRP OVER £405 +VAT

£340 +VAT

MicroValue Exclusive

SHARP MZ80K with Super Graphics

SAVE £200!

The 48K RAM System is offered at a rock bottom price with the Quantum Micros Hi Res Graphics which gives resolution down to a single dot and high res. plotting. Characters are user definable and the pixel characters actually *join*. Five free games packages are included too!

RRP £645 +VAT

MicroValue price

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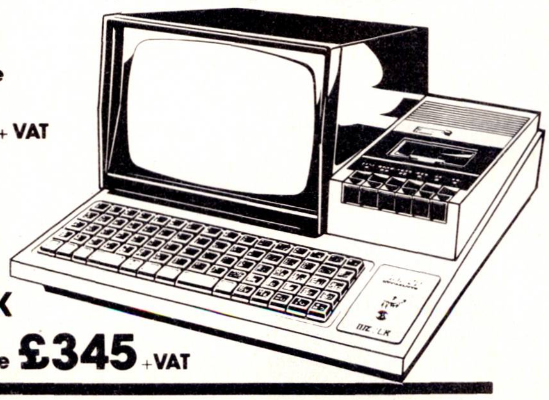
SHARP



48K MZ 80K

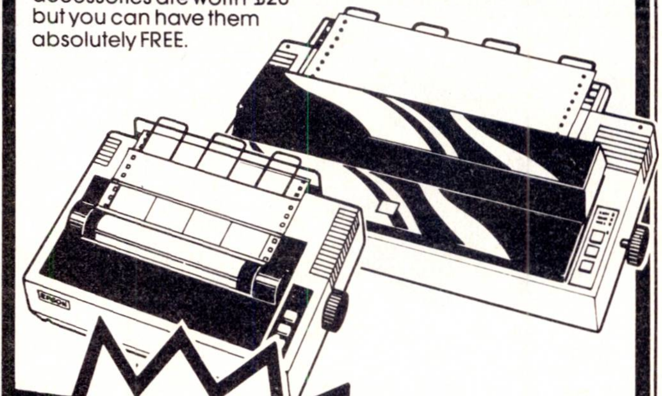
RRP £460 +VAT

MicroValue price £345 +VAT

£30 worth of accessories FREE with every Epson Printer

	MicroValue price
Epson MX80T	£359 + VAT
Epson MX80FT1	£399 + VAT
Epson MX80FT2	£465 + VAT
Epson MX100	£575 + VAT

Buy one of the above Epsons from MicroValue and we'll give you a Pack of Fanfold paper, Interfacing Document and Connecting Cord for Multiboard or Nascom. The accessories are worth £20 but you can have them absolutely FREE.



Cheapest Printer in the UK!

Nascom IMP + Graphics Only £199 + VAT

SAVE £156

MicroValue has slashed the price of the 80cps, 80 column IMP dot matrix printer. And added Imprint's high res. graphics and double width character option. IMP has bi-directional printing and friction/tractor feed.

RRP £355 + VAT

MicroValue price

£199 + VAT

Subject to only 6 months' warranty.

NASBUS Compatible DOUBLE DENSITY Disk System - Available Ex Stock

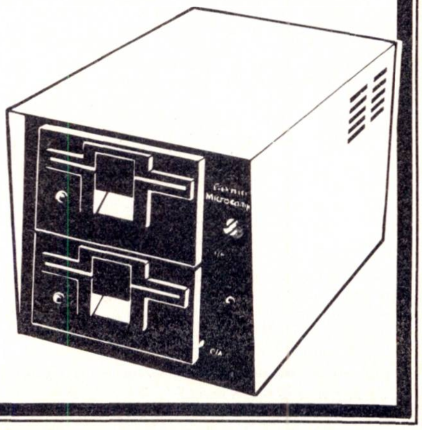
With hundreds in daily use the Gemini Disk system is now the standard for Nascom and Gemini Multiboard systems. Single or twin drive configurations are available, giving 350K storage per drive. The CP/M 2.2 package supplied supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers, and auto single-double density selection. An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 2 it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single drive system
(G809, G815/1)
£450 + VAT

Double drive system
(G809, G815/2)
£675 + VAT

CP/M 2.2 package
(G513)
£100 + VAT

Polydos 2
£90 + VAT



MicroValue

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New CP/M System based on Gemini Multiboard

Gemini Microcomputers is launching at Which Computer? Show a new system based around its successful MultiBoard range, and MicroValue dealers will have first deliveries in February. It will have:

HARDWARE

- Twin Z80A CP/M System
- 64K Dynamic RAM
- 700K Disk Storage (Formatted)
- 80 x 25 Screen Format
- Inverse Video
- Prog. Character Generator
- 160 x 75 Pixel Graphics
- Centronics Parallel I/O
- RS232 I/O
- Light pen interface
- 59-Key ASCII Keyboard

SOFTWARE

- Full 64K CP/M 2.2 with screen edit facility
- Comal-80 structured BASIC
- GEM-ZAP Assembler/Editor
- GEM-PEN Text editor
- GEM-DE BUG debugging software

MicroValue price

£1,450 +VAT

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80 × 25 Video for Nascom

Nascom owners can now have a professional 80 × 25 Video display by using the Gemini G812 Intelligent Video Card with onboard Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Built and tested.

£140 +VAT

MicroValue Exclusive

NEW

I/O Board for Nascom & Gemini Multiboard Systems

Quantum I/O

The new Quantum Micros I/O board takes the unique approach to the problems of interfacing your Nascom or Gemini Multiboard to external devices. This 80 Bus and Nasbus compatible card is supplied fully built, populated and tested and includes three Z80 PIOs, a CTC and a Real Time Clock with battery back-up. In addition, a range of "daughter" boards that attach straight to the I/O board are under development catering for a wide variety of interfacing requirements.

Quantum I/O board	MicroValue price – **£140** + VAT
Prototyping daughter board	MicroValue price – **£20** + VAT

IEEE-488

The EV Computers' IEEE-488 card is an 80 Bus and Nasbus compatible card designed to fully implement all IEEE-488 interface functions. This built and tested card gives the user a very cost effective and versatile method of controlling any equipment fitted with a standard IEEE-488 or GPIB interface.

MicroValue introductory price

£140 + VAT

MicroValue Exclusive

New Software for Nascom Systems

POLYDOS 1 A disk operating system for use with Nascom 1 or 2 and Gemini G805 Disk Systems. An incomparable and extremely well presented DOS that includes an editor and assembler and adds disk commands to the Nascom BASIC. MicroValue price **£90 + VAT**

MATHSPAK Double precision maths package on tape. MicroValue price – **£13 + VAT**

MATHSPAK Handler Used in conjunction with MATHSPAK. MicroValue price – **£9.95 + VAT**

Command Extender For use with MATHSPAK it extends BASIC's reserve word list. MicroValue price **£9.95 + VAT**

Logic Soft Relocater An integrated assembler and disassembler package which allows disassembly and reassembly from anywhere on the memory map. MicroValue price **£13 + VAT**

SAVE MORE MONEY

Standard Firmware for Nascom at Reduced prices

NASPEN	RRP £30 + VAT	**MicroValue price £20 + VAT**
Nas-Sys 3	RRP £25 + VAT	**MicroValue price £20 + VAT**
NasDis · D-Bug (EPROM)	RRP £50 + VAT	**MicroValue price £30 + VAT**
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Imprint	RRP £30 + VAT	**MicroValue price £20 + VAT**
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*MicroValue Warranty

All products, except kits and Nascom Imp, sold by MicroValue dealers are supplied with 12 months warranty and will be replaced or repaired by any dealer (even if you didn't buy it from him) in the group in the event of faulty manufacture.

YOUR LOCAL MICROVALUE DEALER

All the products on these two pages are available while stocks last from the MicroValue dealers listed on right. (Mail order enquiries should telephone for delivery dates and post and packing costs.) Access and Barclaycard welcome.

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Tel: (0937) 63774.

ELECTROVALUE LTD.
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28 St Judes, Englefield Green, Egham, Surrey TW20 0HB.
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SKYTRONICS,
2 North Road, The Park, Nottingham.
Tel: (0602) 45053/45215

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Tel: (0272) 421196.

INTERFACE COMPONENTS LTD.
Oakfield Corner, Sycamore Road, Amersham, Bucks.
Tel: (02403) 22307. Tlx: 837788.

HENRY'S RADIO
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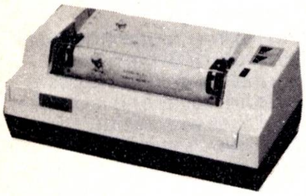
Tlx: 262284 (quote ref: 1400).

LEEDS COMPUTER CENTRE,
62 The Balcony, Merrion Centre, Leeds.
Tel: (0532) 458877

PRINTERS

SEIKOSHA GP-80

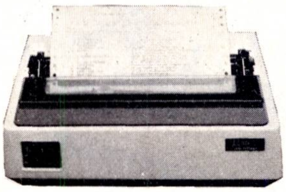


The Smallest 80 Column Dot Matrix Printer.

Unique printer principle. 80 col lines. 30 cps. 12 cpl. Plain Paper. Tractor drive. Weight 2.5 kg. Footprint 12.6 sq. ins. Bit addressable graphics. Parallel interface standard. RS 232 Apple Pet TRS 80 options

£199

OKI MICROLINE 80 & 82A

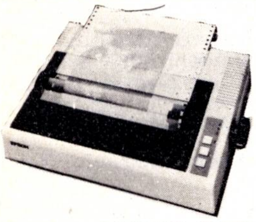


Compact 80 Column Printer.

80-120 cps. Uni direction ML 82A bi-direction). Parallel interface. Serial interface option. (ML 82A standard). Pin and friction feed. Tractor option. Condensed and expanded characters. 80, 40, 66 and 132 cpl.

ML 80 £299
ML 82A £437

EPSON MX SERIES



Low Noise, Low Price-
High Performance Printer

Six models. 80 cps. Bi-directional. Parallel interface. RS232 Pet Apple TRS 80 Video Genie Sharp options. Letter quality. Lower case descenders. Condensed enlarged and bold characters. Models provide tractor roll and sheet feed - bit image graphics - up to 15 ins paper.

MX-80 £353
MX-80 F/T £399
MX-82 £447
MX-80 II £399 MX 80 F/T-II £447 MX-100 £569

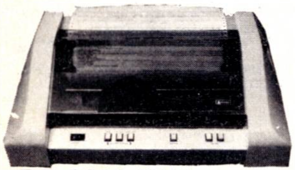
OKI MICROLINE 83A

Medium Speed 15" Printer.

120 cps. Bi-direction. Pin and friction feed. Tractor option. 132 cpl at 10 cpi. 4 character sizes. Graphic characters. Parallel and serial interface. Fast serial interface option.

£827

ANADEX DP–9000 RANGE

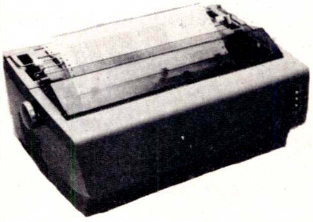


Fast, Versatile Printers.

Seven models. Up to 15 inch paper width. Lower case descenders. 160-220 cps bi-directional printing. RS232 current loop & parallel interface. X on X off. Optional 2K buffer. Multiple print densities. Fast print of high-density bit image graphics.

DP-8000 £541
DP-9000L £747 DP-9001 £888 DP-9500 £935
DP-9000 £841 DP-9500L £841 DP-9501 £982

TEC STARWRITER

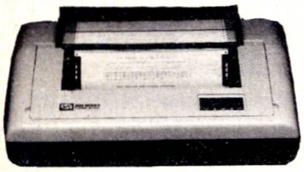


Best-Buy Daisy Wheel Printer.

Bi-direction. 25 cps. Low cost supplies. Standard Daisy Wheel. Carbon and fabric ribbons. Parallel or RS232 interface. Sheet feeder options.

Parallel Interface £1020
Serial Interface £1067

LEAR SIEGLER 310



Professional Dot Matrix Printer.

High throughput. 180 cps. Bi-direction. Fast head travel. Space skip over. Lower case descenders. Enlarged and bold fonts. Parallel RS232 and current loop interfaces. X on X off. Condensed character option. Sound reducing option.

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Tel: 0244 317667.
Manager: Jeremy Ashcroft. Next to the Town Hall.

Edinburgh

4 St. James Centre, Edinburgh, EH1 3SR. Tel: 031-556 6217.
Manager: Colin Draper.
East end of Prices Street, St. James Centre.

Preston

1/4 Guildhall Arcade, Preston, PR1 1HR.
Tel: 0772 59264.
Manager: Jim Comisky. Directly under Guild Hall.

Manchester

12/14 St. Mary's Gate, Market Street, Manchester, M1 1PX.
Tel: 061-832 6087.
Manager: Lesly Jacobs. Corner of Deansgate.

Glasgow

22/24 West Nile Street, Glasgow, G7 2PF. Tel: 041-226 3349.
Manager: David Livingstone.
Between Buchannan Street and Central Station.

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58 Leopold Street, Sheffield, S1 2GZ. Tel: 0742 750971.
Manager: Justin Rowles. Top of the Moor, opposite Town Hall.

Liverpool

33 Dale Street, Liverpool, L2 2HF. Tel: 051-236 2828.
Manager: Mark Butler.
Between the Town Hall and Magistrates Courts.

London

42 Tottenham Court Road, London, W1 9RD.
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Laskys, the retail division of
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MICROCOMPUTERS AT LASKYS

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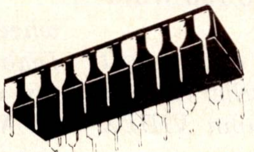

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Guaranteed quality – thousands already supplied. Any faulty chips should be returned to us within 12 months of purchase with proof of purchase for replacement by return of post.

4116 200 nanoseconds	Nett: 0.66	Vat: 0.10	Total: 0.76
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Cassettes

We are probably the largest supplier of microcomputer cassettes in the country and have them specially manufactured to our quality specification.

● C15 Agfa Tape ● Special Labels ● Cellophane wrapped ● Precision transport mechanism ● Leaderless ● Insert Cards ● Proven performance

One cassette	Nett: 0.80	Vat: 0.12	Total: 0.92
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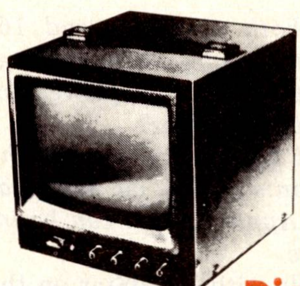

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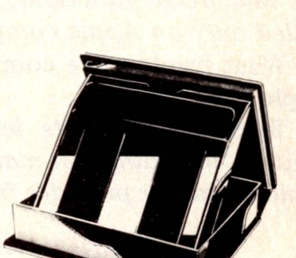
Visit one of our shops and see our range of low cost high quality Video Monitors.

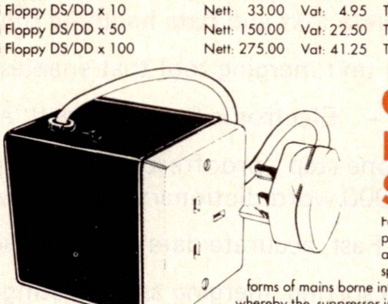
Disks

Manufactured to our specification by Dennison Kybe, imported by us direct from the manufacturer to give superior quality at a sensible price.

● Free library cases with tens ● All disks have reinforced centres ● Double density quality – soft sectored ● Anti-static envelopes, labels and write protect.

Mini Floppy SS/DD	Nett: 2.50	Vat: 0.38	Total: 2.88
Mini Floppy SS/DD x 10	Nett: 20.00	Vat: 3.00	Total: 23.00
Mini Floppy SS/DD x 50	Nett: 87.50	Vat: 13.13	Total: 100.63
Mini Floppy SS/DD x 100	Nett: 150.00	Vat: 22.50	Total: 172.50
Mini Floppy DS/DD	Nett: 4.00	Vat: 0.60	Total: 4.60
Mini Floppy DS/DD x 10	Nett: 33.00	Vat: 4.95	Total: 37.95
Mini Floppy DS/DD x 50	Nett: 150.00	Vat: 22.50	Total: 172.50
Mini Floppy DS/DD x 100	Nett: 275.00	Vat: 41.25	Total: 316.25





QED Mains Interference Suppressor

For use when mains interference is causing your computer problems. Simply plug the equipment into the suppressor and plug the suppressor into the wall socket (see specification for maximum power). Inserted in this way, most forms of mains borne interference will be cured. An alternative method of fitting, whereby the suppressor is connected to the mains circuit of the appliance causing the interference, may prove to be more effective in some cases.

QED Mains Suppressor 3 amp	Nett: 12.80	Vat: 1.92	Total: 14.72
QED Mains Suppressor 6 amp	Nett: 17.30	Vat: 2.60	Total: 19.90

Printers

Established quality printers – at competitive costs.

Microline			
Microline 80	Nett: 270.00	Vat: 40.50	Total: 310.50
Microline 82A	Nett: 395.00	Vat: 59.25	Total: 454.25
Microline 80 Tractor	Nett: 45.00	Vat: 6.75	Total: 51.75
Epson			
MX80 T Newtype 2	Nett: 415.00	Vat: 62.25	Total: 477.25
MX80 FT/1	Nett: 399.00	Vat: 59.85	Total: 458.85
MX80 FT Newtype 2	Nett: 465.00	Vat: 69.75	Total: 534.75
MX100	Nett: 575.00	Vat: 86.25	Total: 661.25
Seikosha			
Seikosha GP80	Nett: 195.00	Vat: 29.25	Total: 224.25
Seiko Paper 8½" x 11" 2000 Sheets	Nett: 12.00	Vat: 1.80	Total: 13.80
Paper 9½" x 11" 2000 Sheets	Nett: 12.00	Vat: 1.80	Total: 13.80
Paper Delivery	Nett: 3.00	Vat: 0.45	Total: 3.45

"WORDSTAR GOES APPLE!"

Q: What additional equipment do I need to run WordStar on my Apple computer?

A: WordStar 3.0 and later versions require a Microsoft SoftCard and a minimum of 48K RAM. Earlier releases of WordStar require both, plus an 80-column VIDEX Videoterm card.

Q: What about "shift-key" modifications to the 80-column video board? Do I need these to run Wordstar?

A: Not necessarily. All WordStar functions run without modification. Upper/lower case characters can be generated using the escape key.

Q: What Disk-Sector format do I need to run WordStar on the Apple computer?

A: WordStar is available on both 13-Sector and 16-Sector Apple formats — but please specify when ordering.

Q: Are there any differences between the Apple version and the standard CP/M version of WordStar?

A: No, there are no functional differences between the two versions. The Apple version supports all WordStar and MailMerge functions. The Apple version can be installed only on Apple computers.

Q: What printers are compatible with WordStar on the Apple?

A: WordStar supports letter-quality and teletype-like printers, including dot-matrix, line, and thermal devices. While WordStar provides full functions for quality daisy-wheel printers (e.g. NEC, Ricoh, TEC, Qume, and Diablo), it can also take advantage of many lower priced non-daisy-type printers.

Q: Why is WordStar considered the "ultimate" word processor?

A: Strength, versatility and many useful features position — WordStar as the leading word processing package. WordStar offers:

1. Screen orientated editing — when you add, delete, or manipulate text, all changes are displayed on the screen.

2. Install program — WordStar can be user installed for many configurations of VDU's, video boards, and printers.

3. Extensive menus — comprehensive prompting reduces the need to refer to the manual, and you can choose between one of four help levels.

4. Disk-biffered text entry — the size of your document is limited only by the storage capacity of your disk.

5. Incredible features — video editing, word-wrap, powerful editing commands, dynamic page-break display, print enhancements, decimal tabbing, paragraph indent, global search and replace, on-screen flexible page formatting, horizontal scrolling, block and column moves, and many more.

WordStar has been enhanced by other MicroPro products that work together to provide complete text and data-handling solutions for business:—

MailMerge: A powerful data and text merging tool that enables WordStar to produce personalised form letters.

CalcStar: NEW: — "Electronic Spread Sheet" and financial modelling program.

SpellStar: A one-step "proofreader" that exposes misspellings and typos.
Provides a compressed 20,000 word dictionary, and allows user-created supplementary dictionaries.

DataStar: Fast, accurate data entry, retrieval and updating system.

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WordMaster: Comprehensive text and data editor designed for programmers.

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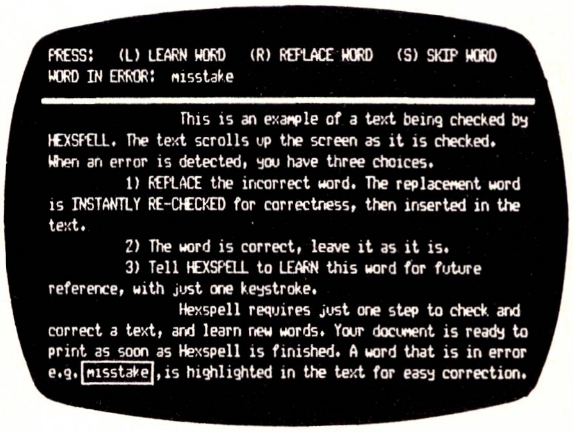
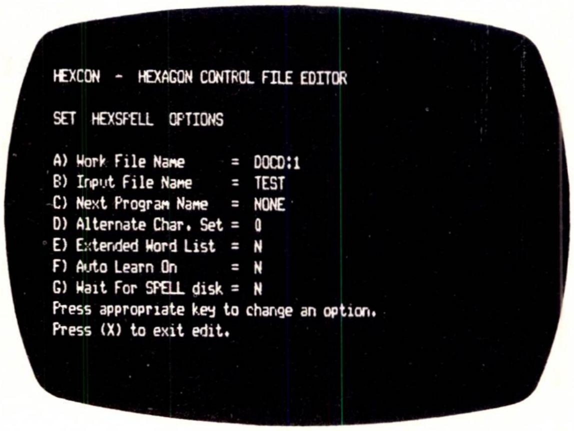


```
PRESS:   (L) LEARN WORD   (R) REPLACE WORD   (S) SKIP WORD
WORD IN ERROR:  misstake
----------------------------------------------------------
                This is an example of a text being checked by
HEXSPELL. The text scrolls up the screen as it is checked.
When an error is detected, you have three choices.
          1) REPLACE the incorrect word. The replacement word
is INSTANTLY RE-CHECKED for correctness, then inserted in the
text.
          2) The word is correct, leave it as it is.
          3) Tell HEXSPELL to LEARN this word for future
reference, with just one keystroke.
                Hexspell requires just one step to check and
correct a text, and learn new words. Your document is ready to
print as soon as Hexspell is finished. A word that is in error
e.g.[misstake],is highlighted in the text for easy correction.
```



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HEXCON  -  HEXAGON CONTROL FILE EDITOR

SET  HEXSPELL  OPTIONS

A) Work File Name      =  DOCD:1
B) Input File Name     =  TEST
C) Next Program Name   =  NONE
D) Alternate Char. Set =  0
E) Extended Word List  =  N
F) Auto Learn On       =  N
G) Wait For SPELL disk =  N
Press appropriate key to change an option.
Press (X) to exit edit.
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Hexspell 2 is the product of nearly three years research and experience. Unlike other microcomputer spelling checkers Hexagon Systems didn't simply rewrite the multi-step batch process found on large computers, we invented a simple one-step process that capitalizes on the interactive strengths of the personal computer. Hexspell's simple one-step process makes it practical for daily use on all your letters and documents.

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First there were the TRSDOS's, 2.0, 2.1, 2.2 and 2.3. Then came Newdos+, essentially a patched version of the TRSDOS's but with a number of very useful commands and utilities added. Then VTOS 3.0 and VTOS 4.0. These constituted a departure from the earlier DOS's and featured Device Independence so that devices such as the keyboard, printer, VDU and disk drives could interact directly together. Then came Newdos80 which is a rewrite of Newdos+, adding new utilities and new Basic commands, its main features being the ability to mix different capacity drives on the same cable and the ability to use variable length records. Now from LOBO International comes LDOS, the fifth generation disk operating system for the TRS-80 microcomputer. It combines most of the advantages of the preceding disk operating systems and unlike some of them, is accompanied by a complete and readable set of documentation, which includes a Technical Section containing relevant addresses.

It is impossible to describe all of the features of LDOS in an advertisement. For instance it includes no less than 35 library commands as follows:—

APPEND COPY DEVICE DIR DO FILTER KILL
LIB LINK LIST LOAD MEMORY RENAME RESET
ROUTE RUN SET SPOOL ATRIB AUTO BOOT
BUILD CLOCK CREATE DATE DEBUG DUMP FREE
PROT PURGE SYSTEM TIME TRACE VERIFY XFER

All of the useful abbreviations in Newdos are included and the System Commands in Basic (CMD) now number eleven. A program called LBASIC/FIX is included, with which the normal TRSDOS Disk Basic may be patched to include a number of new commands and features. A Job Control Language is included and in fact is one of the most powerful features of LDOS. It allows the user to compile a sequence of commands or key strokes for later execution as a chain, with or without user intervention. There are too many new features to list them herein, but examples are: The ability to provide an audible signal, output through the cassette port. To flash or blink a one line message on the video display. A WAIT feature is included so that the machine can be put into a ''sleep'' state until such time as the system clock matches the time specified. And so on!

Hard disks in addition to single/double density, single/double sided, 8″ and 5¼″ floppies are supported although they may, of course, require hardware modifications. Utilities included in the package are:

BACKUP COMMAND FILE FORMAT LCOMM
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A Basic Renumber facility is included, as is a Basic Cross Reference function. Both are similar to the ones in Newdos+ and Newdos80. Most of the utilities are library commands which were existent in the previous DOS's, have been improved with the addition of new functions or facilities.

The prime development team of LDOS consisted of no less than 8 first rank programmers and they had the support and advice of six other well known programmers. They have done an excellent job to bring to the user what must be the best disk operating system so far produced for a microcomputer, which is destined to become the Standard DOS.

LDOS is totally upward compatible with TRSDOS, that is to say LDOS will be able to copy files and programs from TRSDOS disks onto LDOS formatted disks. As they are competitive disk operating systems, it is not suprising that the manual states that disks created under Newdos are not guaranteed to be compatible with LDOS, but we have not experienced any difficulty. We have done some work on investigating the compatibility of LDOS and the Video Genie and at the time of going to press we have found no incompatibilities. LDOS appears to run on the Video Genie without any problems at all. LDOS is compatible with either the Tandy or Electric Pencil lowercase modifications and Scripsit. LDOS is available for the Model I and Model III. A Model II version will be available shortly.

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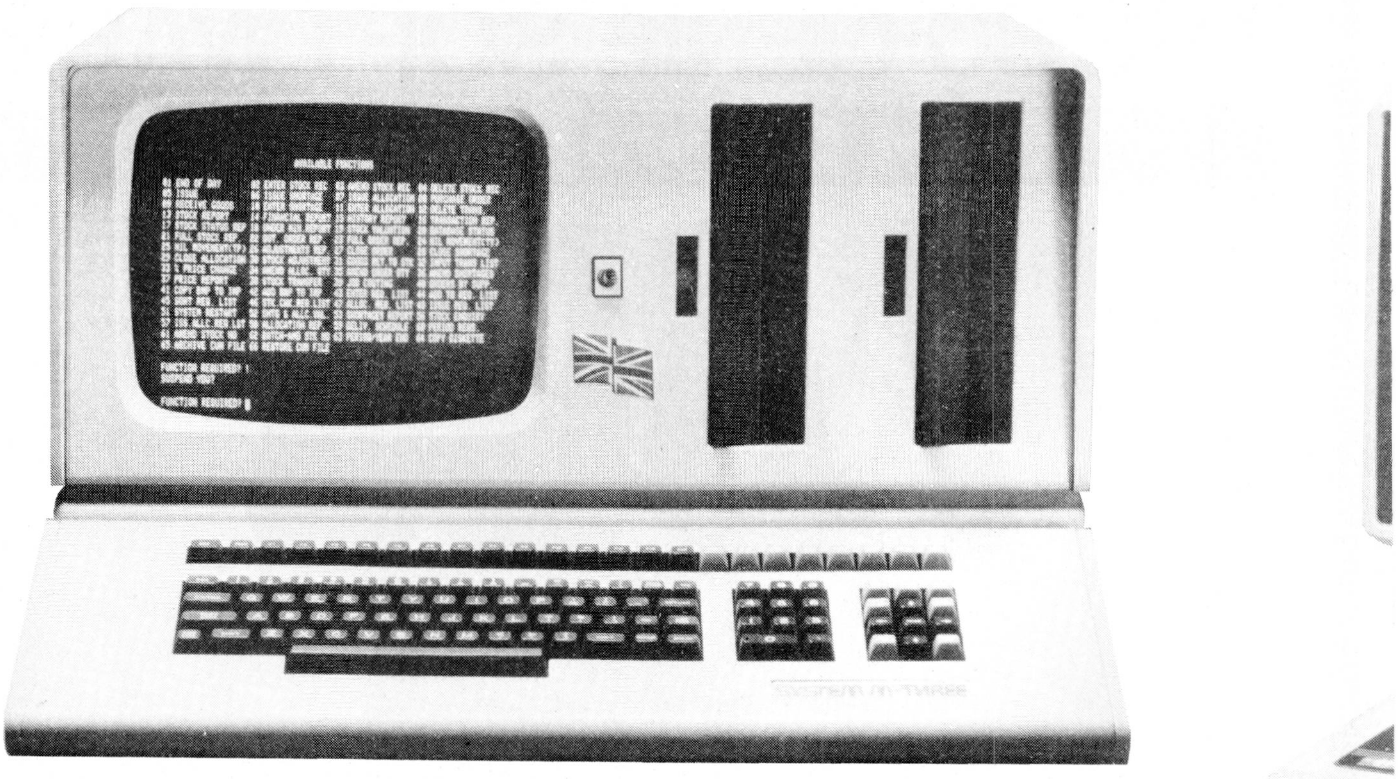

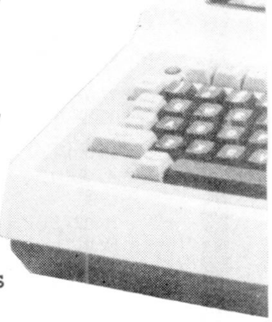

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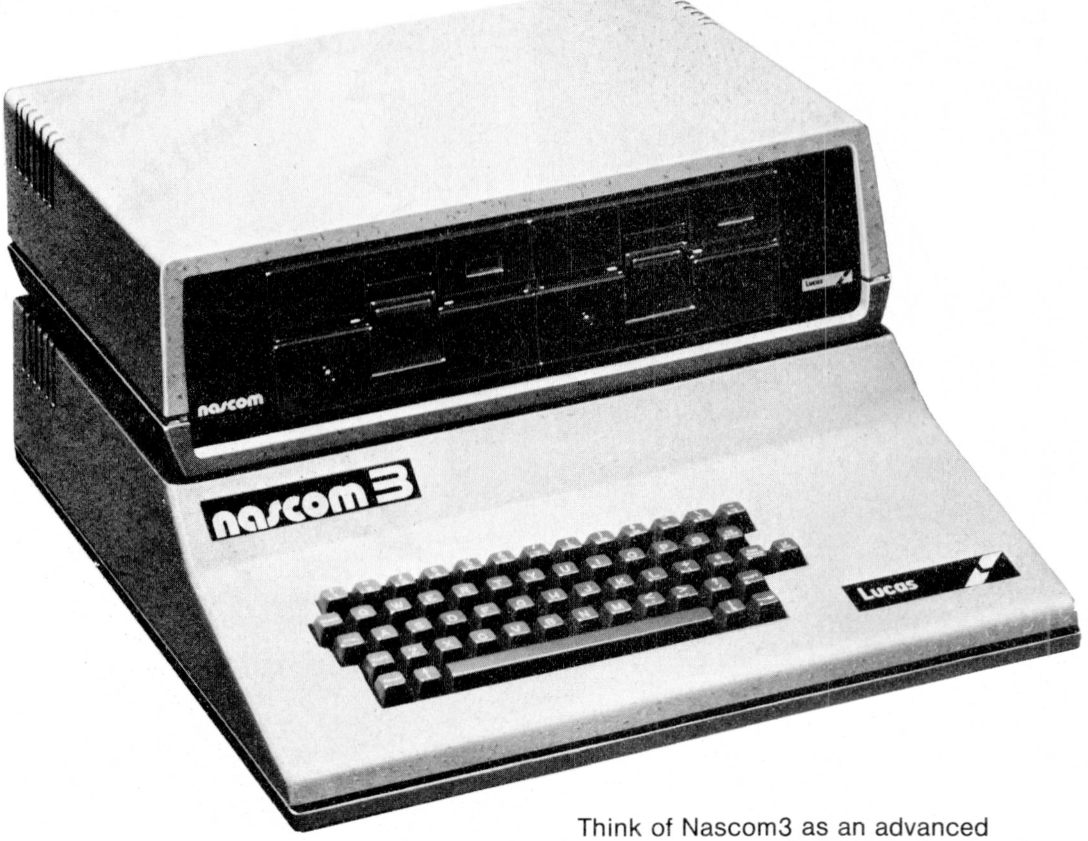

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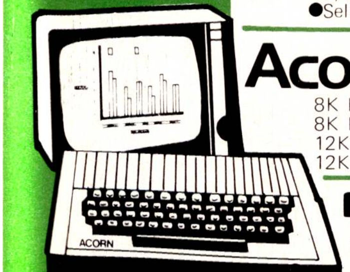

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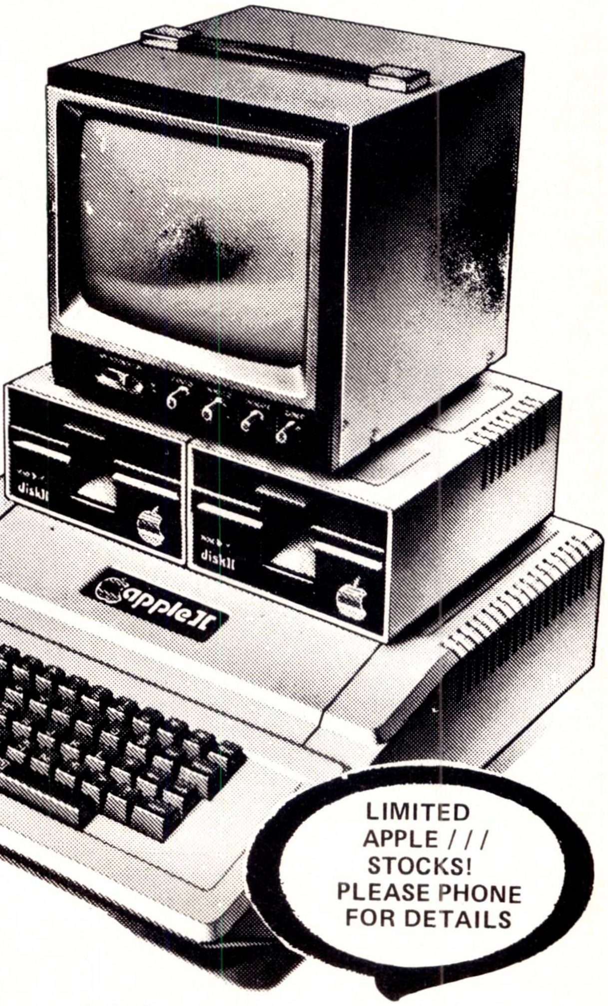

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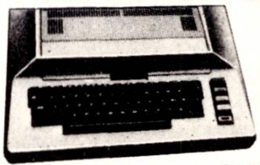

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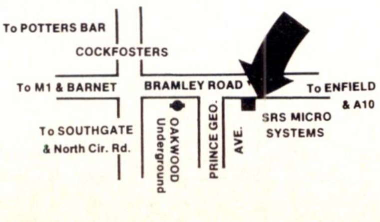

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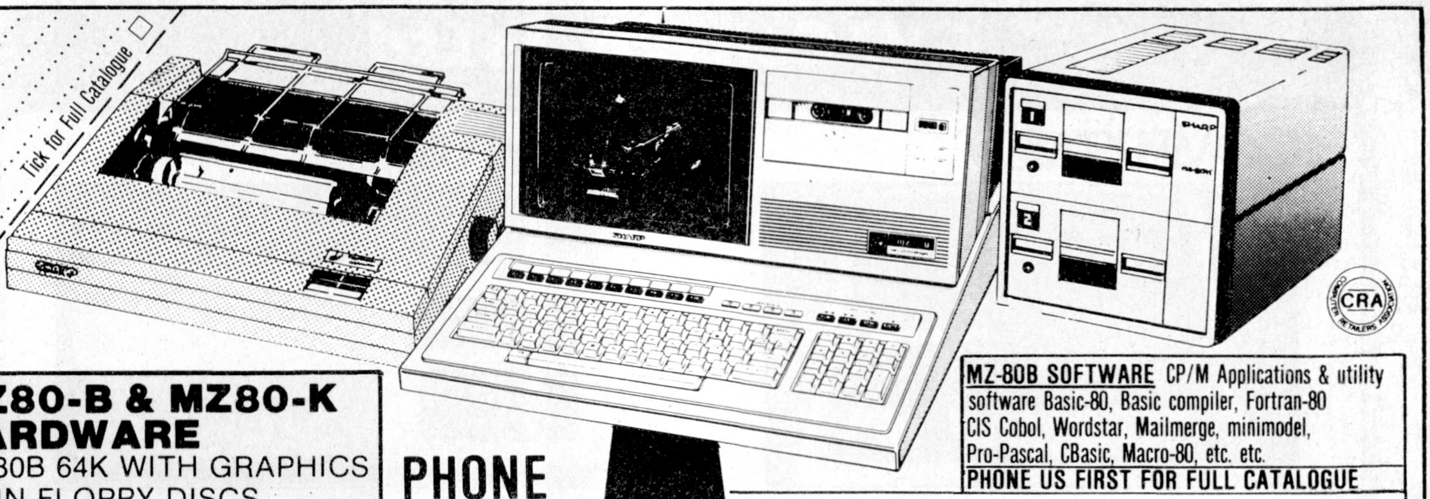

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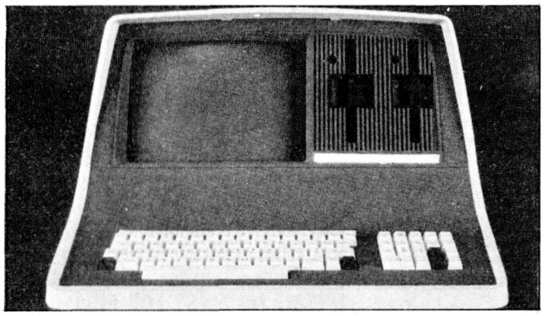
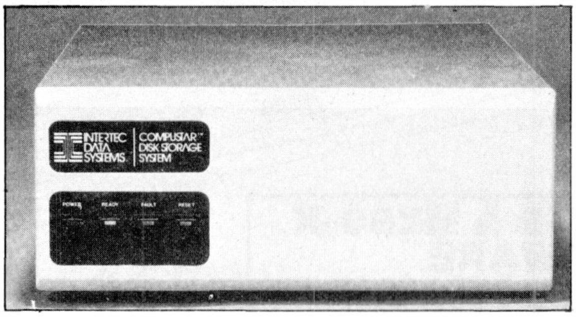


But the real beauty of the CompuStar is its 'shared logic' design concept. Each user station contains its own distinct microprocessor and RAM. The result is lightning fast program execution. Even when all 16 users are on-line. Even when all are performing different tasks! A special multiplexor circuit in the CompuStar ties all external users together to 'share' the system's disk resources so that no single user ever need wait on another. An incredibly exciting concept!

A remarkable breakthrough in price/performance, the CompuStar boasts nearly 1 megabyte of online mini-disk storage (almost 2 megabytes on CompuStar II) and can be easily expanded to 20, 36 or 96 megabytes of hard-disk in just seconds. And since each user station can accommodate up to 64k of RAM, a total of over one million bytes can be incorporated into the system to tackle even your most difficult programming tasks.

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 enquiry/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 disk 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 54k of RAM and over 700k of disk storage. But, most importantly, no matter what your investment in hardware, the possibility of obsolence or incompatability is completely eliminated since user stations can be configured in any fashion you like – whenever you want – at amazingly low cost!

COMPUSTAR™



Functional characteristics
The CompuStar 10 megabyte Disk Storage System (DSS) consists of read/write and control electronics, read/write heads, a track positioning mechanism, a spindle drive mechanism, dual disks, an air filtration system, and our exclusive 255 user controller – all packaged in a compact desktop enclosure. Although designed primarily to accommodate multiple CompuStar Video Processing Units (described at left), the unit can easily be connected to a single SuperBrain Video Computer System to facilitate additional disk storage. When used with CompuStar VDUs, however, the integral Z80 based controller will permit up to 255 users to 'share' the resources of the disk with minimual CPU response degradation.

Read/Write Heads and Disks

The recoding media consists of a lubricated thin magnetic oxide coating on a 200mm diameter aluminium substrate. This coating for mulation, together with the low load force/low mass Winchester type flying heads, permits reliable contact start/stop operation. Data on each disk surface is read by one read/write head, each of which accesses 256 tracks.

G.W. COMPUTERS LTD. 01-636-8210, 01-631-8210, TELEX 892031 TW6G.

THE NEW DBMS (DATABASE)*

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- Sort files
- Cashflow
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- Filing
- Profit analysis
- Mathematics
- Tabulate values
- Edit records

Within hours perform all the above in **French** or **German**.
The list is as endless as that which meets the requirements of your own imagination.
Within the appropriate frames of reference you could ask questions like the following.
Find someone whose name begins with W, who is either in London or Birmingham, and available for work at a salary of less than 10,000.00; and is under 40 years of age, not married, of credit worthiness grade 1, with a car, prepared to travel, and who likes horses, does not mind the hours he works, is congenial and has good references. *When you find such persons* produce a printed list of them showing their names, telephone numbers, and what their salaries are as well as their salary *if increased by 10%* and show their availability for work. At the end of the list enumerate the total of such persons.
Find all stock items that are codes *micro-computers* that are either in warehouse 1 or warehouse 2, where the quantity on hand is more than 50 units, the cost is less than 1000.00, the selling price higher than 2000.00; that are not in cartons, bought from supplier 52, allocated more than 20, rated for tax at .15% and weigh less than 50 lbs. *When you find such categories* then print a report showing the description, cost price, quantity on hand, lead time for refills, what the selling price *should be if raised by 12.3%* as well as the profit in either per-cent or round figures of that projected selling price.
Find all patients who suffered from cold, that are either girls or women younger than 23 years old, and who live in London at a socio-economic grade higher than 3; do not smoke; have more than 3 children, are currently at work and where treatment failed to effect a cure in under 6 days. **When yoy find such persons** then print a list showing their age, marital status, income, and frequency of illness in the past 2 years.
Currently you can ask **5 types** of questions **20 times** for a single selection criterion, and then you can compute **10 mathematical relationships** between the questions for the individual **as well as** for the total number of matches. In all some **60** bits of information relating to **one** record or a **group of records** on simply one permutation of the selection criterion, with a cross referencing facility as well.
Every word in the system, as well as the file architectures, print masks, and field attributes, is capable of alteration by you **without** programming expertise (but with some thought).

ALL IN ONE PROGRAM FROM G. W. COMPUTERS. *THE DBMS2 !!.*

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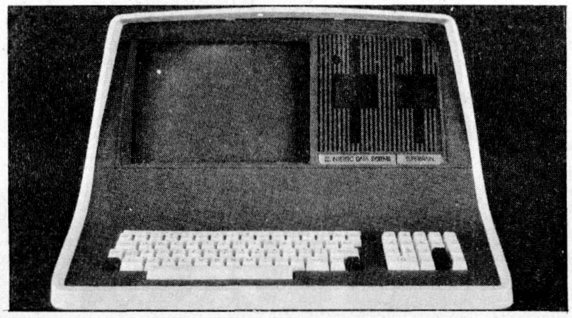
SUPERBRAIN™



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

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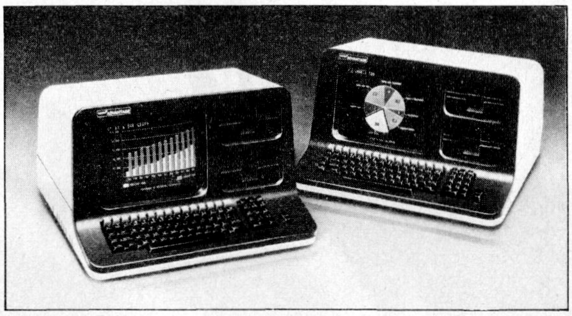
ADVANTAGE



Integrated Desk Top Computer with 12 inch Bit-Mapped Graphics or Character Display, 64Kb RAM, 4 MHz Z80A,® Two Quad Capacity Floppy Disk Drives, Selectric* Style 87 Key Keyboard, Business Graphics Software.

The North Star ADVANTAGE™ is an interactive integrated graphics computer supplying the single user with a balanced set of Business-Data, Word, or Scientific-Data processing capabilities along with both character and graphics output. ADVANTAGE is fully supported by North Star's wide range of System and Application Software.

The ADVANTAGE contains a 4 MHz Z80A® CPU with 64Kb of 200 nsec Dynamic RAM (with parity) for program storage, a separate 20Kb 200 nsec RAM to drive the bit-mapped display, a 2Kb bootstrap PROM and an auxiliary Intel 8035 microprocessor to control the keyboard and floppy disks. The display can be operated as a 1920 (24 lines by 80 characters) character display or as a bit-mapped display (240x640 pixels), where each pixel is controlled by one bit in the 20Kb display RAM. The two integrated 5¼inch floppy disks are double-sided, double-density providing storage of 3600Kb per drive for a total of 720Kb. The n-key rollover Selectric style keyboard contains 49 standard typewriter keys, 9 symbol or control keys, a 14 key numeric/cursor control pad and 15 user programmable function keys.

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04 = Sales ledger
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07 = Bank update
18 = User database area
09 = Invoice creation
10 = Order files
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12 = Arithmetic section24 = Disk swap/exit system

13 = Print customer statements
14 = Print supplier statements
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16 = Print tax statements
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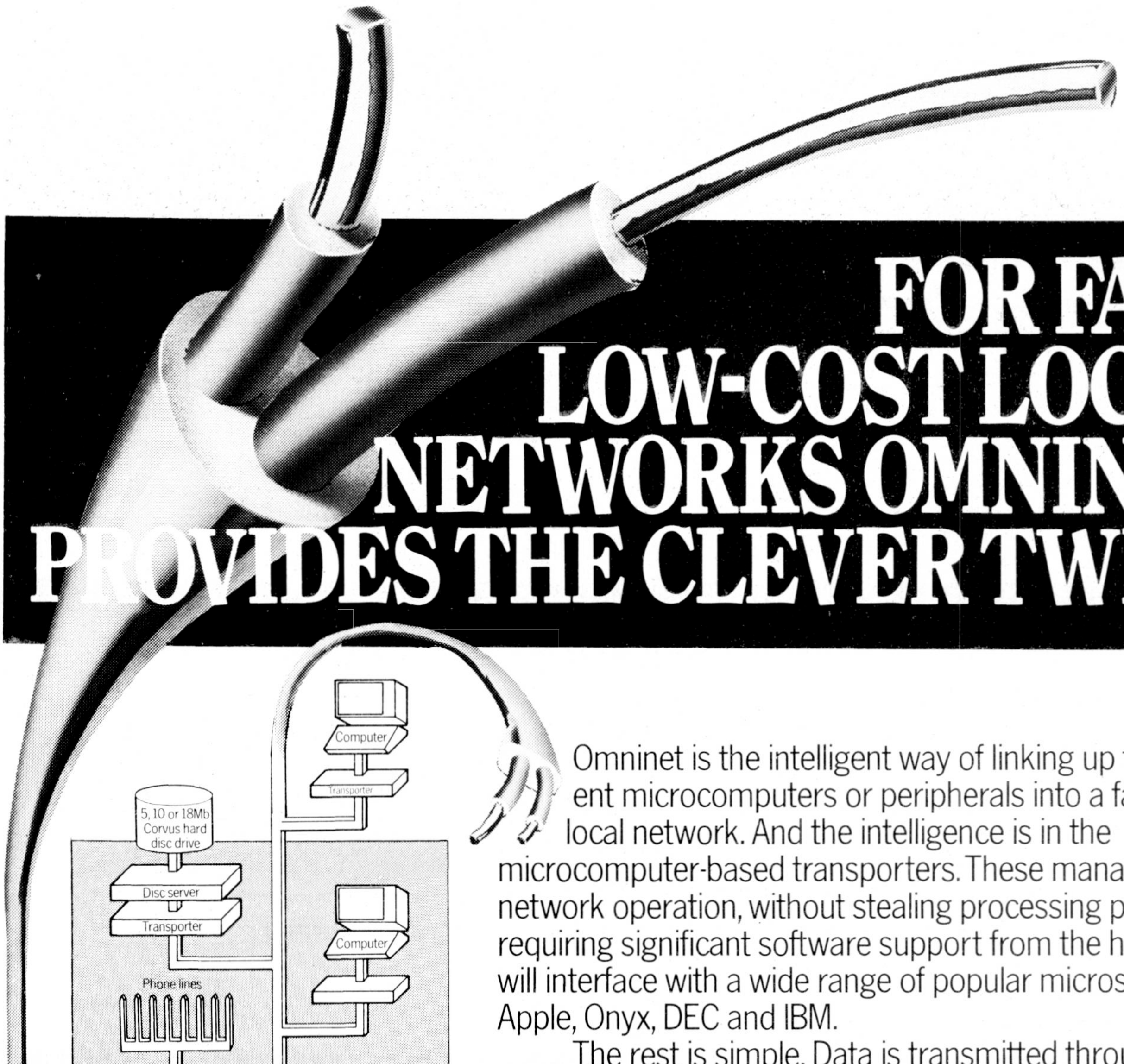

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SOFTWARE. Business accounts packages start at £800 when purchased with the Tuscan system. Word processing packages start at £315; Database packages start at £100.

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SUPPORT. The Tuscan S100, designed and built in Britain, is backed by Transam's substantial experience in electronics plus a dedicated hardware and software team. National third party maintenance is available at ten per cent of hardware costs.

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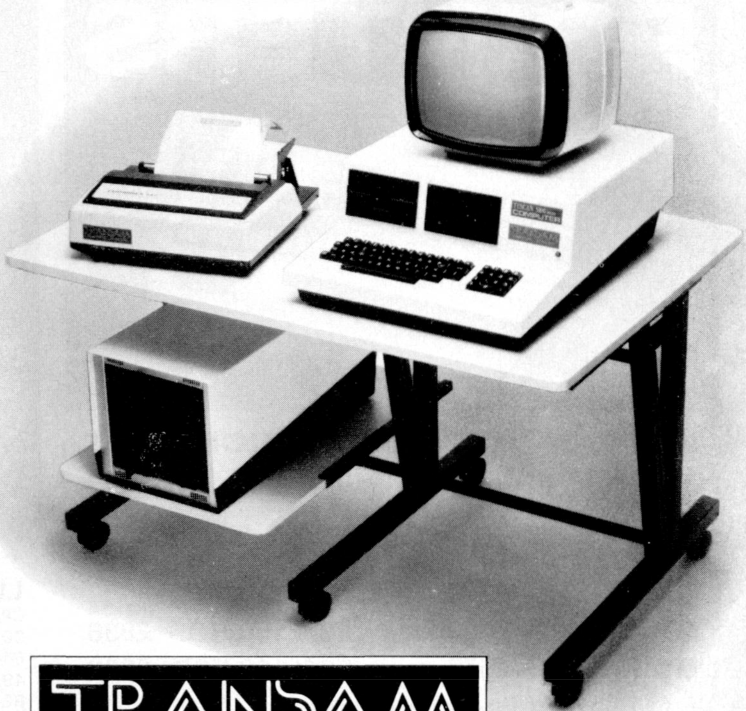

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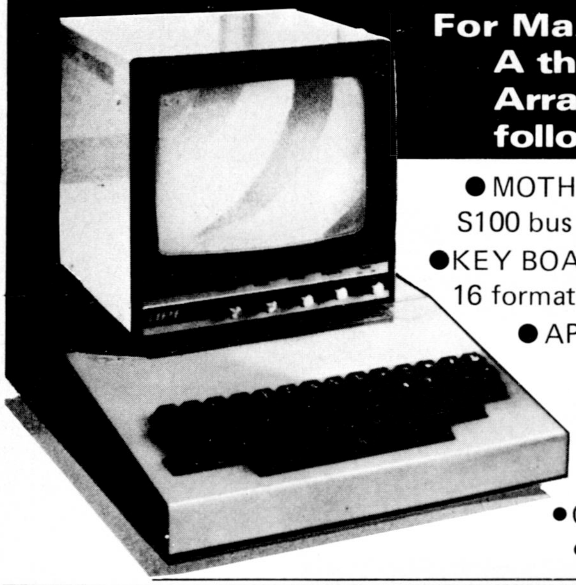

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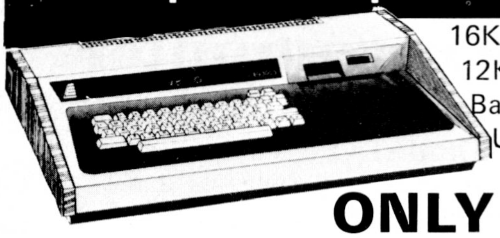

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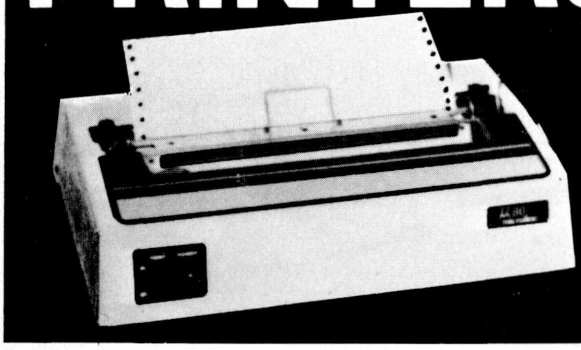

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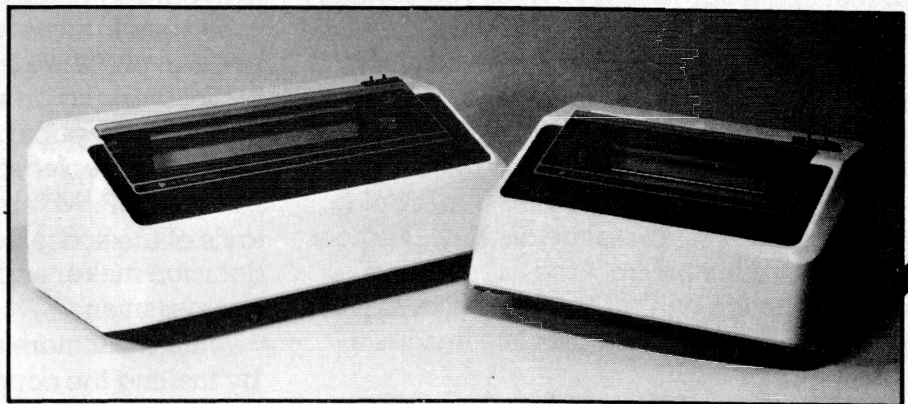

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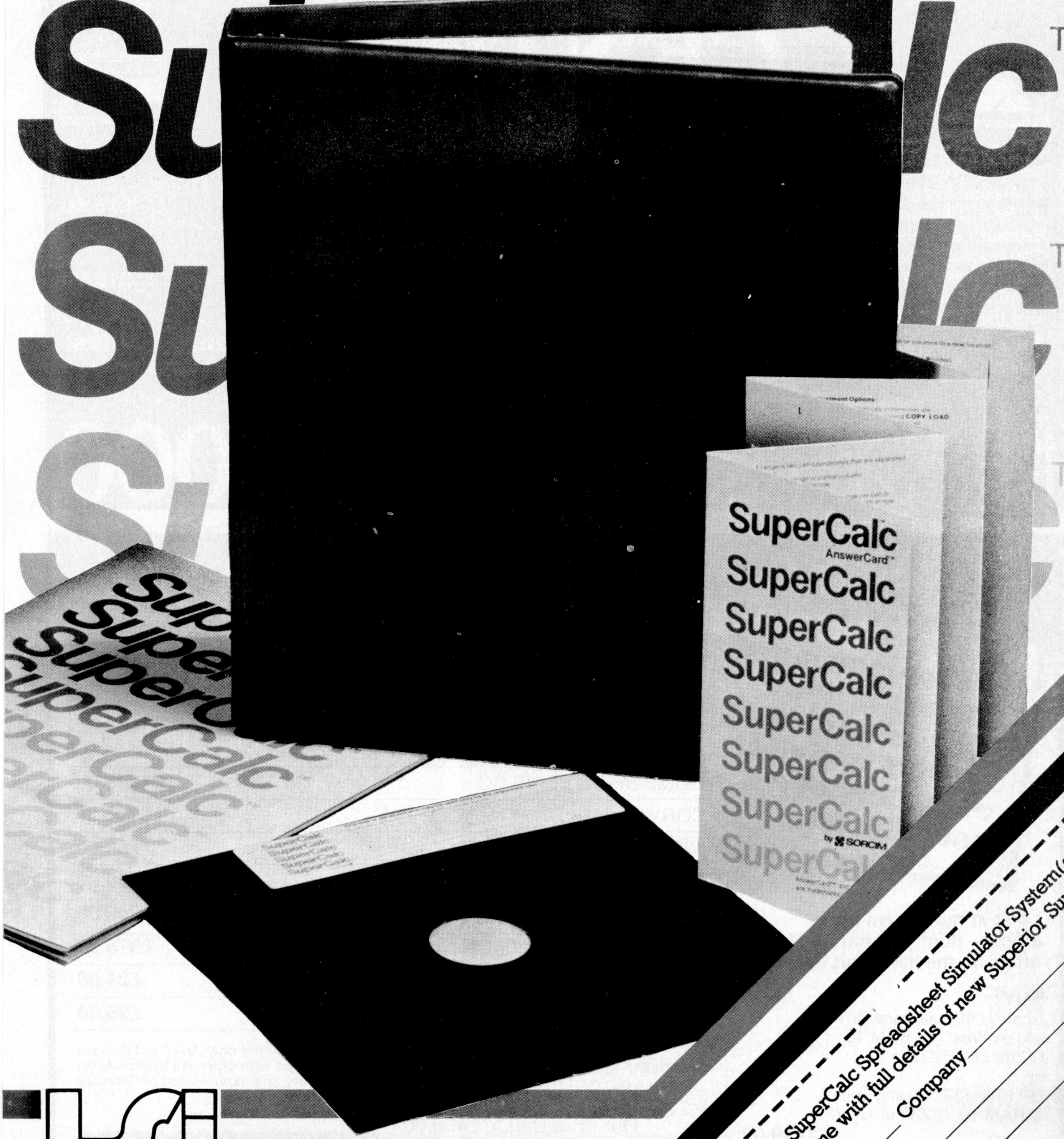
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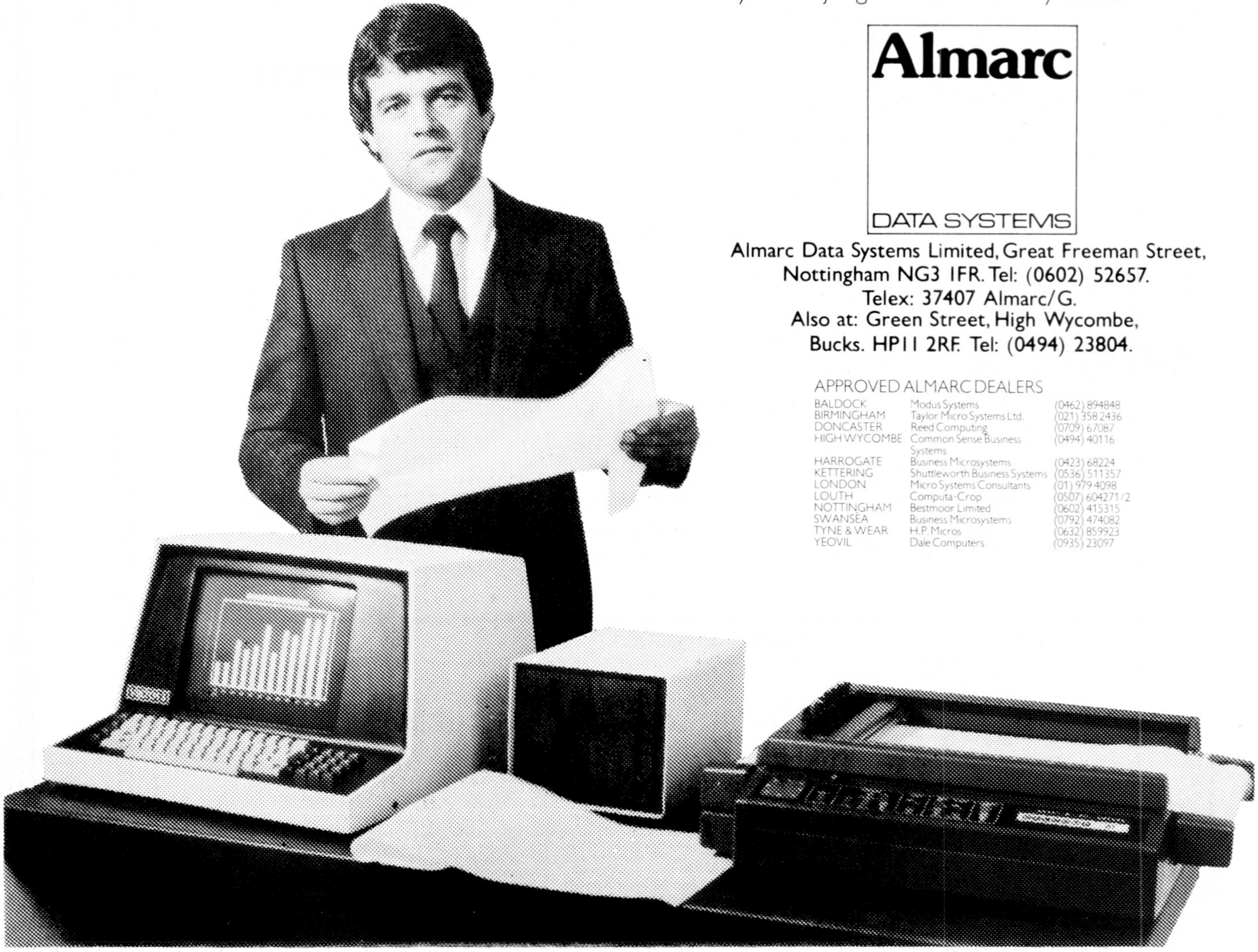

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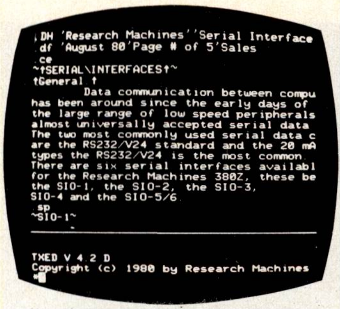

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.DH 'Research Machines''Serial Interface
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        Data communication between compu
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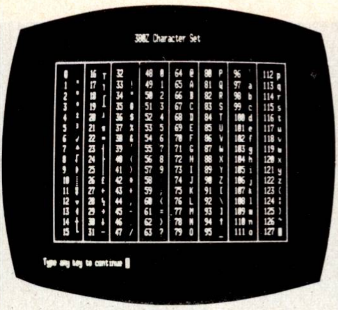

380Z Character Set

0		16	[illegible]	32		48	0	64	@	80	P	96	`	112	p
1	▪	17	[illegible]	33	!	49	1	65	A	81	Q	97	a	113	q
2	▪	18	[illegible]	34	"	50	2	66	B	82	R	98	b	114	r
3	•	19	[illegible]	35	#	51	3	67	C	83	S	99	c	115	s
4	²	20	[illegible]	36	$	52	4	68	D	84	T	100	d	116	t
5	³	21	[illegible]	37	%	53	5	69	E	85	U	101	e	117	u
6	✓	22	▬	38	&	54	6	70	F	86	V	102	f	118	v
7	▲	23	[illegible]	39	'	55	7	71	G	87	W	103	g	119	w
8	[illegible]	24	[illegible]	40	(	56	8	72	H	88	X	104	h	120	x
9	▶	25	[illegible]	41	)	57	9	73	I	89	Y	105	i	121	y
10	[illegible]	26	£	42	*	58	:	74	J	90	Z	106	j	122	z
11	[illegible]	27	←	43	+	59	;	75	K	91	[	107	k	123	{
12	▼	28	½	44	,	60	<	76	L	92	\	108	l	124	¦
13	◀	29	→	45	-	61	=	77	M	93	]	109	m	125	}
14	[illegible]	30	↓	46	.	62	>	78	N	94	↑	110	n	126	~
15	[illegible]	31	–	47	/	63	?	79	O	95	_	111	o	127	█

Type any key to continue

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display is desired, a cable will connect the 380Z VDU board to the
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.cp 5
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correct number of plugs to take the add-on boards you have ordered. i.e
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                 380Z                  380Z
Smooth scrolling .... Smooth scrolling .... Smooth scrolling
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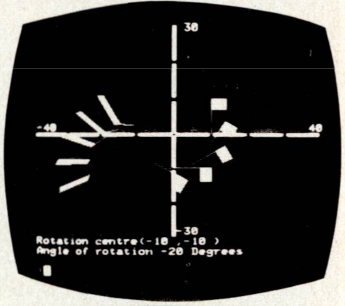

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Rotation centre(-10 ,-10 )
Angle of rotation -20 Degrees
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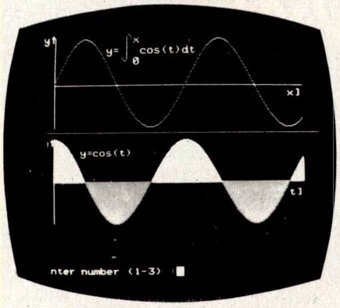

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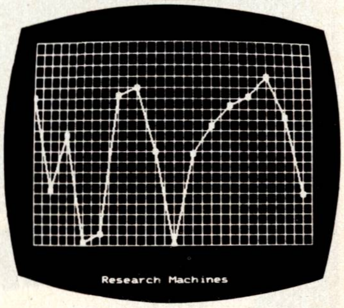

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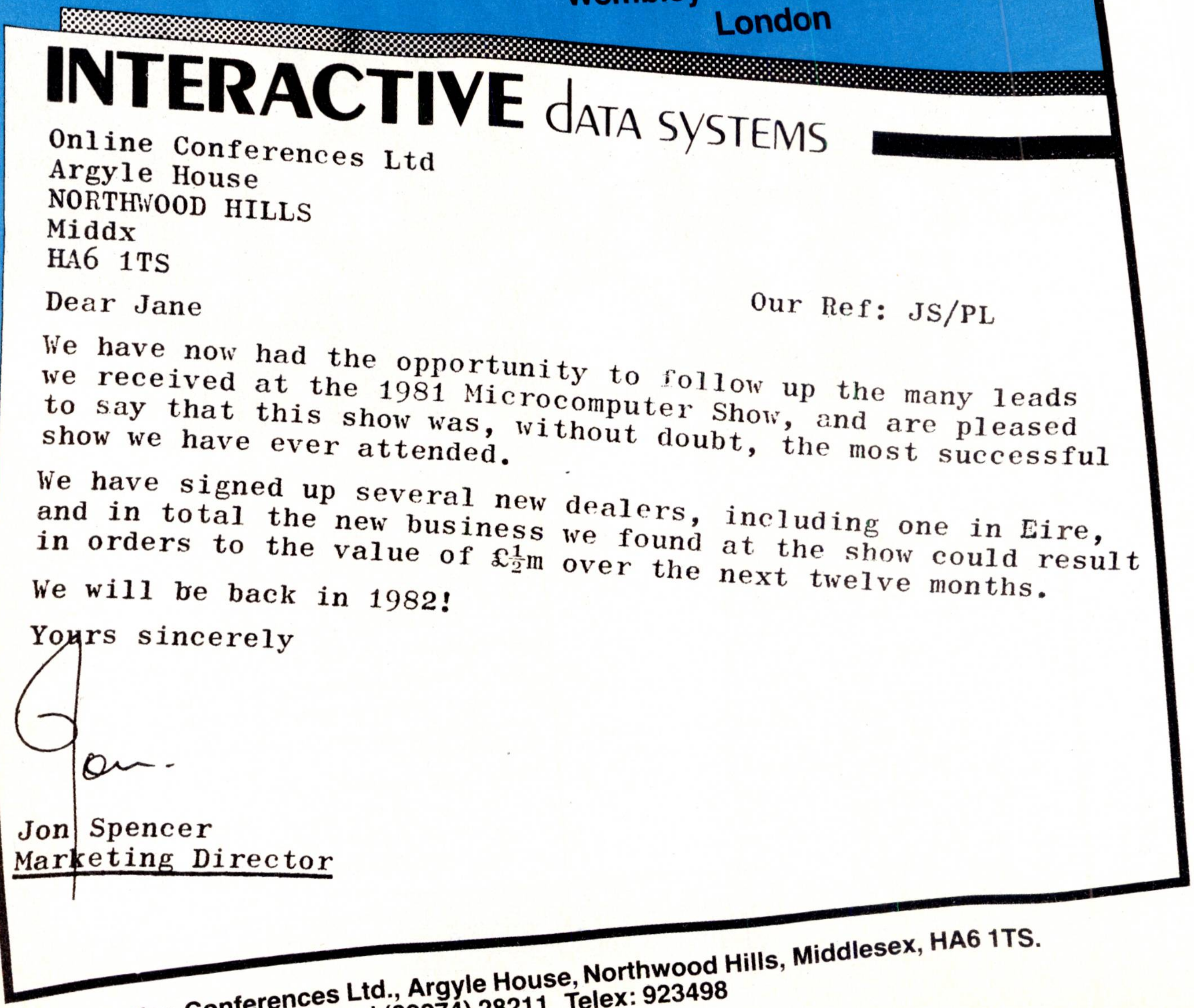

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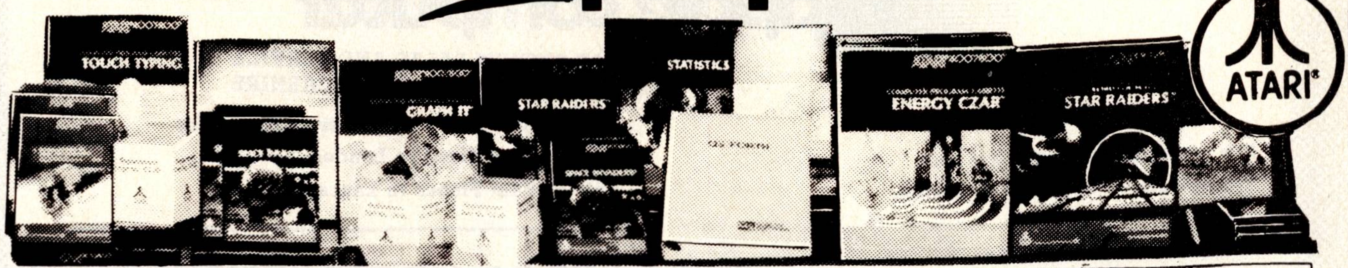

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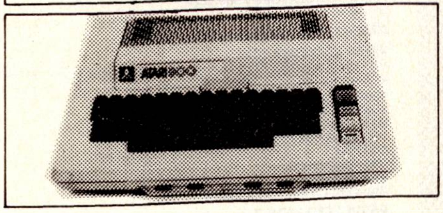

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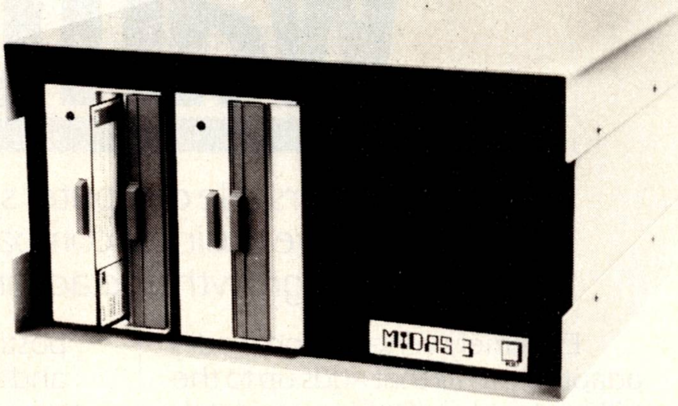

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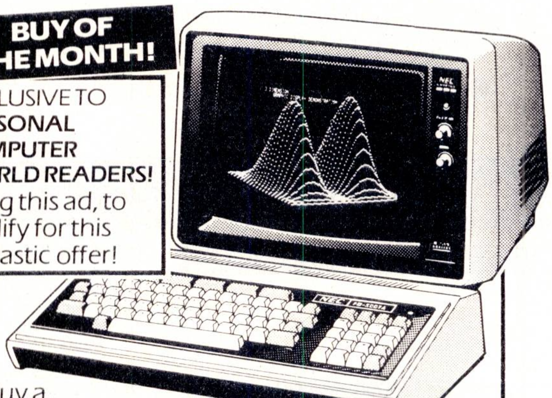

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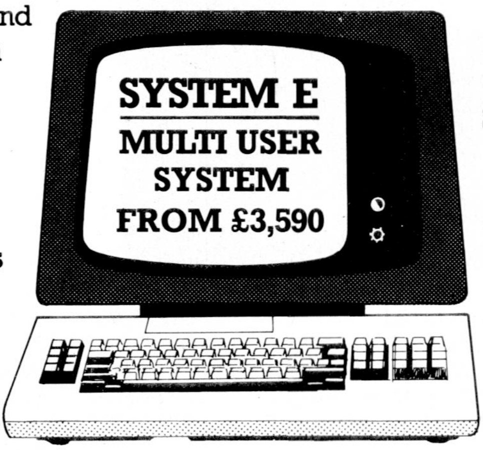

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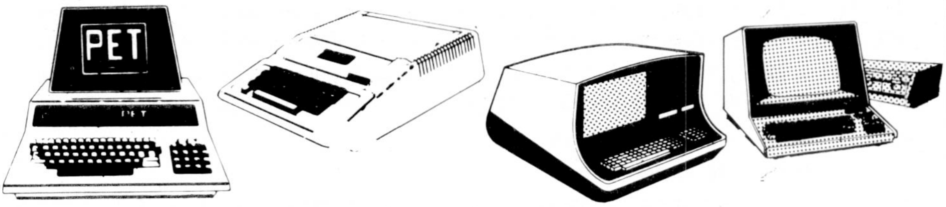

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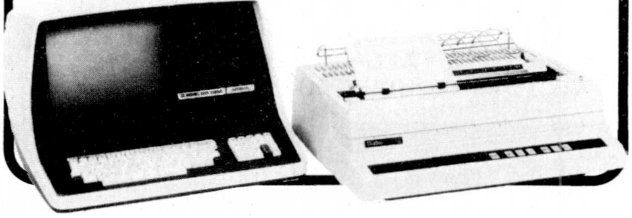

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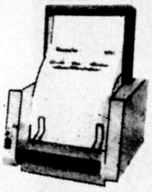

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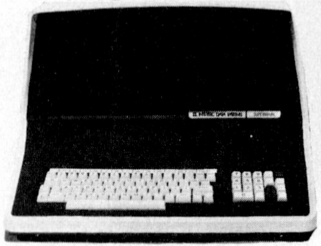

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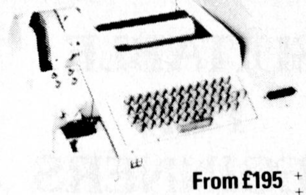

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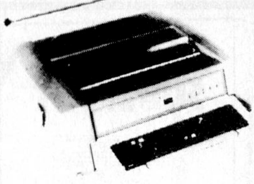

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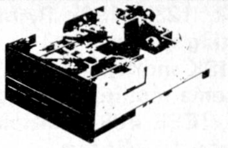

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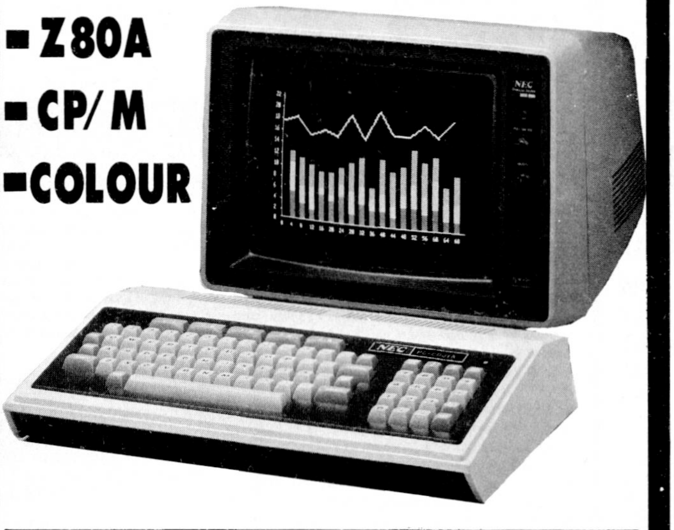

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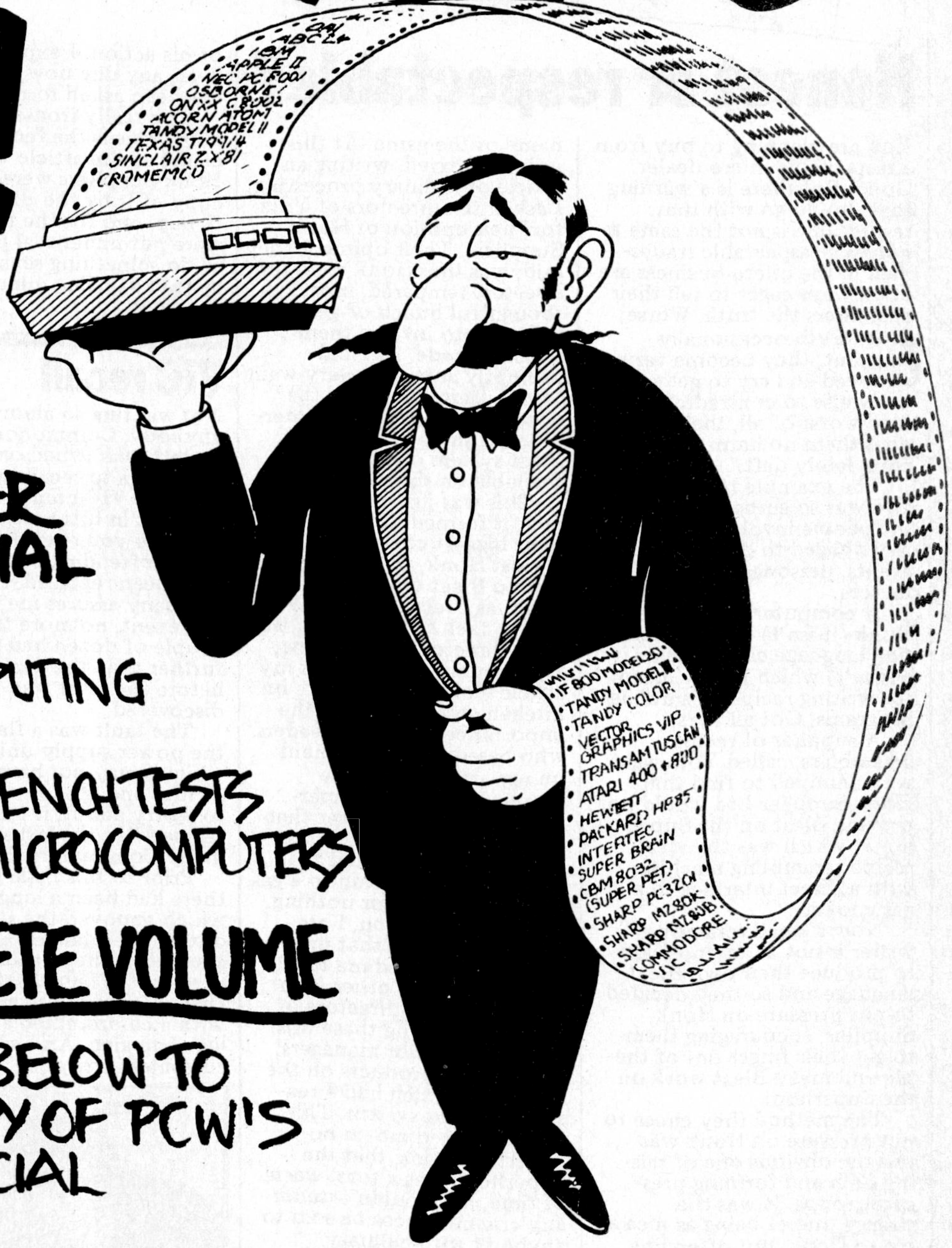

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NEWSPRINT

Compiled by Guy Kewney

Honest or respectable?

You are planning to buy from a respectable micro dealer. Good. But there is a warning that should go with that: respectable is not the same as honest. Respectable tradesmen in the micro business are not always eager to tell their customers the truth. Worse, if the truth occasionally slips out, they become very annoyed and try to get somebody else to contradict it. And worst of all, the truth does them no harm. It's completely daft.

The example I'm going to give was so embarrassing to the people involved that I feel obliged to disguise the events, personalities, and factors.

A computer called The Honk (it isn't) has an interesting language called Bleat (it doesn't) which is very useful for writing recipe scrambling programs. Got all that?

A supplier of recipe scramblers, called Yolk was very annoyed to find that Honk Supplier Ltd would not provide Bleat on the Superhonk, which was the ideal recipe scrambling machine with a direct interface to a gas cooker.

Now a small scrambler writer is not in any position to produce their own Bleat language and so they decided to put pressure on Honk Supplier, encouraging them to get their finger out of the pie and make Bleat work on the Superhonk.

The method they chose to put pressure on Honk was not the obvious one of raising Cain and forming pressure groups. It was the strange one of being as nice as pie to Honk, not offending them, and flattering them at every opportunity, with the eventual object of becoming so high on Honk favours that their request for a Bleat system would become a high priority in Honk strategy. You are free to make your own judgements about the likelihood of success this approach would bring and remembering phrases such as 'let sleeping dogs lie' and 'it's the squeaky wheel that gets the oil' might help you understand my own judgements.

Ingratiating, then, was the name of the game. At this point, I arrived, writing an article on culinary processing. I asked the directors of Yolk for their opinion of Honk Suppliers. Their opinion, they said, was that Honk were the sweetest tempered, most thoughtful bunch of gentlefolk ever to involve themselves in trade, and had promptly supplied every want of the users, whenever the occasion had arisen. Furthermore, Honk had the best Bleat system on the market, available on the Superhonk.

This was just not true. In fact, it formed the basis of their biggest complaints against Honk, that there was just no Bleat on the Superhonk, as I related above. This minor fact didn't bother the Yolk directors. They knew, furthermore, that part of my article would be a feature on kitchen equipment and the importance of Bleat. Readers who based their judgement on my article would be encouraged to buy Superhonks, only to discover that the machine was absolutely useless at Bleating and that the direct connection to a gas cooker counted for nothing.

On this occasion, I am relieved to relate that professional scruples led me to question people other than the respectable directors of Yolk, and among these was one of the senior managers, in charge of products on the old Honk, which had a reasonable Bleat system. This man informed me, in no uncertain terms, that the Superhonk was a total waste of time, and couldn't under any circumstances be sold to anybody with culinary interests until Honk Suppliers got off their pie-crust and got Bleat working — and that there was no sign of this happening inside a year.

My article quoted this man generously as the source of this essential information and conveyed the warm recommendation to my readers that so honest a supplier was obviously to be trusted, and they would be in safe hands asking him for advice on Bleat problems.

I suppose I need hardly add that the creeps on his board took a very dim view of his action. I expect to hear, any day now, that he has been asked to resign.

The really ironic thing about this is the fact that one effect of the article was that Honk Suppliers were sent a copy of it by the Bleat User Group, and for the first time, were put under real pressure to do something sensible instead of being mindlessly flattered.

VIC recall

Not wanting to alarm anybody, Commodore has nonetheless issued orders to its dealers to recall the first batch of VIC computers it sent out in this country. By the time you read this, most of the offending ones will have been replaced, the company assures me, and in any event, no more than a couple of dozen had got further than the dealers before the fault was discovered.

The fault was a flaw in the power supply unit and while it may not have been serious enough for customers to worry about, it must have seemed like the last straw to many Commodore dealers.

Prior to this little hitch, there had been a long delay which annoyed the stuffing out of the retailers. Understandably, they decided to support the launch of the cheap Commodore micro with a co-ordinated advertising campaign. And when the customers arrived in the shops, there were no VICs. Rage was reported to me from several quarters and no official statement has yet been issued explaining the delay, so I can only pass on a rumour, from a 'usually reliable' source.

This source reported that the little socket, on the side of the VIC, where the power comes in, was (quite by chance) identical to the shaver output socket found in German hotels, and that the German authorities decided this was an unacceptable match in a machine built in Germany.

Anyway, the picture shows the man in charge of marketing the VIC, John Baxter (with a nice smile, leaning on the Thorn colour TV), presiding over the awarding of a prize VIC to 15-year-old Mark Watson of Wimbledon, a student at St Paul's school in South London. The prize was the result of a competition held in Summer at the PET show. The man with the beard (and quite possible another nice smile?) is Cyril Grant, managing director of the local dealer, Microcomputer Centre of Sheen.

See Vic Recall

New TABS prices

The price of business software from TABS (The Accounting Business System) for serious accounting work has gone up. It can't really be said that it is now expensive — from costing under

£100, the price is now just under £200.

The old price applies to each of the following: the Foundation, Fast Data Entry, Mail List, Word Processor, Invoice compiler, Sales Order Processing and Management Accounts. The new price applies to Sales Ledger, Purchase Ledger, Nominal Ledger, Stock Control, Job Costing and Payroll (each). Reason for the rise is not just that the company found it was having to do more helping work than planned for each new customer, but also that people are daft and reckoned that something costing £100 couldn't be any good. According to the industry, TABS packages are in fact up to a high standard. Details from Sopers House, Chantry Way, Andover, Hants SP10 1LU, tel: (0264) 58933.

Hard time

I need some help in spotting hard and soft returns.

The difference between a soft return and a hard return in cricket is obvious, unless you are looking the other way when the ball is thrown at the stumps. It is less obvious in the text processing program called Wordstar but, nonetheless, I shall try to explain it.

A 'soft' return is the way Wordstar knows that it has reached the end of a line and that the next word must start a new line. It puts these in itself, which is very clever. When you are typing away and reach the end of the line (the right margin) instead of having to decide whether the next word will fit in, you just type on. If it fits, Wordstar leaves it there. If it doesn't fit, Wordstar takes the whole word to the beginning of the next line. Lovely, isn't it?

A 'hard' return is the end of a paragraph. You type it yourself, in exactly the same way you would on an electric typewriter, and Wordstar prints the next letter at the beginning of a line, even if the previous word was at the beginning of a line.

Anybody who has ever used Wordstar will know that you sit in front of your screen and type, using lines that are not spaced out. Then, when you want to print it, you re-format the text so that there is a space between each line, so that a reader can make notes between the lines.

When you do this, Wordstar refuses to space out the paragraphs. As far as this program is concerned, a hard return merely signifies the end of a paragraph and has no other purpose. If you like spaces between your paragraphs — tough.

Most people can live with this but I can't. I want to adapt Wordstar so that I can find all 'hard' returns in the file and replace them with two 'hard' returns, or else I want to change the reformat command. Alternatively, I could do with another way of marking paragraph ends.

No, I realise this isn't the most crucial matter likely to affect the computer world in the next few years, but I thought I'd share the thoughts with you as an illustration, if nothing else, of the fact that there is no such thing as the perfect program. And, of course, somebody reading might have already solved the problem.

The bear is buried

The announcement that Newbury Laboratories is going to make its own micro is not a startling turnround from the sad decision to drop the NewBrain hand-held computer (now being made by Grundy).

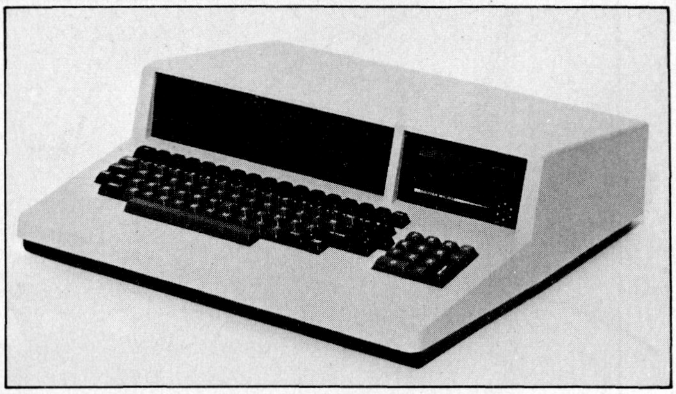
The plan was announced as part of a package involving the full merger between Newbury, which makes video terminals, and Newbear, a subsidiary which sells microcomputers.

Newbear now becomes Newbury Micro Systems, a splendid change of name designed to make us all forget the excellent reputation Tim Moore has built up over the years he has been The Bear, and to substitute the image of the company which had the BBC micro contract and failed to produce a single computer in a year.

In the circumstances, Newbury's prediction that its new micro will be available in the third quarter of this year and will be a 128k byte, 8-bit micro using a dual Z80 board built into the company's new 8000 series moulded case video terminal cuts little ice with me.

It is nice, however, to see Moore get a little credit for having sold one or two systems — the company has actually published a list. It reads: more than 50 Apples sold to (and still supported at) the Atomic Energy Authority; multiple Sharp and Apple systems installed at 30 universities, 15 polytechnics, and in major organisations such as British Aerospace, Marconi, Plessey, Ferranti, Thorn EMI, Tektronics, the BBC, ITN, Texas Instruments (or Tube Investments, it isn't clear which because it is listed as TI), GEC, English Electric, Honeywell and the *Yorkshire Post*.

For my part, I'm still waiting for Newbury boss Rod Saar to return a series of calls I made in April last year. I suppose that means I'm not impressed by Newbury's micro performance so far.



The important thing to look for in this photograph of Mimi is the extra row of rather darker keys at the top of the keyboard, where there were no keys on the original Gemini 801 which John Marshal announced about this time last year. The machine remains one of the best-value CP/M systems, with a total of 700 k bytes of floppy storage, CP/M, screen interface and Mbasic, for around £1350 — if you can get one. British Micro is still sending the bulk of the production abroad, which is nice for the pound but not much use for the rest of us. Those extra buttons are Hewlett-Packard type, programmable function keys, which provide ways of letting a user give complex commands without having to spell them on the unfamiliar typewriter keyboard. Details of the new machine on Watford (0923) 48222.

Show goes East

Our own show, the *PCW* Show, has happened in the Cunard Hotel in Hammersmith for two years now — and the time has come to give the other side of London a chance. Next year, on 9 — 12 September, it will be in the City at the Barbican Centre.

Those who have been before will know that the show is suitable for hobby users or business users, because it is divided into two sections. You can get into either section or both.

Unlike last year, the show runs for four days, not three. We hope this will mean shorter queues (ho ho).

Details from organisers Montbuild on 01-486 1951.

Disk course

Winchester disks are very large capacity data storage items, with the clever feature of being airtight enclosures with absolutely no dust inside. This allows the magnetic data surfaces of the disks to be very close indeed to the recording and reading heads. The truly important thing about them is the fact that they can be built in exactly the same size boxes as ordinary floppy disk drives, which allows most of us to buy a computer with a small disk in it and then save up for a big disk later on. So, naturally, many of us are doing this.

Anybody who wants to go into this a bit further can attend a seminar on the subject. It is being given by Robin Bradbeer, editor of *Educational Computing* and of the monthly newsletter *Microprocessors At Work*, together with his co-editor Jonah McLoud (who is also consultant to Strategic Inc, a market research company in California). Also speaking are Martin Whitaker of Sintrom, and Frank Burger of Frank Burger and Associates. The course is sponsored by the newsletter and organised by Oyez IBC Ltd. It runs for a day at the Royal Lancaster Hotel in London on 16 February, and the cost is £115 inc VAT and refreshments, lunch and some drinks — and documentation.

Details on 01-242 2481 from Suzanne Mayhew.

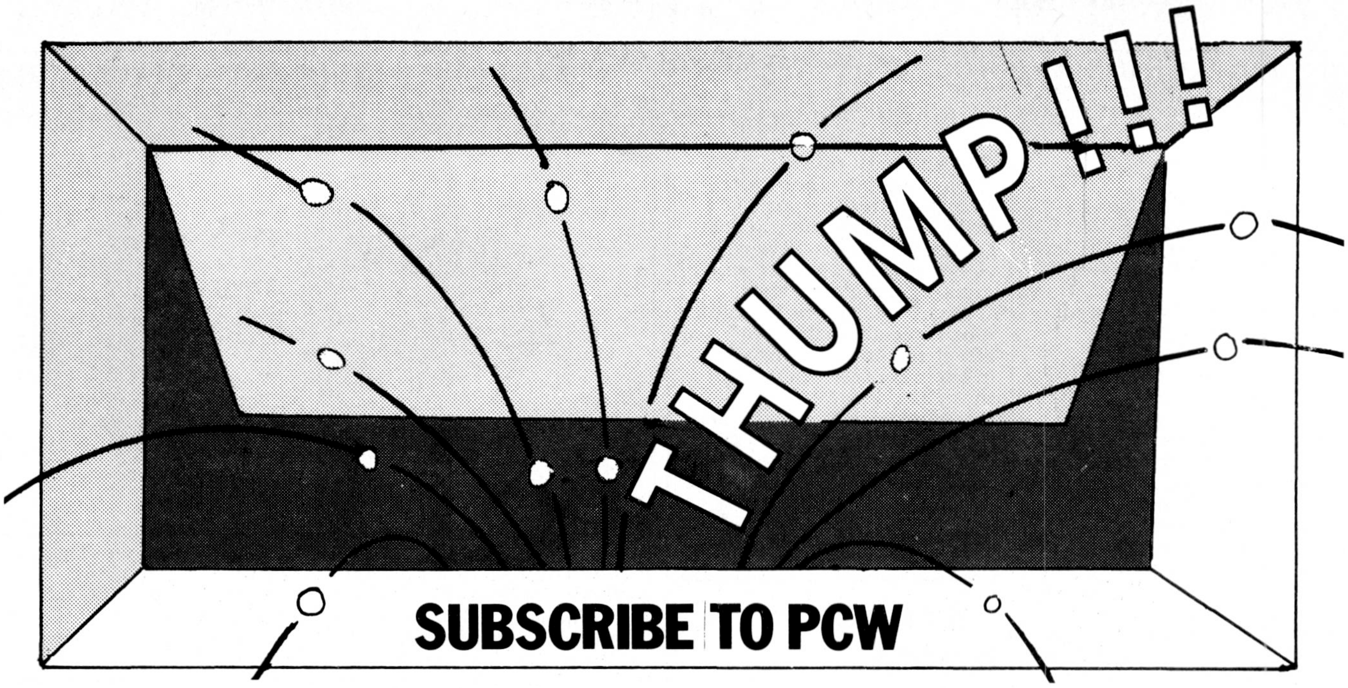
Will it catch on?

I am just about as nervous to see all these micros with Motorola 6809 chips in them as the motoring world must have been when the Wankel engine first appeared on the roads. Will it catch on? How can we tell? And is it really as good as the fans say?

The latest machine to appear with this chip inside is the Positron, a new company's design and aimed at the sophisticated viewdata users who want personal computing power.

The two founders of Positron are Peter Loftus and Peter Plinston. Both were IBM systems engineers before and both are unimpressed by the argument that a machine has to be able to run CP/M software: they both thought the 6809 was a better chip than the Z80 and backed their judgement.

'We realised the need for a general purpose, personal workstation device,' commented Loftus (marketing man). 'It has colour as we believe colour enhances the display of information, making it easier to understand. External communication we felt was important,



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hence the viewdata capacity and, especially, it needed a lot of "horse-power" in terms of capacity and speed.'

The machine backs up South West Technology's contention (see 'Communications' a couple of months back) that the 6809 is neglected, but capable of doing things which normally are regarded as impossible on 8-bit micros — for example, running Unix (or Unix-like) operating systems. Positron has a multi-user timesharing operating system called OS-9, which it describes as 'using Unix type I/O facilities'. This is a Motorola software product.

The first model will handle up to 512 kbytes of internal RAM, and another 256 kbytes of ROM providing high-resolution colour graphics and multi-user facilities.

The company was provided with a £250,000 capital investment by Anglo-American Venture Fund (which has government sponsorship) last year.

Details on 061-228 3768.

Acorn software

Getting its hand in before releasing software for the BBC Computer, Computer Concepts has launched a program for the machine's predecessor, the Acorn Atom.

The first CC program for the BBC Computer will be a word processor, which the company says will be available in a ROM chip early February (with luck). In the meantime, Softscreen aims to provide some of the display features of the BBC machine to Atom users — for example, the ability to mix high resolution graphics and text anywhere on the screen, or the ability to define your own character shapes, or to have 'windows' of text. The text is full upper and lower case (not just capitals as on the standard Atom). To run this program, Computer Concepts says, you must have the extra 6k bytes of graphics memory fitted. The 2.75k bytes of code are loaded from cassette, and fit in at memory locations 2900H to 3400H.

Cost is £11.40 including VAT, and details are available on (09277) 62955. Cheques to 16 Wayside, Chipperfield, Herts WD4 9JJ.

Atom afloat

You have to admire Acorn's nerve: publicising the fact that an Atom performed happily on a ship and on the island of St Helena, even with the fluctuating power supplies found in both those places.

The feat was performed as part of a publicity generating trip (that wasn't how it was planned, but it certainly turned out like that) by University College in London. The geography department used the machine in a field exhibition and the thing worked perfectly, say the academics.

I only hope that Atom isn't besieged by hundreds of people whose Invaders games went down in December's storms, all demanding a refund or replacement.

Human aspects course

Human aspects of computer systems: a seminar on the subject is to be held from 21-26 March at Loughborough University of Technology. It covers such aspects as display terminal ergonomics (I do wish they wouldn't call them 'visual displays', as if there were such a thing as an olfactory display or audio display, or tactile display), dialogue design, and human aspects of the system design process. Details from Brian Pearce on Loughborough (0509) 63171. The course repeats in September.

Turbo Apple

Putting the enormously powerful Motorola 68000 chip inside the Apple II microcomputer instead of its nice little old 6502 engine is a process described by Simon Laurence of Simon Computers as 'turbo-charging'. It certainly is that, and more.

Most people now expect Apple to announce a special machine (Apple IV, maybe) at the end of this year (1982) with this giant micro inside it. Simon's idea could give professional systems builders who already have an Apple II a lead on this.

Simon's own blurb emphasises the benefits to the experienced assembler programmer: 'How often have you struggled on those Assembler programs which become just too complex?' he asks. 'Or never quite managed to grasp the awkward knack of programming those 8-bit machines?'

True, assembler programming can be easier on the 68000, because it has instructions which perform functions that a programmer has to write in himself on the 68000's grandfather or the 6502 (its bastard brother).

But I rather suspect that the reason Simon emphasises the assembler benefits is simple: at the time of announcing, assembler is all he can offer. 'Many software products are planned, commencing with a native 68000 Assembler,' he notes. The assemblers supplied with the board rely on the 6502 chip for input and output.

For people who already have an Apple II, the cost of an Aristocard 68000 (the turbocharger) is £475. For people who want a complete evaluation system including a 64k byte Apple II, a disk drive and a monitor, with the Aristocard, the price is £1695.

Simon plans a system to plug the Aristocard into the bigger Apple III as well. That won't be available much before the summer, however. Details on 01-680 4646.

Better Beta Basic

Long have I wanted to see a version of Microsoft Basic which was compatible with Microsoft's own product, but made life easier for the programmer, especially at the time of testing.

It has now been done. I have to confess, however, that my enthusiasm for Micromedia's Beta Basic is slightly tempered by the fact that the interpreter is written in a language called BCPL 'and can thus be run on any computer which supports BCPL, from a single-user microcomputer to an IBM 370' (a sort of giant mainframe with a brain in its tail) 'and beyond'.

The claimed improvements over Microsoft's editing facilities include what Clive Sinclair has already proved is a vital function that of checking what the programmer is typing in while the keyboard is still rattling, not only when the RUN command is given.

If you have a microcomputer that 'supports BCPL' then contact Micromedia on Newport 5927. I have to admit to a terrible ignorance — I don't know of any micro that does. Also, the interpreter costs £800-odd. It certainly won't do for my Genie, will it? But it might be handy for somebody developing Tandy Software on a big IBM machine.

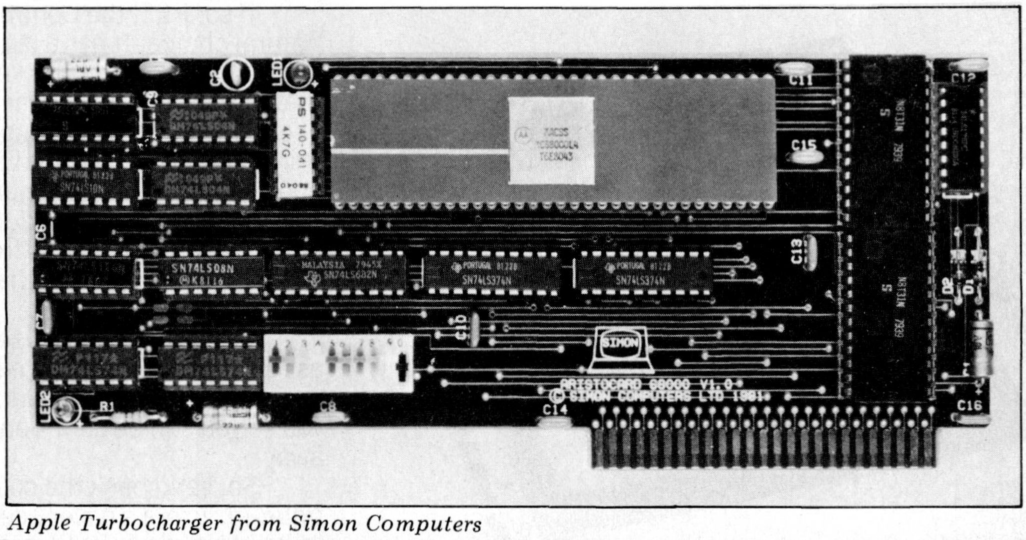
Decorous micro

'DECOR-conscious office managers' (it says on this here press release) 'will appreciate that the cabinet of the Model 30 can be ordered in Teak, or in a wide choice of real wood veneers,' according to Computability, the London agent. The machine costs less than the magic £2000 for an S100, CP/M system with only a single 160,000 character disk store, plus a screen and keyboard. Details on 01-380 0807.

Terminals spreading

New Televideo computers are animals to take seriously, if only because the company's terminals are so confoundedly ubiquitous. The company launched the first processors in summer last year and has followed them up with two more in November, at the Las Vegas Comdex show.

As a guide to the power of Televideo in terminals, it would be worth asking a cross section of users of CP/M systems what are the few niggles they have about their systems, and then asking the manufacturers why those fea-



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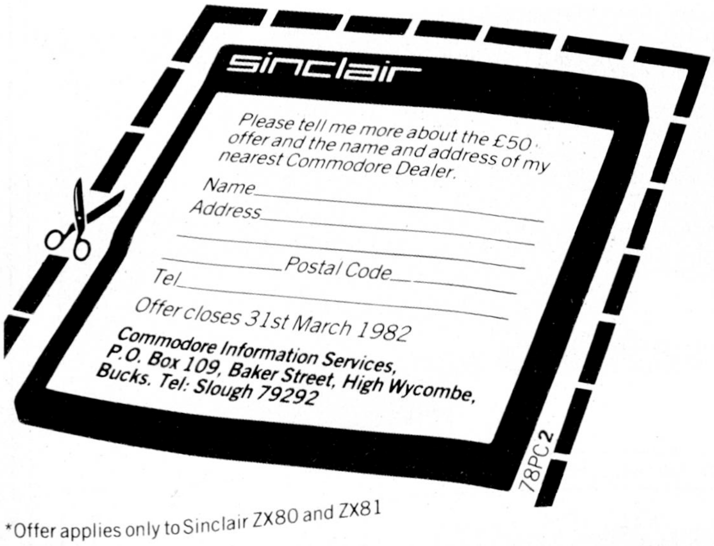

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You might be surprised how many times you get the answer from the factory: 'we didn't plan to do it, but we found we had to, in order to be compatible with Televideo terminals. . .'

We will have to see how the computers sell. The new ones are the TS802, with a megabyte or so of floppy disk storage capacity, costing $3500 in the US; and the TS802 H which has a hard disk instead of one of the 5in floppies and costs $7000.

Details from the Sunnyvale office: phone (408) 745 7760.

Another biggie

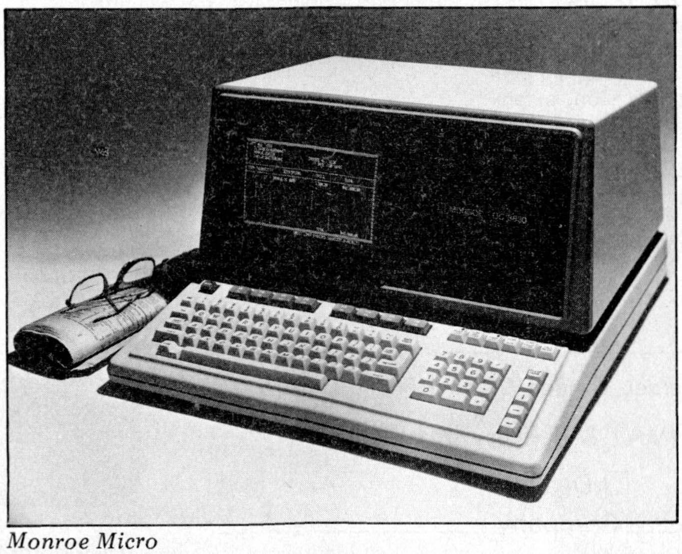
A new machine, which can do several things at once, has been launched by Manchester distributor Fi-Cord. The machine costs under £3000, says Fi-Cord, and its only obvious 'defect' is the absence of CP/M as the operating system.

Theoretically, the machine should be able to run CP/M as well as its own operating system ('one of the most powerful and flexible operating systems to be available as standard on a latest generation microcomputer,' as the US builder, Monroe Corporation, a calculator supplier, puts it). It does have the necessary internal processor, a Z80A chip.

The Fi-Cord machine is code-numbered the OC 8820 for no apparent reason. I shall call it the Monroe, to avoid irritating people who don't recognise numbers. It has twice the normal amount of memory internally — 128 kbytes instead of 64k. This allows Monroe to give it a special operating system which can handle 'as many as 12 tasks at the same time,' says Fi-Cord. 'For instance, while permitting you to review random reports (on the bright, easy-to-read amber display), the Monroe could simultaneously be printing sales ledger statements.'

Disk storage provided gives 650k bytes on two minifloppies. Software available includes Basic and Pascal (supplied as 'standard', but I can't be sure if that's included in the price) supporting index sequential access method (Isam) file handling. Applications programs already available include Wordstar, Datastar, Infoster and Supercalc — but no information is available at press time on their prices. They have been adapted and upgraded by Monroe to run under the Monroe operating system, so obviously a Benchmark test of some complexity must be done before anybody knows how good these new versions are.

Details from Fi-Cord on 061-445 7716.



Monroe Micro

IBM expansion

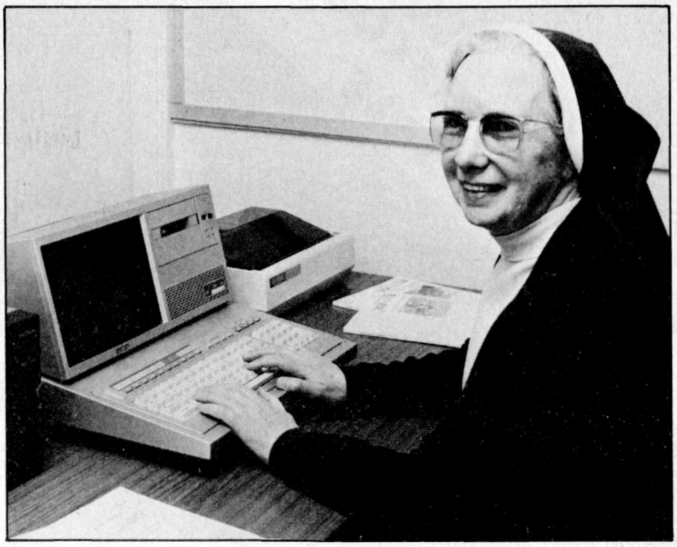
Memory for the new IBM micro is normally available on add-in boards which take up rather more space than they should, thinks Datamac Computer Systems of Sunnyvale, California. The company has produced a $500 board with 64 kbytes and also has boards with two, three and four times the storage capacity, compared with IBM's own design with either 32k or 64k.

'IBM users will now be able to put together much larger systems,' claims Datamac sales manager Robert Lindgren, 'since fewer expansion slots will be needed for memory and more slots will thus be available for peripheral devices'. Details on (408) 735 0323.

Two cats

Two catalogues of educational programs. One, for Apple, PET and Tandy computers, is available from New York software publisher K-12 Micro Media, for $3.95. The catalogue contains information on over 300 programs from over 65 publishers, says the company, and the scope is pretty wide. Details from Alan Zoldan at Box 17, Valley Cottage, NY10989, or phone (914) 358 2582.

The other is from UK firm Software Production Associates. The type of games and lessons is roughly the same in each case, as is the price level of around £10 per program on average. However, this company concentrates almost entirely on the Research Machines 380Z micro (it includes a £20 Adventure program) and I have no phone number. Address is PO Box 59, Royal Leamington Spa, Warwickshire W31 3QA.



The reason we have this picture of a lady of the cloth is not because she is a nun (she's also a headmistress) but because Sister Mary Agnes is using the first UK installation of the Sharp MZ80B, at the Notre Dame Convent, Cobham, Surrey. As a first it comes as a surprise, because dealers have been saying how nice the B is for so long I hadn't realised they weren't installed before.

Xerox software

Obviously taking its new dynamic role seriously, software supplier Lifeboat is adding to the list of CP/M computers which can run its software, with the announcement of support for the Xerox 820. Details from Helen Smith on 01-836 9028 if you know where to find an 820.

Prestel project

Meanwhile, back to Prestel, software is now being distributed for educational users of the Research Machines RML 380Z computer. The project is being organised by the Council for Educational Technology (CET) in the United Kingdom, and funded by CET and the Department of Industry.

A group of 25 schools, colleges, and other institutions, says CET, are being supported to take part in the initial trials, and 'a growing library of well-tried and tested programs is being built up.'

Now they want volunteers to join in with the project 'on an associate basis.'

You need not have a Research Machines machine to join in: 'A number of other manufacturers, including Acorn computers in relation to their work on the BBC microcomputer, are already working towards providing a similar facility on their machines,' says CET.

Details of the service and the programs themselves are stored on Prestel, on pages leased from CET's Prestel Umbrella Service for education and Training, #2114. Further info from Jill Coates on 01-580 7553.

School Teletext

A serious study of Prestel as a tool for education has been carried out. It makes a bit of a change from all the opinionising which proponents and detractors have been able to indulge in so far and it shows that the remote information base was something of an incentive to class work.

The educational trial was done by CET, the Council for Educational Technology, for the United Kingdom. 'It helped to encourage advanced reading skills, skimming and scanning, and there were some indications that, in the case of slower readers, the motivation of using Prestel and the need to understand the options presented on a frame, were an incentive to, the development of reading,' says CET.

Criticisms: mainly, the lack of information relevant to subject areas other than economics, business studies, geography and social studies, which were the subject areas

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Caxton

Distributor for MICROSOFT CONSUMER PRODUCTS where teachers found Prestel useful. Costs were not a grumble, especially after the classes got used to Prestel — but lack of good indexing was.

A full report on the trial is available for £2.00 from CET — it was written by Vincent Thompson and details are available on 01-580 7553.

Virgo puts a Dent in

There is at least one High Tory with a sense of humour. And anybody who has ever met the delightful Philip Virgo, who is trying to become the Party's authority on What Computers Really Mean to Conservatives, will not be at all surprised to find that he has smuggled the Hitch Hiker Round the Galaxy, Arthur Dent, into the latest Bow Group paper.

I can't honestly say that the paper has no value apart from the appearance of the Hiker, because it does deal with several interesting items about life in the future and the problems of training citizens to cope with it, and with micros. But the jewel in the paper is the arrival of the 'typical school leaver of the 1990s, John Dent, cousin of Arthur Dent, who has no academic interests'.

John Dent is not carried of off into space by marauding Vogons: instead, he ends up a retired authority on the Welsh long-bow in use and in literature, in a ruined hill farm in Mid-Wales, converted to a holiday camp.

He starts off as a robot supervisor and part-time CAMRA activist, and gets retraining four times in his life . . . oh, it's a laugh a minute. And it costs a mere £2.00 from Bow publications, 240 High Holborn WC1V 7DT and is designed to be discussed. It may even provide the future Opposition with useful ammunition one day. — and it is called *Learning for Change*.

Share and Enjoy!

Friend or foe?

I'd like to go on record as heartily endorsing the opinions of my colleague Martin Banks in his grouses about software that won't let you make mistakes. My comments are provoked by several brushes with a very interesting type of software tool, of which The Last One is the best known and Nucleus one of the latest — the program writing program.

Nucleus, like The Last One, is now permanently on show at the NCC's micro centre in London, where people can walk in and try it out free, My own experience of it is so far limited to a demonstration at the official launch, where the demonstrators proved conclusively that they knew all the necessary mistakes involved in totally crashing the system on several different machines.

The point to make is not that the systems crash, but that if you are sold on the idea of using them, a quick trip to the Centre to see whether you can live with their current limitations is well worth the petrol; it may be true that you can crash these systems three times in an afternoon and still have a program developed in hours rather than in weeks in the normal, Basic-writing way — but if you have put a boot through the screen in sheer frustration in that afternoon, you aren't that much ahead of the field.

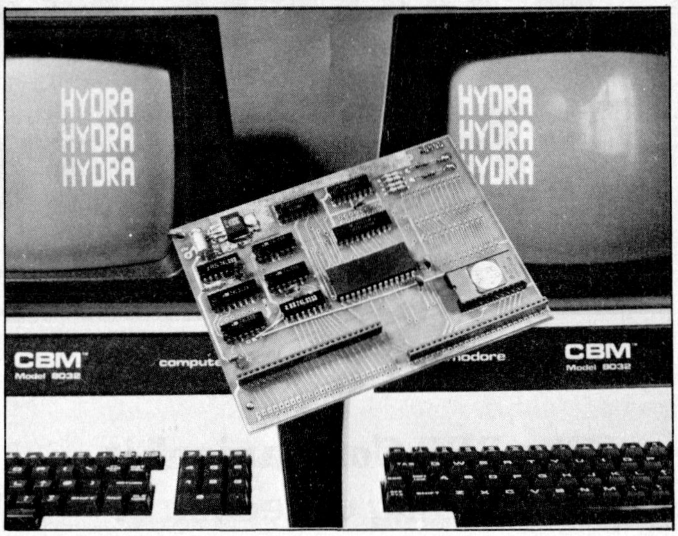
The NCC centre is virtually empty, most days, too.

PET links

Up to 255 PETs can be linked together with a little board called Hydra, now available from Wordcraft Systems of Derby. The machines can communicate, load and or save programs, and interchange screen display, says Wordcraft Systems, passing messages at a rate of 250,000 baud down a four-way screened wire, up to a kilometer long.

Apparently the board plugs into the memory expansion port, and costs £125 for every PET in the system. It will work on model 3000, 4000 and 8000 PETs.

Details on (0332) 760127.



Hydra links PETs

Torch set to shine

The question of what computer shops will find to be pleased about in the BBC micro project is (sort of) answered in a new announcement by a company called Torch computers, which is, in fact, a company with Acorn behind it.

Torch is a joint venture between Acorn and Climar Group, and it plans to release a machine called the Communicator — a name already used by another manufacturer. Similarities between this machine and the BBC micro are obvious. If one were to take the BBC machine and attach a Z80-based host at the other end of the Tube connection, thus turning the BBC machine into a terminal, it would end up very like the £2500 Torch.

The obvious addition is the provision of the communications facilities hinted at by the name. The Torch, say its makers, will be capable of handling telex, Prestel and Teletext facilities, because it can connect directly to a telephone line, with a built-in dual modem.

It also uses Acorn's local net system, Econet, to send messages from one Torch to another and a full word-processing system, integrated with the communications software, allows messages to be edited before transmission.

Languages include Microsoft Basic, BBC Basic, Pascal, Fortran, Cobol, Algol 68, C, Lisp and Forth, and the operating system is 'CP/M compatible.' Further data on 01-930 1612.

Upmarket I/O

When a company asks for £400 for a board to handle message input and output on an ordinary micro there has to be more than the ordinary justification — that you may want to attach a printer.

Metrotech's input/output board is, in fact, a computer in its own right, with a Z80 micro. Its function, however, is to provide ultra-reliable control of communications between the central micro and its printers, terminals, and other remote 'peripheral' devices.

'Metaport uses the full interrupt capabilities of the Z80 and SIO/2 chips,' says Metrotech, 'to ensure no data loss in transmission or receipt of information — this means error-free communications even under multi-user operating systems such as MP/M'.

This isn't the sort of information which the average user can do much with, but for consultants, putting systems together for non-expert customers, it could be a way of creating a more reliable system. Metaport fits into an S100 socket, and provides four serial input/output ports capable of running synchronous, asynchronous, or SDLC protocols. Speed of data transmission and reception is independent, and variable between 75 baud and 19,200 baud (which in this case means bits per second).

Details from Metrotech's Craig Ogilby on 0895 58111.

Atom database

Ideal for storing a personal phone directory, says Acorn's Acornsoft, referring to a small program it has produced for the Atom and which it describes as a database.

The program takes up 5 k bytes, and will organise information on cassette or disk, sorting items into alphabetic order, selecting various items and listing selected batches. It will be available in July, however, so there isn't any need to get worked up just yet.

Details on 01-930 1612.

Japanese software coming

Craftsmen can't compete with factory efficiency, because no matter how much we may admire their work, we can't afford to buy the stuff they make. For this reason, the Japanese will take over the software world, because they are steadily and determinedly building software factories, well stocked with software tools.

This warning was issued recently by the boss of Britain's National Computing Centre, David Fairbairn, just back, from a visit to Japan.

'British software vendors will have to discard the myth that the Japanese are good at producing computer hardware but out of their depth in the field of computer software,' he said. 'It is time for this misconception to follow into the dustbin the earlier myth that Japan has a genius for imitation but no capacity for innovation.'

Fairbairn's opinion is that there is clear evidence of a 'consistent national plan to

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Chuck Peddle, Inventor of the PET

"The PET Companion" is a fascinating collection of essential PET information from the pages of *Microcomputer Printout*. It contains **all** of the editorial from the 1979 & 1980 issues, including 105 PET programming hints and tips, 116 news reports, reviews of 54 peripherals ranging from light pens to printers and 27 major articles on PET programming. All of it written in straightforward English.

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produce highly efficient software development tools' in Japan. Unlike the earlier plan to put Japan in front of America's silicon chip skills. this plan is kept under cover. 'The existence and context of the plan is not fully declared, but is evident in a consistent pattern of work undertaken in both the manufacturers and in independent sectors.'

It appears, says Fairbairn, that some six years ago, plans were laid for the development of new programming languages, code-named a, b, c, and so on, and these are now nearing fruition. 'The same dedicated logic is being applied there to the processes of software production, as enabled Nissan (in the field of cars) to achieve six times British Leyland's output with only half the work force. The merits or demerits of existing software products are of little consequence compared with the techniques that may be used to produce their successors,' he said.

Hup, two, three, beep......

American cinemas have been rendered unsafe by the arrival of the alarm watch. All over the country, romance is destroyed by the near-simultaneous sound of hundreds of bleepers sounding out the hour every hour, followed by frantic rustlings as hands are removed from . . . well, as hands are rushed to the job of silencing the little bleepers.

Now Casio tells us that it has found a new function for the wrist watch. It is a novel 'pacer mode' for joggers.

Parks and country roads, Casio plans, will be made into arenas of hideous beeping by joggers who have fed in the details about their length of stride (in feet and inches or in metres) and their preferred running rate. 'Provided a jogger keeps pace with the pips and holds the set stride length consistently, the J100 watch offers the wearer a series of meaningful data for display at the touch of the button, showing target speed, time elapsed from start, distance covered, or number of strides made.'

Any one of these factors may be progressively increased in future training sessions,the company adds.

At £22.95 per watch, it's an expensive joke, if silly rather than funny. I suppose company executives inside Casio will be encouraged to take the thing to bed with them . . .

Heavy PET

The expanded Commodore, the 8096 with 96 K bytes inside it, has had Visicalc loaded into its capacious store by Heronview. The company claims that this increases the capacity from 1200 items of information to 8000, which is three times the capacity of comparable Visicalc machines. Details on 01-734 3532.

Give your Atom an arm

There's a lot more to building a robot than merely having a mechanical arm though this is a high priority and is normally very costly. So an arm for £430, designed for teaching purposes, is quite a breakthrough.

The arm in question is the Smart Arm model 4E (E for educational) from Systems Control. It has a micro in it — the original Acorn card which the company produced before it got round to building the Atom — and it is designed to be controlled by an Atom.

Smart Arms come in a range, from the small 4E with just four movements, a maximum reach of 200 mm and a 120 degree rotation span, only able to lift 50 grammes and exert 2 kg — to the industrial 61 model. That has six motions, can reach out a metre, turn through 300 degrees with much greater precision, and lift 1.5 kg with a grip of 10 kg. It costs £2560. Details on 01-930 1612.

Sinclair–ICL tie-up

Now for the news of Sinclair's deal with big computer builder ICL — the announcement touched on in the other news item above, about educational software.

Surprisingly, the deal with ICL doesn't involve computers, but terminals. And, at last, it involves the use of Clive's clever flat-screen video tube, as both phone connection and computer connection inside big companies.

The tube was announced as a research project a year ago, with predictions of availability some time next year in a £50 pocket TV set. So it shouldn't be any surprise to find that this project isn't planned to bring fruit until next year (1983) too.

More impressive, to my mind, is the news that ICL has received an order from W H Smith for 100,000 software tapes — for the ZX81. Sinclair expressed surprise that nobody had heard about ICL's involvement so maybe everybody else knew all along that the training division of the computer giant had written training software for the little compulator and that Smiths were selling it as fast as they could record the tapes.

According to Smiths executives, the ICL tapes are far superior to other tapes, because they are enhanced to make loading more reliable than normal on the ZX81. In other words, the machine finds it easier to load these tapes than it does to load tapes it generates itself on tape recorders with the SAVE command.

The reason this impresses me is that it underlines an achievement of Sinclair which his competitors would like to ignore — that is, to get the first chain store in this country to really get into micros to take on his machine only. The fact of the matter is that no other product would stand up to being sold by non-expert staff like this.

Logical choice

Long ago, people who called themselves electronic engineers were able to design logic. They could connect transistors together to form gates. Then, because the chip makers got clever, it became possible to design gates onto single chips and logic designers became people who could link gates together to produce logic circuits. Finally, logic circuits got so complex that nobody knew which circuits to design and they invented micros, to do everything.

It has now been definitely discovered that micros can't do everything, and that specially designed logic circuits are still needed — but you can't make a specially designed chip unless you plan to produce a few thousand, because that's how the business works.

So the chip makers are now producing all-purpose logic chips which the engineers can modify. They are logic arrays, either field-programmable, or uncomitted — and Sinclair used one very effectively in the ZX81, while the BBC microcomputer has two very powerful chips of this sort.

But logic design engineers still don't quite know how to use gate chips at first. So Texas Instruments is now running £500 courses on the subject. The courses last for a week each, and there is one a month from now till June. Full details from Mike Hughes, Logic Array Training, on (0234) 67466.

Lie detector

You may possibly have imagined that you don't need a digital multimeter fitted to your personal computer (Atari, Tandy, PET or Apple). How wrong you were!

Without one, you could not have tried any of the following: turned it into a lie detector by interpreting changes in skin resistance; programming your plant watering by measuring oil conductivity; monitoring or controlling pressures of gases or liquids using pressure transducer in lab analysis, process control, school projects; testing the effects of stress using strain gauges; monitoring and or controlling temperature-related functions in solar projects, water heating, greenhouse control; monitoring mains power by automatically monitoring the circuit and having the computer set off an alarm . . .

Details from Black Star, which sells the Sabtonics Model 2020 digital multimeter with interfaces to all the above micros. Price £165, details on (0480) 62440.

Easier formatting

Because Basic is inherently clumsy (like most languages of its vintage) at allowing programmers to plan and to change the layout of forms on a terminal screen, people are always producing ways of improving its powers in formatting. Latest product is a piece of add-in software for CBasic, called Microscreens.

According to supplier Microbits, Microscreens 'provides professional form-style input to CBasic programs to interface with dumb terminals in page mode. Full control of protected fields and cursor controlled editing is provided and numeric fields are validated on input.'

This facility is probably more important on CBasic than other forms of the language, because of the fact that CBasic is not even as friendly as Microsoft Basic in detecting errors — you have to edit it using a text processor and then compile it, before noticing that you've screwed up the syntax as well as the logic.

Incidentally, if you edit your CBasic program on Wordstar, don't use the reformat command, because it puts all sorts of illegal characters into the program and they are all invisible. (Anybody who knows a way of going through a Wordstar-produced CBasic file and re-setting the high bits, let me know, and I'll certainly give your code a plug.) The company Microbits is in Wokingham on (0734) 792021 and the program costs £110.

Inteligent decision?

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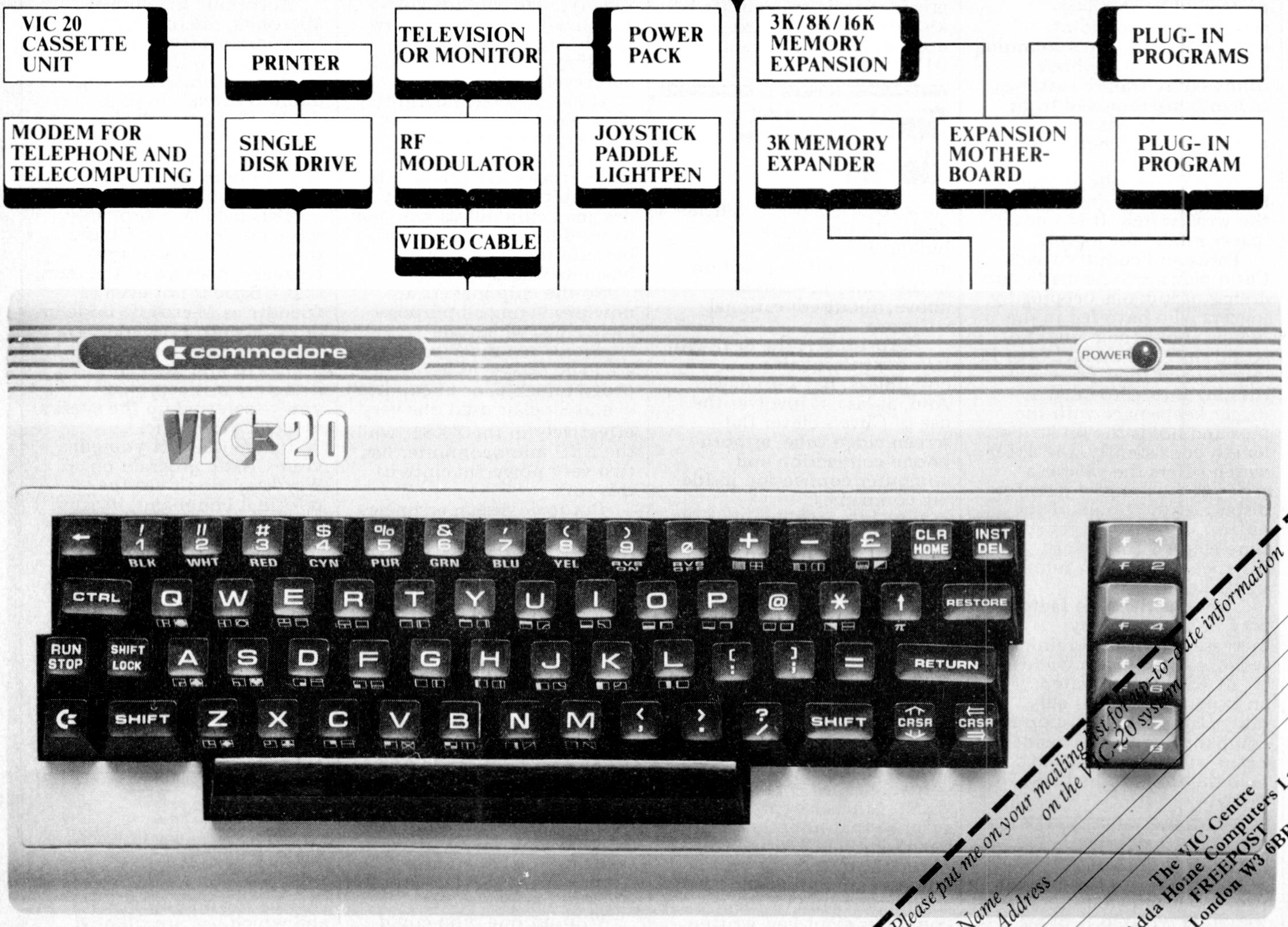

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steadfastly refused to give us a microcomputer. Instead, it has put its own chips inside a few highly crafted minicomputers and has (perhaps sensibly) steadfastly refused to compete with those of its customers who put them inside cheap micros.

There are now some signs that this is changing. The company recently announced a 16-bit minicomputer built round its 8086 chip, which is the processor that Future Technology uses and which IBM and Sirius are working towards. Intel's new machine is the 86/330 and it is half-way to providing the fashionable future-style operating system, Unix, because it has C language already. (Yes, I know Unix is ten years old, but most future things are ten years old.)

More interestingly, this seems to be the forerunner of more significant products. This 86/330 is one which Intel hopes will be used as a development system by other people who want to build and test 8086-based systems for a wider market. And there is starting to be some evidence that one of these people will be Intel itself. A genuine business system for some time this year is, say sources, really on the cards — and the people who have seen somewhat of the prototypes in California are coming back white-faced with shock at its sophistication and handcuffed by non-disclosure agreements.

Details are not available to any but the favoured few as yet. Whether sophistication is really what the market wants remains to be seen. But if a Rolls-Royce system is built, Intel can do it. And the 86/330 may be the straw showing the way the wind blows, or so I am told.

IBM PC on sale in UK

The IBM Personal Computer has appeared in the UK, much to the surprise of everyone and, not least, the surprise of International Business Machines itself.

It was imported by a company calling itself Microcomputerland, which turned out to be a subsidiary of a well-known UK software houses, called Zeus-Hermes, which was buying the machines from Computerland in San Francisco, an authorised IBM micro dealer.

To use the machine in the UK takes a bit of thought, because it not only requires a different voltage from our 240 V, but wants it supplied at 60 Hz rather than the 50 Hz frequency of UK mains. So Microcomputerland was obliged to sell the machine with a voltage converter in this country. At Compec, the biggest UK computer show, they sold 20 or so at about £2500 each with 64 k bytes of memory only and with only the Adventure game as demonstration software.

A couple of weeks later, Z-H director Nick Punter turned up at the Software Information Exhibition with Visicalc added to the software repertoire, and with the promise of CP/M-86 coming soon.

But even Punter had no idea when IBM planned to release the machine in a UK version.

Hardware in software

Time was when computer designers virtually built programs into the hardware by the way they connected valves and wires together. Today, on a Tandy micro, they can build circuits into the software, with a program that Wayne Green calls Electronic Breadboard. It simulates the effects of adding or removing electronic components from a circuit, saving a lot of experimenting. Details in Peterborough, New Hampshire on (603) 924 7296.

Scripsit for Model 1

There are so many Tandy users running a text processing prackage called Scripsit that the people who have an old Model I machine must feel jealous. One deduces this easily enough from an enhancement to the Model I, announced by RHA (Minisystems) — an enhancement, which amongst other things, provides lower case letters that are compatible with Scripsit.

The product is a display enhancement, which also allows the user to invert the characters (black on white rather than the normal white on black) and provide a clearer display thereby.

Sigh for Cifer

The name Series 1 normally applies to a rather old and somewhat strange IBM minicomputer, so Cifer will probably not really offend anybody by giving that designation to a new desk-top micro.

Starting at £2700, the machines are notable for the amount of diskette storage they offer, with the three-floppy model 1888 having 2.4 megabytes, rising to the 1887 with 12 megabytes on a winchester and 800 k bytes on one floppy.

The really beautiful machine from Cifer is a different one, however — and it isn't a computer itself. It is an add-in graphics board, with 1024 by 300 point resolution, high accuracy graphics at £650.

It may not be cheap enough for amateurs, but it is pretty nifty looking, isn't it? It plugs into the 2680 and 2630 series machines, providing Tektronix emulation.

The Commodore Vic is expandable. It has to be, because it comes with a measly three and a bit K bytes of memory. But by press time, Commodore still didn't have lots and lots of expansion memory or interface boxes available (or VICs, come to think of it). So Arfon Microelectronics was understandably pleased at getting this little box out.

It contains its own power supply, capable of powering the added boards and also the printer which Arfon expects to put on the market very shortly at £100 or less. Price of the expansion system is £98 including VAT and it will take seven cartridges at once.

Arfon has also put together its own add-in cartridges, and is convinced these will be generally available before the official Commodore ones. Its add-on memory is available to plug into this box now, at a cost of £65 for a 16 k byte cartridge. Details on (0286) 5005.

See Sigh for Cifer

The Printer People

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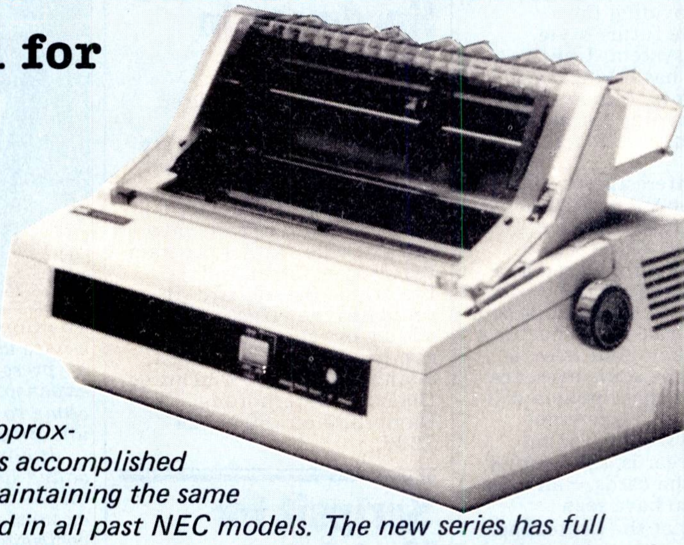

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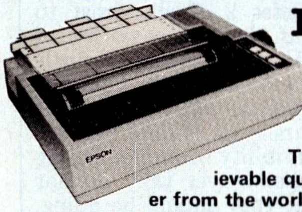

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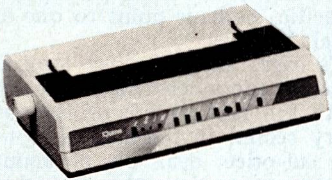

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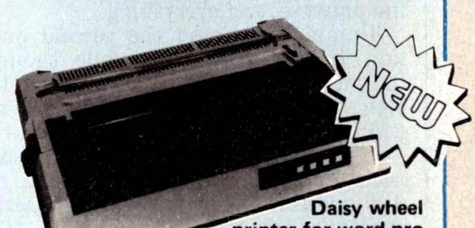

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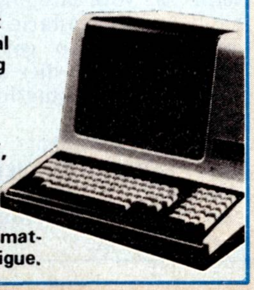

The Hazeltine Esprit is a buffered terminal capable of displaying the complete 128 ASCII character set. Based on a 12" diagonal non-glare CRT, the video is crisp and clear with each character presented on a large matrix to reduce eye fatigue.

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Banks Statement

HOW SMALL IS BEAUTIFUL?

Martin Banks holds forth on politics, bureaucracy and stuff....

So I said to 'Bumper', said I, 'what do you reckon, then?'

At the time we were sharing a quiet corner at this illustrious journal's autumn fete at the Cunard Hotel (the one where Mike Sterland employed all those cute little midshipmen). I had managed to corner one of the personal computer industry's most sagatious sages, 'Bumper' Harris, the man whose finger is really on the pulse of who is doing what, with what and unto whom. I felt it was time to ask him some serious questions.

So I said to 'Bumper', said I, 'what do you reckon, then?'

His answer was most revealing. 'Interesting,' he said, after a great deal of consideration. In fact, he gave the same answer to the two questions I had asked him. The first concerned the potential for government intervention in the business, and what the end result might conceivably be. The second concerned the ultimate question of life, the universe, and everything.

Bumper pondered the second question first and after a while thought the answer might lie somewhere in the high 30s. 'But maths was never my strong point,' he added, defensively.

Having thus cleared his mind of such trivia, he turned his attention to my first question. 'Now this is of far greater import,' he said importantly. 'The potential for government intervention is limitless within all normal bounds of reason,' he continued, 'and the scope for Government to make a complete and utter balls-up of it is directly proportional.'

These seemed harsh views indeed from one so close to the heart of the matter. It appeared that, maybe, they required just a little clarification. Being brave, I asked for it.

'Well, look at it this way,' he said, 'any government worth its salt is going to want to do the best it can for the people it governs.' At this point, it seemed Bumper's clarification needed clarification.

'I'll rephrase that,' he said. 'Any government purporting to be freely elected by the population will be keen to be seen doing what the population can be convinced is the right thing for those people, so that the government will get re-elected next time around. Clear?' Certainly, it felt better the second time.

'So,' he continued, 'one significant option open to the government is in the economic area, the object being to keep as many as practicable of the population in jobs so that they can be convinced they are useful to society. In this way, lots of money keeps changing hands as wages are earned and spent and shareholders get rights issues aimed at them; and the government takes a slice of all the action in taxes.'

Okay so far, but what has this to do with government intervention in the microcomputer business, I asked.

'I'm coming to that,' he said. 'When a nation, or geographically definable governed area, gets to be rather old its opportunities for providing useful means of obtaining a tax take from the population - ie, keeping them working - is directly proportional to the intrinsic age of the indigenous industries. Old industries will tend to show signs of senile decay, usually quite rightly, and they should be allowed to die.' But that won't get many votes. It seemed a logical question, so I asked it.

'Right,' he said, 'so governments are left with two options. One: they can inject monkey glands into the old biddies in the hope that there will be a miraculous recovery. Two: they can do something completely different, and probably make a cock-up of it. On balance, the monkey gland treatment gets the vote by most governments because the cosmetic effects look good in the short-term, and the short-term is vote-catching. But as often happens with miracle cures, the patient only appears to get better. When it keels over and dies it is often rather sudden, and sometimes spectacularly messy.'

But governments are trying some new things, I suggested to him, especially in the microelectronics and general new technology area. What of these? I asked.

'Yes,' he said, 'many of them have cottoned on to the monkey gland syndrome at last, and are trying the second alternative. The trouble seems to be that, as with anything new, it is the nature of the political process not to understand a single thing about the subjects it has decided to support. For a start, the bureaucratic machinery takes over what is often a good theoretical idea and, slowly and inexorably, grinds it into dust.

'Now, I can sense that you are going to ask why.'

I was.

'I will tell you,' he continued without stopping. 'The first Law of bureaucracy is to protect your own backside. The second Law is to build your own empire, thus enhancing the first Law. Any new development, such as a ministerial decision to support a new industry like microcomputer manufacture, poses a direct threat to the first Law as the vast majority of bureaucrats will not understand a single word that is uttered about the business. When this happens, the bureaucrats react quite naturally. It is they that are given the responsibility of implementing any support scheme, yet they do not understand what they should be doing, or how they should go about doing it. They therefore run an immense risk of breaking the first Law. They try to make it look as if they know what they are doing, to fool their political masters, while at the same time making those masters look good to the public. At the same time they actually only do some little bits that they can understand.'

I asked him if he could perhaps be more specific, perhaps point to one or two actual instances.

'That's easy,' he said, 'just look at the education announcement earlier this year. With full fanfare it is proclaimed that every school in the land is to be given a cut-price deal on obtaining a microcomputer. Now this is highly laudable. It is good for the schools and their pupils, it is good for the country's future as all the little children come out into the wide world brim full of computer literacy. It is even good for the politicians that displayed such far-sightedness.

'As it is indigenous manufacturers that are to be supported, it even appears good for the industry as well. But is it? The bureaucrats fail to understand that there is already an enormous groundswell of microcomputing in education, where schools are using machines like PETs and Apples and all sorts. They fail to understand that software is probably more important than hardware and that schools without micros, that are in areas where there are schools already using them, can gain more from being allowed to buy the same machines, even at full price, than from buying something different at an enormous discount.

'The worst sin in my view comes in the administration of the scheme; the fact that the administration is actually more important than achieving the purpose for which is was established.'

This I asked him to explain more fully, and he did.

'Look, they have settled on two systems from indigenous manufacturers. Just two. Now the two they have selected are both very fine machines. I have no criticism of them at all. But while it appears to provide a degree of choice, it is my own view that the real reason is to make the administration of the scheme as convenient as possible for the bureaucrats. With more than two types of machine involved, the bureaucratic mind would tend to haemorrhage.

'But there are more than two indigenous manufacturers worthy of support. Some of them have machines available that, at face value at least, have a great deal to offer the educationalists and pupils. You end up with a scheme that is supposed to partly provide overt support for local industry actually being counter-productive, actually penalising companies and effectively banning them from a good and long-term marketplace.'

This seemed to beg the question of what 'Bumper' Harris would propose as an alternative. I felt brave enough to ask him.

'I have a variety of alternatives,' he said, 'that range from taking the bureaucrats and politicians outside and shooting them, through to ideas that are more humane but probably less justifiable, certainly from their point of view. One alternative is for the micro business to carry on as it started - just ignore them. After all, the bureaucrats have done little to provide really constructive help so far. They might sulk for a while, but the business now seems to have picked up enough momentum to ignore them, if necessary.

'Of course, it would be nice if they gave some real help - or, more specifically, money - with as few strings as possible. If the politicians feel that employment for the people is a major vote-catcher - and I'm sure it is - then they should look to history. No company started life as a multi-national; they all started small. So what we need are lots and lots of small companies. They won't all succeed, of course; in fact, the majority will fail. But so what, some will make it. All you need to do is keep the money rolling for start-ups, and reap the benefits from the ones that make it.'

I ventured that this was not unakin to the venture capital approach; and 'Bumper' concurred.

'That's right,' he said, 'and it wouldn't take too much in the way of money either. Just ten per cent of what has been poured into operations like British Leyland could probably start up a thousand small companies. Each of those would actually employ people, and maybe ten per cent of them would survive and prosper, funding other start-ups.'

I asked if he felt it would work. 'God knows,' he replied, 'but it would be more fun than what we have at present.'

Well, Doctor...

John Jackson goes several steps beyond microholism.

It all started when I saw an advertisement in a magazine which said 'Buy our new powerful fantastic computer and you can run your own power station, control your own home-built nuclear reactor, solve simultaneous equations, play Space Invaders, etc. . .'

Play Space Invaders!! Well, visions floated into mind of sitting down at the pub, waiting tenth in line to blast the invaders to bits. Oh boy! No more waiting. A Space Invaders machine to myself. Wow! I must have one, gimme gimme gimme. 'Please let me have one dear, drool, teach the kids, drool, gimme, Space Invaders all to myself, yes dear, future for the kids in computers, etc, etc.'

The waiting was awful, Doctor, truly, *awful!* Three weeks it was. Seemed more like three years. Then it came, Doctor. 'It's here! Ha ha ha ha ha, it's here! Put the kettle on, dear.' It was a big box, I remember. Everybody gathered round. Just like Christmas it was. I think it was then, just at that moment as I looked at the box that my condition started, Doctor. I mean you know what Russian dolls are like? You open one and there's another smaller one inside? Well, it was just like that. A big box to begin with and then a smaller box inside and then some packaging and another smaller box and so on until at last this plastic piece of rubbish, this totally useless piece of modern technology trash, this utterly utterly. . . Oh! It's okay Doctor. I'm okay now. Sorry, I'll continue now — well anyway, I got this piece of the equipment out onto the floor along with the other bits and bobs and had a look to see where everything fitted together.

A couple of hours later I managed to get a small square on the TV screen and started to look for the 'start Invaders' button. *It's all a con I tell you, Doc. It's evil the way they con innocent people Doc, it's evil, evil, evil, mmmm m m mmmmm mmm m m mm.* You'll have to excuse me, Doctor, I'll be okay in a minute. Okay, I'm fine now. By the way, you don't happen to have a proper Space Invaders machine in your consulting rooms do you, Doctor? No? Oh well, never mind. Anyway, when my wife picked up the bits and pieces from the far side of the room, she suggested I read the book and see what it said. Maybe it could tell me what to do to make Space Invaders work. . . Well, to cut a long domestic crisis short, I had to send money to get a cassette with Space Invaders on it before I could start!

Wendy Hoile

Did they tell me that in the magazine ad? Oh no. Nothing about buying one shiny new fantastic powerful wonderful magic FBX92 machine for £35,000 and then send another £2000 for a cassette to play Space Invaders on it! Oh no, they don't tell you that, do they? Oh, sorry Doctor, I didn't know I was holding your neck so tight, sorry. . . Anyway where was I?

Oh yes. I got their miserable cassette. 'Zap the Klingons before they tramp on you!' That's what it said, Doc. 'Blast the Zombies before their lasers blow you to smithereens' it said. Do you know what happened? No? Well, I'll tell you. I loaded this cassette, sat back and pressed the button ready for anything the Klingons could throw at me. What happened was that three small black squares appeared at the top of the screen and an 'X' at the bottom. 'Probably testing the screen before the fun starts,' I thought. Then a question mark appeared from the first black square and moved slowly down the screen and the 'X' disappeared . . . Then a message appeared: 'You are dead, earthling — Klingons rule — press newline for another try, another try. . .' Where were the bug-eyed monsters, the moving saucers, the rockets, the lasers, the moon bases, the noise, the excitement? Nowhere to be seen, Doctor. Three black squares, an 'X' and a question mark and that was it. It had about as much similarity to the real Invaders as a doorbell has to a Brandenburg Concerto. Well, I was okay after my three weeks in the intensive care unit for a coronary, but it still affects me sometimes at night Doc. I sometimes wake up in a sweat thinking of all those games of the real Invaders I'd missed, spending all my money on three black squares, an 'X' and a question mark. . . I just get up and have a game on my very own real Invaders machine I now have in the corner. Admittedly it cost me an arm and a leg but now I'm a sane, healthy, normal person once more. I just feel the need to tell somebody about my experiences sometimes and I feel good for another couple of weeks.

Well thanks, Doc for talking to me. You can come out from under your desk now, Doc.

A Doctor writes: At times like this, I find it useful to remember the words of the great Mongolian sage, Lao Tse Bhom: 'When in worry or in doubt, run in circles, scream and shout'. If that doesn't work, take two asprins and get plenty of rest. Next please.

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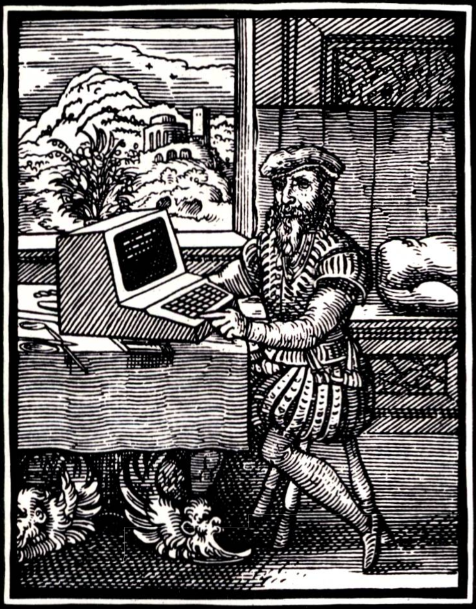

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Caxton

David Tebbutt brings you the latest update.

Shock! Horror! No ComputerTowns have started this month. Oh well, it is December and who wants to start something new just before Christmas? I'm sure business will pick up again in the New Year.

Despite that somewhat gloomy start to the News, there are plenty of good things happening. We've had our first letter from CT Harrow which, at the time of writing, had run five ComputerTown evenings at the Civic Centre Reference Library. Susan Kelly started CT Harrow back in August with half a dozen machines — an Apple, a Nascom and some PETs. She has found that six is about the maximum number of machines that can be accommodated because, beyond this, the noise levels tend to rise. Sue noticed that if games are being played then the noise becomes intolerable for a library environment. Both Eastcote and Enfield had come to the same conclusions and put a ban on the 'Space Invader' type of game.

The Harrow ComputerTown runs on alternate Tuesday evenings between 6 and 8pm but will not run during periods of peak academic activity. The library also provides study facilities and text books for 124 students and there are times when ComputerTown would interfere. Accordingly, ComputerTown sessions will probably be run from early September to early December and mid-January to the end of March. Sue is in the process of preparing a book list which she will send me when it is complete. If appropriate, I'll publish it in this column.

Finally, I'll quote direct from her letter for the benefit of any other librarians reading this piece: 'ComputerTown evenings are good for the library's public relations. Usually, quite a crowd gathers to watch, and the ComputerTown area is full of interested (sometimes baffled!) and enthusiastic people.'

News now of a Town which is expected to start in Tonbridge. Brian Taylor writes from the county library at 4 High Street, Tonbridge, Kent to say that the Area Librarian has given permission for sessions to be run at the new library in Tonbridge starting in the middle of January. Brian plans to use the library from 5 to 7pm on either Tuesdays or Thursdays. Anyone who would like to pitch in and help Brian can contact him at work on Tonbridge 352754 or at home on 351994.

The regular sheaf of news has arrived from Alan Waring of ComputerTown Enfield. Since they are about to install a ZX81 in the library permanently, they are designing a sort of computer 'driving test' so that people who have passed may use the machine out of ComputerTown hours. Alan's newsletter makes the following points: validation is on operating, *not* programming; operating instructions will be provided on a stand-up card by the side of the machine; instruction classes will be held in preparation for the test; the test would be on machine operation and what to do when things go wrong; and validated individuals would be given a card enabling them to use the machine outside ComputerTown meetings.

Among other things, Alan's newsletter also mentioned the ban on the Space Invader type of game.

ComputerTown USA wrote this month asking for details of our constitution for inclusion in a forthcoming 'ComputerTown Implementation' package they are preparing. I'll give you more information about what sounds like an interesting kit when it's ready.

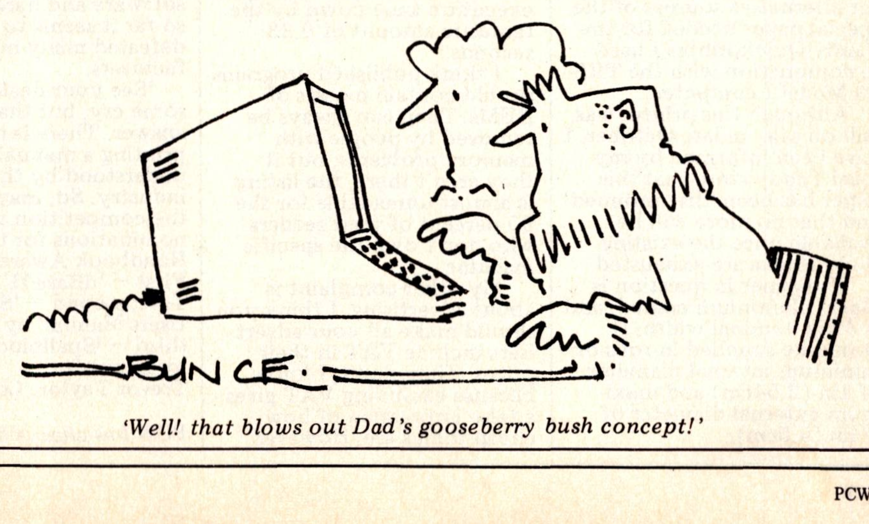
Now for the serious enquiries. These are people who sound as if they'd be interested in starting a ComputerTown. If you'd like to help them then I know they'd be delighted to hear from you: Alan Hardy, 3/177 College Road, Moseley, Birmingham B13 9LJ; P Pullen, East Finchley Library, High Road, London N2; R L Hall, 9 Brackendale Avenue, Arnold, Nottingham NG5 8DQ; Mr R J Cheeseman, 66 Totterdown Lane, Oldmixon, Weston Super Mare, Avon BS24 9NJ; J N Buttler, 15 The Brow, Brecks, Rotherham, Rotherham 544233 (home) or Sheffield 446333 (office); Jim Turner, 63 Millais Road, London E11 4HB, 01-558 3681. Jim has been on the microcomputer scene for a long time and has close links with the East London Amateur Computer Club. I suspect that we'll be hearing about at least one new Town from Jim in the near future.

Maggie Jefferies writes from The National Federation of City Farms. Maybe this is the start of ComputerFarm UK. Maggie can be contacted at 15 Wilkin Street, London, NW5 3NG. Telephone 01-267 9461.

Other enquiries this month came from Rochdale, National Westminster Bank's Computer Users Group in Birmingham, Northallerton, Leighton Buzzard, Folkestone, Harrow, Nottingham, Amersham, Isle of Dogs, Pinner, Staines, Ruislip, Gillingham, Finchley and Glasgow. Strangely, we've had four enquiries from Glasgow, all from the same place — Dowanhill. If you want to be put in touch with anyone from any town mentioned since *PCW* started running ComputerTown News then just send an SAE and I'll dig out the details from our database. Make sure that your covering letter makes your requirement clear.

Thanks to all those who have written this month. I look forward to hearing from lots of new ComputerTowns early in the new year.

ComputerTown UK! is an ever-growing network of computer literacy centres, where members of the public are given free access to microcomputers, courtesy of those willing to volunteer their time and equipment. ComputerTowns might be found anywhere: in a church hall, a library or maybe in a school after hours. The emphasis is on making computing enjoyable and non-threatening and, because Computer Town is entirely non-commercial, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL and remember to enclose a large SAE (A4 would be fine) for your reply. Please don't try to telephone *PCW* for information because this project is entirely a spare-time activity.



'Well! that blows out Dad's gooseberry bush concept!'

COMMUNICATIONS

PCW *welcomes corespondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to:* 'Communications', *Personal Computer World*, 14 Rathbone Place, London W1P 1DE.

Microsoft editing

Do I know something no-one else does? Your correspondent R Silson states that one can't duplicate program lines in Microsoft Basic using the EDIT function. I have been able to do this quite easily.

The technique I use is not mentioned in either the Basic manual which I used with a Vector Graphics System B or in the Apple softcard manual, but it always works. Perhaps Microsoft doesn't know what its own system is capable of.

The following sequence will duplicate a program line:

1. Call EDIT (line number);
2. Press RETURN — line is displayed in full;
3. Press control 'A' - exclamation mark appears with cursor on same line;
4. Press 'I' for INSERT and type new line number;
5. 'ESC' will end insert mode as normal — old line number is no longer there. Press return;
6. Old line still exists in program plus.

So no patching is needed.. With so many copies of Microsoft Basic about I'll be surprised if no-one else has come across this trick. If not, I'll be pleased to receive a 5p donation from everyone who finds this routine useful towards my new computer fund.

P H Elliott, Thundersley, Essex

Paper plea

I am writing to appeal to your readers and advertisers for alternative sources of the special paper needed for the Tandy Quickprinter I used in conjunction with the TRS-80 Model I computer.

Although this printer was still on sale in late October, I have been informed by my local Tandy store that this paper has been 'discontinued' and that no more will be available once the existing (low) stocks are exhausted.

The paper in question is black, aluminium coated, and is 4¾in nominal width. It would be supplied in rolls of minimum internal diameter of 1in (2.54cm) and maximum external diameter of 2¼in (5.5cm).

I expect there will be other readers who would be glad of this information, if it could be obtained.

Martin A Kennelly, Derby

Atari interpreter

I was very interested in the article 'Inside the interpreter' by A F T Winfield (*PCW*, January). I ran the same test programs on an Atari 800 and other readers may be interested in the results.

Test Program 1
(FOR A = 1 TO 1000
NEXT A)
ran in 1.7 seconds compared to the Applesoft's 1.4 seconds. Test 2 (with LET B=1) ran in 3.1 seconds, the same as Applesoft. Test 3 (with LET B=1000 + (1000* 1000)) ran in 6.6 seconds, compared to Applesoft's 15.2 seconds.

Then I took three lines of the test and reran the program using one multiple statement line. I thought that would make execution quicker — it did, but not by very much: 0.15 seconds, in fact.

Deleting the LET from the original did not make the program run any faster at all. Changing the 1000 to a predefined variable ZZZZ gave a speed improvement of only 0.05 seconds — much less than the 50 percent improvement with Crystal Basic.

One of the great pains of computing is trying to read badly documented listings — which means virtually every one I've ever seen in the UK — so I added seven lines of REM statements to pad out the test. These took up 212 bytes and slowed the program execution time down by the fantastic amount of 0.33 seconds.

I think published programs should contain masses of REMs. They can always be removed by people with memory problems, but if they aren't there, the listing is almost unreadable for the 90 percent of your readers who don't own the specific machine.

My other complaint is about advertising. I think you should make all your advertisers include VAT in their prices. They don't, I know, because excluding VAT gives a false impression of how cheap things are. However, probably 95 percent of your readers *have* to pay VAT, and the ones who don't are no doubt capable of subtracting it if they really need to.

Apart from that, keep up the good work on the magazine.

Jack Schofield, London

Manuals belaboured

May I, through the columns of your excellent magazine, suggest a competition to be run through 1982 with the monthly winners going in for the annual award to be announced in January 1983?

The prize is for the worst handbook... and from what I have seen, the competition is fierce.

Why is it that most manual authors appear to think in machine code and have difficulty in converting their neat computing tricks into English so that others may share their skills?

I have been the owner of a Superbrain computer for some months; together with the computer I bought the Spellbinder word processing package and a database system called dBase II. Now, I have every reason to believe that when coupled to my Sanders 12/7 Media printer I have a potent system, but I'm damned if I can fathom the dBase II handbook. The Superbrain tome makes up in weight what it lacks in clarity and even Spellbinder, though by far the best of the trio, is far from clear.

I do not believe that it is difficult to write clear, logical handbooks to accompany software and hardware, but so far it seems to have defeated many manufacturers.

'See your dealer,' I hear some cry, but that is not the answer. There is no point in printing a manual if it is only understood by those in the industry. So, may I kick off the competition with my own nominations for the 'Duff Handbook Awards 1982'? First — 'dBase II' by Ashton Tate; second — 'Superbrain Users Manual' by Intertec; third — 'Spellbinder Manual' by Lexisoft.

Trevor Taylor, London W1

PCW *has always been aware of the rarity of good documentation; we even have a separate section for its evaluation in our Benchtests. Should Mr Taylor's awards ever be presented, however, I don't think his three nominations will even figure in the top (or is it bottom?) ten! — Ed*

Speak no eval

I was interested to read your reviewer's comments on the EVAL function built into the BBC Microcomputer. Is this operation all that unusual? I have used VAL A$ on my Sinclair ZX81 to perform what seems to be essentially the same operation — eg, the program

```
10 LET A$ = 'X**2—3*X+6'
20 PRINT VAL A$
```

gives 4 if (previously) X has been assigned the value 2. I use this in a small program to turn my ZX81 into a calculator:

```
10 PRINT TAB 9;'CALCUL-
ATOR';TAB 41;'=========='
20 PRINT
30 INPUT A$
40 PRINT A$;' = '; VAL A$
50 GOTO 20.
```

A$ is then input as the expression to be evaluated (which may contain any function, eg, SIN and indeed logic expressions such as AND).

G W Dorling, Wymondham, Norfolk

Instrument flying

In answer to the question put by B M Neary, Coventry (*PCW*, November) regarding simulation intrument flying, I know of three programs: 'Air Flight Simulation' from Instant Software, Dept HC-2, Peterborough, NH 03458, USA, cassette $9.95, for TRS-80 L1 and L2, Apple II 16k (Applesoft); 'Sublogic A2FS1 Flight Simulator' from Sublogic, Box V, Savoy, Il 61874, USA, disk $33.50, for Apple II (write-up of this program in July/August issue *Computers & Programming*; 'Flight Simulation' from Elcomp, cassette $17.95, for Atari 800 16k, Tandy Colour Computer 16k.

I have not used any of

these programs but a friend tells me that the Sublogic program is particularly good, so perhaps you could pass this information to Mr Neary or even publish it!

Thanks for a great column and a great magazine — I'm a regular reader.
Rod Stewart, Singapore

Worried

I have been puzzling since November over a problem which I have tried to program for my Apple. The crunch finally came in December, by which time neither I nor my Apple had come up with a solution.

The problem is how to fit 12 issues of PCW into a binder which is clearly designed for only ten.

My Apple did suggest that I stop buying *PCW*, but since I have only just taken out a subscription, I rejected this option.

Can you help?
L E Upton, Bexley, Kent

Since PCW *is continually increasing in size, in a non-linear fashion, the problem is a version of the well known 'knapsack problem' which defies easy computer solution. The partial answer is that we've made the binders bigger — Smart-ass Ed.*

Taxing application

In the 'heavy' newspapers and other business press there is a study flow of news, editorial and correspondence about the use of computers in the Inland Revenue. At the moment, a major topic within this brouhaha is the proposal that a local income-tax should replace the rating system as a means of raising revenue for local authorities.

The Chairman of the Board of Inland Revenue (no less) has stated categorically that conversion of the PAYE system to computer is planned to take several years, and that the Inland Revenue should not be asked to handle local income-tax during the transitional period.

I have just completed my 1980/81 tax return (yes, I know it was late, but have good reason and the agreement of the IR!) The questions are not always simply phrased and the explanatory notes do not, but completion of the form itself is relatively simple. Having seen a moderately bright 11 year old programming the ZX81 and a TRS80 with relatively complex mathematical tasks, I reckon a similar 12 year old should be able to write a Basic program:

1. To calculate the code number from the 'Claim for Allowances' section.
2. Work out the tax under/overpaid from last year's code and actual income.
3. Replace the tax tables used by the employer; essentially these apportion the tax allowances and tax-rate break-points over the weeks/months from the start of the year, and then apply tax at the appropriate rates to the residues.

I would guess that the whole lot would run comfortably on the 'GLS' version of most home micros, so perhaps one of your readers could have a crack at it and save the Inland Revenue six years hard work.

Inevitably, figures have to be checked before entry, but this is not in any case a job for the computer. Even so, a cross-check for inconsistency with previous years' returns could rapidly be programmed.
M Campbell Jones, Dinas Powys, South Glamorgan

Price Goof

As we at Terodec (*not* GDSS), especially Paul Joyce, are pleased that our new business system, PBM-1000 impressed Guy Kewney, we are a little upset that he didn't report the price correctly.

The PBM-1000 does in fact cost approximately £4000 and not £7000 as stated. The heading should have read: 'Faster and Cheaper'.
Ellie Joyce, Terodec Ltd, Reading

Help wanted

I am carrying out research into 'applications of microcomputers to small businesses' and I am particularly interested in the problems of first time users.

I would like to get in touch with anybody else researching in this field. I am particularly interested in talking to any small businesses who have used microcomputers, and any consultants involved in the field.
Frank Blewett, Principal Lecturer in Computing, Polytechnic of North London, Holloway, London N7 8DB

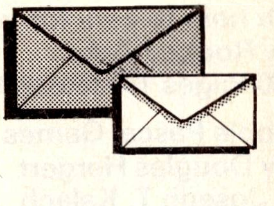
Fortran overlays again

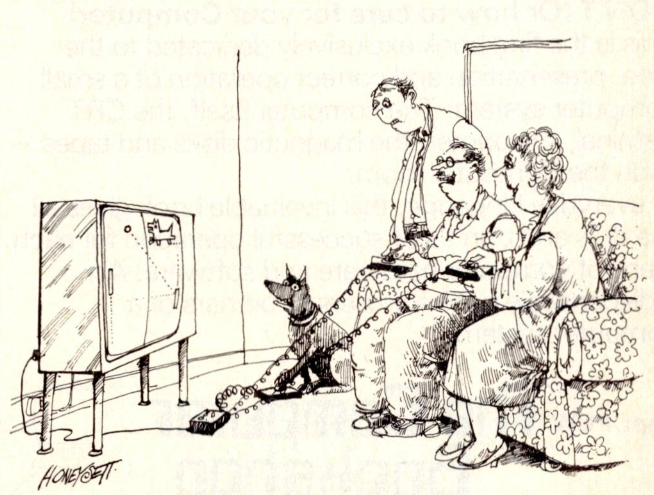
With reference to recent correspondence on the subject of overlaying Fortran-80 programs I should point out that a simple and effective system was openly advertised in successive issues of *PCW*. Clearly Mr R D-Redman, Mr P L McIlmoyle and Mr Steve Withers are unaware of this system — VERA, which is now in common use in several of the nationalized industries, local authorities and other offices. Mr Withers cites an article in what he calles the 'relatively obscure' Journal of the Operational Research Society. No doubt this article would help Mr Redman, but it may be easier to use existing software which is obtainable at low cost. Details are in the July and August 1981 issues of *PCW*.
E W Solomon, Engineering Computations, London

Please don't poke

After reading about the BBC micro, and its excellent graphics specification, I wondered where the 'catch' was; a micro cannot, in my mind, be both excellent in all categories and yet relatively inexpensive. After examining your articles, and a few from other magazines, I have found a major shortcoming the BBC Micro's Basic interpreter does not have PEEK or POKE in its command set. This surely limits its uses for advanced programming, and since it has 32k of memory only, an alternative RAM-based interpreter is pointless. The only alternative would be a machine code routine (on the line of the PET's toolkit) to provide these functions: this should not have been necessary, as the command should have been supplied. This lack makes such accolades as 'As a programmable machine, it will be by far the easiest thing to write useful code on' sound rather hollow.
Nigel Cole, Cuffley, Herts

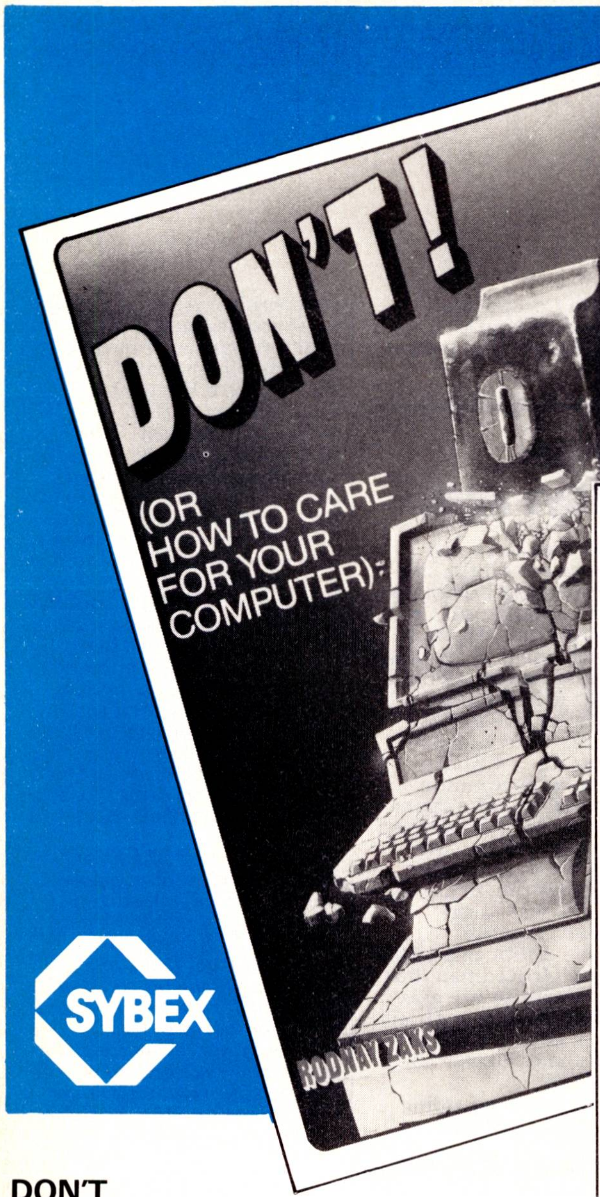
The absence of PEEK and POKE most certainly does not hinder 'advanced programming' (whatever that might be!). In fact, the powerful BBC Basic has sufficient facilities to avoid the need for these commands. Far from being a 'major shortcoming', it makes programs just that bit more portable by removing some (but not all) of the machine-dependence — Ed.





'We bought this game for Rex, really. He just loves chasing balls.'

FRESH OFF THE PRESS FROM SYBEX!



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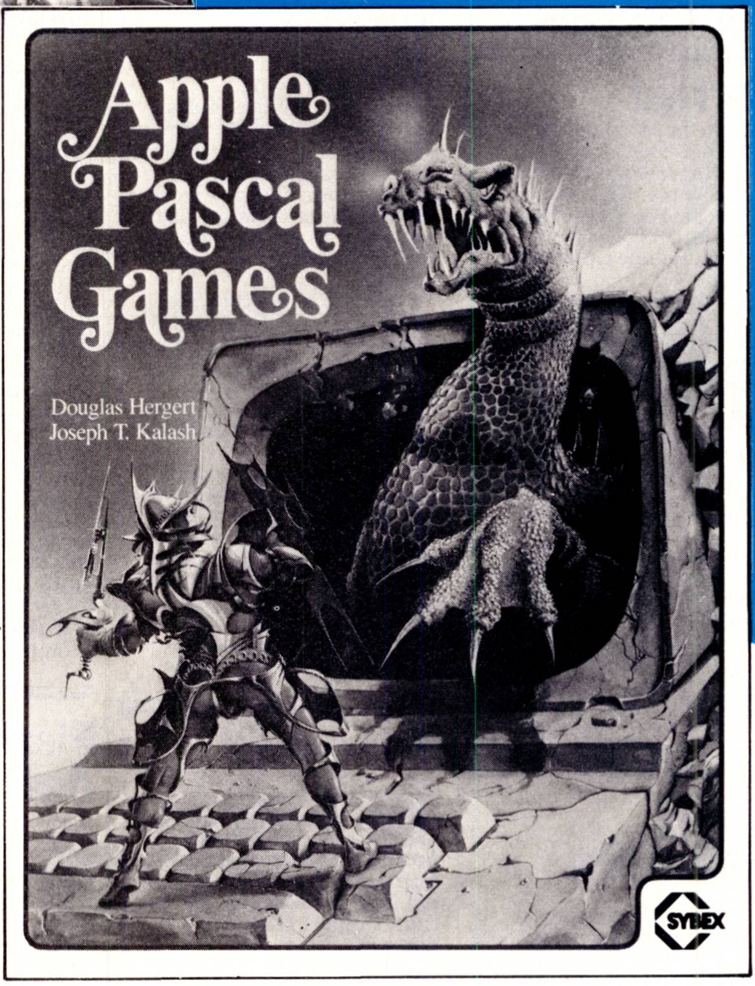

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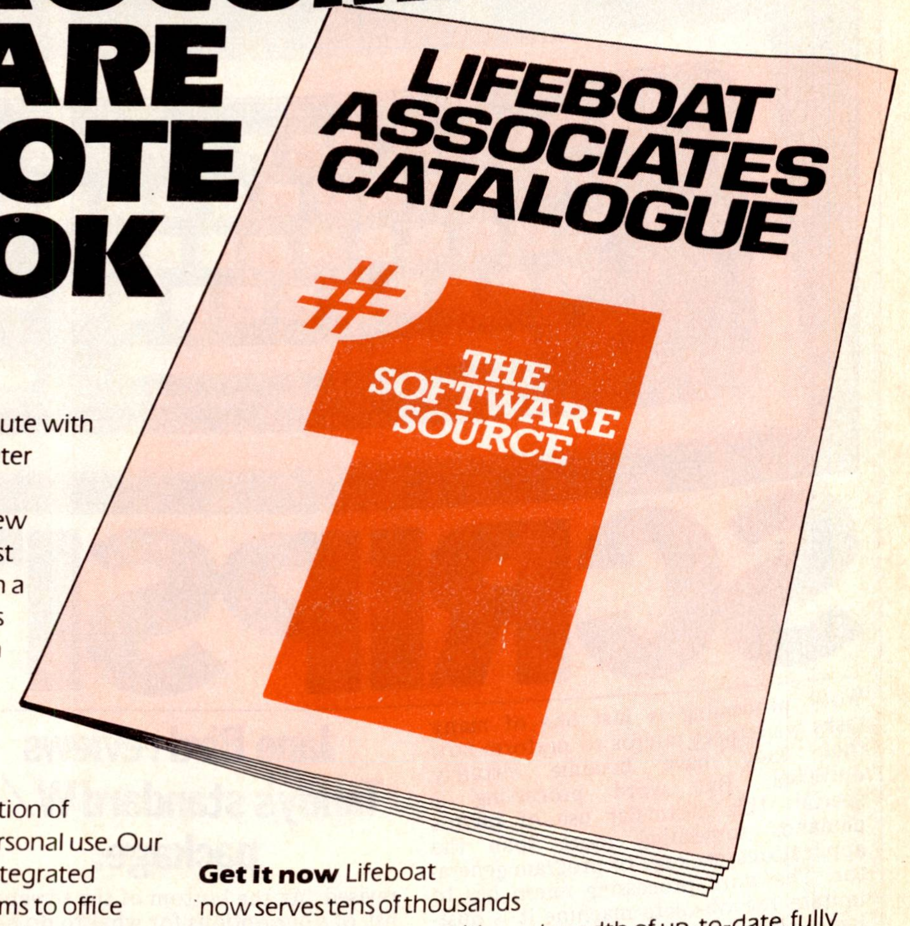

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BENCHTEST
WORD PROCESSOR

SCRIPSIT 2.0

Jane Bird reviews Tandy's standard W/P package.

Word processing is just one of many tasks we expect micros to perform now that they have become virtually universal. But word processing is special: this particular use of micros demands something more than the applications package or program generator. The word processing micro has to imitate the obsolete machine it is ousting — the typewriter — while still being an intelligent terminal or stand-alone computer.

Scripsit 2.0 is the latest version of the standard word processing package for the Tandy TRS-80 and, as such, combines the benefit of powerful computing resources with the drawback of hardware designed also to be used by the programmer.

This test was done on a TRS-80 Model II which includes one 8in floppy disk drive, in addition to which I used a disk extension unit containing two more drives, although this is not essential to run Scripsit. Scripsit comes on its own disk, which also contains a copy of the operating system and space for creating documents.

On loading the Scripsit disk and inputting the appropriate date and time, the Scripsit directory is displayed. Pay due respect to the directory as it tells you a lot about the state of your disk and is very much the focal point of the system. It also appears on completing a utility or exiting from a document. The directory shows details of five documents at a time from the disk and you can scroll through to find the rest. The sort of details given include a brief description of content as entered by the user on each header, dates when the document was created and revised and the amount of space it occupies on the disk, with an 'efficiency figure' relating to how many times the document was revised. At the bottom of the screen is a list of your options for what to do next, each activated by a single letter command and pressing 'enter'. You can open one of the documents, copy one, print, delete or create a new document. (New documents are always listed at the beginning of the directory.) You can also jump straight to the directory for the next disk, or end the session.

To open a document you simply align the cursor against the appropriate name and press 'enter'. This brings you straight to the document's header, the 'open document' menu which has eight responses you have to go through. The open document menu includes information identifying the document and specifying how many lines you want on a page. It displays updated figures on size and usage of the document. The 'create new document' menu also lets you state whether you want a vertical document with margins anywhere between columns 1 and 96, or a horizontal document with margins between columns 1 and 156. You tab through pressing 'enter' if you are changing the responses and 'escape' if you are not.

As soon as you've made it through the menu, a clean screen leaps into vision. At the bottom of the screen is the 'format line' and below that a status line which reminds you what page, row and column you are on. At this point, you can set up your special formats if you like, although at any stage within a document you can jump the cursor into the format line and alter margins, paragraph indent or tab settings. One very useful feature when inputting text is the ability to go into 'full video' mode, press CTRL and V, and have all the document's internal format commands displayed on the screen. This lets you see precisely where you have pressed 'enter' for a forced end of line, or 'tab', or simply let the soft wrap-around take effect.

The wrap-around prevents division of words and puts the whole word onto the beginning of the next line, but it is not perfect. One problem arises if you reach a full stop at the last position on the line. The following two spaces are wrapped around to the beginning of the next line where they look very odd. Of course, they can be edited out later.

On the subject of wrap-around, however, I did have one inexplicable 'bug' where the system failed and left me with the last letter of the word on the next line. I was building up a column of information on the right-hand half of the page and had margins set at 35 and 70. On typing the word 'advertising' I got 'advertisin' at the end of the first line and 'g' at the beginning of the second. Perhaps the computer was trying to introduce a more vernacular style into my turgid prose, but experiments showed the same thing happened when other words were substituted.

One advantage of using the 'full video' mode when editing is that you can see when the existence of a forced end of line, for example, is preventing text from shuffling back into the shape left from a deletion. But the confusing thing about editing with these format codes in view is that, while ordinary characters can be overtyped on the screen, format commands have to be deleted and then re-entered. Familiarity probably eliminates this problem, like others on the system.

Inserting and deleting can be done by pressing two keys to the far right of the keyboard marked F1 and F2 respectively, presumably so named on account of their function for the programmer since the abbreviation has no obvious reference for the average typist. If you want to delete volumes of text you can use the CTRL-D command which lets you define areas of text in words, sentences, paragraphs and larger blocks. Line centering is done by first entering the heading with a forced end of line and then pressing CTRL-L (mnemonic L for line-centering reflects the fact that the system only centres single lines). You can edit the text as you go along and have up to 22 lines of text in view, constantly inputting into the bottom line of the page.

Formatting

There are a number of ways of specifying how you want the text to be printed, the most obvious being to input special print codes within the text as you type. To get an underline, for example, you input the underline code at the beginning and end of the text you wish to be affected and similarly for text to be printed in bold. One obliging code allows you to input notes to yourself which will appear on the screen but which will not be printed. However, a problem with these codes is that they involve two distinct operations, first pressing 'escape' to get out of the straightforward text input mode and then using the shift key in combination with another key to input the command. This can be very laborious if you are writing something which needs lots of words underlined or in bold, and a shortcut I used was the search string utility. This allows you to choose your own shorthand, 'XX' for example, and at the end of the piece change every occurrence of 'XX' to, say, 'campaign for user-friendly micros'. The search string facility gives you the option of stopping as each string is found and checking that you want it to be deleted or replaced.

An apparent inconsistency means that the system ignores a single underlined space at the beginning of a line, which might later have something filled in by hand. The printer will simply not print unless you take the precaution of using the 'required space' command (ESC pressed with space bar). The same goes for the end of a line when the text is being right justified.

A gaping hole in the print facilities, however, is the absence of the vertical line. In fact it's there on the printwheel and a sufficiently dedicated user could work out the routine for using it, but there is absolutely no reference in the manual to the vertical line. This seems to ignore any need to put text in columns or boxes and offers no easy-to-use facility to draw lines round things on the screen.

There are commands for a wide range of diacritic marks, superscripts and subscripts.

The second method of affecting the final printed copy is by use of the format line which, unlike the print codes, allows you to see on the screen the effect of your format commands. Basically, the format line deals with tabs and margins but there are permutations of each. There is the 'outline' marker which determines the position to which the cursor will return after any forced end of line. The left margin can be to the right of the outline marker if you want the first line of each paragraph indented, and left of the left margin if you want paragraphs to start to the left of the rest of the text.

There are three different types of tab, a fact which seems unnecessary at first, but they do all perform discrete functions. Apart from the ordinary use of tab, you can also have aligning around a decimal point which is useful if you have columns of figures that run beyond the decimal point. By typing tab marker '@' you have the option of either function with the same tab marker.

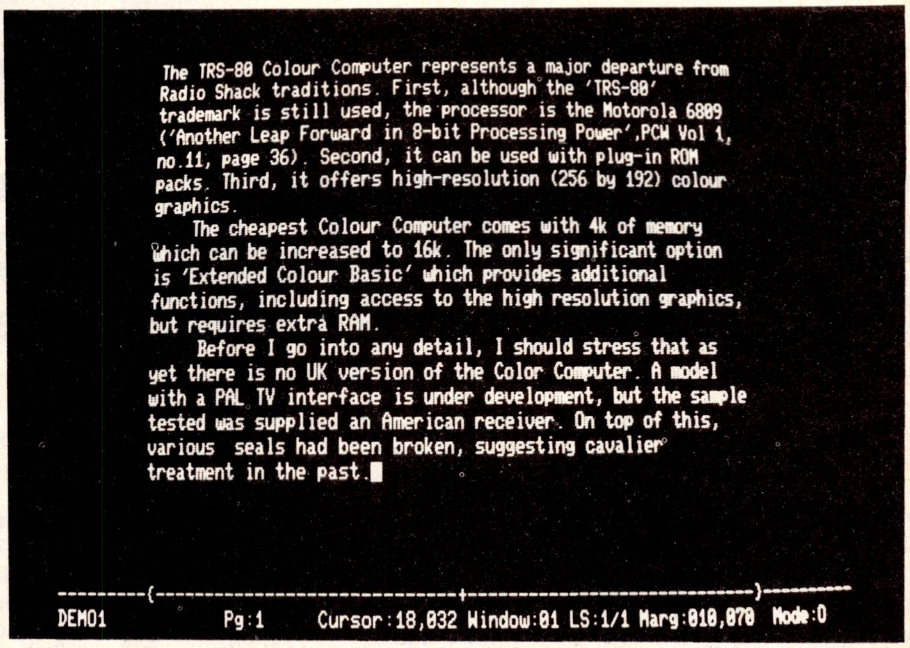
Printing

Whenever you try to print a document you will be presented with a print document menu. Apart from specifying precisely which pages you want to print, it also offers you another chance to affect the appearance of the text on the page. Options given include defining the column position for the left side of the paper, by justifying in character or word increments, and specifying the maximum number of lines on a page. Again, however, there is no way of bypassing this menu if there is nothing you want to change and you have to tab down through it. If the layout still doesn't look right then you can repaginate or define forced ends of pages. The print monitor menu allows you to pause between printing each page, or to stop printing or to move into another document while continuing printing.

Merging files

One valuable facility of Scripsit for the businessman is the ability to merge information from different files onto one sheet of paper. The classic application for this is the personalised letter with individual names and addresses attached to a standard text.

Merging files is done by creating two documents, one which contains the 'base document' where all variables are identified by names between brackets. You then build up a 'merge file document' which repeats the names of variables that you have used on the base document, followed by lists of what all these may be in individual cases. At the printing stage you can create standard



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The TRS-80 Colour Computer represents a major departure from
Radio Shack traditions. First, although the 'TRS-80'
trademark is still used, the processor is the Motorola 6809
('Another Leap Forward in 8-bit Processing Power',PCW Vol 1,
no.11, page 36). Second, it can be used with plug-in ROM
packs. Third, it offers high-resolution (256 by 192) colour
graphics.
    The cheapest Colour Computer comes with 4k of memory
which can be increased to 16k. The only significant option
is 'Extended Colour Basic' which provides additional
functions, including access to the high resolution graphics,
but requires extra RAM.
    Before I go into any detail, I should stress that as
yet there is no UK version of the Color Computer. A model
with a PAL TV interface is under development, but the sample
tested was supplied an American receiver. On top of this,
various  seals had been broken, suggesting cavalier
treatment in the past.█



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DEMO1          Pg:1    Cursor:18,032 Window:01 LS:1/1 Marg:010,070  Mode:0
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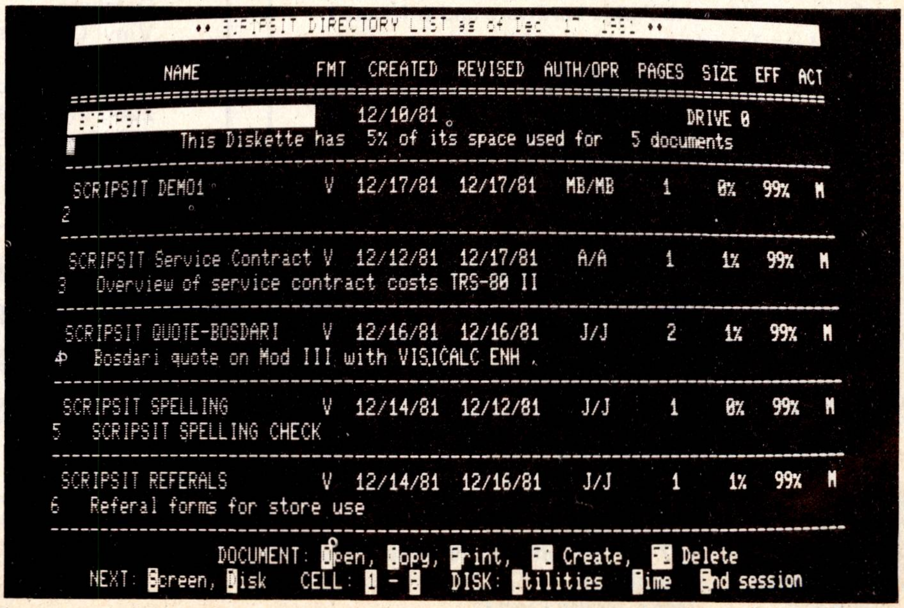

```
          •• SCRIPSIT DIRECTORY LIST as of Dec  17  1981 ••

        NAME             FMT  CREATED  REVISED  AUTH/OPR  PAGES  SIZE  EFF  ACT
===============================================================================
 SCRIPSIT                     12/10/81                        DRIVE 0
█         This Diskette has  5% of its space used for   5 documents
-------------------------------------------------------------------------------
 SCRIPSIT DEMO1            V  12/17/81  12/17/81   MB/MB     1      0%   99%  M
2
-------------------------------------------------------------------------------
 SCRIPSIT Service Contract V  12/12/81  12/17/81    A/A      1      1%   99%  M
3   Overview of service contract costs TRS-80 II
-------------------------------------------------------------------------------
 SCRIPSIT QUOTE-BOSDARI    V  12/16/81  12/16/81    J/J      2      1%   99%  M
4   Bosdari quote on Mod III with VISICALC ENH .
-------------------------------------------------------------------------------
 SCRIPSIT SPELLING         V  12/14/81  12/12/81    J/J      1      0%   99%  M
5   SCRIPSIT SPELLING CHECK
-------------------------------------------------------------------------------
 SCRIPSIT REFERALS         V  12/14/81  12/16/81    J/J      1      1%   99%  M
6   Referal forms for store use
-------------------------------------------------------------------------------
             DOCUMENT: Open, Copy, Print, F1 Create, F2 Delete
     NEXT: Screen, Disk   CELL: 1 - 8   DISK: Utilities   Time   End session
```

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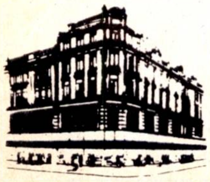

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text with different 'variable' information in each case. Although this facility is most obviously useful to the small businessman who can generate much more effective mailshots by addressing them to named individuals, there are applications for the hobbyist. One example is the production of letters that you may write regularly: 'Dear Mr Shilling. . . please transfer X pounds from my deposit account to my current account. . .' where X might be any one of a number of predefined sums. You can also create a base document which contains wholly variable information, such as lists of names and addresses.

In this case, all the base document contains is a set of identifiers for each piece of information: name, number of house, road, town county, postcode. Printing commands as to where the address should appear on the envelope can also be stored. When the files are then merged you get individualised envelopes generated.

Spelling and hyphenation

Dictionaries against which spellings can be checked are becoming a standard feature of word processing packages and are available from companies like IBM and ICL. They also include the facility for the user to include a list of specialist words that are likely to come up frequently in his own writing. This facility is provided on Scripsit which allows the user to add up to 2047 words of his own to the dictionary's 100,000 words. The dictionary facility is somewhat complicated to use since you are emphatically ordered first to make your own copy of the dictionary onto a backup disk. Then, as with the global search and replace facility, you have the option to stop and check over each correction that the dictionary wants to make. The capacity of the dictionary is huge; it can catch up to 1500 misspellings in one go which ought to be enough even for near-illiterates. It also deals with the hyphenation of words.

Given the considerable processing power of Scripsit it is disappointing that there is no simple arithmetic function. It is quite possible to list columns of numbers but there is no option to run the cursor down them and reach a total at the bottom. Given that this function is easily performed by the flimsiest of calculators these days, it seems an unnecessary omission from the all-singing, all-dancing word processor. Tools to perform simple mathematical functions have already proved to have great popular appeal. Scripsit already handles numbers dextrously with its facility for aligning columns of figures around the decimal point.

Documentation

Since the version of Scripsit that I tested was still very new, there was no completed documentation available. However, my major criticism of the prototype training manual is that the order of introducing the new procedures manual is extraordinary. The method is to direct the reader to perform certain exercises which draw on lessons of the *ensuing* chapter. It is easy enough to find out how to do the exercises by reading ahead but this tends to undermine one's faith in following the manual step-by-step. The reference manual deals with all the same procedures in a much more compact form but its index could prove unhelpful to the non-programmer. You have to be competent in computer jargon to know which words to look up for a solution to your problem. Words like merge, define, format and scroll.

The 'help' facility could be useful here although it is not particularly readable on the screen, amounting to a single line entry for all commands that can be entered under Scripsit, and appears as screens full of text. 'Help' could save you bothering with the manual over a simple command you have forgotten, but is not useful in explaining peculiar error messages on the screen or the apparent impossibility of entering a character where you want to put it.

Good and bad points

The most obvious irritation with Scripsit is the flashing cursor. Although word processing shouldn't require the user to look at the screen much, apart from when editing, the flashing cursor is most unpleasant. However, the method of highlighting text to be deleted or moved elsewhere is very effective and puts all the text concerned very clearly into reverse display.

I also found it laborious that the keys didn't automatically repeat when held down, although this facility can be awkward if you're not used to it. Cursor movement up and down the screen requires holding down the 'repeat' key at the same time as the 'arrow' key or the use of 'hold' to move directly to the top, bottom or either side of the screen. An automatic repeat on arrows would be particularly useful.

There are also no arrows to move the cursor diagonally across the screen. Also, the end of the page isn't marked on the screen, so unless you keep a sharp eye out, your sentences and paragraphs will be split in odd places from one page to the next.

Another straightforward facility which would be useful is to be able to alter upper case to lower case with a single key and vice versa. This would avoid the need to re-type headlines which you subsequently decided should be in upper case, for example. The 'convert-case' key could also be an automatic repeat if held down.

Where pieces of text that you want to alter do not fit neatly into words, sentences, or paragraphs it would also be nice to have a facility to let you run the cursor through the particular phrase or one-and-a-half paragraphs you want deleted.

There are some characters which cannot be printed without special user intervention. The keyboard contains no '£' sign and, by default, the printer makes the numeral '1' and lower case 'l' the same character, a characteristic of old-fashioned typewriters.

Attractive features of the system

You can make an individual document as big as you like up to the capacity of the disk. The 8in high-density disks have a capacity of over half a megabyte (509,184 bytes, to be exact). Tandy claims that it would take a 70-words-per-minute typist 24 hours of typing at speed to fill an 8in disk.

Another plus is that you can work on one document and simultaneously print another without getting any significant degradation on the system. Of course there are some special functions, such as formatting a disk or merging or copying documents, which you cannot do in this mode.

The need to back up documents created every day is made easier by means of the 'back-up' utility which copies disks wholesale at the end of the day at ten minutes a time.

Summary

Scripsit is a word processing package on the sort of micro that you would expect to find in a small business or educational environment. In both situations the user might be expected to be familiar with the rudiments of computing and, given that background, I would expect him to find Scripsit an exciting tool. For example, the dual function of the keyboard means it is often necessary to hold down two keys simultaneously to perform functions. Scripsit is very versatile but could be off-putting to the non-programmer.

Of the *PCW* 'standard users', I would expect the author/journalist to find this system a little over-complex. He/she wants a system that is relatively cheap and easy to use. He has no great need of sophisticated formatting facilities. However, he would benefit from the speed with which you can move around in the text and from the repaginate and page numbering facilities. And he/she might find the dictionary very useful for proof checking.

The technical/managerial report writer might bemoan the lack of simple maths functions but would appreciate the extensive facilities for formatting, printing and making global alterations. Such users could also employ the user-defined area of the dictionary for specialist words relating to their own subjects. However, they might regret the lack of a vertical line or graphics capability.

The manager might find that there is insufficient time to learn the wide range of functions that the system could perform.

The secretary, once familiar with the machine, should be able to make extensive use of it and find the dictionary useful.

Benchmark timings

1	(na)
2	(na)
3	1.0
4	1.0
5	32.0
6	27.0

Printer (Tandy daisywheel): 37.4 cps
All times in seconds.

For an explanation of the Benchmarks timings see *PCW* vol 4 no 4 April 1981.

FRAMES OF REFERENCE

Part 2: Understanding the microcomputer industry

The objective of this section is to provide pegs on which you can hang and relate information about microcomputing. The microchip has stimulated a bewildering array of new suppliers. When you visit an exhibition or pick up a magazine, it is not easy to determine where the various suppliers fit into the jigsaw that will eventually provide a solution to your problem. Even when you do begin to separate the systems from the chips, the golden rule of selection applies: choose the company you keep, choose a professional supplier.

The micro industry is a component industry. No one company dominates micros as does IBM in the field of mainframe computers. Even the arrival of the world's number one computer supplier to the micro scene will not destroy those already established, any more than IBM's entry into minis killed off DEC or Data General. New companies have emerged to exploit the technology and some older ones have incorporated micro elements in their products and systems. Without this dispersal of the costs of product development and distribution, micro technology in itself would not have produced such exponential growth in supply.

The complex array of component companies is as much a minefield to the unwary as it is a goldmine to the educated. The following are the main participants in a complex industry: semiconductor manufacturers; board manufacturers and assemblers; computer manufacturers; peripheral manufacturers; systems software manufacturers; application software manufacturers; software publishers; importers/distributors; dealers/shops; micro systems companies; and maintenance companies. There are two categories of component supplier, 'new' and 'old', specialist and generalist. For example, Dynabyte is a new specialist microcomputer manufacturer, whereas DEC is an old mini manufacturer that has its own LSI chip and microcomputer.

Semiconductor manufacturers

The new specialist group noted for filling the huge demand for chips includes Intel, Zilog, National Semiconductor and Motorola. Existing computer manufacturers with their own chips include IBM, Data General, Texas Instruments and Hewlett Packard. In many cases the demand for chips has been beyond the capacity of the original manufacturers and the business of 'second-sourcing' has developed where one semiconductor manufacturer licences another to make its products.

Because of the investment needed to generate large-scale chip production and the need to guarantee supply in quantity, the business of second-sourcing is very important. OEM purchasers tend to shy away from new chip sets until second-sourcing has been arranged so that they can be sure of regular, competitively priced supplies. The big names in second-sourcing are, not surprisingly, the Japanese: Fujitsu, NEC, Mitsubishi (Intel 8086), Hitachi (68000); the Americans: Fairchild (NS16000), Harris (8086), Mostek (68000), Rockwell (68000), AMD (8086); and the Europeans: Siemens (8086), Signetics (68000), Thomson CSF (68000), SGS-ATES (Z8000). Intel gained ground in the 16-bit market by early entry and by licensing such a strong line of second-source manufacturers. Motorola's more complex product took longer to bring to market and to set up second-sourcing. Zilog looks poorly supported compared to the other two.

The semiconductor manufacturers are the 'mining' companies of the industry, its suppliers of raw materials. Some specialise almost exclusively in raw material supply while a few have developed general purpose computers, eg, Zilog, Texas Instruments and, very recently, Intel.

Board manufacturers/ assemblers

Many of the chip and computer manufacturers contract out the assembly of boards. There are assembly shops all over the world. Additionally, a variety of specialist board makers have become established, whose boards re-appear under the labels of other manufacturers. Some of the recurring names in specialist boards include Ithaca, Morrow, Thinker Toys, Mountain Computer and Tarbell. Some board makers graduate to producing their own microcomputers, such as Morrow.

The practice of buying in boards or putting out to assembly has a strong influence on the size of many major microcomputer manufacturers, in relation to the number of machines sold. For example, Dynabyte employed 60 personnel at the beginning of 1981 and had an installed base of 3000 computers. New companies that have sprung up in Silicon Valley (just south of San Francisco) owe much of their growth to the ready availability and high quality of local 'board stuffers' — companies that put chips on boards. In two years, Convergent Technologies' production of MiniMicros has grown from zero to 80, through the use of such companies. Apple's quite phenomenal growth had a similar basis, though Apple itself has been known to set up a whole assembly factory in a month. The slowly emerging British industry is not so well served (except, perhaps, in Scotland) and suffers in consequence.

A DP MANAGER'S GUIDE TO MICROS

by Alan Wood

Computer manufacturers

Some mini manufacturers have produced cut-down micro versions of their products, but the lion's share of the market is taken up by specialist micro manufacturers. Lead time to supply is an important factor as microcomputers seldom want to wait more than ten-30 days, whereas mini suppliers are usually on three to six months' lead times.

There are four main levels of microcomputer:

Level 1. Home and educational devices, using cassette tape, price range £50-500, examples Acorn, Atari, Sharp, Sinclair;
Level 2. Personal computers, supporting floppy disks, low volume data processing, maths and stats applications, price range £500-2500, examples: Apple, PET, Osborne, Tandy;
Level 3. Tiny business systems, one-to-four users, 500k-20M on-line store, price range £2500-15,000, examples: Altos, Dynabyte, Cromemco, Sirius, IMS;
Level 4. Minicomputer replacement: multi-user machines, local area networks, 10-100M on-line store, price range £8000-30,000, examples: Alpha Micro, Micromation, Nestar, Zilog.

A mistake the novice makes is comparing Ford Escorts with Granadas, or not comparing Apples with apples. Some manufacturers span several levels: PET and Tandy span levels 1 and 2, Micromation and Zilog levels 3 and 4.

The mini manufacturers beginning to influence the market are Data General, DEC, Hewlett Packard and Texas Instruments. Affected by minicomputer pricing, their prices tend to be less competitive and their software base not so extensive as the specialist micro manufacturers. Hewlett Packard and Texas Instruments have both produced personal computers which are especially well suited to engineers and draw on much of the software library developed on programmable calculators.

Hewlett Packard has recently adopted Visicalc, a successful package originally developed for Apple. The trend of software manufacturers converting their products to other machines is developing to the benefit of computer manufacturers and users. DEC has one of the widest ranges of micros of all the mini vendors, starting with a single-user 8in floppy and rising to a multi-user hard disk machine. In October 1981, DEC joined the flood to CP/M, bringing out the VT1 8X, a printed circuit module that plugs directly into the VT100 VDU, converting it into a complete Z80 computer with two minifloppy drives.

The entry of IBM into the market has added several dimensions to microcomputing. Firstly, IBM involvement makes micros respectable, so that many users holding back will no longer do so, although that does not mean they will automatically buy IBM. Secondly, IBM customer base and sales strength is bound to ensure that micros become as commonplace as typewriters. Thirdly, the market for software has doubled overnight as users look for programs to play on their IBM hi-fi. And unlike Hewlett Packard and Texas Instruments, IBM has no base of programmable calculator software from which to stimulate programs, so it is encouraging independent authors, including its own staff, to produce programs. It has a long way to go to catch up with Apple, PET and the CP/M vendors.

Component members of the micro industry

The micro industry is a component industry. The principal members are the following:

1 Semiconductor Manufacturers
2 Board Manufacturers and Assemblers
3 Computer Manufacturers
4 Peripheral Manufacturers
5 Systems Software Manufacturers
6 Application Software Manufacturers
7 Software Publishers
8 Importers/Distributors
9 Computer Retailers
10 Microsystem Companies
11 Maintenance Companies

Peripheral manufacturers

The old and the new grouping also applies here and some of the new manufacturers have produced good, low cost input and output devices. Traditional, established suppliers familiar to minicomputer users include CDC disks, Lear Siegler, Newbury, Hazeltine VDUs, Centronics, Texas, Diablo, DEC printers. New names include Trendcom, Epson and Anadex low-cost printers, Volker Craig and Televideo displays. Be wary of the very latest devices on the market which may not be backed up with maintenance or spare parts. In comparing peripherals, one should draw a clear distinction between heavy duty, all day use devices, and occasional use, lightweight ones.

The new peripheral manufacturers have caused a price collapse on the market and prices will continue to fall as volume demand for products, increase, notably for display screens, disks and daisywheel printers. As much as 50 percent was chopped off in 1980 as new micro-controlled devices penetrated. The Japanese effect is being felt in the peripheral market, especially with printers and disks, and it is significant that a number of US computers already contain Japanese disks and chips.

Winchester disks are presently the most important low-cost storage medium for microcomputers. The first in the market were the 8in variety with typically between ten and 20 megabyte capacities. These were followed by the 5in mini-winnie, five megabyte disks that take up the space of a 5¼in floppy disk drive but provide five to ten times the capacity. The Japanese and Americans are the big producers of winchester disks — Fujitsu and Seagate have a name for good quality products. Rodime is a new UK name in winchester disk supply.

Systems software manufacturers

Three companies have become dominant suppliers of systems software for microcomputers. Each supplier's product is sold worldwide and recognised in the major markets of the USA, UK, Japan and Europe. Each has produced what has become an industry standard or classic. Each has its product regularly endorsed by computer manufacturers around the world. The three companies are: Digital Research with CP/M, Microsoft with MBasic and Micro Focus with CIS Cobol.

Systems software manufacturers are one of the most important elements in the micro component industry. And the most significant of these is a Californian firm, Digital Research, the author of the *de facto* micro industry software standard for operating systems, CP/M.

CP/M, available for virtually all Z80/8080 micros, is at the heart of much excellent systems and application software. More recently, Digital has produced MP/M, a multi-user system which is being rapidly adopted. CP/M runs on both 8-bit and 16-bit micros. Like VHS in the video world, it may not be technically the best operating system but the access it provides to a growing range of programs ensures its ever-increasing popularity. Other operating systems suppliers have to supply hooks under which CP/M programs can be run. And faced with the alternatives, the buyers usually prefer CP/M.

MP/M has even more technical detractors than CP/M, although some criticisms have been answered by MP/M version II. However, a large recent investment in Digital Research should help it retain its leading position through the production of the more sophisticated versions compatible with 16-bit and even 32-bit machines.

Digital has also acquired the second most popular Basic, CBasic and developed PL/1 for micros. The IBM Displaywriter now has CP/M, as has the Wang-

Some popular micros

There are several grades of micro, with popular suppliers in each grade.

Grade 1: Home and Educational Devices
Acorn, Commodore, Sinclair, Tandy

Grade 2: Personal Computers
Apple, Commodore, Intertec, Tandy

Grade 3: Business Systems
Altos, Cromemco, Dynabyte, NIMS, North Star, Vector Graphic, Sirius

Grade 4: Minicomputer Replacement (16 bit and local area networks)
Alpha-Micro, Nestar, Zilog

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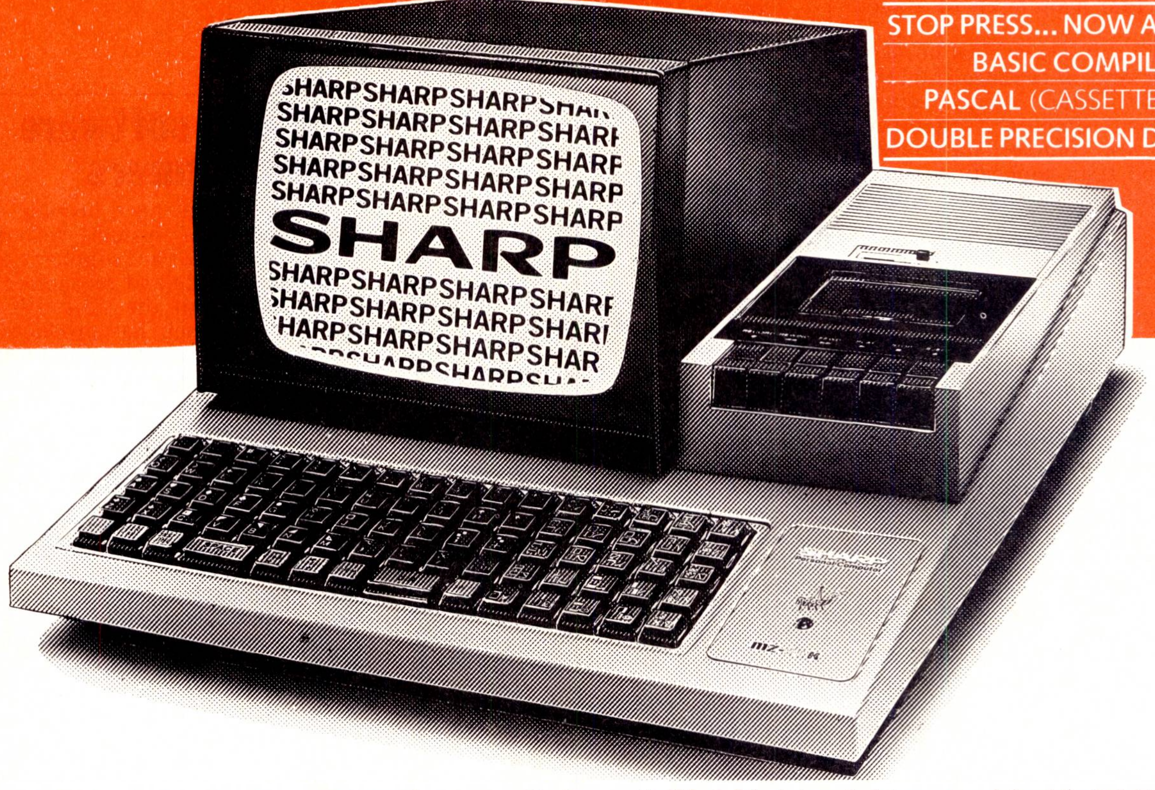

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Products include:- Universal Interface Card, Machine Language and Z-80 Assembler packages, CP/M* plus a comprehensive range of software.

*Trade mark of Digital Research Ltd.

You'll find all the help and advice you need about the MZ-80K at your Specialist Sharp Dealer in the list below.

If there is no dealer in your area, or if you require any further information write to:- Computer Division, Sharp Electronics (UK) Ltd., Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE.

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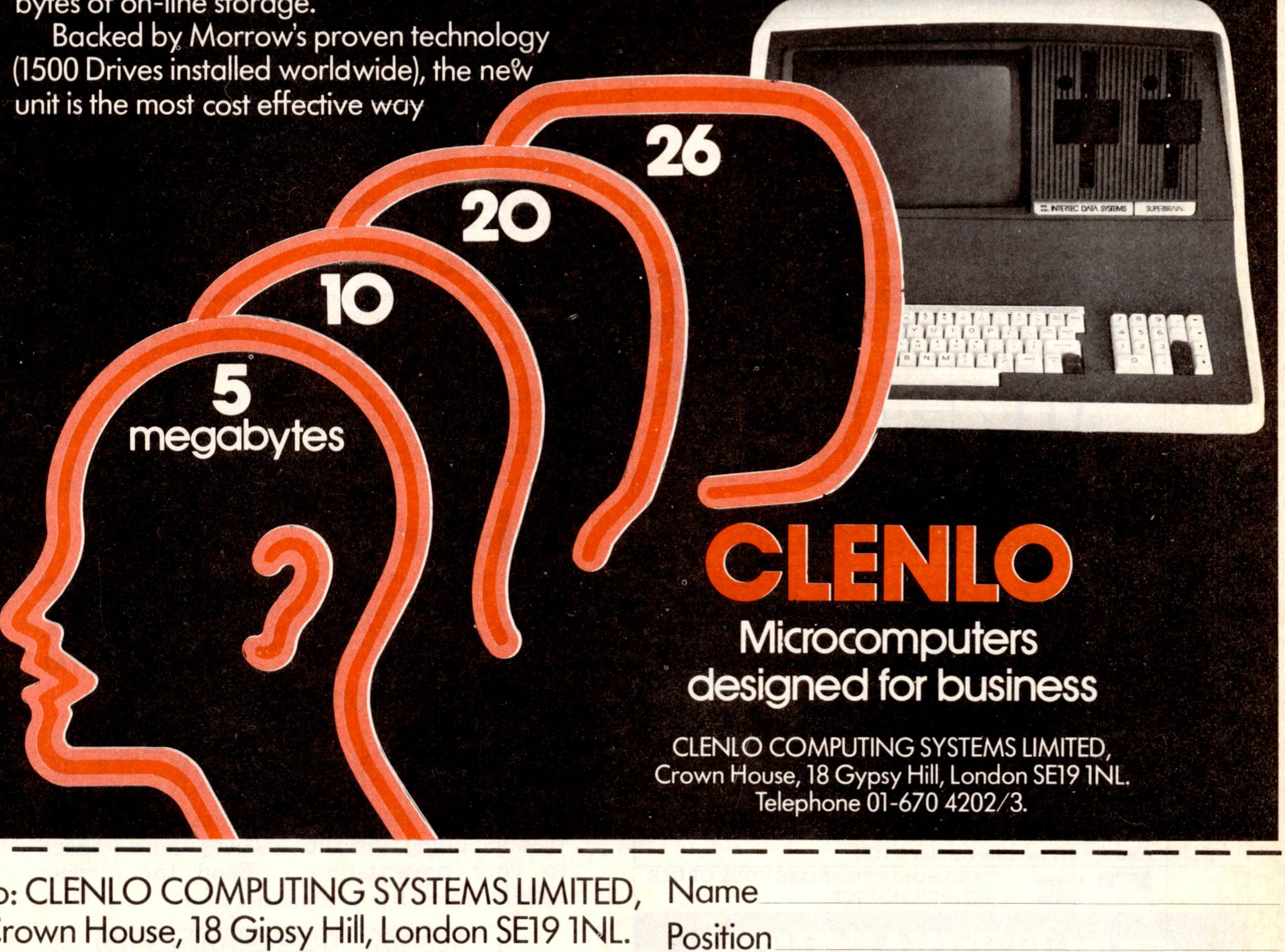

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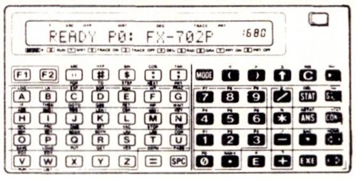

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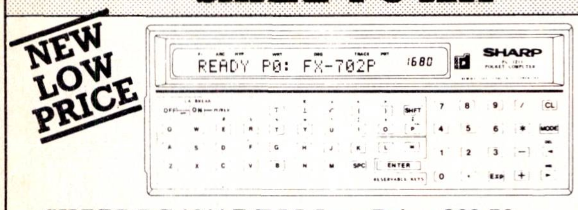

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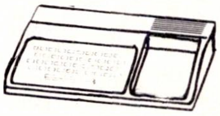

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FRAMES OF REFERENCE

writer and the Hewlett Packard 125. The Japanese have adopted CP/M in the shape of NEC, Sharp and others. Digital estimated copies sold by 1980 was 200, 000, a figure likely to grow tenfold by the end of 1982.

In just under seven years, Microsoft has become the primary source of languages on micros. It was the originator of Basic on micros and supplied the Basic for the very first micro, the MITS Altair. MBasic, available both as an interpreter and compiler, is now in its fifth edition and version six may be issued as this is written. Arguably the main flaw in MBasic is the absence of an ISAM facility, which is to be corrected in version six (there are those who increasingly argue for keeping file management separate from the language, so some regard the absence of ISAM as a plus). MBasic is widely employed throughout the microcomputing world.

Microsoft is not a one-language company; it also has a powerful hold on the Fortran market with Fortran 80, as well as an interest in the Cobol market with Cobol 80 and the Pascal market with MS Pascal. More recently, it has made a thumping entry into the independent operating systems market by supplying MSDOS to IBM and by developing Xenix, its micro version of Unix.

Recently described in the trade press as the 'superstar' of Britain's micro industry, Micro Focus can fairly claim to dominate, if not quite own, the international market for Cobol on micros. Its product has great appeal to Cobol programming shops worldwide and is so structured that it is remarkably adaptable for new machines and operating systems. Micro Focus has penetrated the US, European and Japanese markets in strength. Its product is available on the industry-standard operating systems, CP/M, MP/M, Unix and a growing horde of manufacturers' operating systems. In the USA, Intel, Apple, Vector Graphics, QI and Convergent Technologies all have CIS Cobol. In Europe, Siemens, Tandberg, ICL and R2E have taken to CIS.

Applications software manufacturers

There are now almost as many different accounting packages as there are microcomputers. Each week, a new ledger or payroll package is announced, some very good, many strong in documentation, freedom from bugs and support. Additionally, packages for lines of business and specialist applications, eg, personnel systems, financial modelling and hotel management, are gradually appearing. Existing names include MicroProducts Software, Peachtree, MicroPro. New names will be added to the list and some will be subtracted, having failed to meet the standards of marketing, product quality and support which earn the survivors reputation and profit. MicroPro is an outstanding supplier of generic application software and development aids. Its word processing package, Wordstar, is the industry leader, as is its data management package, Datastar. The MicroPro utility program, Supersort, really does live up to its name. To these it has added Mail Merge mailing with Wordstar; CalcStar, a rows and columns electronic spreadsheet; and soon, Infostar, an information manager. These products are some of the very best in the micro industry and, used in conjunction, they are much cheaper than the old hand programming methods.

MicroProducts Software has one of the most extensive ranges of packages in the UK, which is available for over 25 microcomputers. It supplies standard accounting packages as well as information management and development tools AutoIndex and Autoclerk.

Software publishers

Some of the best microcomputer software has been written by individuals and small groups who lack the know-how or resource to bring their products to an international market. As a result, a few software publishing firms have emerged to take, verify, publish, market and distribute software products. Examples include Lifeboat Associates for CP/M software and Personal Software with triumphant Visicalc The emergence of the software publisher is important, since buyers are able to rely on such reputable names, the prices of whose products might otherwise deter speculative purchase. Closely related to software publishing and frequently overlapping it is the magazine publishing industry. There are approximately two dozen micro publications in the USA, the better known being *Byte*, *Interface Age*, *Infoworld*, *Creative Computing* and *6502*. There are also nearly a dozen micro-related publications in the UK, including *Personal Computer World*, *Micro Decision*, *Office Systems*, *Business Information Technology* and *Microcomputer Printout*. Magazine and book publishers also publish programs, notably Osborne & Associates (now the software publishing arm of McGraw Hill) and Sybex, the Rodnay Zaks publishers.

Importers/distributors

Most hardware — and some software — manufacturers do not supply direct to the end users. There is a two-tier distribution structure in the UK. It divides between the importer/wholesaler/distributor who buys in bulk, splits up and sells to dealers/OEMs/shops. Good distributors build up expertise in their products, employ hardware and software engineers and test their equipment before releasing it on the market. They are in the minority. Bad distributors have minimal knowledge of what they sell. They deliver, ex-airport, ex-box, and supply untested equipment. Buyers are faced with missing parts, loose boards still rattling inside cabinets, US plugs still intact and an engineer is often required to put it all together.

Recently, some of the bigger manufacturers are taking a direct interest in the UK by buying up their local distributor, as Apple has done. Commodore and Tandy are already represented here and it won't be long before the others follow suit. The newly arrived Osborne has bypassed the middleman distributor and gone straight to dealers, thus providing the end user with systems at prices similar to those on the American market with some allowance for carriage, duty and local promotion. We may not have to wait long for the arrival of other manufacturers in the UK, particularly if the US suppliers want to stay ahead of the Japanese.

Computer shops

A new computer outlet is the computer shop, which sprung up because the low cost of micros will not support a large visiting salesforce. This comes as a shock to the man used to having the mainframe or mini representative at his beck and call. Computer shops largely sell off-the-shelf hardware and software. The better ones limit the range they cover and learn their products well. Poor ones attempt to cover too many products and then find they lack the cash and expertise needed to support them. The computer chain stores are a new development: in the USA, IBM is selling through Sears Roebuck, as well as the specialist Computerland chain. In the UK, several retail outlets are experimenting with micro sales including Currys, Micro C, Laskys, Microdigital, Xerox Stores, W H Smith and Ryman Metroplay. Laskys and Ryman have bought in computer skills to combine with their retailing ability. The necessary expertise is of a specialist nature and businessmen are obviously happier when discussing their needs with specialist salesmen. However, outlets like these will come to dominate in the retailing of low cost electronic consumables.

GOTO page 190

Some popular software

Operating systems
CP/M, MP/M
Unix derivatives

Language
Microsoft: Basic, Cobol, Fortran, Pascal
Micro Focus: CIS Cobol,
UCSD Pascal

Popular packages
MicroPro: Datastar, Wordstar, Mail Merge
Micro-AP: Selector IV
MicroProducts Software: AutoClerk, Autoindex, Ledgers
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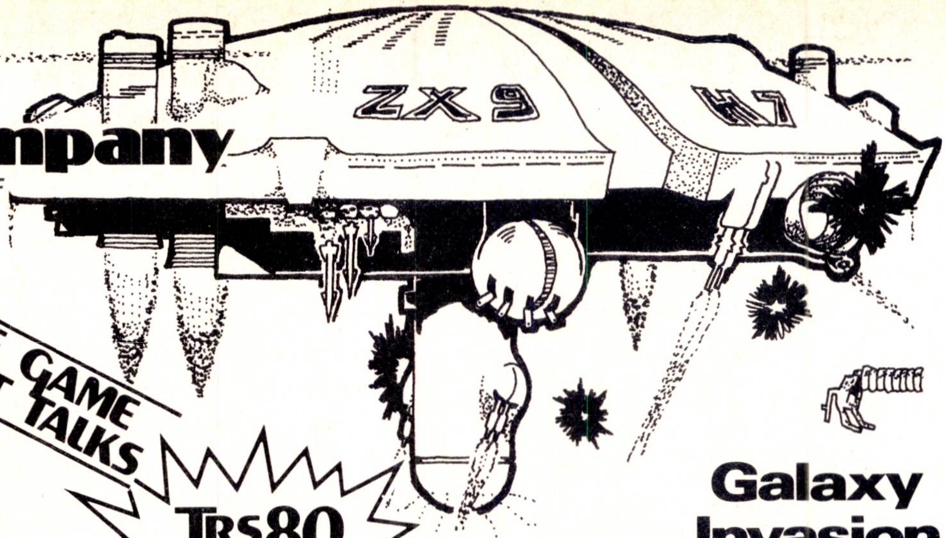

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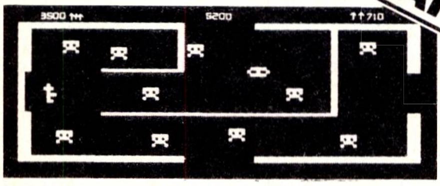

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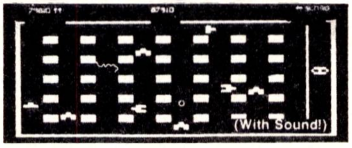
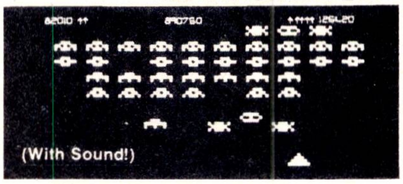


Dodge the alien Ramships and fire missiles to destroy them before they get you. The alien Flagship uses his deadly laser bolt to transform a Ramship into another Flagship or into your ship's double. Look out! Destroy your double and you could destroy yourself.

TRS 80 Level I & II 16K Tape
Video Genie EG3003 16K Tape

Galaxy Invasion



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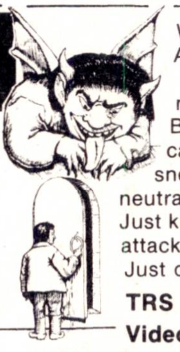
GOBBLE MAN



Watch out behind you! As you hurry through the maze collecting modules you score points. But don't let the Gobblemen catch you. If you are crafty, sneek up behind them and neutralise them to gain extra points. Just keep a watch. When they attack you they come in fast. Just don't lose your nerve.

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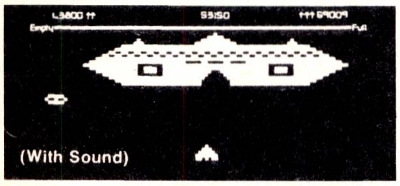

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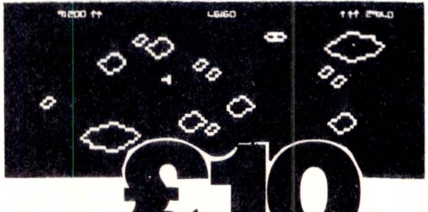

3-D means that as you wander through the mazes and buildings, full screen graphic display constantly shows your position in a perspective format as though you were actually there! This "rat's eye" view adds an entirely new dimension to adventure. English language commands can be entered at any time to manipulate your environment. The command sets are extensive and sophisticated. Dozens of objects are scattered throughout the mazes and buildings. You can pick them up, burn them, throw them, etc. You may need the sword to fight off an ugly little man. Or a steel rod to hold apart crushing walls. Deathmaze 5000 and Labyrinth allow the traditional one and two word commands. Asylum incorporates our Advanced Language Interpreter which allows full sentence input

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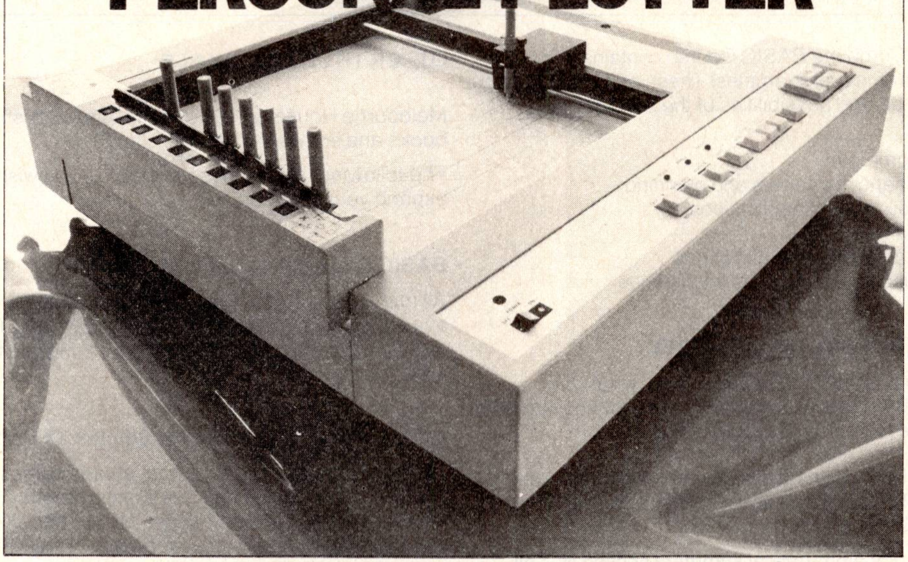

Peter Rodwell takes a close look at a versatile, upmarket plotter which can hook up to any micro

One of the major applications of computers of all sizes is handling information — collecting it, storing it and regurgitating it in a selective or structured way. While the first two have been quite easy tasks to implement, the presentation of information in a form which humans can easily assimilate and use is more difficult, mainly because we humans aren't too good at taking in huge amounts of information.

Suppose, for example, we want to compare a company's sales figures for the first half of this year with those of the first half of last year. We could produce two columns of figures but this provides no instantly-visible comparison; we have to subtract one figure from another for each month to find out whether we're doing better or worse this year than last. If, on the other hand, we draw a bar chart of the figures, we have an immediate visual comparison of the two sets of figures — the visual representation is much easier to take in than the written.

Presenting information visually from a computer is a reasonably easy task these days. Most good business micros have at least some rudimentary graphics capabilities which allow bar charts and graphs to be drawn on the screen. Things get a little more complex when we want these reproduced on a piece of paper, though; photographing a screen isn't very satisfactory and although graphics printers are getting steadily cheaper, they still have limitations. For real versatility, you need a plotter, a device which can draw on paper with a pen under computer control.

Plotters have been around for a long time in the computer world and are used in all sorts of applications apart from presenting business information in a form the MD can understand. Computer-aided design is one major application area in which plotters are having a major impact, in some cases replacing draughtsmen or at least relieving them of much tedious donkeywork.

Early plotters were relatively crude devices in which every single event had to be directly controlled by the host computer. Microprocessors have changed that by giving plotters their own 'intelligence', freeing the host CPU from much tedious work. This 'Checkout' is of one of these intelligent plotters, produced by the Japanese company Watanabe and aimed very much at the microcomputerist.

The Watanabe WX 4636 Personal Plotter is a weighty (18 kg) desk-top flat bed plotter which takes paper up to A3 size (297 mm x 420 mm). It's also available with a paper roll mechanism, which adds 10kg to the weight and £366 to the price. Both models can handle ten pens, which can be ballpoint, ink or felt tip or a mixture of these.

Setting up the plotter and interfacing it to a computer are easy. The pens are held magnetically in a row of holders along the left-hand side — a sticker sensibly warns you to keep disks away from the holders as the magnets will corrupt data quite efficiently. There's an electrostatic paper-holding mechanism which grips the paper very tightly, keeping it not only in position but perfectly flat as well, although it isn't necessary with the roll mechanism.

The power switch is on a panel along the front edge of the plotter, together with the following controls: plotting speed (fast or medium, for use in local mode only), local or remote selector, enter key (of which more in a moment), chart hold and eight keys which, in local mode, allow you to move the pen about: home returns the pen to the lower left corner, lower left and upper right move the pen to those positions but also function with the enter key to allow you to preset the size of the plotting area — you move the pen to where you want the lower left position to be and press 'enter' and 'lower left', for example. The plotter will then only plot within that area and a red LED flashes if you try to plot outside it. There's a key to raise and lower the pen, and four pen movement keys, similar to a computer's cursor control keys, which allow you to move the pen about in local mode.

Three interfaces are available — RS232, 8-bit parallel and GP-IB. The interfaces are on cards which slide in at the back of the plotter and come complete with the appropriate sockets (a plug is also provided with the machine). The RS232 interface contains a battery of switches to allow baud rate (75 to 9600) and framing selections.

The plotter has built-in self test and interface test facilities and the manual provides detailed instructions for setting up and troubleshooting.

In use

Plotting is carried out by sending commands and data to the plotter, either as binary codes followed by two-byte data words, or entirely as ASCII strings. The plotter has a 1.6 kbyte internal buffer, so it's possible to pour in quite a complex string of commands, which aren't executed until a terminating character is sent; the computer can then get on with something else while the plotter does its thing.

For convenience, I used the ASCII format, programming in Basic. A typical format would be:

```
10 PRINT  'M  1000,2000';CHRS(3);
```

which would move the pen to the position 1000 units along the X (horizontal) axis and 2000 units along the Y (vertical) axis. The CHRS(3) is the terminator character which is by default the ASCII ETX code but which can be redefined at will.

The 'units' mentioned above are in fact 0.1 mm, the plotter's resolution. The full-size plotting area is 3810 units by 2540 units. This can lead to some clumsily large numbers, so there's a factor command which will automatically magnify the dimensions you send by a specified amount. The 0.1 mm resolution makes for very smooth curves — plotting speed is 400 mm/sec.

Some 42 commands can be executed, and they are divided into several categories: plotter control (home the pen, change pen colour, etc); plotting characters and symbols (selecting one of the 12 character fonts, size of characters, etc); straight line plotting (including selection of a variety of dotted and dashed lines); graph plotting (drawing axes and hatching); plotting circles and curves; reading pen co-ordinate values; and controlling the interface. The read commands cannot be executed with the 8-bit parallel interface.

Having such a range of commands available makes for good versatility. To draw a bar chart, for example, one can specify the length of the axes and the number and size of its divisions. The divisions can then be labelled using upper and lower case characters in a

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specified size and spacing, with, if desired, the labels on the Y-axis rotated through 90 degrees. The bars can then be drawn and hatched, with any angle and spacing of hatching required, with or without a line around it. The whole business can be made even more elaborate by changing type fonts or writing parts of the text in italics and, of course, to clarify the presentation of information, different pen colours can be selected for different bars!

When drawing graphs, it's possible to draw the axes and labels, etc, then feed in the points of the graph following a command to connect them up either with straight lines or with a curve. Circles can be drawn either around the centre's co-ordinates or from a point on the circumference. In both cases you must define the initial and final radii and the initial and final angles (in tenths of a degree). One can thus draw a curve of varying radius, such as a spiral or a figure-of-eight with quite simple command lines.

Character plotting is very versatile — or complex, depending upon your point of view. The 12-character fonts are tailored to the requirements of most European languages as well as the USA and ISO standard characters. Additionally, it's possible to print Japanese Kana and Greek characters. Having selected a font, it's then necessary to specify the height and spacing between letters; using this latter facility it would be possible, although tedious and of doubtful value, to produce proportionally-spaced text! Characters can be rotated in tenths-of-a-degree steps and italics — either backwards- or forwards-sloping — can be produced, too. The default settings at power-on are for upright, horizontal (ie, parallel with the x-axis) standard characters 3mm high.

There is likewise a useful choice of line types which come in handy for producing small technical drawings. Lines can be solid (the default type), dashed in three styles, dotted and dashed, long and short dashed, double-dot dashed or even long-short-short-long dashed! The length of the cycle at which these dots and/or dashes are produced is also programmable, so you can produce just about any type of line you'd ever need. There are also a number of special characters, such as arrows, crosses and stars, which can be drawn at the current pen position.

Unless you're using the parallel interface, it's possible to read information from the plotter. Thus you can read in the current pen position and the lower left and upper right settings and check on various aspects of the plotter's status such as the amount of empty space in the buffer, whether the plotter is in remote or local mode and whether the chart hold switch is on or off.

Documentation

The plotter comes with a 132-page manual which contains detailed instructions for setting up and testing the plotter and interfaces and for routine maintenance procedures. Each command is explained in careful detail with an example which includes a reproduction of the plotter's output in response to the command. There are also extensive tables showing exactly what characters are produced in each of the 12 character fonts and there's a quick-reference summary of the commands and their formats at the end of the book.

Although the manual does explain every facility, it is rather terse and boringly laid out, with rather difficult-to-scan-through-in-a-hurry layouts and typefaces. But in comparison to many examples of Japanese documentation, it is well-translated and unambiguous.

Conclusion

The Watanabe Personal Plotter is a very versatile, well-built and easy to use device which should prove useful to anyone wishing to present business and scientific information in graphic form. Coupled with a digitising pad, it would make a very useful tool for the draughtsman producing small technical diagrams from rough sketches. Its prices puts it well beyond the range of all but the richest hobbyists but it would appeal to a great many educational, scientific and business institutions.

Prices

WX4636	£2430.00
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Our thanks to Environmental Equipment Ltd (tel: 0270 625115) for the loan of the plotter for this review.
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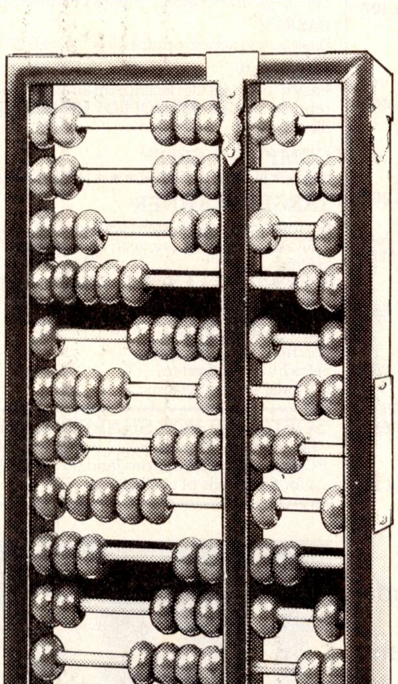

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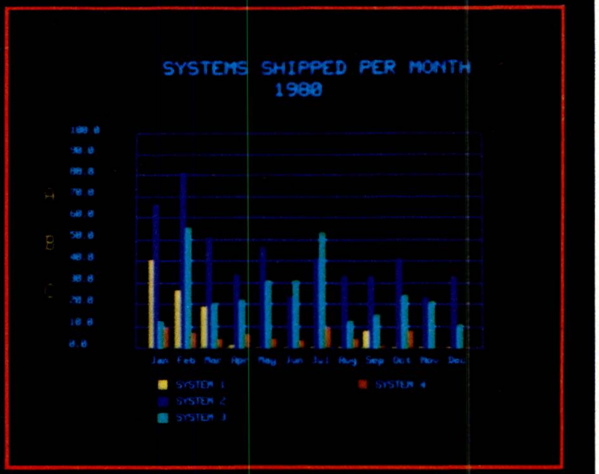

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Slidemaster is a fully self contained application package. It allows images to be developed, stored and manipulated interactively with speed and ease.

The image is developed from a digitising tablet, and reproduced directly on the colour Monitor.

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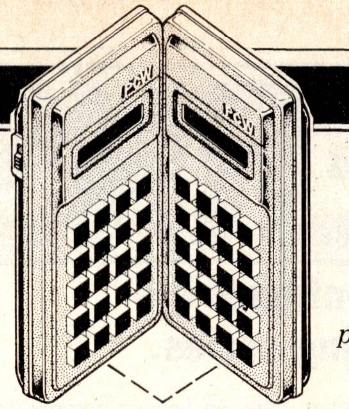


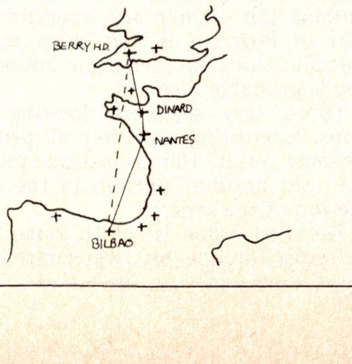
CALCULATOR CORNER

If there are still any people who consider programmable calculators to be poor substitutes for a micro they should have been awakened by the use of HP-41CV's by the Space Shuttle crews (despite the availability of no fewer than five computers). This article by M E Rankin, a BAC 1-11 pilot with Dan-Air, further drives home the point that a programmable can still be the most cost effective solution to computational problems under certain conditions.

I'M PROGRAMMABLE, FLY ME!

In early 1980 I bought a TI-59 programmable calculator with the intention of solving a quite simple problem in air navigation. The commonest form of navigation equipment in use throughout the world allows the measurement of very accurate distances and rather less accurate bearings from ground radio stations placed at suitable intervals along the airways. The display given to the pilot shows him distance to run and, by means of a deviation meter with a single needle, tells him whether he is on track, left, or right of it, in terms of angular displacement rather than distance. The maximum useful range of the groundstations is around 120 miles and they are usually less than 100 miles apart.

Airways are rarely straight, for a variety of reasons. For example, they may make considerable detours to avoid airspace allotted to the military for weapons training. The detours are often not permanent necessities and, at times of light traffic and when the armed forces are not using their bombing ranges, it is often possible to take short cuts. If such a direct routing begins at a point between navigation beacons and leads to a beacon well outside reception range, the equipment described above simply cannot cope. It is neither flying away from a radio station, nor (as far as it can tell) towards one. It cannot advise the pilot of the correct bearing to his destination. If he knows the correct bearing, the system cannot tell him whether he is on it. In short, if he wishes to take advantage of a direct routing offered to him, the pilot of such an aircraft must resort to guesstimation. This is frustrating for him because he is surrounded by navigation beacons, his ability to measure their bearings and distances is unimpaired and if he had appropriate charts and plotting facilities he could in time derive all the information he needs. A typical example of this situation is shown in the illustration. The crosses on the map are a selection of the navigation stations which are within useful range of some part of the dotted direct routing.



The solid line is a section of a common route along airways between, say, Malaga and Manchester or Cardiff, and from Bilbao leads via Nantes, Dinard and Berry Head near Dartmouth. If a route between Bilbao and Berry Head could be flown with complete accuracy in one long, straight line, 22 nautical miles would be saved — about three minutes' flying time in a BAC 1-11. An airliner of that size could cost anywhere between £25 and £75 a minute to operate, so the saving is obviously worth having. Part of this reduction in flight time would be achieved by guesstimation, unless the pilot was rather bad at it, so the amount of the saving which could be credited to any new system of navigating would be rather less than the three minutes of this example. How much less is a matter of opinion, since there is no way of measuring it. However, these figures suggest that the potential savings are not large enough to repay the cost of buying any of the very high cost equipment, such as Inertial Navigation Systems normally priced in six figures. Hence the TI 59.

Since I am no mathematician I bought the Texas Instruments Aviation Module with its ready-made programs for this form of navigation, known as Area Navigation. From the moment I opened the superb handbooks I was lost to everyday domestic life.

I found an adequate system of area navigation based on a straightforward constant-scale grid on which the locations of the navigation beacons can be plotted as pairs of X and Y coordinates. A Load module program provides for the calculation of the coordinates of the beacons, each of which is allotted a 'waypoint' number. The coordinates are stored in a pair of data registers whose addresses are a simple function of the waypoint number.

On entering a waypoint number and the bearing and distance from it, the area navigation program calculates, or 'fixes', the aircraft's position in terms of X and Y. On entering the destination waypoint number, a little Pythagoras provides the track and distance to that destination. Time of the fix and estimated speed are used to forecast the arrival time. Finally, when two or more fixes have been entered, and if the time between them is known, the actual speed achieved can be determined, and used to revise the estimated time of arrival.

The principles are simple enough, but I ran headlong into practical difficulties. To begin with, I simply couldn't key in the data accurately enough. It came too thick and fast for me to enter directly into the calculator; and when I wrote it down, the meaning seemed to evaporate within seconds. (It is an axiom among pilots that the brain drops to about one third power as the wheels retract.) That problem disappeared when I designed a form on which to enter the data. This is a type of Log and turned out subsequently to have many other uses. In a much developed form it is now an essential component of the system.

Secondly, the recommended method of constructing the model of the area required that the bearings and distances between adjacent waypoints on the chart be fed into the Load Module. That didn't work with more than six or eight waypoints because the cumulative effects of errors in these figures built up to an unacceptable level. Accuracy was regained by the laborious use of a further program for the calculation of the bearings and distances. The reasons for the initial errors then became clear — the airways charts themselves contain significant errors.

During this process the amount of keypunching required, and the destructive effects of keying errors, made it clear that a printer was required, so a PC-100B was obtained. It then became possible to trap errors more or less as they occurred: and certainly before any real damage had been done. My first successful waypoint model took two full days of continuous work, but was very accurate. It was about 1000 nautical miles long: and over that distance had errors of 0.2° and 0.2 nautical miles. Not all have been as good as that, but errors of this order are considerably less than the errors of the information fed in and are completely irrelevant for practical purposes.

The system now began to show its paces. For the first time I was able to see where my over-the-horizon destination lay and whether I was maintaining an accurate track towards it. The initial determination by the calculator of the direct tracks between well-known locations demolished a few myths among my colleagues and the significance of the well-known inconstancy and inaccuracy of the bearing information available to the pilot began to sink in for the first time. It was becoming clear quite quickly that the guesstimation methods generally in use are not nearly as good as most pilots believe, and that major deviations from the correct route must be quite common. I had also begun to be aware of some of the other shortcomings of

GOTO page 188

PATTERNS

Alan Sutcliffe continues his thought-provoking series.

A popular exercise in computer graphics is to take a design already represented in store and displayed on the screen, and to make a reverse copy of it alongside, making a pair of mirror images.

I set out to write a short note on how to do this, illustrating it with the particular code for my DAI computer, but along the route I was waylaid by an intriguing series of numbers which themselves give rise to some interesting patterns. It turns out that the central bit of processing necessary to reverse an image on a micro involves reversing the order of bits in a byte. This is because the screen map for graphics cannot afford the luxury of eight or even 16 bits for each cell on the screen that is possible on larger systems. Bits have to be packed into one or two bytes representing several cells on the screen. More of that later.

First I give four ways of reversing the bits in a byte, a kind of theme and variations in programming; then some patterns based on the values of reversed bytes, and lastly the problem that started all this, reversing an image on the screen.

Reversing bits

The process of taking a byte and reversing the bits in it is a single valued function of one argument. Like SIN(X) and LOG(Z), it takes one value and returns one value.

The first thing to decide in programming a function like this is whether the value is to be computed each time one is called for, or whether it is possible to compute the values once for each value that the argument can take and then store the results in a table. This is not practicable for functions like SIN and LOG, as there are far too many possible values. However, for our function there are only the 256 possible values of a single byte 0 to 255. The advantage of using a table is increased speed when the function is used, since the only cost is a single reference to an array. The price is the computation of all the values at the start of the program and the store needed for the array of 256 elements. This is the method used for the following.

Now we come to the far less important but much more interesting question, from the point of view of computing efficiency, of just how the reversed values are to be calculated. You might think of doing it by hand and storing the 256 values explicitly in DATA statements. Here is part of the table to show how the values go, in both binary and decimal:

00000000	0	0	00000000
00000001	1	128	10000000
00000010	2	64	01000000
00000011	3	192	11000000
00000100	4	32	00100000
00000101	5	160	10100000
————	——	——	————
11111110	254	127	01111111
11111111	255	255	11111111

But that way is cowardly cheating — I have a computer to perform precisely this kind of task. So here is the brute force computer method. Each bit is extracted from the byte by ANDing it logically with the appropriate power of 2 and then shifting it right or left the correct number of places, which is easily done by division or multiplication. For example, (I IAND 2)*32 picks out the second lowest bit and moves it up to the second highest position in the byte. Program A shows the whole code. The calculation is split into two lines simply to avoid having too long a line. On the DAI, all eight expressions in one statement produced the error message LINE TOO COMPLEX, so you might have a similar problem on your machine.

Second method

Now this program is correct and the fact that it is a bit slow hardly matters since it only takes a few seconds anyway, and it is only five lines. But I have this mean Yorkshire temperatment that drives me to look for ways of saving a second here and there, no matter what the cost, plus a slight obsession with programming elegance.

The first method I thought of was a mixture of the two I have described so far, the manual and the brute force. It uses a table of the 16 reverse values for the 4-bit nibble or half-byte calculated by hand to set up the main table in a double FOR loop. This is Program B. You can easily confirm that the values in the DATA statements are correct by completing the following table for 4-bit reversals.

0000	0	0	0000
0001	1	8	1000
0010	2	4	0100
———	—	—	———
1111	15	15	1111

Statement 70 uses this table stored in array B to take the top nibble, reverse it and put it at the bottom and contrarywise with the other half of the byte.

Although this takes more than twice as many statements it is very little longer in number of characters to be stored, and very much faster to run. A quick and rough way to compare two pieces of code like these for speed is to count the number of elementary operations in the inner loops. In each case this loop is obeyed 256 times. In program A there are, for example, four multiplications while in program B there are only two. A simple table shows the comparison, where () is the number of references to an array element, an operation that may cost an addition and a multiplication.

	+	*	/	()	=	IAND	Total
A	7	4	4	1	2	8	26
B	2	2	0	3	1	0	8

The total may be misleading if the differences are for very different kinds of operation: IAND is very much quicker than an array reference. Since Basic is interpreted, the cost of this can be approximately compared by counting the number of characters, or more correctly the number of tokens, a variable name and a reserved word, each being a single token. Using these two measures Program B runs three or four times faster than program A. The overheads in program B for setting up the array B and for having two loops make hardly any difference. They have one sixteenth the effect they would have inside the inner loop.

Algorithmic method

The table below shows the reversal values for each number of bits up to four.

0	0									
1	0	1								
2	0	2	1	3						
3	0	4	2	6	1	5	3	7		
4	0	8	4	12	2	10	6	14	1	9 ...

From this, a clear pattern of how the series for n bits can be obtained from that for n-1 bits may be seen. The first half of the series is doubled, and the second half is the first with 1 added to each item. If T_r is an item in the list for n bits, and S_r is an item for n-1 bits, the rule is:

$$T_r = 2*S_r \qquad \text{for } r=0 \text{ to } N-1$$

$$\text{and } T_r = 2*S_{r-N} + 1 \qquad \text{for } r=N \text{ to } 2*N-1$$

$$= T_{r-N} + 1$$

where $N = 2^{n-1}$.

Program C implements this algorithm recursively, so that the table for each number of bits up to eight is computed in turn. Notice that the rule even works going from zero bits to one bit, so that the only data that needs to be supplied is to set the first element of A to zero.

The attraction of this method is its elegance and its generality. Given an array big enough, Program C will compute the table for any number of bits: one more than the number given as the upper limit in the FOR loop, statement 40.

From the point of view of speed, however, there is a penalty. The inner loop is not executed 256 times as in the other programs, but 1+2+4+8+...+256 = 511 times — virtually twice the cost. It contains ten elementary operations to eight in Program B, but there are no multiplications so each time round the loop is probable faster.

Three very different looking programs. Interesting that they all produce the same result. Here is just one more — that uses another pattern in the construction of the series.

The first value is set to zero. Then the series for one bit is generated, but this time in the positions it will occupy in the final table for eight bits: 0 is already in place, and the 1 goes in cell 128. Next the values that will make the series for two bits are added: 2 in cell 64 and 3 in cell 192. And so on.

Program D does all this. It is not obvious, perhaps, just looking at it how it works, but it is easy to obey the first few steps with pencil and paper — and its operation then becomes clear. It is more efficient than any of the others. The inner loop is obeyed 256 times and it contains five operations, with no multiplications.

It also makes a good test of program comprehension. Ask a friend who hasn't read the story so far to work out without a computer what this little program does and why. I would be very impressed by anyone who could figure this out without benefit of writing anything down.

But enough of numbers for a while and on to some graphics — graphics based on these numbers, that is. Program E is simply a histogram of the table for six bit reversals, made pretty with a little flower at the top of each stalk. Array A is already loaded with the values. Figure 1 shows the result, and maybe you can tell that I am doing this just before Christmas.

One or two small points about this program. I used the 6-bit table with 64 values rather than 128 or 256 values simply to get a more bold effect. The first and last values in the table, A(0) and A(63), are left out because the petals of the flowers, if that's what they are, would go off the screen for these two extreme values. It also makes for a more compact picture. It is necessary to plot the lines in descending value of I because otherwise the longer lines plotted later would obliterate petals on the shorter stems next to them. A pretty pattern, simple certainly, but effective I hope.

Program F uses the eight bit values to plot overlapping rectangles. Figure 2 shows the output, reminiscent of a design from the 1920s. The first FILL statement draws a rectangle and the second one draws another one row of cells smaller along each side, so the effect is of a rectangle with a border. That is unless the random function which is used to determine the colour in each case gives the same colour for both rectangles in a pair, when the border is invisible. Different effects can be obtained by using different values for the STEP in statement 520.

For both graphics I changed the colours to one more suitable for photographing once the design was on the screen. This is done by a single COLORG statement.

```
10  DIM A(255)

20  FOR I=0 TO 255

30  B=(I IAND 10*128+(I IAND 2)*32+(I IAND 4)*8+(I IAND 8)*2

40  A(I)=B+(I IAND 16)/2+(I IAND 32)/8+(I IAND 64)/32(I IAND 128)/128

50  NEXT I
```

N.B. IAND is the instruction for a bitwise AND in DAI-Basic.

```
10  DIM A(255),B(15)

20  FOR I=0 TO 15

30  READ B(I)

40  NEXT I

50  FOR I=0 TO 15

60  FOR J=0 TO 15

70  A(16*I+J)=B(I)+16*B(J)

80  NEXT J

90  NEXT I

100 DATA 0,8,4,12,2,10,6,14

110 DATA 1,9,5,13,3,11,7,15
```

Program B

```
10  DIM A(255)
20  A(0)=0

30  N=1

40  FOR I=0 TO 7

50  FOR J=0 TO N-1

60  B=A(J)

70  A(J)=B+B

80  A(J+N)=B+B+1

90  NEXT J

100 N=N+N

110 NEXT I
```

Program C

```
10  DIM A(255)

20  A(0)=0

30  M=1

40  N=128

50  FOR I=0 TO 7

60  FOR J=0 TO 255 STEP N+N

70  A(J+N)=A(J)+M

80  NEXT J

90  M=M+M

100 N=N/2

110 NEXT I
```

Program D

```
200 MODE 2

210 COLORG 0 1 2 3

220 FOR I=62 TO 1 STEP —1

230 B=A(I)

240 DRAW B,0 B,I 1

250 DOT B,I 2

260 DOT B-1,I 3

270 DOT B+1,I 3

280 DOT B,I-1 3

290 DOT B,I+1 3

300 NEXT I
```

Program E

```
500 MODE 6

510 COLORG 0 1 2 3

520 FOR I=0 TO 127 STEP 3

530 B=A(I)

540 C=A(255-I)

550 FILL I,B 255-I,C RND(4)

560 FILL I+1,B+1 254-I,C-1 RND(4)

570 NEXT I
```

Program F

Taking photos

A few words about my experiences in taking photographs from the screen. I am now using a monitor with RGB input, so that the pictures on the screen are crisp and clear. I have found it pays to take great care in positioning the monitor and camera. For the pictures shown here I used a Polaroid SX-70.

My tips are these. Make sure both the screen and camera lens are as near vertical as possible. Get the camera in line with the centre of the screen. Obvious stuff, but it is worth taking measurements to ensure this. Otherwise there will not only be more depth of field than need be and so more problems of uniform focus, but also verticals and horizontals at the edges of the screen will be curved. At little over a foot away from the screen there is still a problem with more light in the centre than at the edges, particularly obvious in Figure 2. Next month I hope to show some conventional 35mm slides for comparison. Another problem is that the colours are not reproduced at all faithfully, a fairly bright red coming out as almost brown.

Reversing a picture

Now to use the byte reversing array A to give the mirror image of a graphic on the screen. It is necessary to say something about the screen map on the DAI,

PATTERNS

which is shown in Figure 3. My example is for four colour mode in low resolution, that is MODE 2. The screen has 72 by 65 cells in this mode. Each line of cells is represented by 24 bytes made up of two control bytes, two bytes for a left margin which cannot be plotted, 18 bytes for the 72 cells, and two more bytes for the right margin. Moving left to right across the screen, these bytes are in descending order in store. The upper control byte for the top line is always at store location # BFEF, so the top left of the plottable screen is stored in #BFEB, the top right (71, 64) at #BFEB-17, and the bottom left (10, 0) at #BFEB-64*24.

Each block of eight cells is represented by two bytes, two bits per cell. The top bit in each byte determine together the leftmost cell in the block, and so on down the two bytes. The value of the two bits together give which of the four possible colours is to be used — how these four colours are chosen from the total of 16 is set in the control bytes for the line.

Program G1 copies an area of 32 by 20 cells from the bottom left of the screen to the bottom right, and reverses it. SCRN reads the colour of the cell at the stated coordinates. This method is slow because each call to SCRN causes two bytes to be fetched from store and the appropriate bit unpacked from each of them, while DOT entails setting a bit in each of two bytes. It does not use the array A.

Program G2 using the reversing array A runs about four times faster. There is no packing and unpacking of bits to do. The bits in each byte are reversed and pairs of bytes along a line are reversed in order so that bytes a b c d e f g h become g h e f c d a b. Once again the price of speed is a more complicated program. This can easily be adapted to work in other modes — higher resolution and 16 colours. I have chosen the simple case where the edges of the areas to be copied to and from, line up with the blocks of eight cells corresponding to a pair of bytes. Clearly if the edges pass through the middle of a block of eight, there will have to be some packing and unpacking, but this will be once or twice for each byte rather than for every bit, and the program will still be two or three times faster than the method using SCRN and DOT.

Next month, if I keep to my plans, I shall show some patterns based on a simple program to generate octagons — and write about deciding in 3-D graphics which lines and planes are behind which others — the famous hidden surface problem.

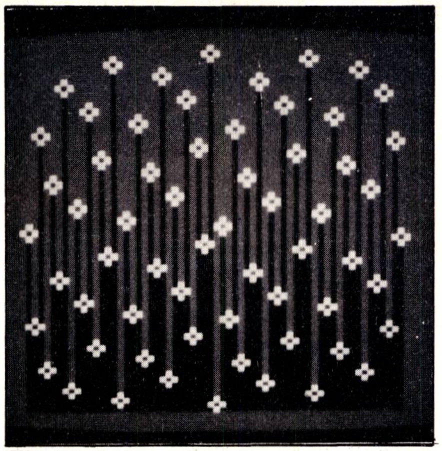


Fig 1

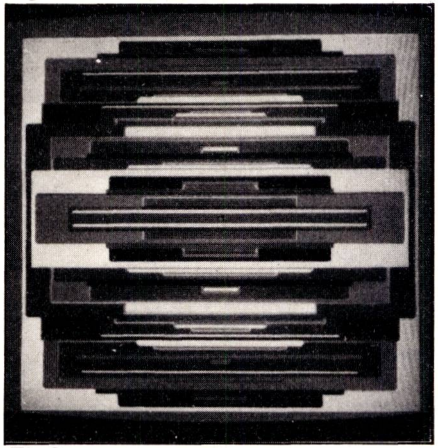


Fig 2

```
200 MODE 2
210 COLORG 0 1 2 3
220 FOR I=0 TO 19
230 FOR J=0 TO 31
240 DOT 71-J,I SCRN(J,I)
250 NEXT J
260 NEXT I
```

Program G1

```
200 MODE 2
210 COLORG 0 1 2 3
220 B=  BFEB-64*24
230 FOR I=0 TO 19
240 FOR J=0 TO 7 STEP 2
250 POKE B+J-16,A(PEEK(B-J))
260 POKE B+J-17,A(PEEK(B-J-1))
270 NEXT J
280 B=B+24
290 NEXT I
```

Program G2

Control bytes	Margin	Main screen area	(71,64)	Margin
BFEF BFEF-24		BFEB BFEB-24	BFEB-17 BFEB-41	
2 bytes	2 bytes	18 bytes for 72 cells All repeated for 65 lines		2 bytes
BFEF-64*24		BFEB-64*24	BFEB-64*24-17	

(0,0)

Figure 3 — DAI Screen Map for MODE 2.

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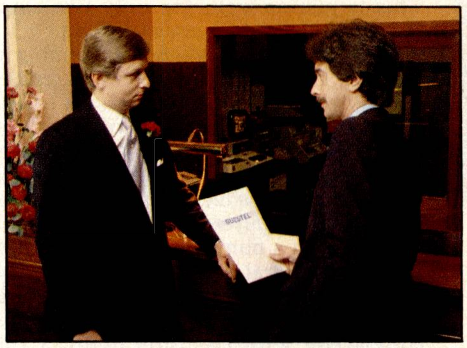

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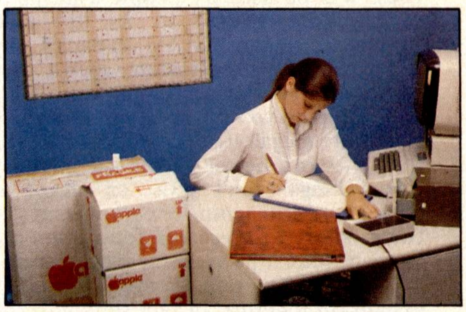

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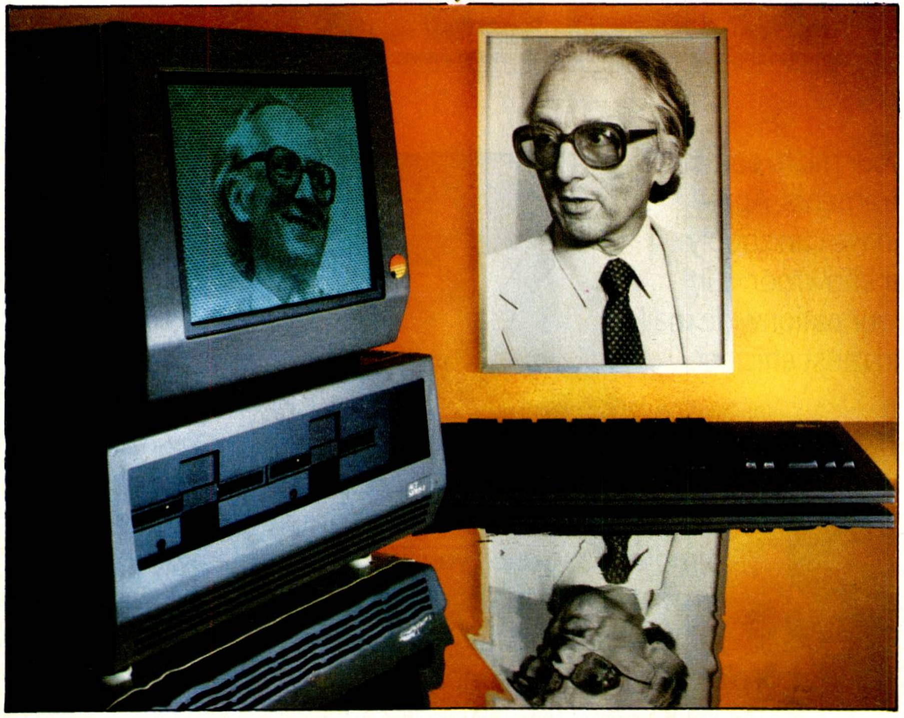


SIRIUS BUSINESS

Peter Rodwell tests the ACT Sirus 1 – 16 bits for the price of eight

Chuck Peddle is widely regarded as the man who started the personal computer industry. He designed the 6502 processor — now the second most widely-used microprocessor in the personal computer scene — and then designed the Commodore PET around it, thereby launching the first generation of true microcomputers.

Chuck has now left Commodore (and at the time of writing was involved in a complex, two-way lawsuit with CBM) and has started his own company, Sirius, the first product of which is the subject of this Benchtest.

The Sirius 1 is Chuck's idea of a 'third generation' microcomputer. The first generation, he says, comprised machines such as the PET and Apple; the second consists of the sort of machines now being offered to the business market — 64k, twin-disk micros with 8-bit processors. The third generation he defines as being based around 16-bit processors and plenty of memory and offering advanced features such as very high resolution graphics and good ergonomics; above all, he says, they should be designed for the end user rather than for the programmer, and should be regarded by the user not so much as a computer but as a piece of business equipment.

The Sirius 1 reflects these criteria in that it has been designed for the end user rather than for programmers or computer freaks. In this country it is being sold through software house ACT and is known as the ACT Sirius 1; in the States a similar deal has been done with a distributor and the machine is known there as the Victor 9000. The basic Sirius comes with 128k of RAM, twin minifloppy disk drives, a VDU and keyboard and software which includes CP/M-86, Microsoft's Basic-86 and various utility packages.

Hardware

Three modules make up the Sirius system: a main cabinet housing the processor, RAM, power supply and disk drives; a display unit which sits on top of the main cabinet on a turntable which allows you to rotate and tilt it and a low-profile keyboard unit.

Opening up the main cabinet immediately reveals one important aspect of the hardware design — it's easy to get at and service, which should reduce maintenance costs. The back panel is secured by two screws and, with this removed, the unit's lid simply unslots to allow easy access to the internals. At the back there's a heavily shielded power supply module, which can be removed simply by slackening half a dozen screws. At the front are the disk drives, under a PCB containing their control circuitry, all of which are similarly easy to remove.

The processor, 128k of RAM (Hitachi 64k chips) and all the other electronics are sited on one large PCB at the bottom of the cabinet; this slides out completely, allowing field maintenance staff to simply replace the entire board in the customer's office within minutes; faults can then be corrected back at the workshop while the client carries on computing. This is just as well, for only five chips in the whole system are socketted.

The CPU is an Intel 8088, running at 5 MHz. This is a 16-bit micro internally but looks like an 8-bit processor to the rest of the system, thus offering the power of a 16-bit micro with the lower system cost of an 8-bit engine. It's the same processor which IBM chose for its Personal Computer and which will be appearing in a number of new machines, including several from Japan, during the course of 1982. Cost-effectiveness apart, its big advantage is that it is code-compatible with the Intel 8086, a full 16-bit micro, and can thus run software developed for the '86, including, most importantly, the CP/M-86 operating system from Digital Research.

Four sockets are provided on the main board for add-in cards. Three of these will be used by people wanting to expand the system to its full half-megabyte internal RAM capacity, by adding 128k expansion cards. An external expansion unit will be available in the future to expand the memory to the full megabyte possible with the 8088. As can be seen from the memory map, things aren't quite as simple as with an 8-bit machine — various parts of the memory are reserved for system use (screen, interrupt vectors, character dot patterns, I/O ports, etc) and the expansion memory in fact slots into the middle of the map, with the operating system then being reconfigured to sit at the top of it.

Disk drives are usually pretty boring things but the twin 5¼in drives on the Sirius aren't — they each cram 600 kbytes onto *one side* of a disk. At the moment only single-sided drives are supplied, giving a total of 1.2 Mbytes of storage, but double-sided drives are on their way to give an incredible 2.4 Mbytes; I know of no other system which achieves this capacity on 5¼in drives. It's achieved by some pretty clever circuitry and software which, firstly, varies the number of sectors per track from 19 at the outer edge to 12 at the centre and then varies the speed at which the disk rotates according to which track the head is over, from 250rpm when it's at the outer edge to 350rpm when it's in the centre, in eight steps. You can actually hear the drives changing speed, especially when copying a number of files from one disk to another; they hum at different pitches, sometimes in harmony — it can only be a matter of time before some bright spark writes a program to play tunes on them. The drives are actually quite noisy and when the heads are seeking back and forth across the disk's surface, the machine emits weird clucking noises not unlike a demented chicken. Quite what the effect on disk life will be as a result of being spun at 350rpm (normal speed is 300rpm) for some of the time, I'm not sure. Ordinary single-sided, double-density disks can be used.

The Sirius has three ports with which to communicate with the outside world. There's a parallel printer port which doubles as both Centronics standard and IEEE-488 and an asynchronous RS232 printer port with programmable baud rates from 75 to 9600 baud. A second serial port is provided for communication (ie, to other computers under a number of protocols) at baud rates between 1200 and 9600.

One very unusual feature is an on-board Codec speech digitiser which allows you to store speech on disk and play it back through a built-in loudspeaker! Unfortunately, the machine doesn't come with any means of inputting speech — there's no internal input amplifier, let alone a jack socket for a microphone. A small mic and amplifier will be available as an extra as it's thought that software houses rather than end users will be doing the speech input — adding verbal prompts and messages to programs, for example. The quality of the replayed speech is quite good — not hi-fi but much better than synthesised speech.

A surprising omission is a clock/calendar with Nicad battery back-up, but an add-in clock card should be available in the Spring.

Two areas of memory are reserved for the display, one of the machine's outstanding features. In normal mode, the display is 80 characters by 25 lines. The 12in green screen monitor gives a clear, steady display, of which the only criticism I have is that the screen has a fairly long-persistence phosphor — the image takes a few seconds to die away, which is rather confusing when listing a long program or scrolling through text. I understand that the current green display will eventually be replaced with an amber-on-bronze screen when one can be found with sufficiently high resolution, and a full colour screen is also promised in the future.

Like just about everything else on the machine, the screen is under full software control. A 4k area high up in RAM holds the characters to be displayed while lower down there's another area containing the dot patterns which make up the characters. Characters on the 80 x 25 standard screen are built up on a 10 x 16 matrix, which makes for very clear, elegant text indeed. But because the dot patterns are there in RAM, you can access them and change them using a utility program called Edot, of which more later. Up to 2048 characters can be held in RAM at any one time and character sets can be stored on disk and called into memory under program control.

Naturally the Sirius has graphics capability, a bit-mapped 800 x 400 display, in fact, finer resolution than any other microcomputer of this price range. In the graphics mode it's possible not only to display some very spectacular graphics but also to display finer resolution text, up to 132 columns by 50 lines, all perfectly readable!

The display allows dual intensity, reverse video and proper underlining, either under program control or from the keyboard. And, of course, brightness and contrast are adjustable (through eight levels), again under software control or from the keyboard — there are no controls at all on the monitor itself. The loudspeaker's volume is similarly controlled, by the way.

The monitor is mounted on a turntable which allows rotation 42 degrees in either direction and it can be tilted upwards up to 11 degrees from horizontal. It has an anti-reflective coating on the screen.

The keyboard is wider than the main unit and has a firm, pleasant feel; it's

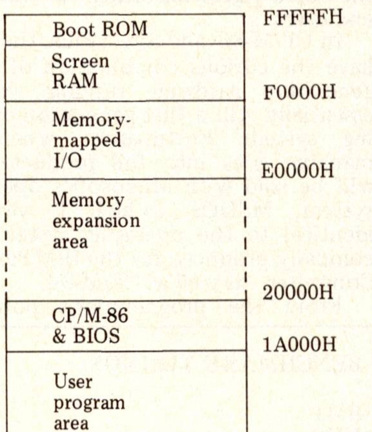
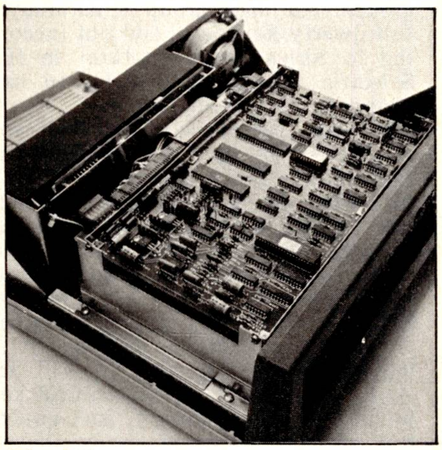
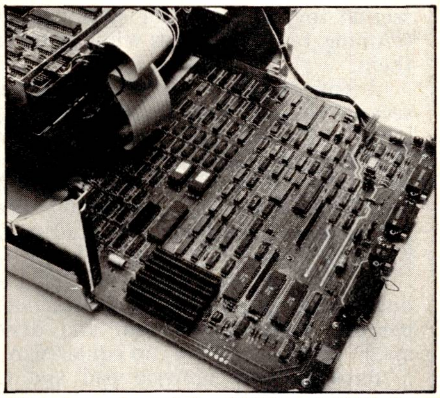


Fig 1 Memory map of basic 128k Sirius 1



The disk controller PCB



Main board contains 8088 and 128k RAM

Slimline remote keyboard is IBM Selectric format also relatively heavy (1.5kg) so it doesn't slide around on a desk top. There are a total of 95 keys, divided into several groups. The main group is, naturally, a full qwerty keyboard, laid out (according to Sirius documentation) in IBM Selectric format; IBM seems to have changed its layout recently, if our newly-acquired office typewriter is anything to go by, but the differences are minimal. At power-on the keyboard is in lower-case, but there's a shift lock key (with a funny padlock symbol on it), although no warning light to show when you're in upper case. Two unusual keys sit at the ends of the space bar, right where my fingers expect to find the shift key. One is labelled 'ALT' while the other is called 'CONT'. The ALT key is, in fact, the control key, while CONT, confusingly, isn't control but suspends whatever the computer's doing and resumes the operation at a second touch, useful for stopping fast-scrolling text or listings while you read them.

Across the top of the keyboard are seven large programmable function keys, only one of which was pre-programmed on the machine I used — it gave a directory command under CP/M-86. They are, of course, all user-programmable, although I would prefer to see more than just seven.

At the right-hand end of the keyboard is a numeric pad which includes percent, plus, minus, add and divide symbols but, strangely, no equals sign.

Between the numeric pad and the main block are two columns of keys controlling the cursor and, on the model I used, clearing the screen and deleting and inserting characters and lines. Pressing ALT with some of these keys gave control over screen brightness and contrast (eight levels) and loudspeaker volume. On the far left of the board is another column containing the escape and repeat keys and controls for the dual intensity display, reverse video and underlining.

The keyboard is fully debounced and has n-key rollover but it isn't encoded — it doesn't generate ASCII codes but 'logical key numbers' which system software converts to ASCII. This means that you can easily redefine any key to generate any character, a necessary feature when programming in Basic, as we'll see later.

Setting up the system is simplicity itself. All connectors are at the rear of the main cabinet (I would prefer the keyboard to plug in at the front) and all that's involved is for the video and keyboard plugs to be plugged in (they use different, keyed plugs, so it's impossible to get them mixed up or plug them in the wrong way up despite the lack of labels on any of the sockets, although there is a labelled drawing of them in the manual) and for the power to be turned on, again at the back of the main cabinet, where a reset button also lurks, sensibly out of harm's way. There is no power-on indicator, although the built-in fan makes so much noise that this isn t really needed. It's a pity about the fan — it *is* noisy and it forms my only real complaint about the hardware design. The disks spring to life and inserting a system disk into the left-hand drive immediately causes the machine to boot up CP/M-86 without any further action required from the operator. All that's missing is an 'Insert disk . . .' message on the screen, a la SuperBrain.

The review model came with CP/M-86 modified to run a voice program on boot-up—the operating system loaded, the disks clunked and chattered briefly and a sinister voiced announced: 'I am the ACT Sirius 1, the number one choice in business microcomputing'. I found this disconcerting the first time, mildly amusing the second time and very irritating thereafter; I cured it by simply erasing the voice program from the disk.

CP/M-86

The first interface a user will have with the Sirius (or most other micros, come to that) is via its operating system. At the moment, the Sirius comes with CP/M-86, the 8086 version of the industry-standard CP/M operating system, written by Digital Research. This was my first encounter with CP/M-86 and, frankly, I was deeply disappointed. If you're familiar with CP/M, you'll know what I mean when I say that, to the user, CP/M-86 looks and behaves exactly like the old CP/M. You can now skip the next two paragraphs while I explain that remark to those who have never tried to use CP/M.

Back in the early days of microcomputers, a Californian called Gary Kildall wrote a basic (not Basic) program which would take care of all the boring nitpicking things a computer has to do, such as receiving character typed in at the keyboard, displaying it on a screen or printer and, especially, carrying out all the intricate work involved in using floppy disks. The idea was to make life easier for the programmer; all these 'housekeeping' routines were supplied so that the programmer could use them easily while writing his (assembler-language) programs, without having the trouble of re-inventing half a dozen wheels by writing them all himself. It had the added, and very considerable, advantage that it was so designed that a program written under CP/M on one machine would run perfectly well on another, completely different machine, providing that it, too, had CP/M on it. And CP/M could easily be configured to fit any machine which had an 8080, 8085 or Z80 processor and a minimum of 16k or RAM.

This ease of transferring programs from one computer to another did much to encourage the growth of the microcomputer industry, both hardware and software. An enormous number of machines are now available which run CP/M and there is a correspondingly massive and ever-growing amount of software available, especially language compilers and interpreters and some applications packages, particularly word processors.

The problem is that CP/M was designed to make life easy for the *programmer* — it does little to make things easy for the *user* and in fact it's very unfriendly, with a nasty habit of displaying unintelligible error messages and stopping dead when something goes wrong.

In producing CP/M-86, Digital Research had the chance to make the system a lot friendlier and easier to use *for the user* but they didn't — they blew it. Various attempts have been made by other companies to produce CP/M-like operating systems which are more user-friendly; the one with which I am most familiar is Cromemco's CDOS, developed three or more years ago as an upwards-compatible version of the 8-bit CP/M (ie, you can run CP/M programs under CDOS, usually, but CDOS contains extra facilities which, if you use them, prevent your program from running under CP/M).

I'll give one example, comparing CP/M-86 with the older CDOS, to show what I mean about user-friendliness (and this doesn't mean that I regard CDOS as the ultimate in user-friendliness; it's just that it provides an indication of what can be done, quite easily, to make life a little easier for the user).

It's possible to write-protect a mini-floppy disk by placing a sticky label over a notch in its plastic envelope; this prevents the computer from altering the data on the disk or from adding new data to it. If you try to transfer a file from one disk to another which is write-protected, then CP/M-86 displays the following message: 'Drive=0, Track=7, Sector=0: Error =32 Bdos Err on A: Bad Sector' and stops dead. I defy any end user who isn't a programmer to make sense of that. CDOS, under the same circumstances, displays: 'Diskette in drive A is write-protected'.

There are those who would argue that a user shouldn't be trying to write to a write-protected disk; this is ridiculous, as it's one of those mistakes which *everyone*, even experienced users, make from time to time and an operating system should cater for it in a useful and helpful way, especially on a machine which is designed to be used by the rapidly-growing army of first-time end users.

In CP/M-86 and the Sirius, then, we have the curious combination of third-generation hardware running what is essentially still a first-generation operating system. Fortunately, when the machine goes into full production, it will be sold with Microsoft's operating system, MSDOS (which is virtually identical to the operating system that company produced for the IBM Personal Computer as well as CP/M-86.

From the programmer's point of

BENCHMARK TIMINGS

BM1	2.0
NM2	7.4
BM3	17.0
BM4	17.5
BM5	19.8
BM6	35.4
BM7	55.9
BM8	42.5

All timings in seconds. For an explanation of the Benchmark tests, see PCW *Vol 4 No 11, November 1981.*

view, CP/M-86 is very similar to the 8-bit CP/M, but with added facilities; this, coupled with the XLT-86 package from Digital Research (which translates 8080 source code into optimised 8088/8086 source code) means that many software houses may initially be inclined to produce CP/M-86 packages for the Sirius rather than tackle the unknown MSDOS. This is a pity, because, although I have no first-hand experience of MSDOS, from all accounts it does sound far friendlier and easier to use than CP/M-86.

Other software

Several packages were supplied with the review machine. Unfortunately, because they (and the machine) had only just arrived from the States, and because the machine itself was a pre-production model, not all of these were usable, mostly because of a lack of documentation.

The first package I looked at was Microsoft's Basic-86, an 8088/8086 implementation of that company's MBasic V5.0. It was pretty standard, with one or two minor alterations but when I ran the standard Benchmark tests I found it appallingly slow. Quite why it was so slow, neither I nor the ACT software experts could figure out, but it could be that this version was a straight translation from the original 8-bit Basic and took no advantage of the 8088's superior computing power. I did discover a curious omission from the Sirius's keyboard when trying to run Benchmark 8, though. This involves exponentiation, for which the symbol required by Microsoft Basic is '∧', this symbol isn't on the Sirius keyboard, although it's in the standard character set. The problem was solved by reprogramming a 'spare' key on the keyboard to produce it, a problem which won't bother most end users but which will prove irksome to Basic programmers.

The slowness of the Basic will be overcome, though, as an 'extended business Basic compiler' is on its way.

A bog-standard version of WordStar came with the review machine. This was a very early version which hadn't been fully tailored to the system and thus made no use at all of the programmable function keys, relying instead on those tedious and difficult-to-remember control sequences (from which you'll correctly gather that it's not my favourite word processing package!). A fully-configured version is on its way, though, and a Version 3 will be available in March or April which incorporates SpellStar, currently a separate package.

A particularly frustrating aspect of the review machine was that there was no easy way to access its more interesting facilities, such as the hi-res graphics or the ability to do fancy things on the screen such as define windows or calling in different character sets from Basic, or to use the voice digitiser. Several demonstration programs were supplied which did all these things from Basic, but relied on masses of assembler language routines. There was, for example, a program called GRAF on disk which could be called into memory from Basic and which contained a number of assembler language modules for using the hi-res graphics; unfortunately there was no documentation at all to enable me to use it. (Once loaded, it requires a CALL statement from Basic to a specific routine's address, together with a number of parameters, but without documentation it's impossible to find out what the correct addresses are, let alone know what parameters are required and what they do.) Fortunately, there's a whole team back in California working on documentation and GRAF will be fully documented when the machine goes on sale, as will all the other utilities.

Additionally, a new Basic should be available in March, called GW Basic (it's rumoured that this stands for 'Gee-Whizz' Basic!). This will incorporate a full set of graphic commands, such as PLOT, DRAW, LINE and BAR. I was pleased to hear this as, although many end users will simply be running prewritten packages (according to Chuck Peddle's philosophy for third-generation micros), there will still be many users particularly in engineering, science and education, who will want to do their own programming in a high-level language without having to dive into assembler to do anything fancy. Making the machine's facilities available through high-level languages will also speed up software development times, and consequently, lower software costs, too.

Earlier I mentioned a package called Edot, which enables the user to define or alter character sets. This I found a fascinating program indeed. Figure 1 shows the screen when Edot is running; the character dot matrix is displayed, together with the full character set currently in memory — you can read in other sets from disk and write your own-developed set to disk. By using the numeric pad, you can manoeuvre a 'blob' (it's up in the top left-hand corner in Figure 1) to any pixel you want displayed and a keystroke then lights up the cell at the blob's position. Simultaneously, the character you are building is displayed in normal, underlined, dual-intensity and reversed modes and is updated as you build it up, as are any other occurrences of that character on the screen if you happen to be working on a character in the set currently in use by the system.

Using Edot, you can call in any character set from disk and use it as the system's 'normal' character set. The demonstration disk contained several sets, including a handwriting-style script set, which looked decidedly funny when used with WordStar.

Again there was no documentation for Edot, but a booklet is under preparation to deal with the whole subject of character sets.

Other packages which will be available for the Sirius — some immediately, others fairly soon — include an Assembler, Fortran, Cobol, Pascal and PL-I for the programmers and application packages such as ACT's Wordcraft, its Pulsar integrated accounts package and products from other companies including Micro Modeller, Decision Modeller, Supercalc and Micro Planner.

Documentation

As you'll have gathered by now, the review machine's documentation was far from complete. By the time you read this, the machines should be on sale with complete documentation and there'll even be a full technical manual available in the Spring.

The documentation I was supplied with was all preliminary, the usual typed-on-a-word-processor-and-photocopied sort with occasional handwritten corrections and additions. Most of the important areas of the machine were covered, although there were a few gaps, which were quickly filled by the people at ACT. The final documentation will, apparently, be properly typeset, which is welcome news and, given Chuck Peddle's obvious determination to win the hearts and cheques of the end user, I would expect it to be of a high standard.

The only 'proper' documentation which came with the machine were Microsoft's Basic manual with an updating leaflet describing the differences between MBasic and Basic-86, which was clear and readable as all Microsoft documentation seems to be; and Digital Research's CP/M86 manuals, one entitled 'System Guide', the other called 'Programmer's Guide'. In fact, both seemed to be aimed totally at the programmer and would give an end user an even bigger shock than CP/M-86 itself. Some of the Sirius documentation mentioned a 'User Guide' for CP/M-86; this wasn't supplied but I hope it's a lot better than previous attempts by Digital Research to communicate with end users.

Users and potential

Chuck Peddle designed the Sirius as a business tool, primarily one which would sit on a desk and run applications packages. As such, with tailored software, it will be a big success, especially at its low cost (which, incidentally, is very slightly *cheaper* here than in the States!).

The machine is very pleasant to use, CP/M-86 and the noisy fan excepted; I feel that any business user, either manager or secretary, will feel at home with the Sirius as, once an application package is up and running and the operating system is left behind, it reveals itself as a machine with many attractive features and into which a lot of very careful thought — especially on the ergonomics side — has been put.

I think, too, that the Sirius will prove useful and popular among other users, especially engineers, scientists and teachers. For these people, a much easier interface to the machine's facilities is essential and will hopefully be provided by the enhanced high-level languages which have been promised. In particular, the very high resolution graphics will be extremely attractive — there's nothing available to compare with the Sirius in

GOTO page 185

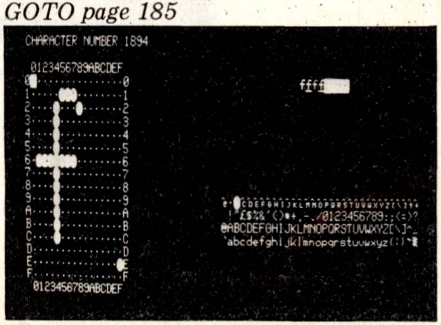


Fig 1 Edot in action

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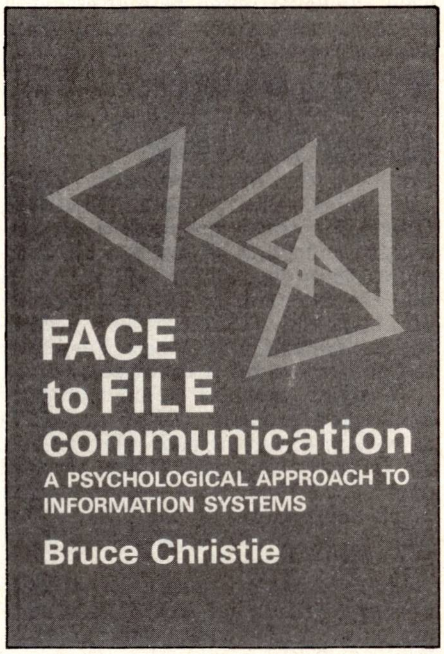
BOOKFARE

Malcolm Peltu looks at the latest micro literature

Too much psychotech



FACE
to FILE
communication
A PSYCHOLOGICAL APPROACH TO INFORMATION SYSTEMS
Bruce Christie

I have believed for a long time that computing is too important to be left to computing people. After reading *Face to File Communication* by Bruce Christie, I am beginning to think that human beings are too important to be left to psychologists. This sour response represents my disappointment at a book which I had eagerly looked forward to reading. I was attracted mainly by its subtitle, 'A psychological approach to information systems'.

I expected to read something which accentuated the human element in computing and relegated technology to its rightful subsidiary role. Yet much of the book is littered with pseudo mathematical formula which are supposed to apply to human behaviour. As early as page 6, Christie says, 'The equation $B = f(E, P)$ will be familiar to psychologists. It indicates that behaviour (B) — primary subject matter of psychology — is a function of the environment (E) and the person (P)'. It reminded me of an article written by Brian Smith of the Royal College of Art in the now defunct *Computer Age* in which he wrote of a student 'pursuing a Master's degree in advanced blindingly obvious things'.

Later on, Christie identifies personal computer users (like you, dear reader) as A ergs. Or even N ergs. (*But not nerds, I hope — Ed.*) It seems that people with assertive ergs (As ergs) are likely to be among those buying personal computers. People with high narcism ergs (Na ergs) and Spouse Sentiment (Sw) support the introduction of systems allowing more work to be done at home. (An erg I gather hazily, is some psychological measure of motivation.)

But before I carry on with what psychologists will regard no doubt as a display of Ph ergs (Philistine ergs), I want to state clearly why I also like the book.

Firstly, and most importantly, the subject matter (human/psychological aspects of information systems) is important but is rarely given the appropriate priority in books on computing. Christie treats the subject seriously. Many books treat human factors in computing superficially and as an add-on to the mainstream of computing. Christie stresses the key role of human factors in determining the ultimate effectiveness of a system.

There is a great deal of interesting material in the book, particularly in the two chapters on attitudes of managers and staff. Drawing on his own research as a consultant for Pactel, Christie explains how a group of managers were found to feel that the automated 'office of tomorrow' will be more 'impersonal, dehumanising, rigid, unyielding, fast, strong, colourless and boring'. And these negative attitudes remained even after the managers were told about the technical wizadry of the electronic office systems. Findings such as these are crucially important to systems designers, managers and others affected by information systems.

Now, back to psychologist bashing. It is because there is so much potential in the book that I was so disturbed by the pseudo-technical jargon used by Christie. Instead of opening up the subject to a wider audience, Christie builds up new, impenetrable barriers. At the start of the book Christie defines his target audiences as managers, psychologists, policy makers, trade unionists and equipment suppliers. Yet his academic style and over-liberal sprinkling of psychological jargon and conceptual psychological modelling is primarily appropriate to other psychologists.

My objection to the pseudo-maths in the book applies where Christie, in a particular psychological tradition, seems to treat people like elements in an equation. Of course, psychologists must use scientific and statistical analysis techniques in evaluating and analysing surveys. But this is different from trying to elevate psychological theories into apparently fixed and objective 'rules' through the use of mathematical notation and scientific waffle.

For example, he tries to define a First Law of Information Behaviour. He bases it on psychological 'laws' of intelligence and attitude. But giving it the name 'First Law' attempts to place it in the same category as the laws of thermodynamics, Newton or other scientific relationships. Christie's First Law of Information states: 'If any two items are selected from the universe of information behaviour items, and if the population observed is not selected artificially, then the population regressions between these two items will be monotone and with positive or zero sign.' I am afraid I do not understand what it means or why it was worth trying to define in the first place.

At the start of the book, Christie has a number of quotes ranging from Pontius Pilate to this one from the Rocky Horror Show which summarises my attitude to much of Christie's theorising:

> 'Crawling on the planet's face,
> Some insects, called the Human Race;
> Lost in time,
> Lost in space —
> And lost in meaning?'

Of course, Christie could argue that I should take the effort to understand what he is writing about. Believe me Bruce, I tried, but I could not see that it would be worth the effort. If he is trying to broaden the subject to a wider audience, he should have avoided such obfuscation. And he should have taken more care to explain the statistical techniques used.

Christie spends a lot of time saying the obvious. For example, he more or less summarises the first hundred pages in one paragraph. What he is stating is that there are two levels in an information system. The superficial one is concerned with 'surface' activity — the machine used, the type of tasks done, etc. Beneath that is a deeper level relating to human interaction, motivation, attitude and other psychological behaviour.

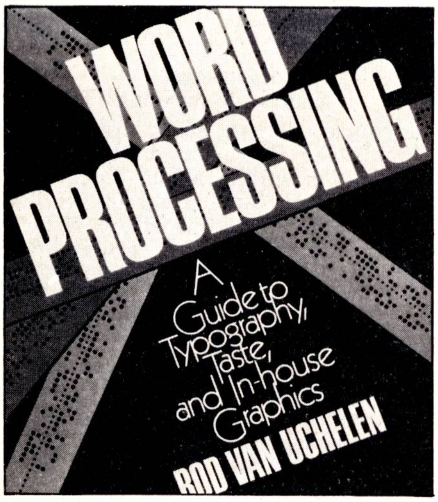
I wanted him to start at this point, not to spend a third of the book leading up to it via various conceptual 'models' which I did not find particularly illuminating. I also find much of the evidence presented unconvincing and unworthy of the scientific aura he tries to create. Generally there appear to be rather flimsy, small-sample surveys trying to prop up woolly pseudo-scientific theories. Christie is aware of the hollow ground on which he stands. At one point he states that any item of Information (I) can be described in terms of its values on a set of Dimensions (D) as follows:

$$I = D_1 + D_2 + \dots + D_n$$

All this says is that there are many factors affecting information (such as content, relation to behaviour and organisational context, etc.) This is hardly worthy of an equation, particularly when he goes on to say that there could be an infinite number of dimensions. If there are an infinite number, it would be very difficult to come up with something meaningful. So he says they could be restricted to just four meaningful dimensions in any given context.

When he goes on to discuss specific evidence for theories he frequently adds disclaimers like: 'These judgements should be regarded as hypotheses rather than facts and should be interpreted with extreme caution'. As a 'lay' psychologist interested in human factors in information systems I found Christie's book valuable, precisely because of what I regard as its flaws. It gave me an insight into the type of work industrial psychologists are doing and to their limitations.

Psychologists seem to be losing sight of human beings, buried beneath a welter of statistics, theories and PhD theses. Stripped of the jargon and conceptualising, there is a kernel of important truth in Christie's book of importance to managers, users, systems designers and other 'ordinary' people. Perhaps if Christie tries to address this lay audience and forgets about his psychological peers, this kernel would be easier to find and would be of greater practical benefit.



Word pictures

'Understanding of the individual is more important than the function of the machine; it is the individual who fashions the product.' That is the credo of Rod Van Uchelen, who provides an interesting new angle on an increasingly well-worn theme in *Word Processing — A Guide to Typography, Taste and In-house Graphics.*

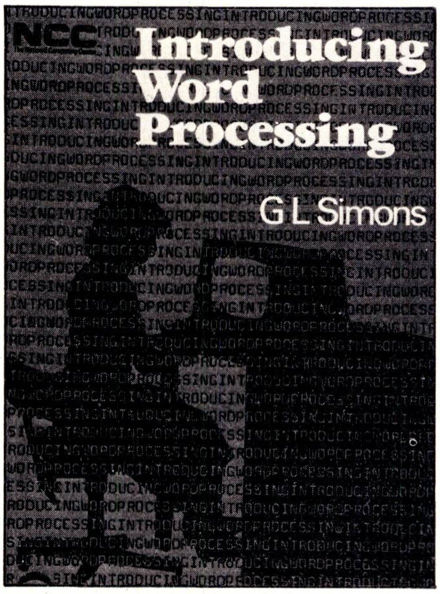
The title concisely summarises the contents. Van Uchelen began his career at Walt Disney Studios, has taught at the Hollywood Art Centre and has written a great deal about graphic design in publishing. He has now tried to relate his artisitic perspective to electronic office and other new information technology. He is pretty weak on computer technology but very good on filling in the background to the development of typographic design and the aesthetic layout of printed (or word processed) pages.

His introduction to computing is confused and confusing. 'The computer itself consists of areas for input, processing, and output . . . the information must be on the ON or OFF current for input . . .' is a typical botched technical snippet. He gets his computing knickers into even more of a twist when trying to talk about how the 'Supervisor' software works. He is, 'however', much stronger on the systems aspects of electronic information technology. Although he overemphasises his own printing/graphic design background, he shows how traditional printing technology is converging into the same integrated information network as word processing and office automation.

An important issue raised by Van Uchelen is whether automation diminishes or enhances creativity. He points out that the power and flexibility of modern word processing and typesetting gives the designer a great deal of extra choice and flexibility from which to select the most appropriate form. Yet he also explains, 'The systematisation of required by the computer led to an increased use of formats. A new concept of typographic design began to emerge with automation and word processing. The discipline imposed by the system, for all its convenience, stereotyped design.'

The bulk of the book is a well written and well presented resume of the art of typography, questions of selectivity and taste in graphic design and the role of the 'typographist' to straddle the traditional functions of typist and typographer. Van Uchelen believes that the spread of office automation will mean that more and more organisations have sufficient demand for automated printed output to warrant the employment of specially skilled staff to ensure that any typed or printed material is made more effective by being more aesthetically pleasing.

Although much of the book has little to do with word processing as such (it applies to graphic design using any printing method), Van Uchelen makes the important connection between art and automation. Despite its cockeyed technical intro and superficially positive tone about the impact of automation on creativity, I found it a stimulating and interesting book.



Vanilla WP

Introducing Word Processing by G L Simons is a good plain-vanilla in guide to the subject. It is a straightforward, no-frills basic tour of word processing that does not try to extend its appeal into exotically tasty byways.

There are six main sections: background; components and capabilities; data processing and software; selection and implementation; the people aspect; and the future. A bibliography is associated with each to provide further, more detailed reading.

Simons places word processing into both historical and technical perspective — and he remembers to put people firmly into the word processing equation. He describes electronic typewriters, various types of word processors, and computer-based WP systems. Particular products mentioned include WordStar and Magic Wand, the Wang integrated word and data processing system and the Qyx and Olivetti electronic typewriters.

Simons draws together the research and writings of others to produce his own excellent objective evaluation of the current state-of-the-art understanding of word processing.

Although there are other books which provide a technical and product overview, there are few which give as much weight as Simons to human aspects, such as the impact on employment, training, motivation, health, ergonomics and industrial relations. This human ingredient incorporated into the plain vanilla-flavoured base gives depth to this cool concise but comprehensive beginner's guide.

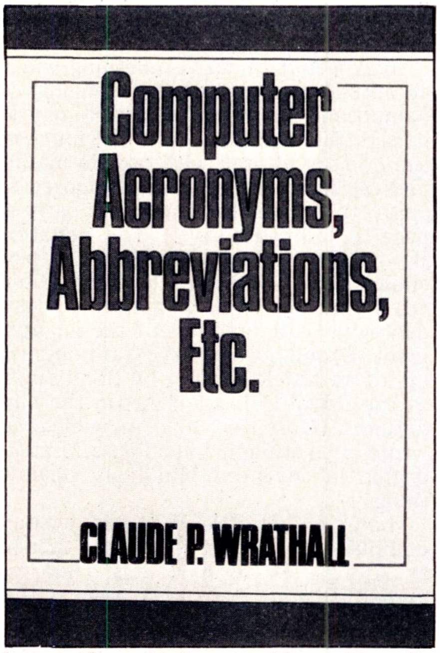
YY UR YY UB, IC UR YY4 ME *

From A for Accumulator to ZRTE for Zilog Real Time Emulator, Claude P Wrathall has made a comprehensive collection of items in his *Computer Acronyms, Abbreviations, Etc* (I like the inclusion of 'Etc' in the title of a book about abbreviations — according to Wrathall, ETC means Easycoder to Cobol or Extended Text Compositor).

Wrathall includes some company names and products (Apple and PET) as well as acronyms and abbreviations. He is pretty thorough (there are well over 120,000 entries). I could not think of an abbreviation or likely name that was not included, except the names of some British products.

Being American, there is naturally a heavy orientation towards Stateside usage but he does have a healthy sprinkling of British and other European terminology. He encompasses the mainframe, mini, micro and software industries and usefully includes definitions of various standards like the X. series of telecommunications specifications, of which X.25 is probably the most famous.

If anything, Wrathall is too meticulous. For example, he says that the letter C could be an abbrevaition for Capacitance, Capacitor, Carry, Celsius, Centi, Centigrade, Clear, Clock, Computer, Constant, Control, Controller, Counter or the name of the program language C. But in a dictionary like this, overkill is better than skimpyness. All all, an excellent reference book.



**The meaning of the heading (not included by Wrathall) is: 'Too wise you are, too wise you be, I see you are too wise for me.' Geddit?*

GOTO page 189

ingenious!

..that's the only word to really describe the superb Genie microcomputer system, the home computer which is compatible with the TRS 80, and ideal for all micro – enthusiasts, especially the committed hobbyist.
Genie has now been upgraded to Genie I, incorporating all of the original, excellent features, but with the addition of:

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- A MACHINE LANGUAGE MONITOR, with Display, modify, enter and execute (with break points) facilities.

Genie I has all of this, plus the built-in cassette deck, 16K RAM, 12k ROM with BASIC interpreter, full-size keyboard, an extremely wide range of new and up-dated peripherals, and literally 1000's of pre-recorded programmes available.
Yet, almost unbelievably, the price of Genie I is even lower than that of the original Genie.

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New!...12″ Monitor

Now, a choice of 2 monitors giving a clear easy to read image. The updated EG101 has a new green phospher tube.

New!...Expander

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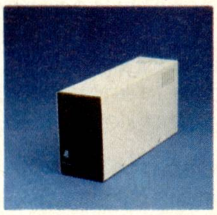
New!...Printer

The EG 602 printer can be connected to the Genie either through the expander or directly into the computer using the Parallel Printer Interface. It is a compact unit, with an 80 column, 5 x 7 matrix print-out, operating quietly and efficiently at 30 characters per second.



Disk Drive

As well as the obvious advantage of mass storage, the addition of the disk system to the Genie means much faster access to other languages and full random access file handling. Up to 4 of these 40 track drives can be used on a system.

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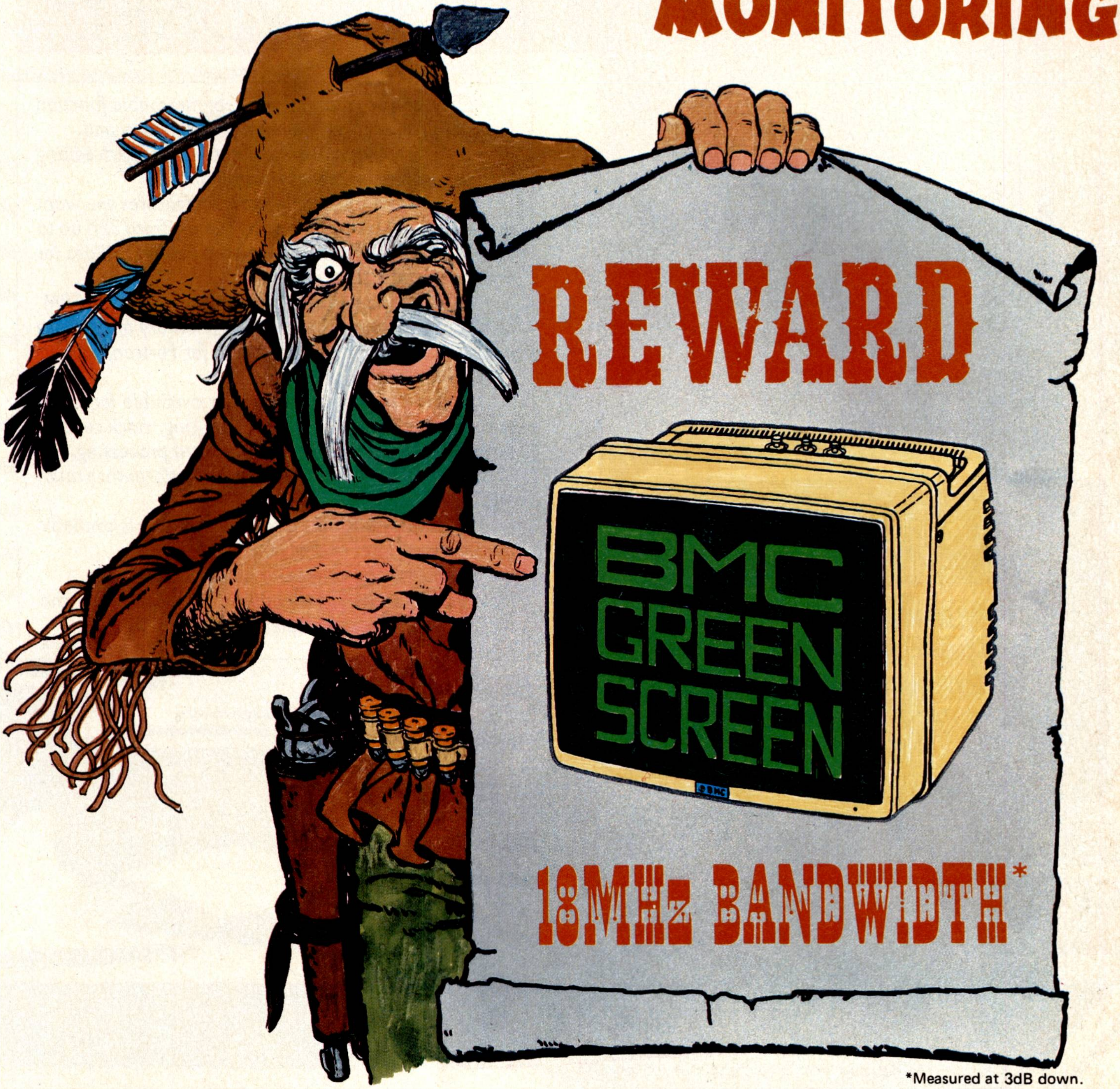

*Measured at 3dB down.

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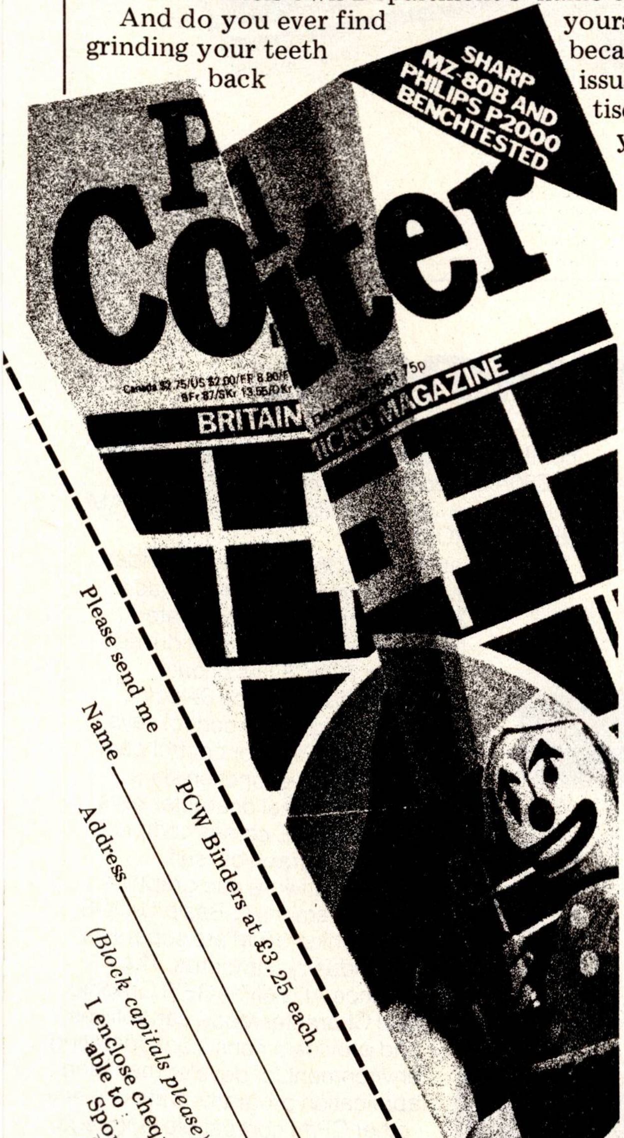

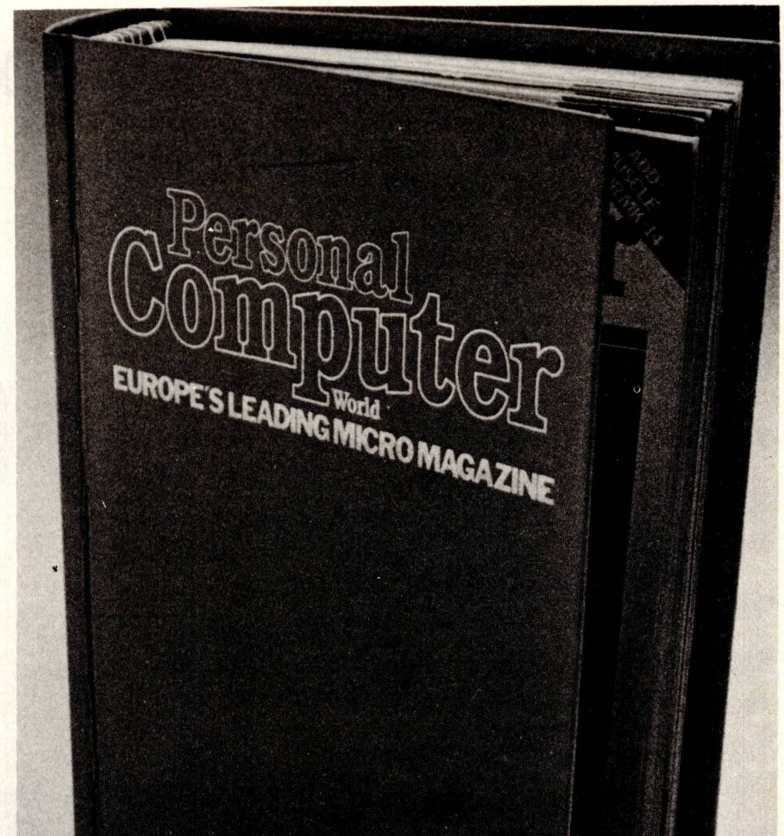

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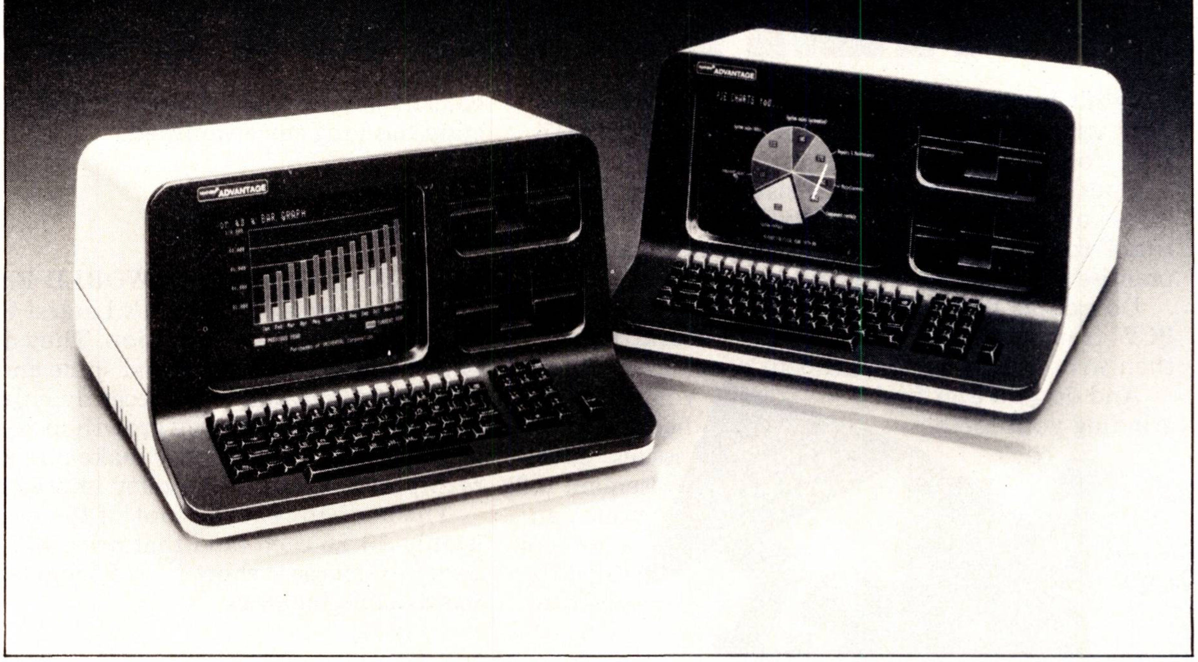

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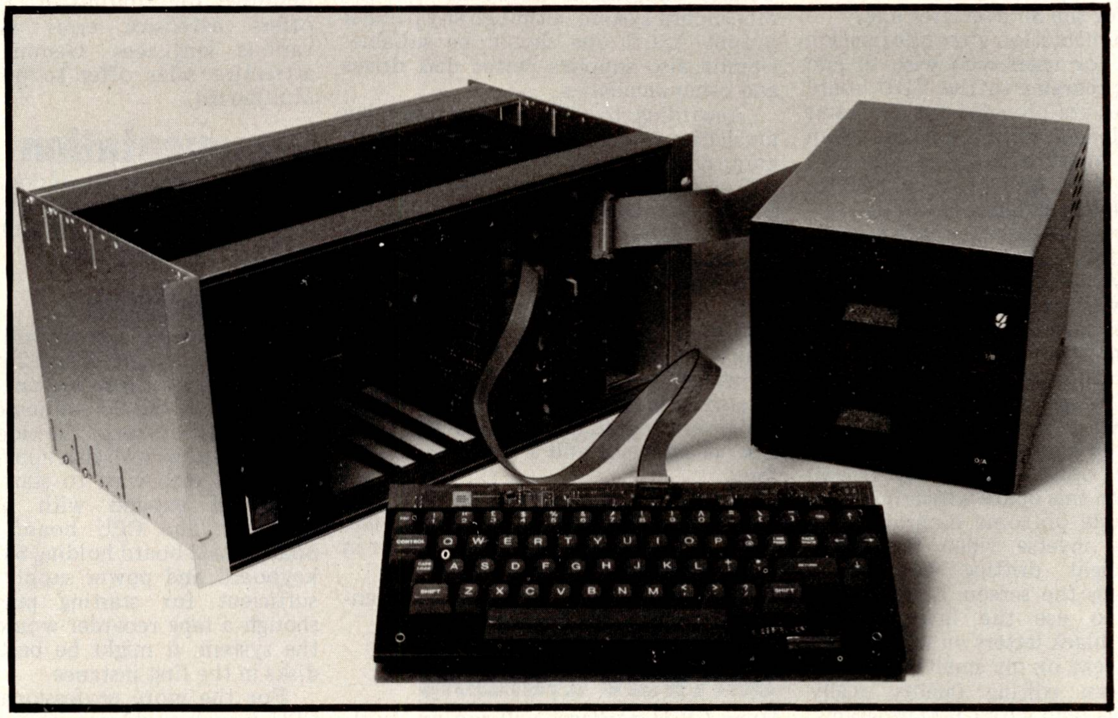
GEMINI MULTIBOARD

Neil Cryer reviews a versatile low-cost modular system.



Gemini Multiboard is an adaptable system of modules which can provide anything from a single board computer to a full CP/M disk system. The following modules are available: a Z80 CPU board, a 64K RAM board, an intelligent video board, a floppy disk controller board, a ROM board, an EPROM programmer, a keyboard and a power supply. The normal minimum configuration would probably consist of a CPU board, video board, RAM board, monitor, keyboard and power supply, with the boards plugged into a backplane for the bus that Gemini call 80-BUS, which is compatible with Nascom's Nasbus. All boards other than the EPROM programmer are 8in by 8in square and all but the CPU board can be used with a Nascom system.

With a RAM and video board and a software package called RP/M which is supplied with the CPU board, the system can run some CP/M programs from cassette tape rather than disk. This is an impressive achievement and makes for a remarkably low starting price for a CP/M system.

CPU board

This board has a great deal of built-in flexibility. It can act either as a standalone controller or, with other boards, as a complete system, such as a software development system or a word processor, etc. The Z80A can be set to run at 2 or 4 MHz and there is a reset jump facility to allow the system to start in a program stored on the board in ROM at any 4k address boundary. Four bytewide sockets are provided to take RAM, ROM or EPROM in a wide variety of sizes. Wait states may be selected or not, depending on the speed of the memory.

All memory on the processor board can be switched in and out under software control. Thus a system could, for example, start from the RP/M monitor supplied with the CPU board, and then switch it out and perhaps run as an entirely RAM-based system.

A parallel input is provided for a keyboard and further input/output is via a Z80A PIO, giving two 8-bit ports. There is also a serial interface which includes programmable baud rates, full modem support signals for the RS232 interface and a 1200 baud Kansas City/CUTS tape interface. Switching between these is under software control.

The RP/M resident software on the CPU board is designed so that software written for CP/M may work without disks. Naturally, the cassette mimic of CP/M cannot substitute for all the disk facilities and can only cope with one single serial access file at a time. It will, however, allow loading of programs such as ZSID, the Digital Research dynamic debugging program, or Microsoft's disc MBasic. MBasic can then be used to write to, or read from, a file which is also on cassette tape.

RP/M supplies the usual series of commands for examining and changing memory contents and ports, executing programs, shifting blocks of code and saving and loading tapes. Particularly useful is the screen editing. This is also available under CP/M (see under 'Video board' below).

RAM board

Like all the boards, the RAM board is suitable for any system with the correct 80-BUS or Nasbus. It comes complete with 64k of dynamic RAM and uses 32 4116 dynamic RAM chips. It can be switched in and out of the memory map using a method which allows up to four memory boards on the bus at the same time. Which one is active is under software control.

Video board

The video board is intelligent in that it has its own Z80 and 6845 video controller chip. All normal writing to the screen occurs during the line flyback time to give a continuous flicker-free display. There is also some spare memory which can hold the user's own programs irrespective of whether they are directly associated with the video display. The display is normally 25 lines of 80 characters, but there is an adjustable dot clock rate to run an alternative of 48 characters per line for a Nascom system. The normal character set is 128 in ROM with a further 128 in RAM although the user could if he wished put it all in either ROM or RAM.

A keyboard socket is provided and Gemini recommends that it be used in preference to the one on the CPU board as then a buffer allows entering of further commands while still processing the current command. A light pen socket is provided.

The interface to the CPU board is via three I/O ports. The system requires a video monitor rather than a normal television to provide the necessary resolution for the 80 character line.

The documentation gives information and advice for users who wish to add their own programs to the VDU board and facilities are provided for programs to be downloaded from the main system to the CPU board where they may take part in the video processing or perform some completely independent task.

There are 51 separate control codes by which the main system can communicate with the video board. These provide a wide range of functions: the normal ones such as cursor positioning, insertion, deletion and scrolling, and many extras such as programmable characters, inverse video and a memory 'lock' (which allows only a definable portion of the screen to scroll).

I found only one (rather trivial) problem with this board which might be less noticeable on some monitors than others. The inverse video tended to show a slight drifting herringbone pattern across the screen. Nevertheless, I tended to use the inverse video because the black letters on white seemed easier to read on my small monitor.

The screen editing facility really comes into its own with CP/M programs, which are often frustrating through lack of editing facilities. The screen editing is initiated by merely touching the delete (DEL) key. The system acknowledges by changing the blinking cursor to a solid one. The cursor can be moved anywhere on the screen and any line can be edited — by overtyping, deletion and insertion — and re-entered as the new command line for CP/M. Although Gemini warns that there may be times when this facility gives unexpected results (due to CP/M programs not having been written with it in mind), it worked every time I tried it. I was very impressed.

The disk controller board

This floppy disk controller board will control both 5.25in and 8in drives, although software is available for only 5.25in drives with a double-density, double-sided disk on drive A. Drive B can be double or single-density; Switching between densities is under software control. The board uses the 1979 chip and occupies five Z80 1/0 ports. A phase-locked loop is used for data recovery and there is automatic motor turn off after ten seconds of no read/write activity.

ROM board

The ROM board will hold EPROMs, which may be of more than one type, and may be switched in and out of the memory map. This has been arranged so that data can be read from EPROM and written to RAM. In particular, the RP/M monitor provides a command whereby a program held in ROM can be copied to RAM at address 100H ready for execution like any normal CP/M program. An EPROM programmer is also available from Gemini. It does not plug into the system bus like all the other boards but is driven from a pair of ports.

Other modules

Gemini supplies a keyboard for the Multiboard system, although any parallel output ASCII one should be suitable. Gemini also supplies Pertec disk drives and other ancillaries.

According to Gemini, the following ancillaries from other manufacturers are compatible with the Multiboard system: Arfon supplies a light pen and a speech board; the latter utilises the National Semiconductor Digitalker chip set which is somewhat similar to the speech board reviewed in the September 1981 *PCW*.

Quantum supplies an I/O board which offers three PIOs, a Z80 CTC and a battery-backed real-time clock. There is also a facility to accept a range of daughter boards, such as A/D and D/A, a serial interface and a fibre optic interface.

EV Computers supplies an IEEE 488 interface. This 80-BUS compatible IEEE-488 interface has much to offer in scientific and laboratory usage.

Both Vero and Winchester Technology produce a prototyping board.

Software available

Many CP/M packages will run on Multiboard without any modification. According to Gemini, packages such as Wordstar will run if they are configured for a Lear-Siegler ADM 3A terminal. Also according to Gemini, the following software from other manufacturers is compatible and will run from cassette or disk. The GEM ZAP package combines a flexible editor with a fast assembler;
— GEM PEN is a text editor and formatter based on what is claimed to be a considerably enhanced version of NASPEN, a package presently available for Nascom systems. I regularly use NASPEN and am very happy with it but look forward to trying GEM PEN;
— Pascal is being adapted for Multiboard by the author of the Blue Label Software recently adopted by Nascom as its standard;
— Comal 80 is a very topical language which has been receiving considerable press coverage recently. Borg Christensen, who was its originator, acted as consultant to Metanic, the producers of the Comal version being modified for Multiboard. The package offers extensive error messages in various languages. Gemini plans an attractive sales offer to purchasers of Multiboard.

Documentation

There is a separate set of documentation for each module. The layout is clear and the information is sufficiently detailed for all normal purposes.

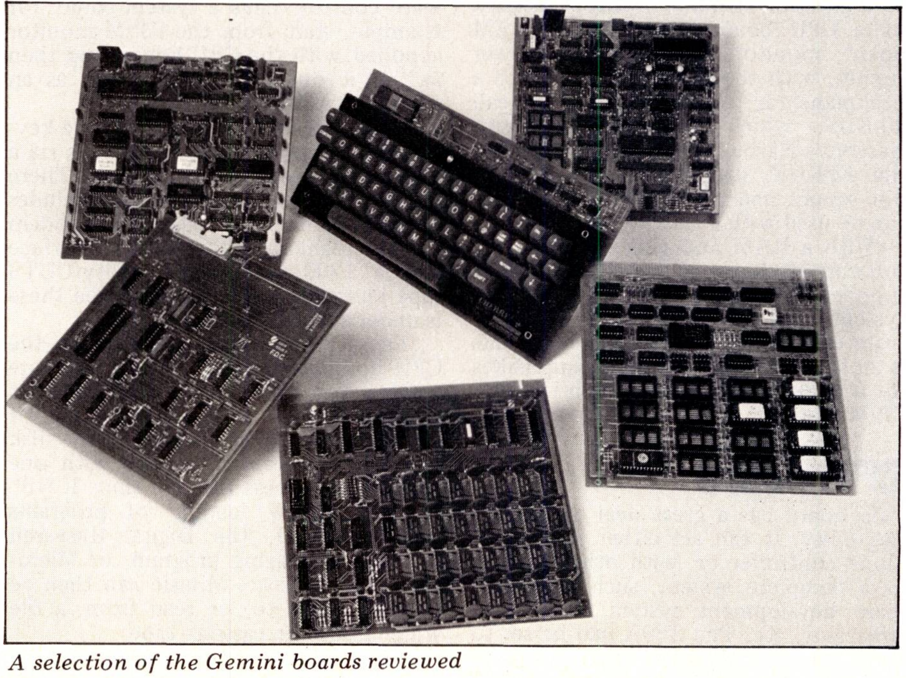
Conclusions

The Multiboard system will appeal to owners of Nascoms 1 and 2 if they wish to expand to a disk system or to take advantage of the 80-column display and additional features of the video board.

The system will also appeal to many hobbyists who wish to start in a small way and expand with off-the-shelf modules. The CPU board, the video board, RAM board holding 64k memory, keyboard and power supply should be sufficient for starting purposes. Although a tape recorder would complete the system, it might be best to go for disks in the first instance.

For the more professional user, the CPU board could act as a stand-alone controller with space for plenty of RAM and ROM and one serial and one parallel port chip, the latter giving two 8-bit ports. Extra I/O may be provided by adding any number of I/O boards to allow as many ports, both serial and parallel, and counter timer chips as required. A daisy-chained interrupt system is implemented to allow rapid

GOTO page 187



A selection of the Gemini boards reviewed

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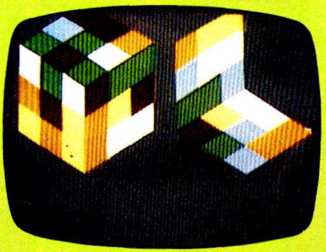

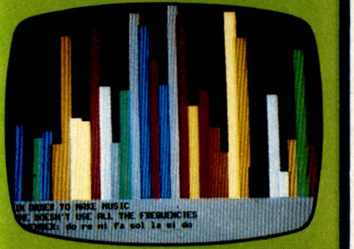

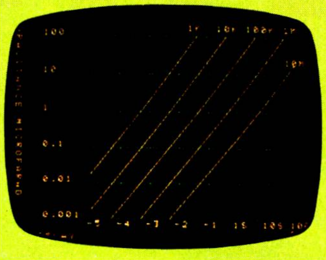

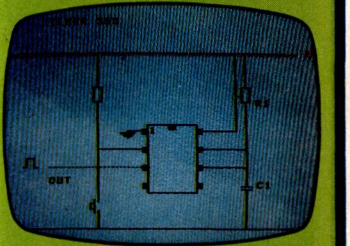

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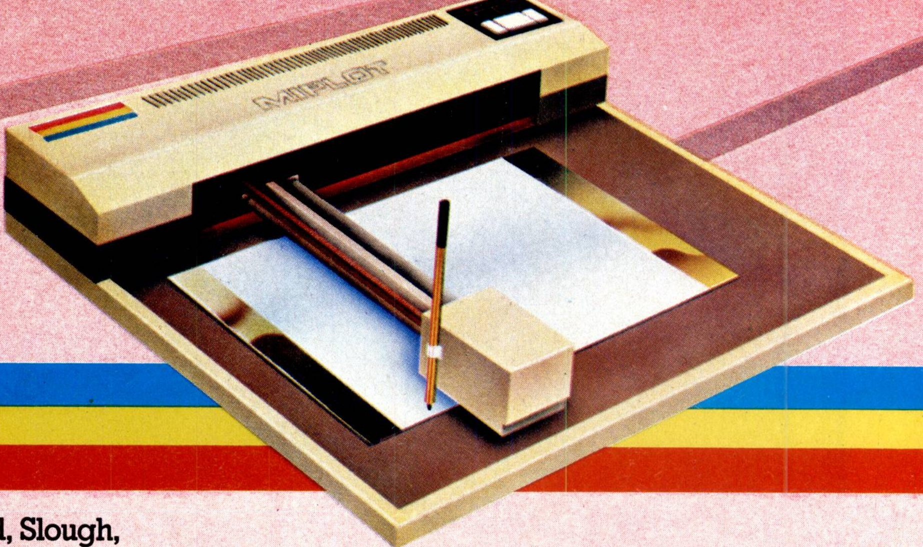

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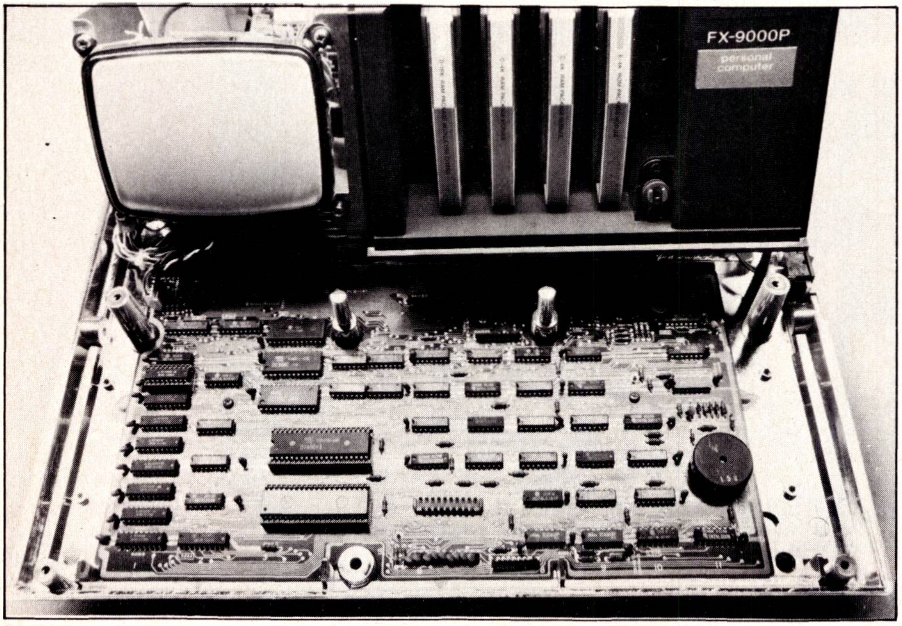
CASIO fx-9000p

Dick Pountain benchtests Casio's first fully fledged personal computer.

Casio emerged from the calculator wars of the 60s and 70s as the world's largest manufacturer of pocket calculators and has maintained this position by a policy of technological innovation combined with cheap pricing. Constant memory, LCD displays, 'credit card. size and various bells and whistles such as music, clock and games facilities have been incorporated into its enormous model range with bewildering speed.

It is rather surprising, though, that Casio has been slow to enter the microcomputer market (especially as its full name is Casio Computer Co Ltd). Sharp beat it by a year to the first pocket Basic computer (the PC-1211) and Europe has yet to see the subject of this review, Casio's fx-9000p desktop computer; in fact, this is something of a preview since no decision has yet been taken to import it to the UK, though it is already on sale in the USA. Whatever the reasons for Casio's reticence in the micro market, it is clear that it is determined to tread cautiously, by which I don't mean that it has followed fashion — far from it. Fashion would have dictated a 64k twin disk, CP/M-based business machine, similar to those now pouring from Japan. Casio has stuck with what it knows: the 9000 is a super-calculator, aimed at engineers and scientists and a niche which is currently occupied solely by the Hewlett-Packard HP-85. It is also quite unorthodox, from the quirky CA-Basic to the CMOS RAM storage.



Main board, memory modules, power supply and dinky CRT.

Expansion ports are on OP-1 adaptor; PCB is connector for memory modules.

Hardware

The external packaging of the 9000 is compact, attractive and a shameless rip-off of the HP-85. The case is a high-quality plastic injection moulding in cream with a windowed hinged trap-door covering the huge port next to the VDU screen into which fit four assorted memory modules. The VDU itself is a tiny 5in diagonal green screen job, which, despite its diminutive size, is eminently readable due to its fine resolution and a good (upper case only) character set. The display is 32x16 characters, or 255x127 dots in the point graphic mode, which means in practice that a fair bit of the tiny square screen goes unused. Brightness and contrast are adjustable by screwdriver at the rear of the cabinet.

The keyboard is of the calculator type, with keys like blown-up versions of those on the Casio 502. Although they are debounced and have two-key rollover, the whole keyboard is too small and the gaps between keys too large for touch typing; this isn't a criticism since only a crazy person would want to word process on this machine. Instead, Casio has deliberately deviated from standard layout to facilitate two-fingered pecking by myopic scientists; commonly-used symbols like ',' '$', '#' ' ', '=', '<' and '>' are all unshifted while all the numbers and arithmetic operators are on a separate keypad. 'Shift' doesn't give any lower case characters but single key entry of maths functions and Basic commands instead.

The numeric keypad has its own return key called 'COMP' which allows direct mode calculation without the need for 'PRINT'; a further nice touch is the 'ANS' key (imported from its latest calculators) which returns the result of the last calculation to the screen and is a godsend in long computations with ten-digit numbers. A 'STAT' key is provided for entering data to the comprehensive, built-in statistics routines.

Probably the most innovative and controversial aspect of the '9000 is its memory organisation. The machine comes with 4k of NMOS RAM and 12k of ROM, holding the CA-Basic, on board; the rest of the memory map is 28k of fresh air, divided into four slots and contained behind the hinged door. There are three options with which to displace this fresh air: 16k NMOS RAM ,4k CMOS RAM with battery protection, or 12k ROM modules. Only one 16k expansion may be added which must sit in slot one. Its contents evaporate on removal or power-off, of course. Similarly, only one ROM pack may be present which must sit in slot four. The one I have is an extended Matrix Handling Basic of which more later. Up to four CMOS modules may be added, using all the slots, which are removable with their contents held safe for up to three years by replaceable internal batteries. Although a cassette interface exists and Casio speaks of disks as a future option, they obviously see these modules as the principal bulk storage medium for programs, if not for data. Access to their contents is effectively instantaneous, faster even than hard disks. Nevertheless, I have reservations about the system, of which more is said below. A little mental arithmetic will soon show that the maximum memory configuration is 32k (12k protected).

Physically, the modules are identical plastic boxes the size of a small paperback with a sturdy metal handle at the front and an edge connector at the rear, via which they plug into the slot. If less than four are fitted the slots must be filled from the left (1) in order to maintain contiguity of the memory map. You're probably wondering what they're going to cost; me too, and the viability of the system is crucially dependent on the answer.

When the case is removed, a single board of excellent layout and construction is revealed which contains all the chips, of which only the processor, its unidentifiable partner and, curiously, a single RAM are socketed. The processor is Casio's own 'Z80 compatible' (this is all the manual gives away) chip which runs at 2.75 MHz.

The internal construction shouts of cost-effective Japanese production engineering; not afraid of a custom connector where required nor too proud for a strip of sticky tape where adequate. Ventilation of this small, tightly-filled space is simply via slots in the case top; when I accidently left it running all night with a document half-covering these slots, it was barely warm in the morning (yes this is the sort of idiot you lend machines to, dealers!). The slots are covered on the inside with the fine nylon mesh to catch small objects — smart thinking. The built-in power supply is filtered and shielded, giving a rock-steady display on our alien occidental mains.

The underside of the case has a large shallow depression, the front edge of which has a slot through which an edge connector on the main board protrudes (BBC micro style). I was supplied with the optional OP-1 I/O adaptor which fits snugly into this depression and fixes by four screws. (It fits so snugly that one disingenuously wonders why it wasn't built in.) The rear edge, which is now the back panel of the computer, flaunts an I/O Bus connector (for disk and RS232C expansions), serial and parallel printer sockets (for Casio's own

miniprinter and the Epson MX-82 graphic printer) and three phono sockets for connection to cassette or reel-to-reel tape recorder, one of which is a remote control line. In addition, the OP-1 contains batteries and a real-time clock/calendar which is accessible from Basic and includes three independent alarms using the built-in bleeper.

Software

The 9000 is programmable only in Casio's CA-Basic dialect, which sits in 12k of internal ROM. There is no mention in the manuals of machine-code operation and no obvious way into the monitor, nor any CALL or USR in the Basic.

CA-Basic is quite large with around 120 instructions, a large number of which have to do with graphics, maths and the handling of RAM files. The 'core' commands are Microsoft-like, particularly the control structures and string handling, but there are two glaring and curious omissions: there are no Boolean operators and no DEF FN statement. I suspect both will be sorely missed by the sort of scientific users the machine is aimed at. Less importantly, there are no AUTO,RENUMber or TRACE commands for those used to the soft life.

The arithmetic is of 12-digit precision with 15 digits held internally and a dynamic range of 10+/—99, which is a good deal better than most micros. Angular modes of degrees, radians and gradians are selected by the 'SET' command. The maths functions not found in 'ordinary' Basics include hyperbolics, factorial, permutation and combination, extensive statistics including standard deviation and linear regression, 'FRAC' as well as 'INT', and 'MODulus'. 'ROUND' rounds off numbers to a chosen number of significant figures. Additional output formatting is performed by PRINT##.## statements — no USING is required.

Another good feature carried over from Casio's calculators is the partitioning of memory into ten program areas assigned to keys P0 through P9 (the shifts of the numeric keys). Ten separate programs can be stored simultaneously and executed by a keystroke; the partition is dynamic and user-transparent. Full cursor editing is provided but, irritatingly, it must be summoned by the EDIT command which has the same syntax as LIST; you can't cursor up and edit a line you just entered, nor edit a LISTing, nor continue editing a line after hitting return unless you call EDIT again. The editor is exited automatically after the last line is reached. On the subject of LIST, it only takes one (optional) argument so you can only list from a named line to the end which is highly inconvenient when you wish to inspect ten lines in the middle of a program; this involves diving for the (shifted) Break key as the listing whizzes past the tiny screen. You can't slow the scrolling, either.

Variable names must be a single upper case letter or letter plus one digit and the same goes for one and two dimensional arrays. String arrays and variables take the conventional '$'. An interesting and useful (in its intended context) eccentricity of CA-Basic is that variables and arrays are not cleared by the RUN command but must be specifically erased by CLEAR DATA. A single named array may be cleared by ERASE (array name). By dimensioning and erasing arrays in a separate program (under a different key) matrix operations involving accumulation of data are easily done. Arrays may be dimensioned and redimensioned (by the REDIM statement) dynamically during run time; excess elements are lost or set to zero as appropriate.

These facilities are already ahead of most Basics but the Matrix Handling extensions in the ROM module widen the gap further. MAT READ (n,m) fills an n by m matrix with DATA 1,2,3. . . without the need for looping and MAT PRINT displays it in any chosen numeric format, though the small screen becomes embarrassing here; memory size is the other limit since in theory a 255x255 matrix can be defined. Functions are provided for matrix sum, difference, scalar and vector product, transpose and inverse and to create zero, unit and constant matrices and take the determinant. To give an idea of the speed, it takes 11 seconds to invert a 10x10 matrix and 130 secs to invert one 20x20.

On the subject of speed, inspection of the Benchmark timings will show that CA-Basic is far from fast and in particular is lamentably show on trig and logs (BM8) for one with scientific pretensions; to keep things in perspective, however, it's still 30 times faster than the fastest programmable calculator. I suspect that the Basic is slow because it uses neither tokens nor link-listing. Certainly when permitted abbreviations such as P. for PRINT are used they are not replaced by the full word when listed, and savings in both memory and execution time accrue when they are used.

The graphics on the 9000 are one of its most endearing features and are excellent for a machine of its size; in character mode it has a fully addressable cursor via the CSR(x,y) statement, in addition to TAB, and any character string may be displayed in reverse field by preceding it with REV which operates until cancelled by NORM. In the 'hi-res' mode the screen is dot addressable by DRAW(x,y) which cleverly doubles as a vector plot by taking multiple arguments;DRAW (a,b)–(c,d)–(e,f)–(a,b) draws a triangle between the named points. QUADx1, y1,x2,y2 is an even more compact form which draws a horizontal rectangle with the named bounds. CDRAW and CQUAD undrawn the corresponding figures. Both these commands may be modified, without having to change their arguments, in INIT(x,y),n,m which sets the origin at x,y and the acles of the axes to n and m.

If this still doesn't make graph plotting simple enough for you then the functions CHGX and CHGY convert co-ordinates from the current system (defined by INIT) to physical screen co-ordinates. Used in an IF statement they can trap off-screen errors and alter the co-ordinate system to fit a graph onto the screen. PLOT (x,y) is a flag which is true if dot x,y is illuminated.

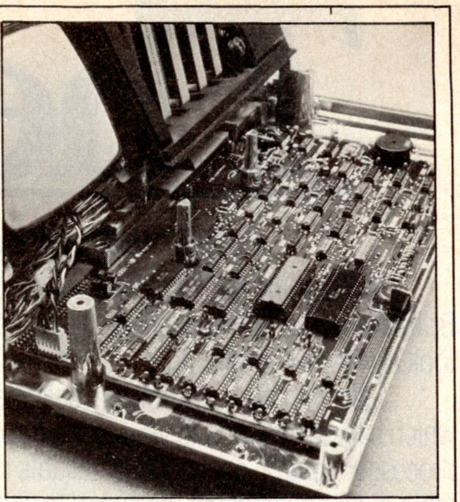
Finally there are GIN$ and GOUT, lovely words which have nothing at all to do with elderly military gentlemen, but enable 8x8 characters to be read from the screen or output to the screen in bit-image form GIN$ reads a character as a string of eight characters whose ASCII values in binary define the bit-image; GOUT takes a similar string as its parameters and can be used in three modes 0,1, and 2 which respectively replace, overwrite or are logically ANDed with the previous screen content. GOUT is used in a PRINT statement and when used with GIN$ enables characters or shapes to be moved about the screen without erasing the background. To summarise, these are powerful and well conceived graphics which make complex plots and charts a pleasure to program.

Finally, the file handling. Cassette files are created by perfectly orthodox SAVE, LOAD, OPEN, GET, PUT and CLOSE commands, the only icing on this cake being SAVE DISP and LOAD DISP which do just what they suggest to the screen contents; nice for fancy plots. A similar screen dump to the graphic printer is allowed. Password protection of program files is provided which prevents listing, editing, saving or loading unless the password is entered.

RAM filing is a different can of worms. Understanding its operation is really not much more difficult than say, Byzantine Theology but unfortunately, should you have trouble, the requisite chapter of the manual appears to have been translated from Japanese to Maori to Urdu and finally into a sort of English.

As I understand it, up to 28k of RAM from the top down can be specified as the RAM File Area which is divided into seven RAM files and is protected from encroachment by the work area and from the effects of commands when so specified. Each RAM file is subdivided into two 2k blocks. The files are numbered from low memory up so that if you specify RFILE 6 you are only protecting the top 8k, the rest being still available as workspace until you specify a lower RFILE number (draw a picture, it helps). This is assuming a maximal 32k is present, in which case you will instantly see that files 1 to 4 are not in CMOS RAM, which is to say they are as much use as tits on a boar. If you have four CMOS packs present (20k total) then the first pack is reserved for workspace so that only files 1 to 3 are available (don't ask me why it isn't 2 to 4). On the review machine I have the 16k pack, two CMOS packs and the Matrix ROM which allows me to specify only files 4 and 5. I can, of course, save into a lower file but the contents will go up to heaven when I switch off (which they did until I sussed what was happening). I leave it as an exercise for the reader to work out what files are available with other combinations of packs (you are following this aren't you?). The point is that the software gives you no clue; when you RLIST you always get a list of seven files regardless of whether they're safe or not; they may not even exist since the RAM file is a purely logical entity.

Once you've found a safe file, RSAVE will put a program (from a single program area) into its first block. A second RSAVE puts another program into its second block. You may now remove this pack with your two programs safely stored in it; regardless of how short they are they are occupying 4k of (probably) expensive CMOS RAM. If a program is bigger than 2k it spills over into the next block unless this is already occupied, in which case the save is aborted without any message to that effect. If a program exceeds 4k it spills over into the first block of the next pack if present; if absent, you are prompted to 'SET NEXT BLOCK'. In no circumstances can you corrupt a previously stored program, which is a blessing. To retrieve your program, select a program area, clear it and RLOAD. Interestingly, this process does not automatically clear the loaded program area so, by cunning choice of line numbers, you can chain, overlay or even interleave programs. When no blocks are left you are prompted to 'SET NEW PACK'. With the configuration on the review machine I could only store four programs as I had no spare packs. All of the foregoing applies equally to data files which are created with ROPEN, RPUT RGET and RCLOSE and are sequential files. The net effect is as if you are working a strange floppy disk system where *you* have to decide which sectors to use instead of the operating system (and I doubt that floppies would have ever caught on if you had to)! The hardware works fine but the software needs to provide better guidance and to be more transparent.



Black 'pillbox' is a beeper.

Even so, the system may find favour with sci/tech users when many smallish programs need to be quickly available, but whether or not it will prove cost-effective depends crucially on how much Casio decide to charge for RAM packs and when you consider what goes into them compared to a floppy disk, I'm not optimistic. In fact the US price suggests that they could be over £40 each.

Documentation

Two manuals are supplied with the '9000, a thin flimsy Operation manual similar to those for the calculators, and a 180 page CA-Basic Reference Manual. The former is overly condensed though useful once you've made the initial strides. The latter is a fairly comprehensive account of the language and error messages though it makes few concessions to the novice programmer. It does, however, have programming problems at the end of each chapter with sample solutions at the back which are helpful. Both are marred by shaky English translations, the section on RAM files being only the most extreme case. Fortunately, the description of matrix operations is quite lucid.

Expansion and potential

It's already quite clear what the potential use of the fx-9000p is. It's not designed for word or data processing and so is unsuitable for most business applications, though I could see possibilities as a desk-top machine in insurance, banking or broking. Whether it can cope as a management tool is doubtful since the small screen rules out Visicalc-type displays (unlike the Osborne it doesn't have sideways scrolling). It is not going to find favour with educationalists who are fighting to separate computers from mathematics and vice versa while hobbyists would want colour graphics or machine language depending on their bent. It is, in fact, aimed squarely at the laboratory, design office and study, as a superior number-crunching replacement for the programmable calculator. To arrive there, it has to compete with the HP-85; no direct comparison is possible because although

GOTO page 187

The Systems

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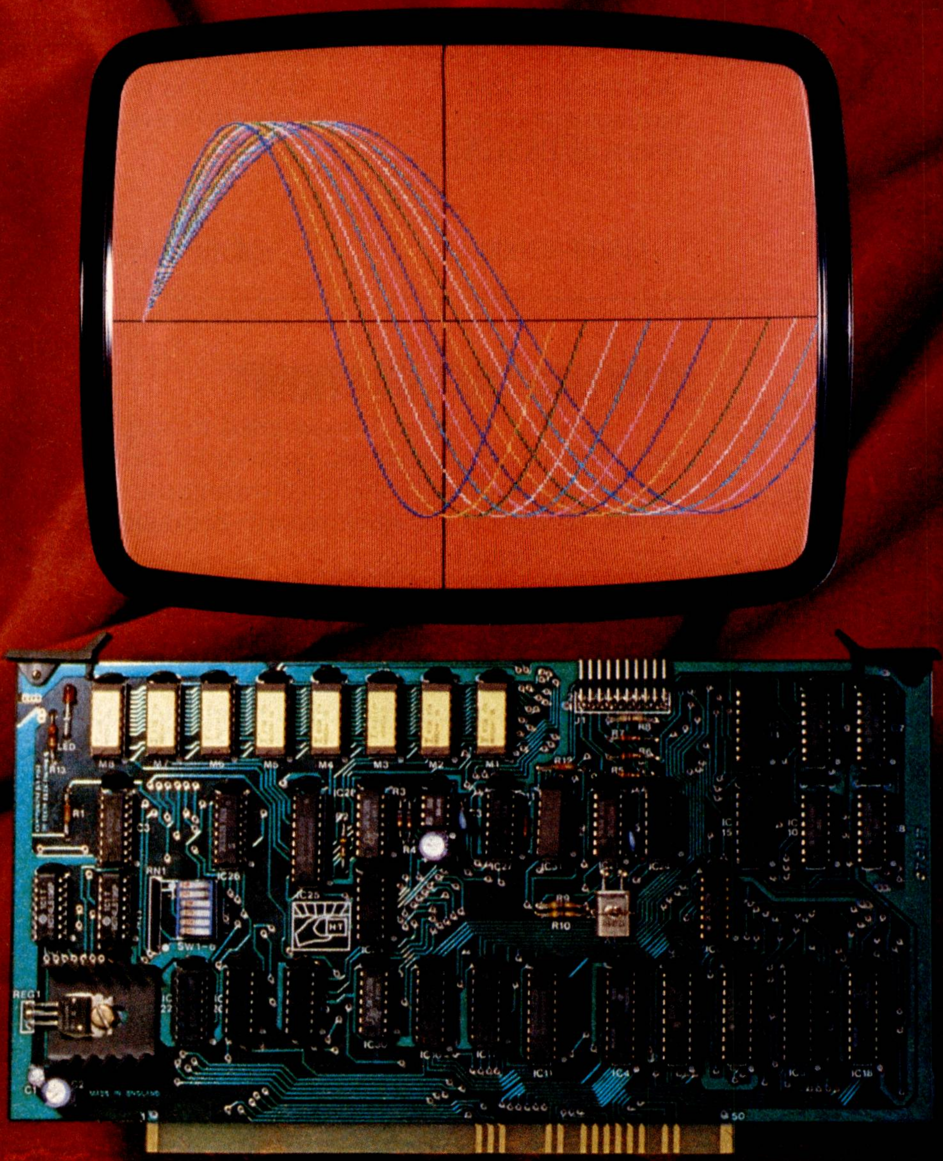

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The display fills the entire active screen area, and all colours can be used simultaneously while retaining full definition. Up to 28 rows of 52 alphanumeric characters can also be displayed. The TV frame, with a completely programmable TV waveform allowing for 625 and 525 line standards, is entirely generated by an on-board 64K byte memory.

The memory is 'off the bus' and addressed through three switch-selectable ports.

Software

The SID 1 software consists of machine-code routines: initialization, set background, plot a point, draw a line, plot a character, print a character, print a character string, fill a rectangle. These may be used directly, or called from a high-level language.

Customized Basic is also available to provide these facilities on North Star, Communicator and other Z80 machines.

Video interface

The SID 1 graphics board has a Hi-tech Electronics standard 20-way connector. The pin-outs provide:

—red, green, blue and sync outputs at TTL level

—red, green, blue and sync outputs at 0.75 V into 75 ohm (CCIR)

—luminance, sync, 6 MHz dot clock and $\overline{\text{PRINT}}$ for standard screen-dump print.

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HIGH DENSITY VDU CARD

B J Hawkins, in a two-part feature, tells how to produce a 80 x 26 display for your Z80/8080 system.

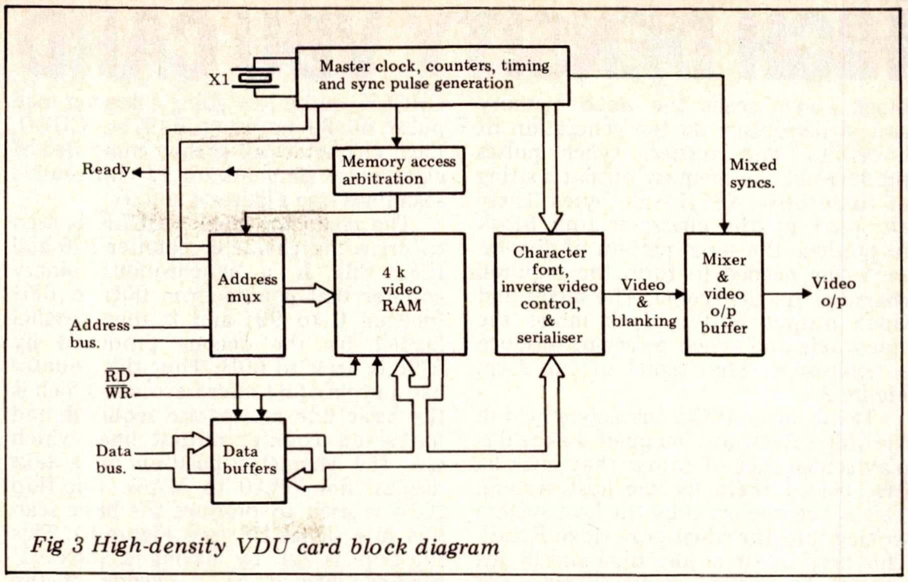


Fig 3 High-density VDU card block diagram

This article explains the principles, design and construction of a high density VDU interface card suitable for a wide range of machines and systems. Next month I'll give the assembler language driver routines to enable the VDU card to be interfaced to an 8080/8085/Z80 — based system to give a professional quality, full cursor control display screen.

Many of the single board computer systems on the market today have for reasons of economy, and so that a modulator/domestic TV may be used as the display screen, settled on a 64 character by 16 line display format. This is ideal for the apprentice programmer in terms of cost and performance but, once hooked, the serious programmer will soon outgrow this display and yearn for a professional 80 by 26 size screen. This project provides a low cost, flexible unit that, coupled with the driver routines in next month's article, will provide a professional quality display interface with the full range of standard functions but no expensive frills. My prototype was interfaced to an 8085-based system but the design is flexible enough to be used with other microprocessors, such as the 6800 or 6502. The driver routines of Part Two would, of course, require translating into the relevant machine code language.

Hardware design

The basic philosophy behind the hardware was to design a unit that meets the following broad criteria: 80 character by 26 line display format, of the memory mapped, non-interlaced raster scan type; standard composite 1V peak-to-peak video output to drive a professional monitor (approx 12 MHz bandwidth); standard low power Schottky TTL and industry standard memory devices to be used as opposed to exotic and expensive LSI chips; economy of hardware by making more complex software carry out functions such as cursor generation and control, screen scrolling and automatic carriage return and line feed; and a unit that uses standard bus signals and has non-critical timing requirements, allowing it to be coupled to a wide range of processors and systems.

A raster scan display is built up of a large number of horizontal lines traced out by the electron beam in a CRT. The scan lines start at the top right hand corner of the screen and trace out the whole area of the CRT face, ending at the bottom left-hand corner; the spot then flies back to the top right-hand corner and the process is repeated (see Figure 1). This sequence is called a field and is repeated every 1/50 second or at a repetition rate of 50 Hz. Because of the visual persistence of the phosphor of the CRT and that of the human eye, this creates the illusion of a steady picture.

To produce a video picture, therefore, certain information in the form of timing and picture data must be provided. The electron beam spot must be told when to start a horizontal scan line and when to 'flyback' to start the next scan line.

In the same way, each video field must be informed when to start and when to flyback to start the next field. And finally, of course, the electron beam intensity must be modulated along each scan line to produce picture information. These timing signals and video are combined together in set proportions to give a composite video signal (see Figure 2) and this is the signal that a CRT monitor will require to produce a steady synchronised display.

Figure 3 shows a block diagram of the main circuit areas of the high density VDU card. The video information to be displayed is held in a 4 kbyte video RAM memory. This is data in the form of ASCII character codes. The main timing generation logic in the

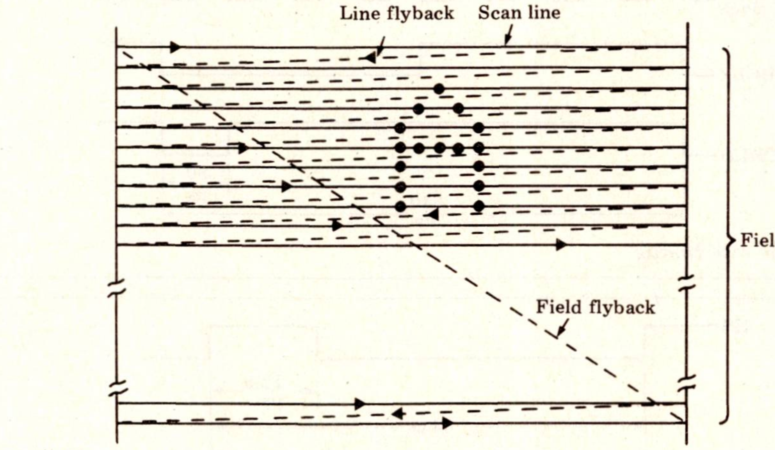


Fig 1 Raster scan pattern.

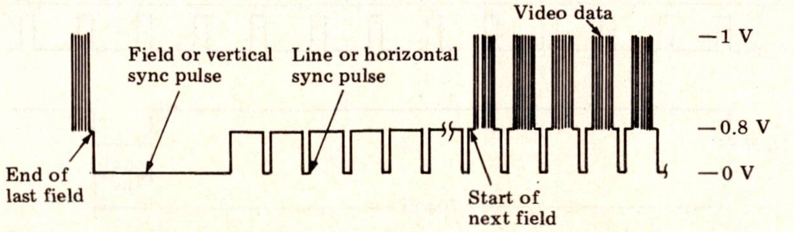


Fig 2 Composite video signal.

HIGH DENSITY VDU CARD

block above scans the video memory and synchronised to the generation of horizontal and vertical synch pulses produces at the memory output a string of consecutive ASCII code bytes. These are used by the character font block to produce the serial pattern of dots on each line needed to form the required character on the screen. The mixer and video output buffer block mixes the video data and synch pulses to produce a composite video signal of the form Figure 2.

This is how ASCII characters held in the video RAM are 'mapped' to the display screen, but of course they must be first placed there by the host system. This is accomplished by the host system writing into the 'dual port video RAM'. This may occur at any time and if this were to be allowed, it would cause the display to look unsteady and 'noisy'. To prevent this happening, the circuit block called Memory Access Arbitration controls when the host system may have access to the shared memory space. This is done by detecting when in each video field the host system may have access without upsetting the video data, ie during horizontal and vertical flyback times. During these times the logic switches over the address multiplexers so that the video memory may be addressed by the host system and data may be written or read from the memory space. If the processor of the host system should attempt to access the memory at any other time it will be placed into a 'Wait' state until the next 'flyback' time occurs. Thus the video memory may only be accessed at safe times and appears to the processor as a block of normal memory, that sometimes has a long access time. (Please note that the processor is only 'slowed down' when accessing the VDU memory and its speed is not affected when it is talking to its own system memory.)

Detailed operation

The master oscillator IC28, R1, R2, C1 and X1, uses a 12.598 MHz crystal to produce a pixel clock with a period of approximately 80 ns. Thus a pixel element, which is the smallest picture element that is displayed on the screen corresponds to 80 ns of a scan line. The basic pixel clock is divided by a factor of eight to produce a square wave character clock of 640 ns period, CHCLK, and a low going character load pulse of 80 ns every 640 ns, CHLD. Each character cell is thus composed of eight pixel elements on 11 consecutive scan lines (see Figures 4 and 5).

The character clock CHCLK is used to drive the character counter IC6 and IC8; this is a synchronous binary counter that counts from 00H to 63H (decmal 0 to 99) and is then parallel loaded by the decode produced by IC20,6 back to 00H. Thus this counter has a cycle of 64 microseconds, which is the basic line rate period required, and has seven counter output lines which give the character position on a text display line (MA0 to MA6). Flip-flop IC14 is used to produce the basic scan line rate signal HS (see Figure 6). This flip-flop is set by having a logic '1' clocked into it by a decode of the counter sequence (81 decimal) and is reset by a clear signal produced by a second decode of the counter sequence (01 decimal). (Gates IC7,8 IC20,12 IC20,6 IC11,12 IC9,3 IC4,2 and IC4,4.)

As can be seen from Figure 4, an individual cell is made up of eight pixels on 11 consecutive scan lines, hence the next step is to divide the scan line rate signal HS by 11 to produce a character line rate signal CLN. This is accomplished by counter IC10. This counter counts from zero to ten and is then parallel loaded by IC3,3 back to zero (see Figure 7). The counter output lines P0 — P3 are used to address the character look-up font to give each row of the character cell pattern.

The next step is to count the number of character text lines to give the line count addresses and the field rate signal VS. This is achieved by counter IC12 and flip-flop IC14. This is a 5-bit counter that counts from 00H to 1BH (0 to 27 decimal) and hence has a sequence length of 19.7 ms, which gives the basic 50 Hz field rate. (Gates IC13,6 IC9,8 IC9,6 IC4,8 and IC4,6.) The counter outputs MA7 to MA11 give the character text line address, and the basic field rate signal (see Figure 8) is produced from a decode of the counter output lines (gates IC11,6 and IC9,11).

This completes the description of the block of circuitry labelled as the main timing generation logic; from it the basic system clock signals and synchronisation pulses and the raster scan bus MA0 — MA11, and P0 — P3 have been produced. Now let's look at the video RAM and its associated address multiplexers.

The video RAM consists of a 4k block of 8-bit memory composed of industry standard 2114 memory chips (IC21 — 24, IC34 — 37) and the two-to-four line decoder chip IC25. The address multiplexer consists of three quad two-to-one line multiplexers IC38, IC39 and IC40. If we assume that the signal X/I SEL is high (ie internal access selected), the raster scan bus MA0 to MA11 is selected by the address multiplexers to become the video address bus VA0 to VA11. In the internal access mode, the video memory R/W signal will always be high and the RAMs will carry out read cycles only. Hence the cycling addresses on the raster scan bus will cause the video memory to produce a string of data bytes onto the video data bus. As will be explained in greater detail in the second article of this project, the memory map is not continuous; this is to economise on the number of counters used to generate the raster scan bus. This also has the effect of allowing all the software pointers and variables needed for the driver programs to be stored in non-displayed RAM areas and gives ¾k of extra continuous RAM for user programs.

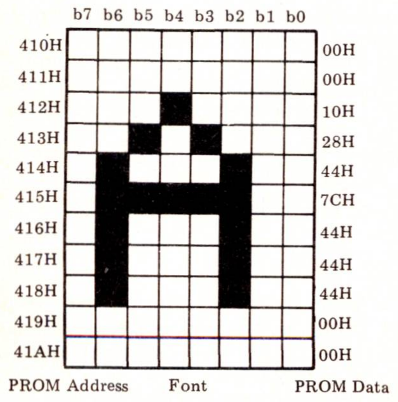


Fig 4 Example from character font PROM.

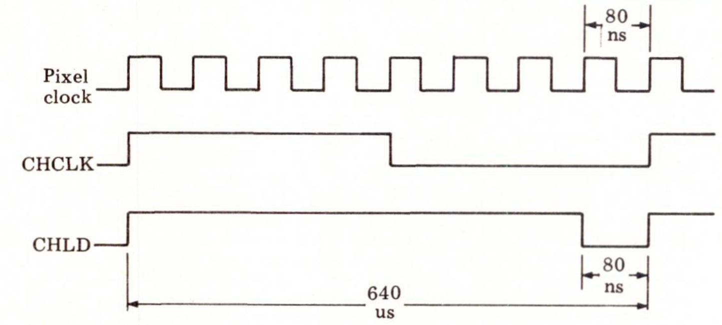
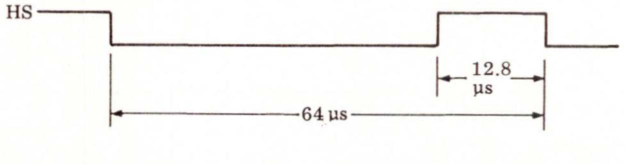


Fig 5 Line rate timing



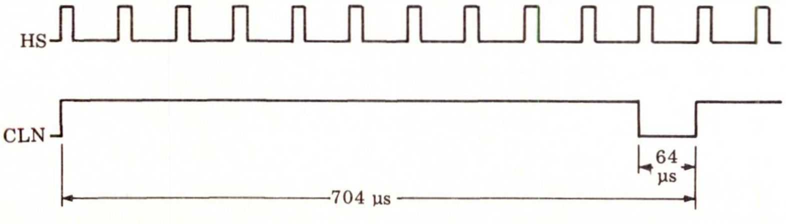


Fig 7 Character line rate timing

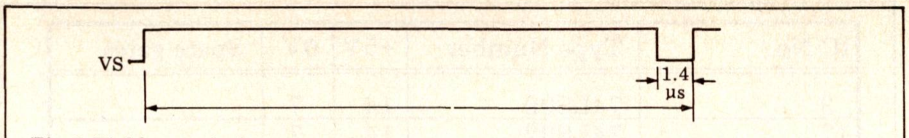


Fig 8 Field rate timing

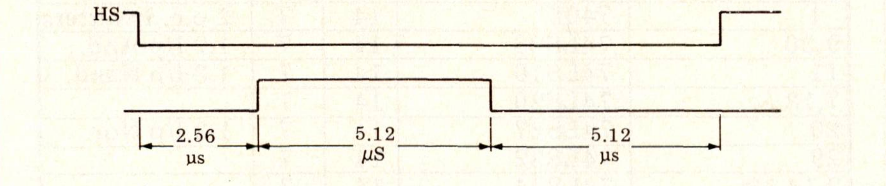


Fig 9 Horizontal sync pulse generation.

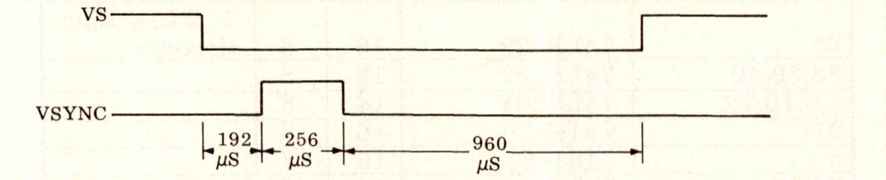


Fig 10 Vertical sync pulse generation

The string of data bytes produced by the video RAM onto the video data bus are presented in turn to the next section of circuitry that will be described, the character font and serial converter logic. ASCII data bytes on the video data bus, VID0 — VID7, are latched into the 8-bit latch IC33 by the character load pulse CHLD. The seven l.s. bits from IC33 are connected to the seven top address lines of the character font PROM IC32. This is an industry standard 2 kbyte 2716 EPROM. The character font PROM contains 128 character patterns (see Figure 4) which each consist of 16 bytes (five of which are unused); each character is selected by its 7-bit ASCII code on the top seven address bits and the required row of the pattern is selected by the scan line address bits P0 — P3. Details of the character font patterns will be given in the second article of this project. The font row data at the output of the character font PROM is latched into the parallel inputs of the serial converter shift register IC31, by the next character load pulse CHLD. This shift register is clocked by the pixel clock and produces a serial data stream from its QH output.

The m.s. output bit of IC33 is connected to the D input of the inverse video flip-flop IC19. The function of this flip-flop is to allow characters to be individually placed into the reversed video mode, ie to appear as black characters on a white or green background. Flip-flop IC19 is used to control the exclusive or gate IC18; this gate acts as a programmable inverter on the serial data stream from IC31. Thus if the msb of a byte in memory is set, the ASCII character given by the other seven bits will appear in reverse video on the display screen.

During the field and line flyback times the character font and serial converter logic will produce unwanted data that is not required to be displayed. The video data stream from IC18 is gated by IC3,8 with a signal called mixed blanking. This is produced by ORing the HS and VS timing signals together after they have been resynchronised to the character clock CHCLK (IC2 and IC30,3). Thus IC3, from its output, produces the complete' video signal carrying the picture information for each scan line and blanking information during the line and field flyback times.

To produce a composite video signal (see Figure 2) we need to add line and field synchronisation pulses to the mixed video and blanking signals. To do this the signals HSYNC & VSYNC are generated (Figures 9 and 10). The horizontal sync pulse HSYNC is produced by the horizontal sync porch generator logic (IC15, IC3,6 IC4,11 and IC4,12). This circuitry produces a line sync pulse correctly framed within the line rate signal HS. The vertical sync pulse VSYNC is produced in a similar fashion by the vertical sync porch generator logic (IC16 and IC29,3). This logic produces vertical sync pulses correctly framed within the field rate signal VS. Finally the synchronisation pulses and the mixed video and blanking signals are mixed together in the correct ratio by using open collector gates and weighting resistor networks to produce a standard composite video signal (IC1,2 IC1,4 IC1,6 & R4 to R8)

The final sections of circuitry to be described are those responsible for placing display data into the video RAM at permissable times. The memory access arbitration logic produces a signal called X/ISEL; this signal determines who has access to the video RAM. When X/ISEL is high the internal raster scan bus is scanning the memory to obtain display data, when the signal is low the external system may if it is required have access to the video RAM to read or write data. X/ISEL is produced by NORing a line flyback access signal (IC19,9) and a field flyback access signal (IC17,4); these signals in each case go non-active before the 'deadline time' to allow my previously initiated external access time to be completed without the R or W cycle being 'clipped' short. The video RAM is thus available to the host system for approximately 25 per cent of the time. The other 75 per cent of the time it is being scanned by the internal logic to display data.

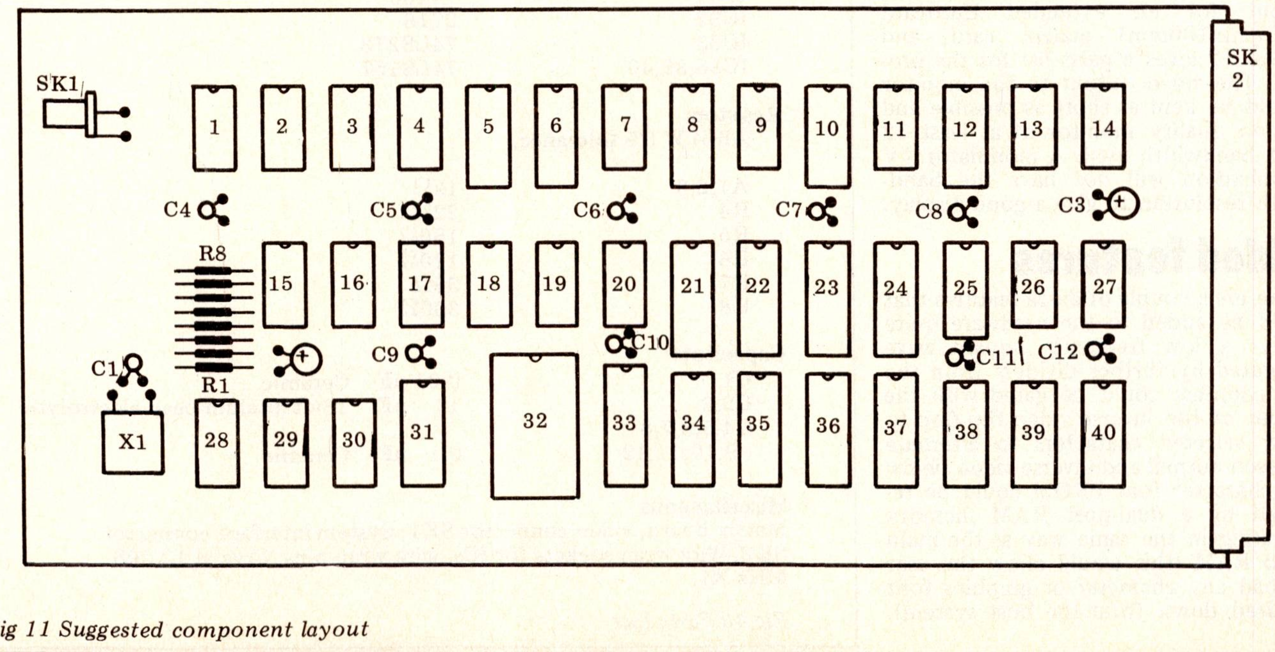


Fig 11 Suggested component layout

HIGH DENSITY VDU CARD

The access control signal X/ISEL is used for a number of purposes: first, it controls the address multiplexer to determine who is addressing the video RAM. Secondly, it qualifies the generation of Ready/Wait signals and finally it qualifies the enabling of the memory and the control of the data bus buffers. The prototype unit was designed to fit into the host system's memory map from the address F000H to FFFFH; of course, if the necessary address changes are made to the driver routines any other 4k block could be used, and the decoding of the top four address lines A12 — A15 changed to suit. When the host system attempts to access the video RAM the decode signal FxxxH will go low (IC13,8).

If the signal X/ISEL is high (ie internal access selected), this will cause the Ready/Wait line to go low forcing the processor into a wait state. When the signal X/ISEL goes low (ie external access selected) the wait signal is removed and the accesses allowed to continue as required until X/ISEL goes high again. During a read or write cycle to the video RAM the active strobe is used to enable the memory in a read or write mode and to control the data buffers to correctly input or output onto the system data bus (Gates IC3,11 IC29,8 IC30,6 IC30,8 IC17,10 IC29,11 and data buffers IC26 and IC27).

This completes the description of the high density VDU card hardware operation.

Construction

My prototype was constructed using wire wrap sockets and pins, but any suitable technique may be used as long as adequate power and ground bussing is provided. The circuitry uses a single +5V power rail at approx 1.1 amps. Figure 11 shows a suggested component layout for an extended Eurocard (220mmx100mm) matrix card, and Figure 12 gives a parts list for the project. The video output to the monitor should be kept as short as possible and a good quality monitor of at least 12 MHz bandwidth used. A modulator/TV combination will *not* have the bandwidth/resolution to give a good display.

Added features

There are a couple of extra features that could be added to the hardware quite easily: a low frequency square wave generated by further dividers from the line counters could be gated with the output of the inverse video flip-flop to allow selected characters to alternate between normal and inverse video fields; the character font PROM could be replaced by a dual-port RAM memory operating in the same way as the main video RAM (this would allow the user to load any character or graphics font required down from the host system).

IC No.	Type Number	+5V	0V	Spare gates
3	74LS00	14	7	
17	74LS02	14	7	
4	74LS04	14	7	
28	74S04	14	7	3 Inverters
1	7406	14	7	2 o.c. Inverters
9,30	74LS08	14	7	1.2 I/p And.
11	74LS10	14	7	1.3 I/p Nand.
7,13	74LS20	14	7	
20	74LS27	14	7	1.3 I/p Nor.
29	74LS32	14	7	
2,14,19	74LS74	14	7	
18	74LS86	14	7	3. 2 I/p Exclusive Or.
25	74LS139	16	8	1. 2 to 4 Line decoder
38,39,40	74LS157	16	8	
6,8,10,12	74LS161	16	8	
31	74166	16	8	
5	74S168	16	8	
26,27	74LS243	14	7	
33	74LS273	20	10	
15,16	74LS393	14	7	
21,22,23,24 34,35,36,37	2114	18	19	
32	2716	24	12	

Fig 12 IC power pins

ICs

IC1	7406
IC2,14,19	74LS74
IC3	74LS00
IC4	74LS04
IC5	74S168
IC6,8,10,12	74LS161
IC7,13	74LS20
IC9,30	74LS08
IC11	74LS10
IC15,16	74LS393
IC17	74LS02
IC18	74LS86
IC20	74LS27
IC21,22,23,23 34,35,36,37	2114
IC25	74LS139
IC26,27	74LS243
IC28	74S04
IC29	74LS32
IC31	74166
IC32	2716
IC33	74LS273
IC38,39,40	74LS157

Resistors

All ¼ W 5% tolerance.

A1,2,3	1kΩ
R4	22Ω
R5	180Ω
R6	120Ω
R7	33Ω
R8	330Ω

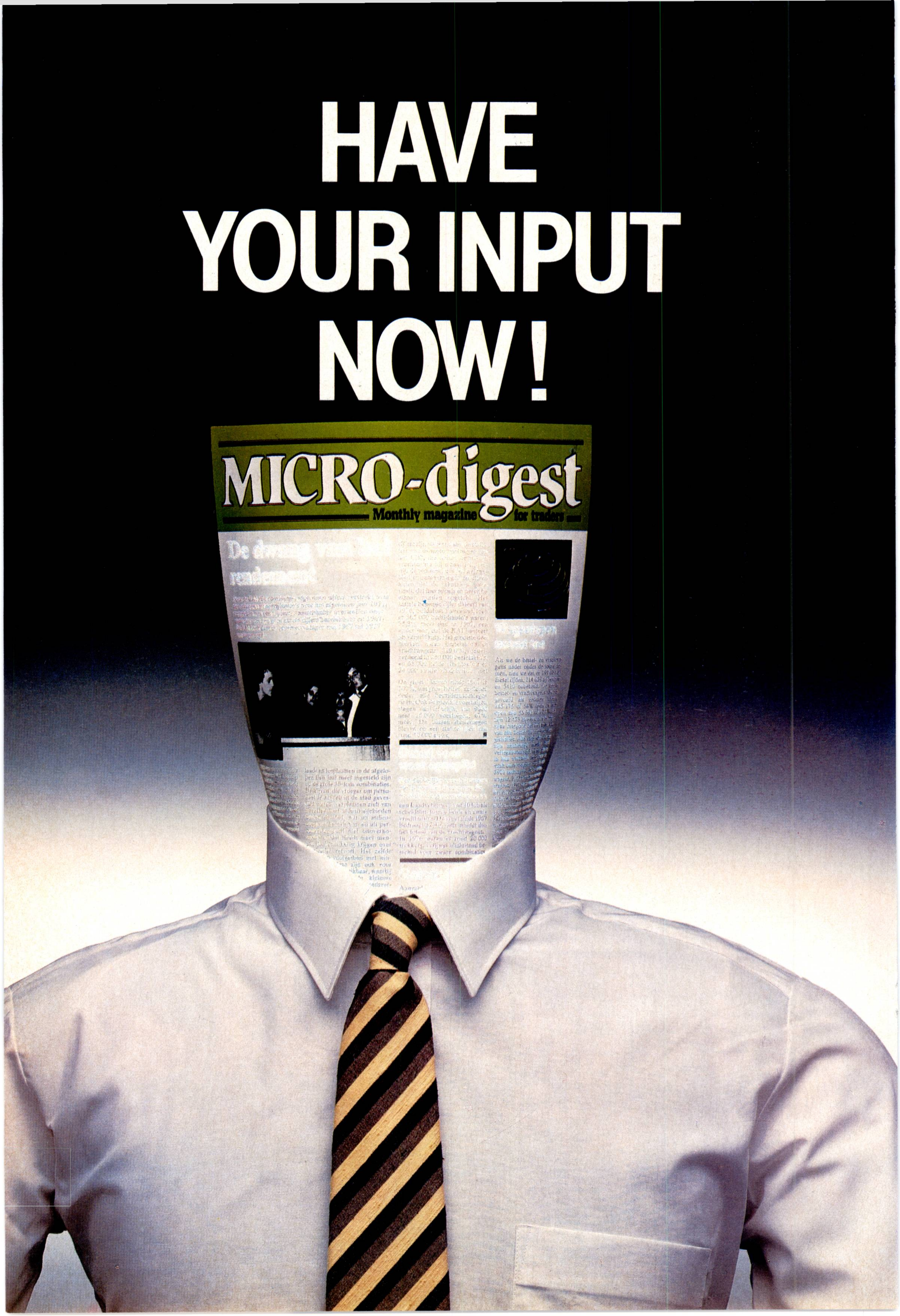
Capacitors

C1	0.01 µF	Ceramic
C2,3	10 µF	16v tantalum bead electrolytic
C4,5,6,7,8 9,10,11,12	0.1 µF	Ceramic

Miscellaneous

Matrix board, video connector SK1, System interface connector SK2, Wire wrap sockets for ICs, wire wrap pins, Crystal 12.598 MHz X1.

Fig 13 Parts List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FREQOUT!

Dr David Ellis checks out a new music synthesiser package.

Up until about a year ago, anyone wanting to use his/her microcomputer for music-making was stuck with square wave renderings of 'your favourite tune'. Such buzzy inputs to the right hemisphere aren't exactly the greatest thing since sliced bread, and most of the sound board add-ons did a pretty efficient job of perpetuating the myth that such microcomputer music sounds like what the average person in the street expects computer music to sound like — some gross extension of Space Invaders sound effects — and, hardly surprisingly, found themselves consigned to the bottom drawer.

Most of these 'systems' use programmable sound generators, such as the General Instruments AY-3-8910 or Texas SN76489, and their great advantage is that they do the lion's share of the hard synthesis work for the computer. However, these chips aren't that brilliant at producing accurately pitched notes, owing to the limited resolution in counting down from a master oscillator, and the sounds themselves are still of an unremittingly square wave nature.

The ALF AMII system (using the old MC16 board) gets around the resolution problem by using an Intel 16-bit timer chip to count out the notes with rather greater accuracy, but, even though the system also includes a CHROMA routine for applying pulse-width modulation (a variable mark-space ratio of the square wave which produces a sweeping of harmonics) to one's musical deliberations, the basic synthetic capabilities are still limited by the hardware.

The arrival of the Mountain Computer MusicSystem on the scene made it quite apparent that the former hardware-directed approach was a bit of a lame duck, for, with some clever hardware (effectively, 16 D/A converters with the added benefit of being driven by DMA), a frequency response of 30 to 14,000 Hz is achieved, and that's of any waveform one cares to program into the respective pages of RAM as a 256-byte waveform table. Where the MusicSystem falls down somewhat, at least with regard to the ALF system, is in the ease of music entry, but that's another story.

Alongside the Mountain Computer approach to producing high quality synthesis, there's also the technique of totally software-driven synthesis using just one D/A converter for each channel of sound, and this is where the Microproducts Music II system steps into the picture.

Musical conversions

A D/A converter is essentially a programmable power supply that generates an output voltage in response to a numerical value received from a parallel output port of the computer. When a program changes the value sent to the converter, so the output voltage changes to a new value. Simple enough in theory, but problems start to arise as soon as D/A conversion is required to produce the very fast voltage changes required in synthesising music.

True hi-fi necessitates a flat frequency response from 20 to 20,000 Hz and most professional music synthesisers will also be aiming for this sort of range. Ironically, it's the rock musicians using this technology who are most likely to be part of the 20 percent of the 'normal' British population with a significant high frequency loss of hearing. For the rest of us, 15 kHz is more or less the top limit, and, incidentally, where FM radio also puts its foot down, so this is a pretty good figure to aim for in D/A conversion.

In practice, not many systems engaged in real-time sythesis (ie, using the processor to produce instantaneous music) achieve this, exceptions being dedicated processor systems like the Fairlight CMI and Synclavier II or a microcomputer system like the Apple II-based MusicSystem. The reason for this lies in the Nyquist formula, a piece of invaluable home truth for the digital synthesist, which states that the sampling rate must be at least twice the highest frequency you wish to output to the analogue world.

Given that the programs needed to generate sounds of specified pitch and amplitude from RAM-stored waveform tables take an appreciable amount of time to run, the sampling rate can never be as high as musical desires dictate, at least with the current generation of 8-bit processors, and compromises tend to be the order of the day.

One of the most obvious compromises is to make every numerical value sent to the D/A converter the product of scanning a single waveform table. If

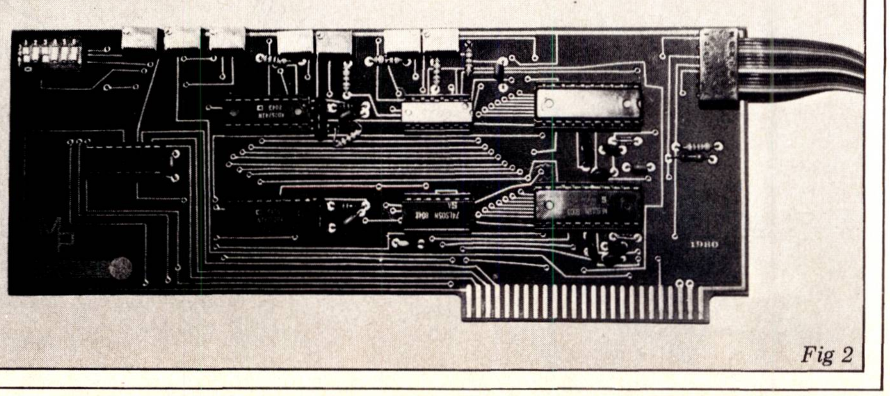


Fig 2

the 256 bytes in the table correspond to a sawtooth waveform, then the sound emerging from the converter will remain a sawtooth for as long as the same data is being directed to the output. The scanning is performed by storing exactly one cycle of the waveform in the table, conceptually bending the linear table into a circle, and then setting up a table pointer that points to the desired numerical value for output to the D/A converter. Coincident with every execution of the lookup and output program, the table pointer is incremented to a new pointer position, thereby achieving a continuous table scan. So, provided that one sticks to the same waveform over the period of a note's duration, the fast execution time for table lookup (approx 23 μs in the case of the 1 MHz 6502) enables a basic high frequency waveform to be adequately synthesised, giving a Nyquist limit of about 21.6 kHz in this case.

Unfortunately, even though the composition of musicians and their instruments generally remain more or less static when they're playing, the notes emerging from vibrating air columns, strings or whatever, don't lead such a normalised existence. The average note produced by an average natural instrument consists of a whole range of harmonics in addition to the fundamental pitch or the note that one's actually reading from a score, fingering and then playing. If all the harmonics interacted with the surrounding air, wood or metal in the same way, then the resultant sound would appear rather flat and uninteresting. In practice, and in the hands of a good practitioner, the harmonics interact with the environment in a differential manner, giving rise to what is called a 'timbral envelope', where the harmonics of a note change dynamically from one moment to the next.

For the listener, this provides sounds that breathe with an internal animation; for the digital synthesist, it's something of a headache!

On an analogue synthesiser, various types of voltage-controlled filters can be used to sweep through the harmonic content of square or sawtooth waveforms when a note is triggered from the keyboard. The effect is dramatic but doesn't actually correspond to the behaviour of real instruments, hence the characteristic sound of synthesisers. In theory, digital filtering could be used to achieve the same sort of filter sweep on the waveform outputted from a particular lookup table, but, as luck would have it, the necessary multiplication and division required to do this takes too much computation to be practical in real-time music synthesis. The alternative is to extend the table lookup operation to a sequence of different waveform tables, each with a different harmonic composition. Using this approach, we actually kill two birds with one stone, as we also gain the necessary attack and decay characteristics of a note (the amplitude envelope) along with the all-important timbral envelope. To set up a typical waveform-sequencing routine, it's necessary to use an additional 256-byte table containing numbers corresponding to the page addresses of particular waveform tables. By moving another pointer rapidly through a waveform-sequence table that contains repeat waveform table addresses for portions of a note where amplitude and timbre remain constant, or one-off entries when sounds are on the move, it's possible to synthesise natural-sounding instruments.

All this is straightforward enough in theory but problematic to implement without making a whacking great compromise in terms of the frequency response of the output. The waveform-scanning routine developed by Frank Covitz and Cliff Ashcraft and used in the Micro-Technology Instrument Synthesis package (reviewed in the March 1981 issue of *PCW*) takes 128 μs to run. This reduces the sampling rate down to 7.81 kHz, giving a Nyquist limit of about 3.9 kHz — a long way from our original 15 kHz aim in D/A conversion!

The Microproducts Music II doesn't achieve this figure either, but it does provide waveform-table sequencing (though not quite to the extent of the Micro-Technology software) and a very fair maximum output frequency of 8 kHz.

Microproducts hardware

Supposedly, there's a great woman behind every great man; and the sexist cliche also applies in a somewhat obtuse way to D/A conversion, because, no matter how elegant the software is, the eventual sound quality relies upon the converter doing a good job. The Microproducts Data Acquisition and Data Distribution System card contains two A/D converters (Analog Devices 7574s) and two D/A converters (Signetics 5018s). The AD7574 is an 8-bit converter using the successive-approximation technique to provide a fast conversion time of 15 μs and is used in the ROM interface mode in order to simplify programming. Microproducts provide a 'quick and dirty' operational and capability test that converts an off-tape music signal to digital information and then back to analogue signals.

This operation clearly demonstrated the accuracy of the bidirectional conversion offered by the board but also showed up a couple of drawbacks. Firstly, the required input voltage levels to the A/D converter are either −10 V to +10 V or 0 V to +10 V. These are high level inputs and necessitate adding an additional amplifier to boost line level or microphone inputs. Secondly, the output from the D/A converter doesn't have the benefit of being smoothed by a low-pass filter from its raw converted state into something more fit for human consumption. One of the main problems with raw signals from a D/A converter is the presence of distortion components arising from 'aliasing'. Mathematically, this component is generated from the difference (F_s—F_w) between the sample rate (F_s) and waveform frequency (F_w). So, if we aim to synthesise a waveform of frequency 7 kHz at the sampling rate Music II uses (16 kHz), then an alias at 9 kHz will also be generated. This isn't exactly desirable, so a low-pass filter is employed to block-out any signals above the Nyquist limit, ie, half the sampling rate. In theory, if the filter was perfect, it should be possible to separate an aliasing component of just greater than 8 kHz from an output waveform of just less than 8 kHz. Because no filter is this ideal, a compromise is made by trading-off some of the theoretical top end of the output for a more secure blocking of the alias signals. The type of filter customarily used is a multi-section one with a sharp cut-off. This latter characteristic gives the filter its other important function in this situation, namely that of filling in the gaps between the voltage steps emerging from the converter and thereby smoothing the output waveform.

So, the first step on from the basic operational test with the Microproduction board is to add a couple of low-pass filters. I chose 7 kHz as a suitable cut-off point and made up some fourth-order Butterworth filters as in Figure 3. The bi-polar power supply for these op-amps is no problem as the board usefully provides ±12 V on the input/

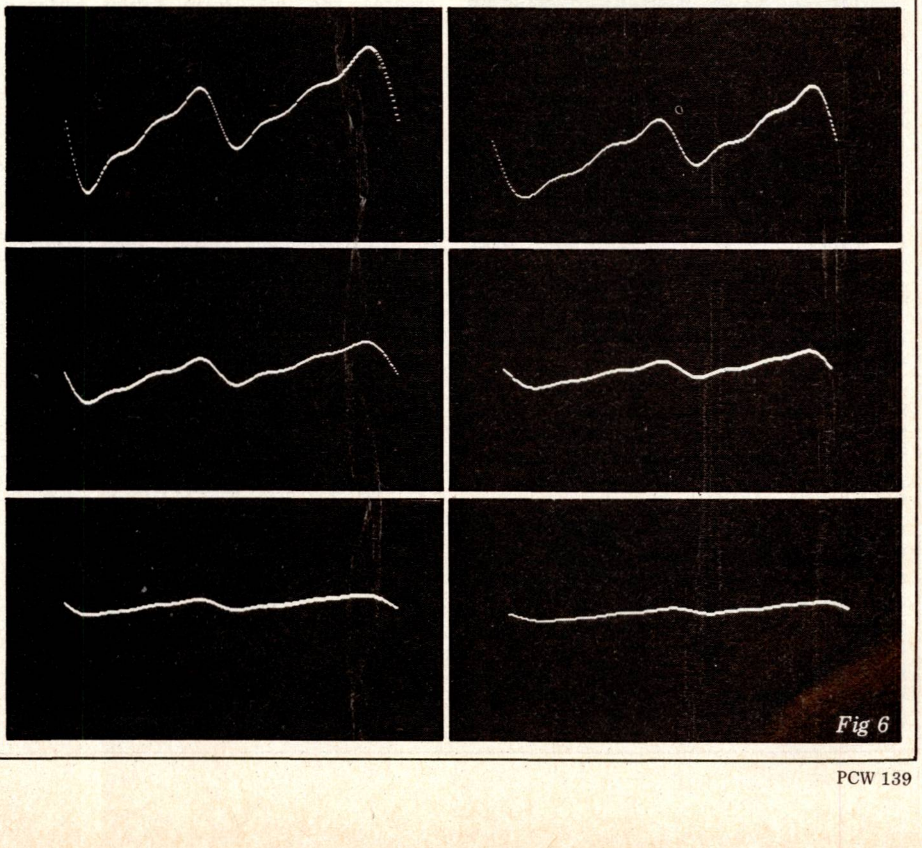


Fig 6

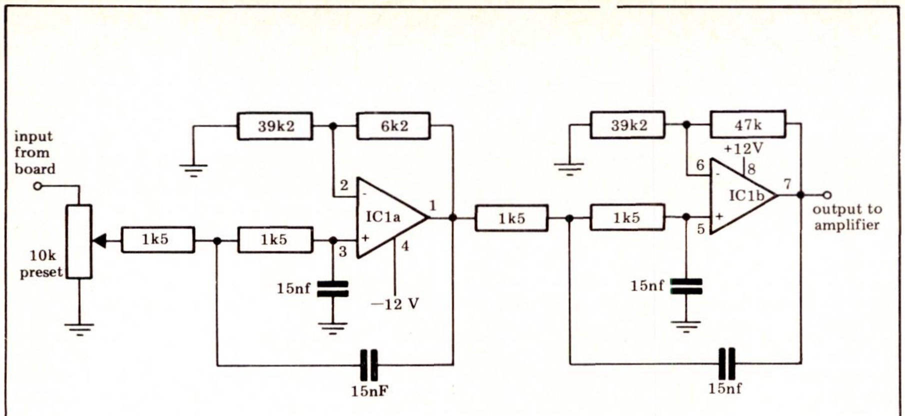


Fig 3 A suitable low-pass filter for the Microproducts D/A converters. The output from the D/A converter should be set to the ±5 V level and the preset at the input of the filter adjusted to give a suitable level for the subsequent amplifier. An ideal op-amp for IC1 is the high slew rate LF353.

output DIL socket. Switching in the filters really makes a big difference to the sound quality and, for serious musical use, is essential. While I appreciate that Microproducts has aimed for an open-ended converter board without the frills necessary for some highly specialised applications, it strikes me as being somewhat myopic to produce a piece of hardware that's unable to do full justice to the sophisticated Music II programs — especially when it's for the sake of a few dollars-worth of extra components. After all, why sink the ship for a ha'p'orth of tar?

Music II

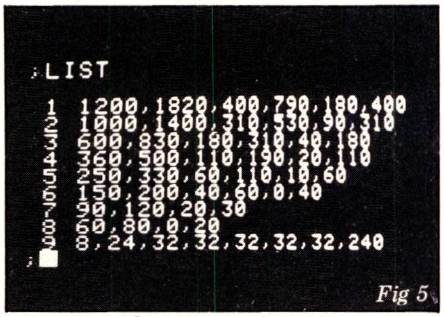
```
MICROPRODUCTS
MUSIC II

SELECT BY NUMBER:
   1. DEFINE WAVEFORM
   2. ENTER SCORE
   3. COMPILE SCORE
   4. PLAY SCORE
   5. PRINTER ON
   6. PRINTER OFF
```

Fig 4

The programs comprising Music II enable the Apple II to perform four music-related functions: the creation of multi-waveform instrument definitions; the entering of scores using a Music Composition Language; the compilation of text scores entered with the MCL into machine code; and the playing of compiled scores through the D/A converters. In addition, a print mode provides hard copy of waveform specifications, the entered text score and errors detected during score compilation.

DEFINE WAVEFORM constructs eight 256-byte waveform tables out of segments containing up to 16 harmonics. Care has to be taken in entering amplitude levels as overflow or 'clipping' (producing digital raspberries) occurs if waveform amplitudes are excessively high. However, the table construction routine very kindly includes a warning of the dreaded clipping if the composite waveform exceeds the range of the table. The text display in Figure 5 shows the eight segments (but without all the 16 allowable harmonics entered) and a ninth line that sets the duration of each segment between one and 254 time units. These time units are based on divisions of the beat duration entered with the ENTER SCORE program. Thus, one unit of time corresponds to 7.5ms at a tempo of 40. Exactly how Microproducts scans waveform tables isn't explained (indeed, the entire manual is short on anything corresponding to detailed explanation of program operation) but presumably the duration line establishes dwell times for the eight waveform tables in a further waveform-sequencing table by specifying repeat entries of the relevant page addresses. The Generate command creates the waveform tables entered from the text display and, as each table is created, it is also displayed in HIRES graphics (Figure 6). One would also expect to hear the waveform once it has been successfully turned into a waveform table but, alack, alas, Music II doesn't think so. A curious omission, this, considering how difficult it is to construct harmonic slices that actually fit together well and/or interestingly.



```
:LIST

 1  1200,1820,400,790,180,400
 2  1000,1400,310,530,90,310
 3  600,830,180,310,40,180
 4  360,500,110,190,20,110
 5  250,330,60,110,10,60
 6  150,200,40,60,0,40
 7  90,120,20,30
 8  60,80,0,20
 9  8,24,32,32,32,32,32,240
:█
```

Fig 5

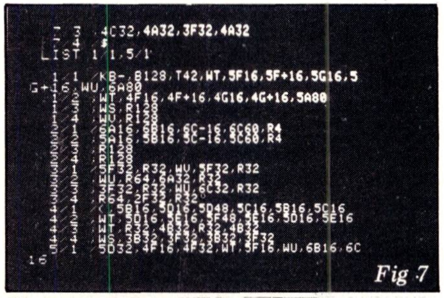
ENTER SCORE is basically a specialised text editor that requires the user to turn his muddled musical thoughts into a rather more organised set of instructions. This involves getting to grips with a Music Composition Language which, unlike equivalent languages used by the Fairlight CMI or the Mountain Computer MusicSystem, doesn't simplify the process of entry by means of defaults or values that remain in force unless otherwise cancelled. Music is entered as parts within measures (M/P), where M, the measure, can be any number from 1 to 254 and P, the part, is either 1, 2, 3 or 4. If you glance at Figure 7, you'll find the first four measures of a piece entitled 'Boogie'. To start the score, it's necessary to specify the key (K), which, in this case, is B- flat (B-). After that comes the trickiest part of the MCL, the derivation of note durations. In this case, 'B128' indicates that the measure is to be divided into 128 intervals. Thus, in the 2/4 time used in 'Boogie', a quarter note (crotchet) lasts 64 intervals, an eighth note (quaver) 32 intervals, and so on. 'T42' sets the tempo so that an interval (not to be confused with pitch intervals) spans a little over 10 ms; a sixteenth note (semiquaver) then spans about 1/6 seconds. 'WT' indicates that WAVEFORMT is to be used with this voice, and each of the other three voices are allotted voices in a similar manner. With preliminaries over, it's then just a question of entering the notes in their respective octave, where an octave spans from A-flat to G-sharp. '5F16' is then read as fifth octave, note F, 16 intervals, ie, a semiquaver F 17 semitones above middle C. An excellent feature of this entry program is the ability to prescribe nested repeats. The '(' at 4/1 indicates the start of a repeat and '>' is used to skip from the end of one repeat to the end of another. Thus, segments of music with the following repeat punctuation result in the indicated play sequence.

```
     1    2    3    4    5    6
-----(----->-----)----->-----)----- =

1,2,3,4,5,2,3,2,4,6
```

Overall, I found this MCL very easy to use, and the addition of text commands such as Add, List, Edit and Delete really make it a very viable compositional tool.

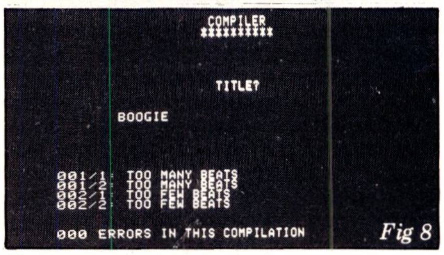
COMPILE SCORE generates a machine code version of the text score derived from ENTER SCORE and includes the waveform duration times (line 9 of DEFINE WAVEFORM display) of each of the instruments used in the score. If the original text file contains errors, messages appear on the screen as compilation proceeds. Each of these messages is preceded by a measure/voice (part) locator and there are a total of 13 errors detected by the Compiler: Note syntax error, Syntax error, Missing voice, Repeat error, Beat syntax error, Tempo syntax error, Extra voice, Bad ending, Rest syntax error, Too few beats, Too many beats, Bad key and, finally, Full memory. Pretty comprehensive! Figure 8 shows



```
 1/3  ,4C32,4A32,3F32,4A32
 1/4  ,$
LIST 1/1,5/1

  1/1  /KB-,B128,T42,WT,5F16,5F+16,5G16,5
G+16,WU,6A80
  1/2  ,WT,4F16,4F+16,4G16,4G+16,5A80
  1/3  ,WS,R128
  1/4  ,WU,R128
  2/1  /6A16,6B16,6C-16,6C60,R4
  2/2  ,5A16,5B16,5C-16,5C60,R4
  2/3  ,R128
  2/4  ,R128
  3/1  /5F32,R32,WU,5F32,R32
  3/2  ,WU,R64,6A32,R32
  3/3  ,3F32,R32,WU,6C32,R32
  3/4  ,R64,2F32,R32
  4/1  /(,5B16,5D16,5D48,5C16,5B16,5C16
  4/2  ,WT,5D16,5E16,5F48,5E16,5D16,5E16
  4/3  ,WT,R32,4B32,R32,4B32
  4/4  ,WS,3B32,3F32,3B32,3F32
  5/1  /5D32,4F16,4F32,WT,5F16,WU,6B16,6C
16
```

Fig 7



```
                COMPILER
                ********

                 TITLE?

       BOOGIE

001/1: TOO MANY BEATS
001/2: TOO MANY BEATS
002/1: TOO FEW BEATS
002/2: TOO FEW BEATS

000 ERRORS IN THIS COMPILATION
```

Fig 8

what the Compiler thought of 'Boogie': some beats out of place but no errors as such. This is because the two messages encountered in putting Boogie to bed — 'Too few beats' and 'Too many beats' — are treated as warnings rather than errors, while the other 11 are unambiguous spanners in the works. I think this Compiler is quite splendid — especially in comparison to the brusque and unhelpful Compiler in the Mountain Computer MusicSystem.

PLAY SCORE loads the compiled machine code score with appropriate sets of waveform tables and a player program, SCORE. After specifying the slot in which the Microproducts card is located, the score is then played through the two D/A converters, parts 1 and 2 by the first and parts 3 and 4 by the second.

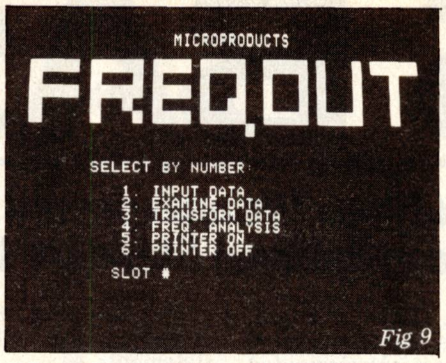
So far, so good, but how does the final output quality compare with comparable systems like the Micro-Technology Instrument Synthesis software? Well, if asked that question when I first received the system for review, I'd have had to make some fairly disparaging comments. Of the two demo scores included on the Music II disk, only 'Fanfare for the Uncommon Apple' (yuck) would load successfully, and turned out to be an extremely uninspired version of Aaron Copeland's 'Fanfare for the Common Man' complete with lots of noise, glitches and clicks between events while the processor was doing its job. However, once I'd entered my own score, made up some more imaginative waveform sets than those given, and added the aforementioned low-pass filters, the sound quality improved fairly dramatically. Consequently, I'd certainly recommend Music II in preference to the Micro-Technology software, and you gain double the frequency range to boot.

Fishing for sounds

An area of digital synthesis which extracts the maximum amount of interest from rock musicians, the public and the media, centres around sampling 'real' sounds via an A/D converter and the subsequent use of this data as a set of waveform tables with which to play music. The main problem with this lies in the vast amount of memory needed to capture in real time any appreciable length of analogue sound. Using a 16 kHz sampling rate (and therefore a Nyquist limit of 8 kHz), just one second of sound can be frozen for eternity (or until the plug gets pulled out) in 16k of free RAM. Apart from the inimitable Fairlight CMI, which collects samples at rates from 2 to 30 kHz, and then loads the data directly into 16k voice banks of dedicated RAM, two computer drum machines, the MCS Percussion Computer and the Linn Drum Computer, have got in on the act by burning-in real drum/percussion sounds into EPROMs.

All this produces jolly sounds like choirs of cats, chords of kisses, and so on, but none of this is the product of true digital synthesis. What's much more interesting is if you can take the sampled sound and then chop it up and reconstitute it with harmonic analysis/synthesis. To do this, we need to apply some Fourier analysis techniques, which is what Microproducts's Frequot program is all about.

Freqout



```
MICROPRODUCTS
FREQOUT

SELECT BY NUMBER:

  1. INPUT DATA
  2. EXAMINE DATA
  3. TRANSFORM DATA
  4. FREQ. ANALYSIS
  5. PRINTER ON
  6. PRINTER OFF

SLOT #
```

Fig 9

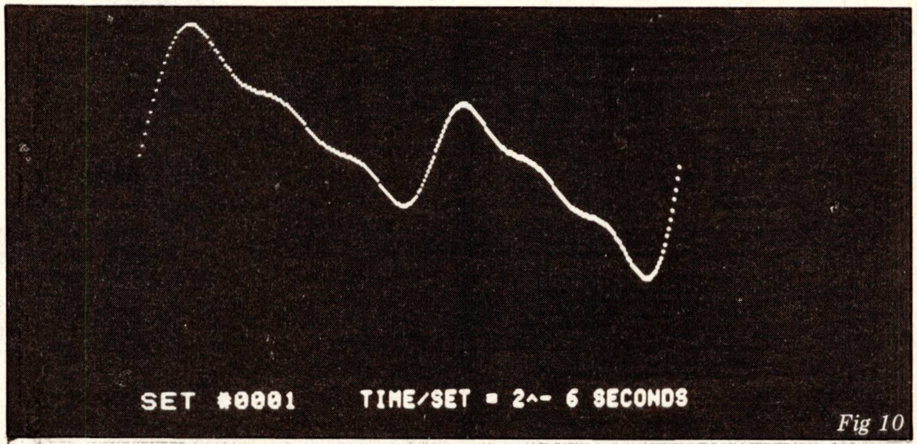
This program is a package of routines that utilizes one of the A/D converters on the Microproducts card to turn the Apple II into a signal analysis tool. The four principal routines are: acquisition of data from disk files or via A/D converter; examination of data in HIRES 'oscilloscope' mode; Fourier transformation of the data to the frequency domain; and display of harmonic envelopes.

Data is sampled at a rate selected from 1 to 16,384 Hz and turned into a binary file of single byte samples, 00H being most negative and FFH being most positive. The sample length can be any size up to 8192 bytes and acquisition is started either manually (by pressing any key) or automatically (when the input level exceeds a preset value). HIRES graphics can then be used to display the sampled waveforms (Figure 10) with the text beneath the graphics informing you of where you are in the sample set. The combination of right arrow, space bar and CR enable you to advance through the data point by point or with a continuous series of sweeps from beginning to end. In theory, these sample sets should provide 32 256-byte waveform tables if 8192 bytes of RAM have been loaded with sample data. Life's not that simple, though, because the real trick to successful sampling is to get exactly one cycle of the waveform into each sample set. Remember also that Music II defines instruments on the basis of only eight waveform tables, so it's necessary to scan through the sets of sample data and choose those that make the most sense to your current musical pursuits.

So far, we've only been considering the resurrection of sample data in an abbreviated format suitable for instrument definitions. The other two Freqout routines apply Fast Fourier Transform (FFT) analysis to the sampled data. Transform Data converts the sampled waveforms into a display (Figure 11) showing graphical representations of individual harmonic components, the set number, duration of each set, and the amplitude and fequency of each component as it appears on the screen. Frequency Analysis can then be used to plot the amplitude envelope of any chosen frequency (harmonic) component drawn from all the sets of frequency domain data.

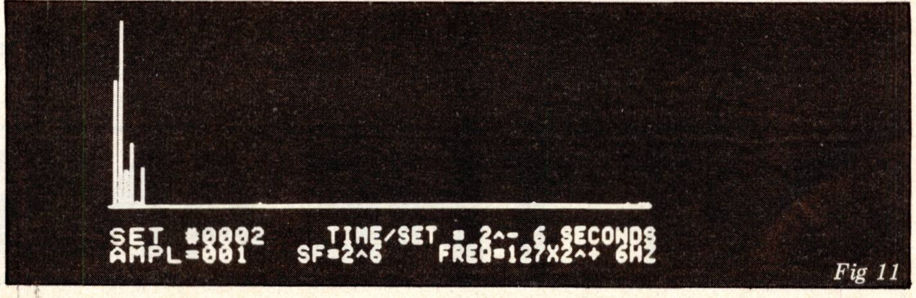
Taken as a whole, the set of Freqout routines provides one of the best musically applicable Fourier analysis programs I've come across. I had a lot of fun sampling sounds and turning this data into instruments for use by Music II. Admittedly, not all of these were equally effective, which isn't surprising considering the tricky nature of sampling and FFT techniques when applied to such demanding sources as real (and, therefore, identifiable) sounds.

I'm grateful to Wildport Ltd (7 Willow Rise, Kirkbymoorside, York, tel: 0751 32308), the sole UK/European agents of Microproducts systems, for lending me the dual D/A and A/D hardware/Music II software (£187.50) and Freqout software (£37.50). The obvious drawback to the Music II package is the price — especially when you consider that the Mountain Computer combined A/D and D/A board sells for around the same price, but with 16 channels in both directions and a 9 us conversion time. The addition of Freqout to the system makes it much more attractive, but a serious user may well find the limited documentation and absence of any explanation of software implementation rather frustrating — I certainly did!



```
SET #0001     TIME/SET = 2^- 6 SECONDS
```

Fig 10



```
SET #0002     TIME/SET = 2^- 6 SECONDS
AMPL=001    SF=2^6     FREQ=127X2^+ 6HZ
```

Fig 11

ANS BASIC:

Mike Parr outlines the unexpected features of American National Standard Basic.

Basic is unusual in that, unlike Fortran, Cobol or Pascal, there has been no realistic standard — the nearest we get is the 'de facto' standard of Microsoft, because it is implemented on many micros. A new standard though, will soon make an appearance; American National Standard Basic, which defines a language of greater power than Microsoft (in the following, I'll use ANS, or simply Basic to stand for the new language).

When I first heard of a new standard, I expected some hat-tipping to Microsoft, ie, a tight definition of Microsoft with additional 'structuring' statements, but this is not the case — the ANS designers have gone for a new language that bears little relationship to Microsoft.

This article will examine the new standard, concentrating on new or different features from what we have come to know as Basic. As the standard is some 200 pages long, you'll be pleased to know that many points are omitted but I trust that the main ideas will come across.

Firstly, the standard is written as a set of modules, not all of which need be present in every implementation. You will always have certain 'core' modules, but may not have those dealing with graphics, enhanced file I/O, or real-time. In practice, though it seems likely that any manufacturer wishing to sell an ANS implementation will (at least) need to implement graphics and enhanced file modules.

The language

ANS includes much that can be found in traditional Basic. Perhaps a quick way of describing this is to say that it will accept most Microsoft programs that don't use string variables or multi-statement lines. On top of this, variable names can be up to 31 characters long (all significant). Lower-case characters can be used, and variables can be local to sections of a program. The use of numeric variables is conventional in that they aren't declared and are all floating-point. Lines are numbered and may only contain one statement, though a comment may be added at the end of a statement by prefixing it with an exclamation-mark:

```
30K=K+1 ! INCREMENT COUNTER
```

Control structures

There are two main functions performed by control structures: repetition and selection. For repetition, we have a conventional FOR — NEXT, but also a DO — UNTIL, eg,

```
80 DO UNTIL X>N
90     X=X + 1
100    PRINT X, N
110 LOOP
```

Every structure is delimited by DO and LOOP but we can ring the changes by:

a) using WHILE instead of UNTIL
b) placing the terminating condition after LOOP
c) breaking out of the loop by an EXIT IF statement-

Here's a couple of examples:

```
120 DO
130    X=X + 1
140 LOOP WHILE X<N

150 DO UNTIL K>10
160    EXIT IF A(K)=0
170    K=K + 1
180 LOOP
```

For selection, we have traditional single-line IF statements, but also multi-line IF. . .END IF and SELECT (case) statements, eg,

```
190 IF X>=0 THEN
200    Y=SQR(X)
210    PRINT Y
220 ELSE
230    PRINT “NO SQUARE ROOT”
240 END IF
250 SELECT AGE
260    CASE<16
270       PRINT “NOT WORKING”
280    CASE 16TO 65
290    PRINT “WORKING”
300     CASE ELSE
310    PRINT “RETIRED”
320 END CASE
```

If you like to design programs with a pseudo-code approach, these control structures should fit the bill.

Strings

The implementation of strings is radically different from that in Microsoft. Firstly, the maximum string length is implementation-dependent, but must be a minimum of 72. Secondly, the familiar LEFT$ and RIGHT$ are replaced by a 'substring qualifier', as in:

```
10 A$=“ABCDEFG”
20 B$=A$(2:5)
```

Here, the bracketed qualifier specifies characters 2 through 5; thus B$ becomes 'BCDE'. Qualifiers may also appear to the left of an assignment, eg,

```
30 A$(2:3)=A$(4:6)
```

would set positions 2 and 3 of A$ to 'DEF', resulting in the value 'ADEFDEFG'. To save you the trouble of writing the Microsoft equivalent, it is:

```
30 A$=LEFT$(AS,1) + (MID$(AS,4,3) + RIGHT$(AS,4)
```

ANS also has a concatenation operation '&', together with string functions, the main ones being:

CHR$(N) ORD$(X$)	character/internal code conversion
LWRC$(X$) UPRC$(X$)	lower/upper case conversion
STR$(N) VAL(X$)	character/number conversion
LEN(X$)	length of a string
POS(X$, Y$)	substring search (the Microsoft INSTR)

Arrays

Surprisingly, only a maximum of two subscripts are allowed, but a number of very useful features exist:

a) several matrix functions, eg,

```
40 MAT A=INV(B)
```

b) the ability to pass an array of any size to a function, eg,

```
50 X=FINDMAX(A())
```

c) a SIZE function to find the maximum allowed subscript, eg,

```
60 N=SIZE (A,2)
```

sets N to the largest possible value for the second subscript of array A.

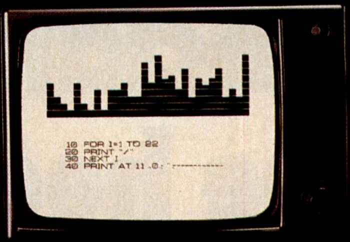
d) character string arrays exist as in Microsoft, but ANS allows their use in MAT statements, eg,

```
70 MAT A$=A$ & “.”
```

would put '.' at the end of every string element of array A$.

IS IT THE ANSWER?

sinclair
ZX81
PERSONAL COMPUTER



```
10 FOR I=1 TO 22
20 PRINT "/"
30 NEXT I
40 PRINT AT 11,0;"----------
```

Sinclair ZX81 Personal Comp
the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

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With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.

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Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

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- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
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- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

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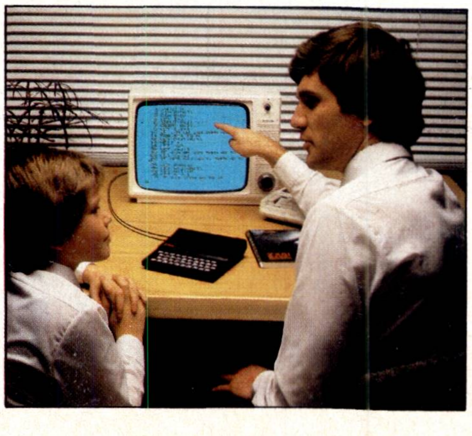
Kit or built – it's up to you!
You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



ter-

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

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Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alphanumerics *and* highly sophisticated graphics.

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Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your computer – using a stackable connector so you *can* plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

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BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard.
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	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
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How the ZX81 compares with other personal computers

SYSTEM IDENTIFICATION		ZX81	ZX80	ACORN ATOM	APPLE II PLUS	PET 2001	TRS 80 LEVEL I	TRS 80 LEVEL II
ROM		8K	4K	8K	8K	14K	4K	12K
GUIDE PRICE	Basic unit – inc. VAT	£70	£100	£175	£630	£435	£290	£375
	Unit plus 16K RAM (*12K RAM)	£120	£150	£285*	£630	£530	£360	£375
COMMANDS	LIST, LOAD, NEW, RUN, SAVE	●	●	●	●	●	●	●
STATEMENTS	PRINT, INPUT, LET, GOTO, GOSUB/RETURN, FOR/NEXT IF/THEN	●	●	●	●	●	●	●
	STEP	●		●	●	●	●	●
	TAB	●			●	●	●	●
ARITHMETIC FUNCTIONS	ABS, RND	●	●	●	●	●	●	●
	INT	●			●	●	●	●
	ATN, COS, EXP, LOG, SGN, SIN, SQR, TAN	●			●	●		●
	ARCSIN, ARCOS	●						
STRING FUNCTIONS	CHR$	●	●		●	●		●
	LEN	●		●	●	●		●
	ASC(CODE), STR$, VAL, INKEY$	●				●		●
NUMBERS	FLOATING PT $\pm 10^{\pm 38}$	●			●	●	●	●
	INTEGERS		●	●	●	●		●
NUMERIC VARIABLES	A-Z			●			●	
	AA-Z0				●	●		●
	An-Zn, n=any alphanumeric string	●	●					
STRING VARIABLES	A$ & B$						●	
	A$ to Z$	●	●	●				
	An$ to Zn$ n=any alphanumeric character				●	●		●
NUMERIC ARRAYS	SINGLE DIMENSIONAL		●	●			●	
	MULTI DIMENSIONAL	●			●	●		●
DISPLAY	ROWS	24	24	16	24	25	16	16
	COLUMNS	32	32	32	40	40	64	64
	LOW RES GRAPHICS (<7000 pixels)	●	●	●	●	●	●	●
	HI RES GRAPHICS (>40000 pixels)			●	●			
SPECIAL FEATURES	USR (CALL, LINK)	●	●	●	●	●		●
	PEEK, POKE (OR EQUIV)	●	●	●	●	●		●

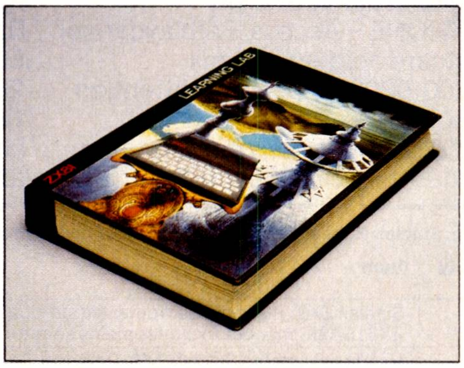
Sinclair software on cassette.

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with others to form single-subject cassettes.

Software currently available includes games, junior education, and business/household management systems. You'll receive a Sinclair ZX Software catalogue with your ZX81 – or see our separate advertisement in this magazine.

The ultimate course in ZX81 BASIC programming.



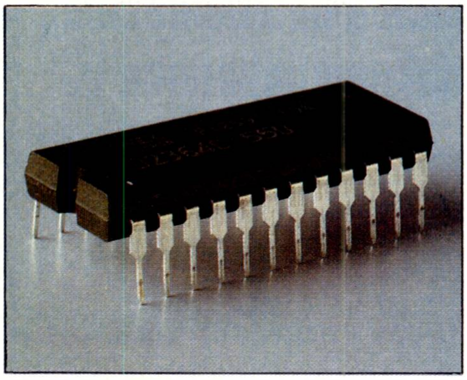
Some people prefer to learn their programming from books. For them, the ZX81 BASIC manual is ideal.

But many have expressed a preference to learn *on* the machine, *through* the machine. Hence the new cassette-based ZX81 Learning Lab.

The package comprises a 160-page manual and 8 cassettes. 20 programs, each demonstrating a particular aspect of ZX81 programming, are spread over 6 of the cassettes. The other two are blank practice cassettes.

Full details with your Sinclair ZX81.

If you own a Sinclair ZX80...



The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 – including the ability to drive the Sinclair ZX Printer.

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ANS BASIC

Segmentation

Together with GOSUB/RETURN, ANS provides three other methods of splitting programs into modules. Firstly, there's a CHAIN statement, which can load and run complete programs — many existing Basic systems have this facility. Secondly, as well as the familiar single-line function definition, we have a multi-line version, as illustrated by:

```
350 DEF BIGGEST (A, B)
360   IF A>=B
370     THEN DEFEXIT BIGGEST=A
380     ELSE DEFEXIT BIGGEST=B
390   END IF
400 END DEF
```

Note DEFEXIT, which returns control to the calling program, with a result assigned to the function name.

We could use such a function by:

```
35 X=BIGGEST (G, SIN(Y))
45 PRINT BIGGEST (K+3, T)
```

Thirdly we have a subprogram, similar in concept to a Pascal procedure, eg,

```
410 DEF SWAP (A, B)
420   TEMP=A
430   A=B
440   B=TEMP
450 END SUB
```

and we could make use of this (to interchange the values of two variables) by:

```
55 CALL SWAP (G, N)
```

Functions and subprograms have facilities for string and array parameters, together with the allocation of local variables each time a module is entered. Among other things, this simplifies the business of writing recursive routines.

At first sight, it may seem that functions and subprograms are very similar, but the crucial difference is in the way parameters are passed: in a function, a copy of the value of a parameter is made available, but in a subprogram a reference (similar to an address) is provided. What this means in practical terms is that given only the copy of a value, a function can't change the original value. However, if a subprogram has a reference to an item (be it an array or simple variable), then its value can be altered.

Input-output

'Core' ANS Basic has sequential files only, but an interesting feature is the ASK statement, by which a program can make enquiries about a file, eg,

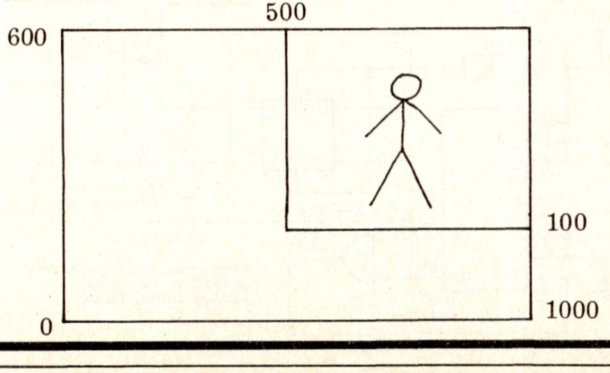
```
500 ASK#3: ACCESS A$
```

This set A$ to either 'INPUT' or 'OUTPUT', depending on how the file was opened. If you are lucky enough to have Basic with 'enhanced' file facilities, you also get random and indexed-sequential files.

Graphics

Most languages don't have built-in graphics, hence the incomprehensible use of PEEK/POKE on many Microsoft systems. Let's examine some features of the ANS graphics module.

Assume that we want to plot in a square at the top right of the screen:



In other words, the physical screen ranges from 0 to 600 vertically, and 0 to 1000 horizontally, and we need to select a certain area. In Basic, we do this by —

```
600 SET VIEWPORT 500, 1000, 100, 600
```

in which the order of the values is: left, right, lower, upper. Unfortunately, the coordinates of our square are likely to be unsuitable for our problem so Basic allows us to define a mapping, eg,

```
610 SET WINDOW −100, 100, −100, 100
```

which gives us an origin at the centre, and 100 units in each direction. Once the plotting area is set up, we can use the PLOT statement, eg,

```
620 PLOT X,Y
```

Here, the beam is moved to the position specified by the values of X and Y, and then switched off. To leave the beam on, a semicolon is used, eg,

```
630 PLOT A,B;
```

In one PLOT, we may use several points, so to draw a square:

```
640 PLOT 0,0; 0,1; 1,1; 1,0; 0,0
```

Progressing to more advanced features, we can define routines which draw objects (called pictures) and transform them with rotation, scaling and positioning:

```
700 PICTURE SQUARE
710 PLOT 0,0; 0,1; 1,1; 1,0; 0,0
720 END PICTURE
```

So, to plot the square we can use:

```
65 PLOT SQUARE
```

and to plot it half-scale and rotated by 45 degrees:

```
75 PLOT SQUARE WITH SCALE(0.5) * ROTATE(45)
```

Finally, in a similar manner to file enquiries, we may ask about facilities:

```
730 ASK VIEWPORT A,B,C, D
```

Real time

In a real-time system (eg, control of a chemical plant) the computer may have to perform tasks such as:

- examine a thermocouple every second;
- ring a bell every eight hours;
- detect when an alarm button is pressed;
- write some information to disk.

But, at any instant, several such activities may be partially completed: they proceed in parallel and such activities may be defined:

```
800 PARACT WORKSHIFT
810   WAIT DELAY 8*60*60 ! 8 HOURS
820   PRINT "SHIFT COMPLETED"
830 PAREND
```

This activity may be initiated by:

```
85 START WORKSHIFT
```

The result of this WAIT is that execution may proceed to other parts of the program, control only returning to line 820 after the specified delay.

However, there's more to real-time systems than this and Basic also provides for the suspension of activities until events occur, and for passing messages between parallel activities.

The future

After this quick look at the language, would you want to use it? More precisely, how does it compare with (say) Pascal, Comal, and other Basics?

ANS Basic has very good control structures — better than Pascal — but is weak in the data-structuring area, eg, no records or user-defined types. Also it's insecure compared to Pascal; mis-spelled identifiers may not be detected.

The graphics and real-time modules are attractive and relatively easy to use but ANS will have to stand against competition from existing languages supplemented by systems software (eg, graphics packages, real-time operating systems), or in the future, competition from Ada.

Perhaps it is doomed to be treated as just another Basic dialect, and users will stick to the devil they know — if manufacturers take this attitude, will it ever be implemented?

TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to: **'TJ's Workshop', *PCW*, 14 Rathbone Place, London W1P 1DE.** *Please keep your contributions as concise as possible. We will pay £10 for any tips we publish (think how much solder and/or Elastoplast that would buy).*

TESTING MACHINE CODE

It may sometimes be found necessary to write machine code routines to be incorporated in Basic programs (using USR command). This program was developed to facilitate the entry and testing of machine code for a Video Genie, although it could be used for other machines. After loading the Basic program, machine code can be input to any locations above those occupied by the Basic program. I use 4A38H as a start point since this happens to be easily remembered as 19000 decimal. Using this address will allow machine code in excess of 1 kbytes even a 4k machine, sufficient.for any machine code likely to be required to be incorporated in a Basic program.

The program shown in Figure 1 will only accept hex digits (O-F) as input. The first input required is the start address in hex; 4 digits must be input and these are converted to a decimal start address which is then displayed, and the program waits for a pair of hex digits to be input. These are poked into the address and the address incremented by 1 — when all the necessary instructions have been input, the break key will return to command level.

A specimen routine is shown in Figure 2, and this was prepared by writing assembler instructions then hand-assembling to arrive at the machine code required. The routine shown will fill a screen with asterisks, go into a waiting loop, then change three lines from asterisks to percentage signs, not a great breakthrough but sufficient to demonstrate a principle.

After loading the Basic program, enter RUN and insert the machine code instructions, when all instructions have been entered press BREAK to return to command level. Type in SYSTEM to enter system level and enter /19000 in reply to the *? prompt. The routine described in the previous paragraph will be executed and the processor will go into a waiting loop which can be cleared by pressing RESET. If the last instruction is omitted then control will automatically be returned to command level.

Various modifications would be possible to the program described; for example, it may be thought desirable to print decimal equivalents of hex code as input, or it would be possible to PEEK the machine locations and display data when the machine code routine has been verified.

When you are satisfied with the machine code routine, it can be implemented in a Basic program after incorporating the necessary linkage as described in your user manual.

R.M. Degg

Figure 1: Basic Program

```
 10 DIM L$(15)
 20 DATA "0", "1", "2", "3", "4", "5", "6", "7",
    "8", "9", "A", "B", "C", "D", "E", "F"
 30 FOR I = 0 TO 15
 40 READ L$(I)
 50 NEXT
 60 PRINT @ 130, "ENTER START ADDRESS"
 70 GOSUB 310
 80 A=X*4096
 90 PRINT @ 150, A$
100 GOSUB 310
110 A=A+X*256
120 PRINT @ ISI, A$
130 GOSUB 310
140 A=A+X*16
150 PRINT @ 152, A$
160 GOSUB 310
170 A=A+X
180 PRINT @ 153, A$
190 PRINT @ 258, "ADDRESS", A;
200 PRINT @ 290, "DATA"
210 GOSUB 310
220 D=X*16
230 PRINT @ 295, A$
240 GOSUB 310
250 D=D+X
260 PRINT @ 296, A$
265 FOR I = 1 TO 150: NEXT
270 POKE A,D
280 PRINT @ 275, "      "
290 A = A+1
300 GOTO 190
310 A$ = INKEY($)
320 FOR I = 0 TO 15
330 IF L$(I) = A$ GOTO 360
340 NEXT
350 GOTO 310
360 X=I
370 RETURN
```

Figure 2: Machine code example

```
                                                Address Machine Code
       0RG   4A38H                              (Hex)   (Hex)
       LD    HL,3C00H         START OF SCREEN   4A38    21003C
       LD    BC,1024          BYTES TO FILL     4A3B    010004
       LD    D,2AH            ASTERISK          4A3E    162A
LOOP1  LD    (HL),D           STORE BYTE        4A40    72
       INC   HL               BUMP POINTER      4A41    23
       DEC   BC               ADJUST COUNT      4A42    OB
       LD    A,B              GET MS BYTE       4A43    78
       OR    C                MERGE             4A44    B1
       JP    NZ,LOOP1         REPEAT IF NOT DONE 4A45   C2404A
       LD    BC,0             SET DELAY         4A48    010000
LOOP2  INC   BC               ADJUST COUNT      4A4B    03
       LD    A,B              GET MS BYTE       4A4C    78
       0R    C                MERGE             4A4D    B1
       JP    NZ,LOOP2         REPEAT IF NOT DONE 4A4E   C24B4A
       LD    HL,3C00H+384     LINE 6            4A51    21803D
       LD    B,192            3 LINES           4A54    06C0
       LD    D,25H            PERCENT           4A56    1625
LOOP3  LD    (HL),D           STORE BYTE        4A58    72
       INC   HL               BUMP POINTER      4A59    23
       DEC   B                ADJ COUNT         4A5A    05
       JP    NZ,LOOP3         REPEAT IF NOT DONE 4A5B   C2584A
STOP   JP    STOP             WAITING LOOP      4A5E    C35E4A
```

COMPUKIT 600 BAUD MODIFICATION

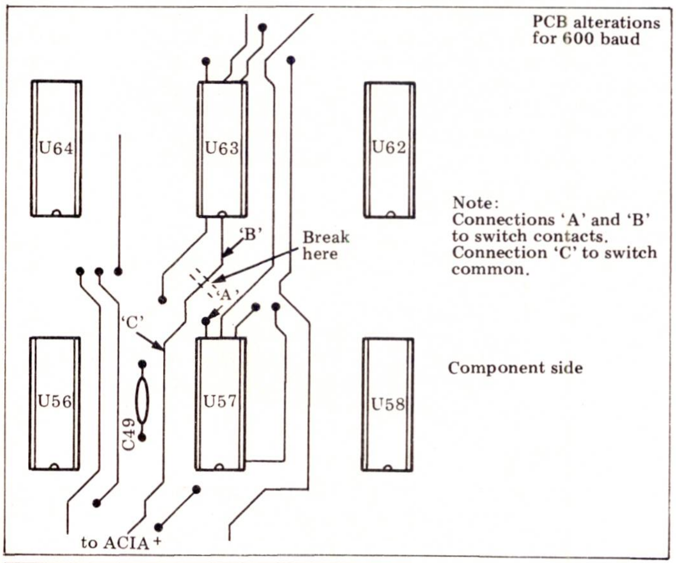
The following describes how to convert a Compukit cassette interface to operate at 600 baud as well as 300.

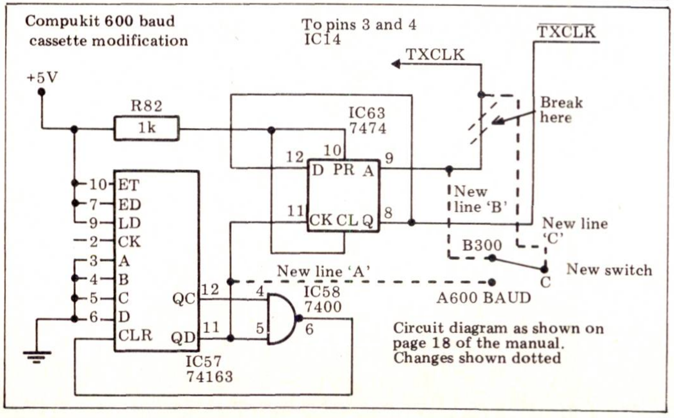
On page 5 of the Compukit manual, a method is described for increasing the baud rate of the cassette. This modification will not, in fact, work since as well as speeding the baud rate of the machine by a factor of two, four or eight, it also increases the '1' and '0' tones by similar factors, bringing the frequencies out of range of most tape recorders. Therefore unless the operator uses a video recorder, the speed increase is not much use.

The method I have used is to connect the clock inputs of the ACIA to the other side of the divide by two systems formed by IC63. This doubles the baud rate, while not affecting the tone of the transmissions.

To effect the change it is simply necessary to cut one track on the PCB and connect a single pole changeover switch in its place (see diagram).

A D Love





for inclusion in prog etc.

ZX81 TIPS 1

see april PCW p149

Machine code users might like to know that you *can* reset RAMTOP without clearing the memory (useful if you suddenly remember you haven't reserved enough space). Method is as follows: POKE desired value for RAMTOP into 16388 and 9; PRINT USR 1040. It's as simple as that. Any Basic program remains unaffected, though variables are cleared.

Replace bulky IF statements used to control printing with one line as follows:

```
10 IF X=1 THEN PRINT 'YES'
20 IF X=0 THEN PRINT 'NO'
30 IF Y=D THEN PRINT 'FALSE'
40 IF S<>F THEN PRINT 'TRUE'
```

becomes:

```
10 PRINT 'YES' AND (X=1);
   'NO' AND (X=0),, 'FALSE' AND
   (Y=D0,, 'TRUE' AND (S<>F)
```

Unfortunately, even if the third condition is not fulfilled the two commas are still acted upon, so you have to watch line spacing. This can be a terrific memory saving.

Why not structured Basic on a ZX81? Simply identify program areas with REM statements (you do anyway, don't you?), giving each area a name. Declare that name as a variable at the beginning of the program with a value equal to the line number following the REM statement in which it occurs. Then, in your GOTOs, specify the variable name. This also makes simple renumbering routines which cannot cope with GOTOs more useful. After renumbering the lines you have only to check the REM statements to see what new values have to be assigned to the variables; no need to keep a record of where lines specified by GOTOs have been moved to. An end to incomprehensible GOTOs?

David Lawrence

ZX81 TIPS 2

I have noticed a few useful features of the ZX81 logical operator set. In addition to the standard functions (AND, OR, NOT), relational operators are valid boolean operators. This is because the logical result of a comparison is one or zero, instead of true and false, ie, PRINT A=B is a valid expression. This has useful implications when modelling combinational logic systems.

ZX logic is defined in Figure 1.

Care must be taken when mixing arithmetic operators (+,*) with standard logical operators (AND, OR, NOT) as the latter have much lower priority when the expression is evaluated, so application of brackets is essential. In fact, the only use for AND and OR as standard functions is the mixed type expression, ie, A£AND B will return string A£ if A is true. Full truth tables for a switching function can easily be generated thus as in Figure 2. (note I=one):

Try expression A< >(B< >(C< >D)) — 4-bit parity generation!

David Davies

Figure 1

ZX notation	Boolean expression	
A<B	$\bar{A}.B$	(NOT A) AND B
A>B	$A.\bar{B}$	(A AND (NOT B)
A<=B	$\bar{A}+B$	(NOT A) OR B
A>=B	$A+\bar{B}$	A OR (NOT B)
A< >B	$A\oplus B$	A EXOR B
A=B	$\overline{A\oplus B}$	A EXNOR B
A*B	$A.B$	A AND B
A+B	$A+B$	A OR B

Arithmetic operators work too!

Figure 2

```
100 FOR A=0 TO 1
110 FOR B=0 TO 1
120 FOR C=0 TO 1
 "       "       "
260 FOR Z=0 TO  1
270 PRINT A;B;C;...Z;"=";(SOME EXPRESSION.)
280 NEXT Z
290 NEXT Y
 "       "       "
530 NEXT A
```

EPROM PROGRAMMER FOR PET

An EPROM programmer is out of my price range, especially when I only want an occasional 2716 programmed; also as a hobbyist felt I should do as much as possible myself, even if it took a long time — that's part of the enjoyment.

The current 'standard' EPROM is the 2716; it costs around £5, but will doubtless cost half that by the time this article is published. It holds 2048 bytes of memory. It has 11 address pins, eight data pins and five others:

Vcc : 5 volts
Ground : 0 volts
Vpp: 26 volts when programming, 0 or 5 volts when reading
OE : needs Vcc when programming, 0 volts when reading
CE/PGM : requires a 50 millisec pulse of Vcc when programming and 0 volts enables the 2716 when reading.

To program the first address of the EPROM we do the following:

1 apply 25 volts to pin 21 (Vpp);
2 apply 5 volts to pin 20(OE);
3 apply the address to the address pins (1—8, 22—23 & 19);
4 apply the data required to the data pins (9—11 and 13—16);
5 apply a 50 millisec TTL high-level pulse to pin 18. (CE/PGM).

To program the next memory we now increment the address in 3 above, change the data, and then send another program pulse.

When all 2048 bytes of data have been programmed, we switch off the 5 volts to pin 18 and then the 25 volts to pin 21. It is important to do the switching in this order. Vpp should only be switched when CE is at ground potential. It is also important that the program pulse be fairly accurate. If it exceeds 55 millisecs damage will almost certainly be done to the EPROM.

Of the PET's output ports the Parallel User Port (PUP) is the most useful. It has the data bus available — for both input and output — and the CB2 output for control. I wanted two other outputs so I spent some time studying the IEEE port. In the past I have treated this with great suspicion, but after some experimentation (not to mention several frustrating crashes) I obtained two outputs that could be programmed fairly easily. These were from pins 6 and 8 (DAV and NDAC), which can be addressed in machine code within $E821 and $E823.

The provision of addresses for the 2716 is straightforward. Three SN749s will give 12 addresses — one more than needed — with only two inputs to think about: one to zero the counters and another to increment them one at a time.

Basic is too slow and unreliable for times as short as 50 millisecs so the programming and checking of the EPROM is done entirely with machine code. The Basic program (shown in Figure 1) which leads to it is merely a print-out program which slows me down, forcing a 'Y E S' from me when I have done various things in the right order. The machine-code program is shown in Figure 2.

During the programming of the 2716 there is a need for four states. A SN7474 is used to latch these states according to the following truth table:

Figure 1

```
LIST
  100 PRINT"2716 EPROMMER"
  110 PRINT"-------------"
  120 PRINT"MEMORY FOR ROM MUST BE PLACED BETWEEN"
  130 PRINT"$0C00 AND $13FF BEFORE RUNNING THIS"
  140 PRINT"PROGRAM ANY FURTHER.  IF THIS IS OK"
  150 PRINT"PLEASE WRITE";CHR$(34);"Y E S";CHR$(34);".":GOSUB2000
  160 PRINT"PIN 20 (OE) SHOULD NOW BE AT 0 VOLTS"
  170 PRINT"AGREE? (Y E S)":GOSUB2000
  180 PRINT"PLEASE APPLY 25 VOLTS TO PIN 21(VPP)"
  190 PRINT"DONE? (YES)":GOSUB2000
  200 PRINT"PLEASE APPLY 5 VOLTS TO PIN 20(OE)"
  210 PRINT"DONE? (YES)":GOSUB2000
  220 PRINT"FINAL CHECK.  IS EVERYTHING NOW READY"
  230 PRINT"FOR PROGRAMMIMG?":GOSUB2000
  240 PRINT"THE EPROM IS NOW BEING PROGRAMMED.":SYS2688:REM 2688=$0A80
  250 PRINT"PLEASE APPLY 0 VOLTS TO PIN 20(OE)"
  260 PRINT"DONE? (YES)":GOSUB2000
  270 PRINT"IF OE IS NOW AT ZERO PLEASE APPLY 0"
  280 PRINT"VOLTS TO PIN 21(VPP)":PRINT"DONE? (YES)":GOSUB2000
  290 E=0:PRINT"EPROM IS NOW BEING CHECKED.":SYS2853:REM 2853=$0B25
  300 IF PEEK(2880)=0 AND PEEK(2881)=20 THEN360:REM 2880=$0B40
  310 F=PEEK(2924)+PEEK(2881)*256:G=255-PEEK(59471):REM 2924=$0B6C
  320 PRINT"ERROR:";F;"SHOULD BE";PEEK(F);"BUT IS";G
  330 E=E+1
  340 SYS2920:REM 2920=$0B68
  350 GOTO300
  360 PRINT"THE EPROM HAS NOW BEEN CHECKED.  THERE WERE";E;"ERRORS."
  370 END

 2000 INPUTA$:IFA$<>"YES"THEN2000
 2010 RETURN
```

Latch A	Latch B	
0	0	No action
1	1	Clear the 7493s
0	1	Clock the 7493s
1	0	Send program pulse

Table 1 Memory map for the 2716 Eprommer

$0400 — $09FF : Basic program
$0A80 — $0B24 : M/Code for programming
$0B25 — $0B70 : M/Code for checking
$0C00 — $13FF : Data for transfer
$16F6 — $1FFF : Reserved for monitor

The various programs are contained in the PET's 8k memory according to the memory map in Table 1. The monitor program at the top of memory is SUPERMON — an exremely useful piece of software used for checking everything — and which now is part of an EPROM between A000 and AFFF. The program takes just under two minutes to transfer the full 2048 bytes.

Figure 2

```
          0A80 EA           NOP
          0A81 EA           NOP
          0A82 EA           NOP
          0A83 78           SEI
          0A84 20 C0 0A     JSR ZERO
          0A87 20 D0 0A     JSR CLEAR
          0A8A A9 FF        LDA #$FF
          0A8C 8D 43 E8     STA $E843
          0A8F A9 0C        LDA #$0C
          0A91 8D 9F 0A     STA MEMRY+2
          0A94 A9 00        LDA #$00
          0A96 8D 9E 0A     STA MEMRY+1
          0A99 A0 08        LDY #$08
          0A9B A2 00        LDX #$00
MEMRY     0A9D BD 00 0C     LDA $0C00,X
          0AA0 49 FF        EOR #$FF
          0AA2 EA           NOP
          0AA3 EA           NOP
          0AA4 8D 4F E8     STA $E84F
          0AA7 20 F0 0A     JSR PULSE
          0AAA 20 10 0B     JSR DELAY
          0AAD 20 E0 0A     JSR CLOCK
          0AB0 E8           INX
          0AB1 D0 EA        BNE MEMRY
          0AB3 EE 9F 0A     INC MEMRY+2
          0AB6 88           DEY
          0AB7 D0 E4        BNE MEMRY
          0AB9 20 C0 0A     JSR ZERO
          0ABC 58           CLI
          0ABD 60           RTS

ZERO      0AC0 A9 B4        LDA #$B4
          0AC2 8D 21 E8     STA $E821
          0AC5 A9 B4        LDA #$B4
          0AC7 8D 23 E8     STA $E823
          0ACA 20 00 0B     JSR $0B00
          0ACD 60           RTS

CLEAR     0AD0 A9 BC        LDA #$BC
          0AD2 8D 21 E8     STA $E821
          0AD5 A9 BC        LDA #$BC
          0AD7 8D 23 E8     STA $E823
          0ADA 20 00 0B     JSR LATCH
          0ADD 60           RTS

CLOCK     0AE0 A9 BC        LDA #$BC
          0AE2 8D 21 E8     STA $E821
          0AE5 A9 B4        LDA #$B4
          0AE7 8D 23 E8     STA $E823
          0AEA 20 00 0B     JSR LATCH
          0AED 60           RTS
PULSE     0AF0 A9 B4        LDA #$B4
          0AF2 8D 21 E8     STA $E821
          0AF5 A9 BC        LDA #$BC
          0AF7 8D 23 E8     STA $E823
          0AFA 20 00 0B     JSR LATCH
          0AFD 60           RTS

LATCH     0B00 A9 EC        LDA #$EC
          0B02 8D 4C E8     STA $E84C
          0B05 A9 CC        LDA #$CC
          0B07 8D 4C E8     STA $E84C
          0B0A 60           RTS

DELAY     0B10 A9 FF        LDA #$FF
          0B12 8D 0F 0B     STA DELY2
LOOP2     0B15 A9 15        LDA #$15
          0B17 8D 0E 0B     STA DELY1
LOOP1     0B1A CE 0E 0B     DEC DELY1
          0B1D D0 FB        BNE LOOP1
          0B1F CE 0F 0B     DEC DELY2
          0B22 D0 F1        BNE LOOP2
          0B24 60           RTS

CHECK     0B25 78           SEI
          0B26 20 D0 0A     JSR CLEAR
          0B29 A9 00        LDA #$00
          0B2B 8D 43 E8     STA $E843
          0B2E A9 0C        LDA #$0C
          0B30 8D 41 0B     STA MEMEX+2
          0B33 A9 00        LDA #$00
          0B35 8D 40 0B     STA MEMEX+1
          0B38 A0 08        LDY #$08
          0B3A A2 00        LDX #$00
NEXTD     0B3C 20 C0 0A     JSR ZERO
MEMEX     0B3F BD 00 0C     LDA $0C00,X
          0B42 49 FF        EOR #$FF
          0B44 CD 4F E8     CMP $E84F
          0B47 D0 16        BNE ERROR
          0B49 20 E0 0A     JSR CLOCK
          0B4C E8           INX
          0B4D D0 ED        BNE NEXTD
          0B4F EE 41 0B     INC MEMEX+2
          0B52 88           DEY
          0B53 D0 E7        BNE NEXTD
          0B55 20 C0 0A     JSR ZERO
          0B58 A9 FF        LDA #$FF
          0B5A 8D 43 E8     STA $E843
          0B5D 60           RTS

ERROR     0B5F 8A           TXA
          0B60 8D 6C 0B     STA REGX+1
          0B63 98           TYA
          0B64 8D 69 0B     STA REGY+1
          0B67 60           RTS
REGY      0B68 A9 00        LDA #$00
          0B6A A8           TAY
REGX      0B6B A9 00        LDA #$00
          0B6D AA           TAX
          0B6E 4C 49 0B     JMP $0B49
```

The SYS instruction in line 240 of the Basic program puts us into the machine-code program, which starts at $0A80. This uses several sub-routines which are as follows:

ZERO ($0AC0) — this puts A and B to logic '0';
CLEAR ($0AD0) — puts A and B to logic '1' to produce a '1' from an AND gate to clear the 7493s;
CLOCK ($0AE0) — puts latch A to '0' and B to '1'. This produces a clock pulse to input A of the first SN7493 counter;
PULSE ($0AFC) — puts A to '1' and B to '0'. After the jump to LATCH the program pulse will start;
LATCH ($0B00) — this clocks both latches. Whatever was present on the D input is now transferred to the Q outputs;
DELAY ($0B10) — A delay sub-routine of 50 milliseconds.

Table 2

```
RUN
2716 EPROMMER
-------------
MEMORY FOR ROM MUST BE PLACED BETWEEN
$0C00 AND $13FF BEFORE RUNNING THIS
PROGRAM ANY FURTHER.  IF THIS IS OK
PLEASE WRITE"Y E S".
? YES
PIN 20 (OE) SHOULD NOW BE AT 0 VOLTS
AGREE? (Y E S)
? YES
PLEASE APPLY 25 VOLTS TO PIN 21(VPP)
DONE? (YES)
? YES
PLEASE APPLY 5 VOLTS TO PIN 20(OE)
DONE? (YES)
? YES
FINAL CHECK.  IS EVERYTHING NOW READY
FOR PROGRAMMIMG?
? YES
THE EPROM IS NOW BEING PROGRAMMED.


PLEASE APPLY 0 VOLTS TO PIN 20(OE)
DONE? (YES)
? YES
IF OE IS NOW AT ZERO PLEASE APPLY 0
VOLTS TO PIN 21(VPP)
DONE(YES)
? YES
EPROM IS NOW BEING CHECKED.

THE EPROM HAS NOW BEEN CHECKED.   THERE
WERE 0 ERRORS.

READY.
```

The 7493s are cleared by $0A87 to make all 11 addresses of the 2716 logic '0'. $0A8A — $0A8E makes the PUP available for outputting data and then registers X and Y are set to count 2048 bytes.

The program (which has been previously loaded into the area between $0C00 and $13FF) is now, one byte at a time, loaded into the accumulator at $0A9D and transferred to the PUP at $0AA4.

With the address and data now held at the 2716 inputs, we now send the 50 millisecond program pulse. The clock sub-routine at $0AAD stops the program pulse and we then load the next byte of data. When both the Y and X registers are finally zero we return to the Basic program, with instructions for switching OE and Vpp appearing on the screen.

The checking program now starts. The 7493s are again cleared and as we increment through their addresses we check that the memory in RAM coincides with its equivalent in the ROM. Any failures cause the appropriate error message to appear on the screen.

It is not necessary to program all 2 kilobytes at any one time. By altering the LDY at $0A99 and the LDAs at $0A90 and $0A9F you can program fewer amounts of 256 bytes, or start programming from a higher address than $0C00.

When the 2716 is new (or newly-erased) it is full of '1's (16,384 of them). It is programmed by converting some of these '1's to '0's. It is therefore important that all locations between $0C00 and $13FF, other than those which contain data to be transferred, contain $FF.

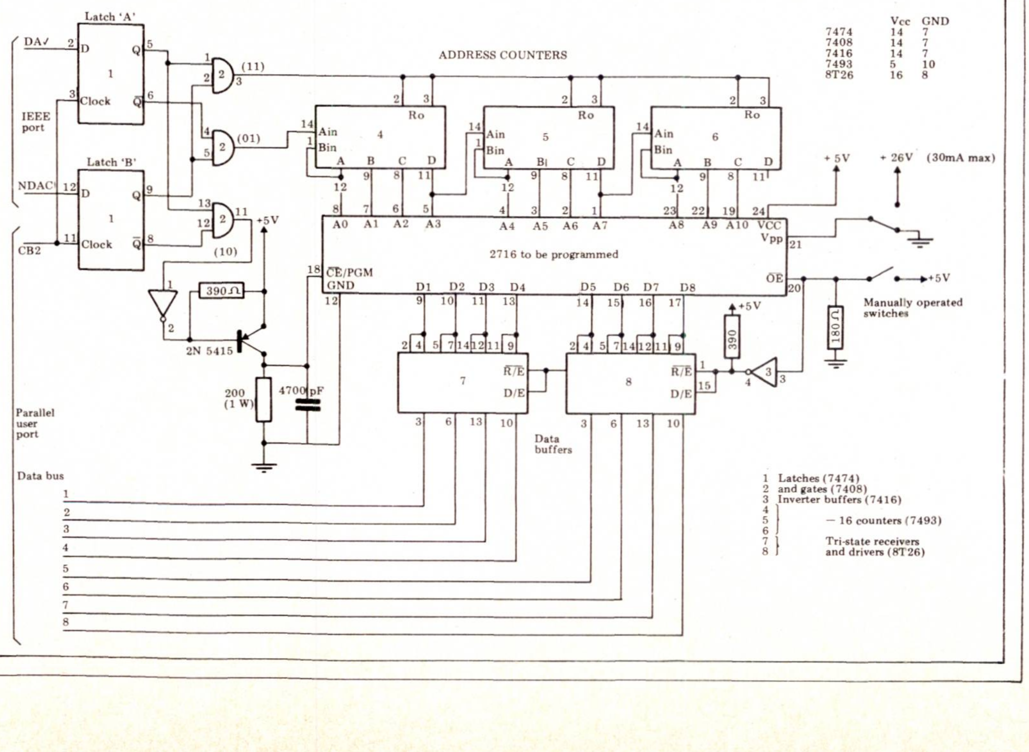
Programming mistakes are fairly easily rectified with the help of a sun-ray lamp if you don't have access to a proper eraser. 25 minutes within 3in of a glowing ultraviolet bulb make the EPROM as good as new. But be careful which way round you insert the chip — the sun-ray lamp doesn't correct for 25 volt mistakes! You will find that Data 1 on pin 9 doesn't read '0's ever again if you try to program the 2716 with it inserted back to front.

ICs 7 and 8 are 8T26s which invert the data when both programming and checking. The EOR ≠$FF at $0AA0 inverts the data before it leaves the PET and another inversion occurs at $0B42 when checking the data. If 8T28s are used these should be amended accordingly.

The circuit diagram of the device is shown at Figure 3.

J D Beaven

Figure 3

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INTERAM

THE MAN BEHIND THE WEST COAST FAIRE

An insight by David Tebbut and Judy Lower into WCF organiser Jim Warren

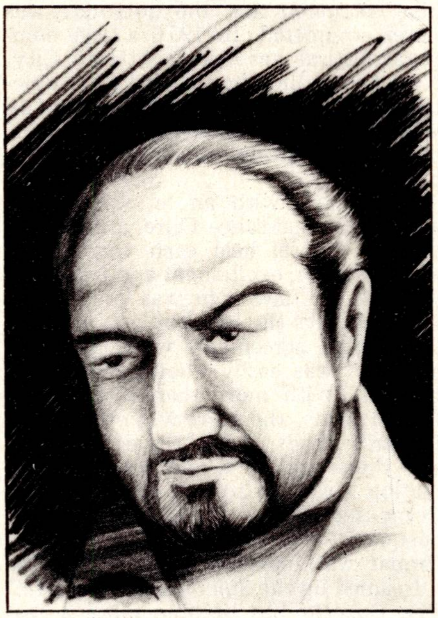
The day following the 1981 West Coast Computer Faire I found myself interviewing the show's organiser, Jim Warren, at his office-cum-home on a Californian mountain top. To my astonishment, halfway through the evening Jim suggested that we take our clothes off and finish the interview in the hot tub! Since note-taking was nigh on impossible under these circumstances, Judy Lower kindly offered to go back and complete the job.

This is a story about a man with dreams and, in these times of almost exclusively bad news, I feel that it's a story worth telling just to prove that dreams can come true, especially in the rapidly expanding microcomputer business.

Like so many people in the personal computer industry, Jim Warren was a bit of a drifter, fooling around with things that interested him rather than the things that other people thought he ought to be doing. He had no plans to become 'something big in micros' because, until just a few years ago, the darned things hadn't been invented! Now, every spring in San Francisco, Jim runs the biggest and best micro show in the world.

Jim's success has enabled him to buy 40 acres of prime Californian mountain top on the ridge that divides what he calls Silicon Gulch from the Pacific. Typically, Jim decided to design his own home/office for himself and his staff where they could all enjoy themselves while getting on with the serious business of organising the West Coast Computer Faires. The house is built on three storeys, with Jim's circular office/bedroom occupying the top level. The bedroom half overlooks 50 miles of Pacific coastline, including San Francisco, while the office/library half faces magnificent redwoods. The middle floor contains his computer with its seven terminals (three or four more are planned) and his staff, when they're not taking advantage of his fridge, hot tub, sun deck, visiting masseur or swimming pool. Fortunately (?), all the 'phones are on very long leads so that his staff can deal with calls wherever they happen to be.

Since California gets more than its fair share of earthquakes, the house is built almost entirely of wood. The theory is that wood flexes well when a tremor hits and everything returns to its original position after the 'quake. Jim very proudly showed off constructional details when we went into his equivalent of a basement and while we were down there he also showed me a large pit which was being cut out of the mountainside. This will contain rocks which will be used as a form of heat storage. Jim plans to have solar panels and windmills scattered around his plot of land in order to become self-sufficient in heat and electricity. In fact, by plugging into the national network, he expects to become a net producer of electricity and receive negative power bills! Space heating is provided by a wood-burning fire in Jim's bedroom. All sorts of tubes carry the heat away to other parts of the building. It all seems to work very well in California. Sadly, it would probably be less successful in chilly Britain.



The Faire staff

During the day, this beautiful retreat is populated by an unusual crew of 14 who operate together more like a family than a business. Even the carpenter, who has done such an amazing job on the house, seems to have joined the family. Whenever Jim needs someone new he just puts the word out in the computing community or through his existing staff and, lo and behold, the staff 'just magically appears'. Jim readily admits that he hasn't got an optimal mix of personalities or talents but he finds that from 'an overall living standpoint' it is pretty near optimal. Everyone gets along well together and, I suspect, if they don't then they probably drift away of their own accord. Jim feels that loyalty is very important and he abhors the sort of businesses that thrive on ego games and politics. He also believes in giving his employees the maximum amount of freedom. If someone doesn't feel like working one day then fine, perhaps tomorrow they'll produce twice as much. Jim feels that nobody should have to do anything they don't want to do and he also lets them switch between jobs if that's what they want. Obviously, if someone refuses all jobs offered then they'd have to go, but this sort of thing doesn't seem to happen.

Since this all sounded jolly good coming from Jim, we thought we'd ask the staff how they saw things working out. Sarah Candelario is rapidly becoming Jim's 'right hand woman' and she had this to say: 'We're free to use whatever we want around the house — raid the refrigerator, whatever. No-one takes advantage, though. This environment is the best.' Sarah lives with her husband, Rick, just down the road from Jim in a little wooden cabin deep in the forest. She continued: 'Working in this area has made my whole world smaller because you only see a few people. On the whole I like it, but once in a while I have to go out of the area and see other people, otherwise I get cabin fever.'

Bruce, the man in charge of construction, planning and landscaping, had this to say about Jim: 'I've worked on and off with Jim for about five years. I think he's a pretty outrageously fine person. The more I know him the more I like him. He's conscientious, very sure of himself.'

Another, anonymous, friend had plenty to say about Jim. Things like: 'Jim's substantially ahead of his time . . . He's casual about formal organisation, has no patience with society's organisation . . . He's a bit of an anarchist, a one man band.' And, finally, perhaps giving a little insight on the remoteness of his home: 'His great love is his house, he wants people to come to him.'

Early years

Jim was born in Oakland, California and when he was three or four he was taken to live in Texas. He doesn't know what Texas is like now, but he says in those days it was a 'major social disease'.

We're told that during his childhood Jim was 'bright, introverted and rejected by his peers'. Following school he spent two and a half years at college but before his course was complete he left to begin teaching at a Texas high school. He felt obliged to finish his own schooling during summer holidays. He describes the earning of the subsequent degree as 'obligatory bullshit'.

Somehow he found himself involved with the South Texas Math Council and, typically, he wound up chairing it. He expanded and revitalised the organisation and ended up with a few National Science Foundation grants — two for the council and one for himself to get a master's degree. He finally ended up with three master's degrees — in Mathematics, Medical Information Systems and Computer Engineering. In case that seems to contradict what he said earlier, this is what Jim had to say about his life in general: 'I see my life as accidental. I sort of meander along and if something tweaks my interest I wander over and sniff that rose for a while. Not only is my life not planned, I don't mind it not being planned!' Luckily for Jim he finds most of the things that catch his interest are things which other people want to pay for.

California

Jim came to California with no job, no savings and no plans. He wanted to live in the (San Francisco) Bay Area because he wanted to be where a lot of things were happening — innovation, frontiersmanship and people doing things that hadn't been done before, simply because they were considered to be worth doing. He was also attracted by the fact that people in the area live life the way they want to and not in the way which others say they should. Jim found himself teaching at a Catholic girl's school, a job which would see him through the next ten years.

At some time during this period he had fallen into the then popular habit of experimenting with alternative lifestyles, trying to find a better way to live. One of his discoveries was that of hosting nude parties for 'large groups of people with desirable goals, wishes and interests'. At the parties 'there were no rules and guests were encouraged to act themselves' — Jim figures that it is very hard to maintain a facade without a stitch on. These parties gained a certain amount of notoriety. First, good old Auntie BBC filmed one of his parties for a 'Now Generation' documentary, then both *Time* and *Playboy* magazines jumped on the bandwagon. Once the Catholic girl's school heard about this publicity, they invited Jim to move on.

He then got involved with the Free University, a Stanford-based alternative school founded by left-wing political activists. Jim found it exciting and interesting so he gave a hand with the administration. At the next election of officers all the left-wingers were ousted and the hippie counter-culture types, Jim Warren included, found themselves in power. Jim started a newsletter called *The Free You*. I think the nude parties petered out soon afterwards.

While working with the Free University, Jim needed some sort of part-time job. A friend suggested that he work at Stanford Medical Center. There he learned a lot about computers in process control and data acquisition work. Although these were fairly specialised applications, there was an immense demand for his services among the Bay Area electronics companies, so he became a successful consultant. The more he went along the more he realised that he had great peaks of expertise surrounded by chasms of ignorance. He had zero interest in research mathematics but a profound interest in the practical applications of computing. The path he was about to follow would lead him to become one of the most knowledgeable people in the microcomputer business.

Dr Dobbs and the Computer Faire

Jim migrated from consultancy into the editorship of *Dr Dobb's Journal*. He was its first editor and, according to many, it still bears the impression of his personality. At the time that Jim got involved with *Dr Dobb's* he was on the point of completing his PhD dissertation. It seems that he was enjoying the magazine so much that the doctorate was never completed. In 1976 a large computer festival was held in Atlantic City, New Jersey and Jim decided that something like it should be happening on what he considers to be the 'right' coast. The Computer Faire idea was born.

The Faire with an 'e' was named after the Renaissance Faire, a medieval-themed festival held each year in the area. The fun, excitement and festive air was just the flavour he was looking for. In those days the industry was so small that verbal agreements were hònoured and Jim was easily bootstrapped into business. With more than a little help from friends, the Faire was on its way. In Jim's words, 'being the egomaniac I am there was a whole lot of information I wanted to put out about the Computer Faire. A leaflet was inadequate, but I knew a newspaper format was inexpensive so that's how I dreamed up the *Silicon Gulch Gazette*.' The *Gazette* has become quite a feature of the run-up to the Computer Faire. Everyone on Jim's massive mailing list gets each issue as it comes out. It contains news of what's going to be at the Faire, extracts from papers submitted for the conference section, as well as ramblings from the mountain-top muse himself.

The Atlantic City show had attracted 3000 people — a huge number in those days. Jim figured that, since he was in the centre of the industry, he could expect 7000 to come to San Francisco. In fact, the first Faire drew 13,000! For eight months Jim spent something like 60 hours a week working on the schedule that would cripple most people, Jim would claim that he plays 'almost constantly'. He explains: 'If work is performing activities that generate income then I work all the time. If it's something that's unpleasant that you have to do when you'd rather be doing something else, then I haven't worked since high school.'

Since those days the Faire has grown substantially and in 1981 it attracted 32,000 visitors. As if this wasn't achievement for one man, Jim decided that what the industry really needed was a fast-turn-round newspaper so, just a couple of years after starting the Faires, he launched a paper called *Journal of Intelligent Machines* (*JIM!*). Even Mr Warren got tired of the mnemonic and renamed it the *Intelligent Machines Journal*. Tom Williams had been editing *Dr Dobb's* since Jim left, so Jim invited him to take over the editorship of *IMJ*. Jim, in his turn, got tired of running the paper and sold it to Pat McGovern, the owner of Computer-World. John Craig was seduced away from the editorship of *Creative Computing* to become *IMJ*'s publisher, the paper was renamed *Infoworld*, and it is now an immensely popular source of fast intelligence about the microcomputer industry.

The man himself

Jim finds close friends and companions very hard to come by. He longs for a close companionship and is not too worried whether this involves marriage or not. He is easily turned off by people who are significantly constrained by conformity and tradition. Jim is very aware that he has put on a lot of weight and will readily admit to being 'slothful and opinionated'. Despite these things he is a compellingly attractive man. His weight gives the appearance of solidity and strength and he certainly appears larger than life when belting around the West Coast Faire on roller skates, as is his custom. Judy and I both find Jim an intriguing person.

He feels very secure about his professional future because, although the work brings problems, the approaches are usually pretty evident and achievable too. In his personal life things aren't so easy and this is probably why it is becoming so much more important to Jim that he works something out with someone who can relate to him at the right level.

Present and future

The Computer Faire and Conference is the main source of income at present. Jim plans a whole series of one-day topic-oriented mini-fairs. Themes will include small business computing, educational computing, word processing, etc. The format would be a three-hour seminar by independent consultants, followed by an exhibition of products and rounded off with more seminars in the evening. Jim again: 'The seminars will be independent of the vendors to offer straight dope to the Faire participants.' There is also the possibility of running regional swap-meets.

Jim is also considering the possibility of two more good-sized Computer Faires — one in Southern California and the other in the Pacific North-West. These are expected to be smaller, regional shows as opposed to the major San Francisco Faire. A new feature of future Faires will be seminars by carefully chosen independent paid lecturers for fee-paying attendees. In the past the talks have been given by a variety of people, unpaid and talking about whatever they want. Jim says: 'Sometimes the speakers are worth a damn, and sometimes they're not.'

Three publications will be standard for future Faires — the *Silicon Gulch Gazette* already mentioned; the *Faire Word*, which gives even more news about the show; and *Inexpensive Computing for Business*, which will concentrate on promoting Faire activities to businessmen.

Jim has also been working on his Datacast project. Originally conceived as an airwave information provision system, it is at present being developed

GOTO page 189

PCW SUBSET

More usefull assembler code subroutines from Alan Toothill

Random numbers

What I particularly like about doing this series is getting one of those letters that connects up ideas from several different sources. Such a letter is just to hand from Andrew Bain of Welwyn Garden City on the subject of random numbers.

It began in the July 1981 issue with Gavin Evans' 16-bit pseudo random number generator using the formula:
New Random Number = 'a' times Previous Random Number plus C mod M, with 'a' = 257, C = 41 and M = 2**16 (ie, 65536). Gavin gave some better values of 'a': 765; 889, 989 and 2009.

In October, Brian Steel pointed out that the value of 'a' in a good random number routine must, when a modulus of 65536 is used, be between 655 and 64480 and be such that 'potency' is 5 or more, potency being the power to which (a—1) must be raised before it is directly divisible by the modulus 65536.

Andrew now gives us first a simple means of calculating potency when M = 65546: (a—1) is divided by 2 until the answer is an odd number. The number of divisions that have had to be made to produce this result is then divided into 16 and the answer, ignoring any remainder, is the potency. Thus, when 257 is used for 'a', (a—1) or 256 has to be divided by 2 eight times before the first odd number (one) results and 8 divided into 16 gives 2; too low a potency for a good random number routine. When 765 or 989 is used for 'a', (a—1) has to be divided by 2 only twice before an odd number results and 2 divided into 16 gives a potency of 8. Both these 'a's' satisfy Brian Steel's criteria.

Andrew offers a routine, Datasheet RANDM, based on the formula:
$X_{i+1} = 1021\ X_i + 41 \bmod 65536$.
Again 'a' satisfies Brian Steel's requirements, giving a potency of 8 and being >655 and <64880. Is RANDM then a particularly good pseudo random number generator or would it be better with an 'a' of 765, 989 or something else? You might see how this could be tested if you read Alan Sutcliff's 'Patterns' in the November 81 issue of *PCW*.

Datasheet

```
;=RANDM — 16-bit pseudo random number generator
;/CLASS: 1
;/TIME CRITICAL ?: No
;/DESCRIPTION:  Generates a 16-bit random number from the series
;/              Xi+1 = Xi*1021   41 mod 65536
;/ACTION: See program comments
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT:    HL contains the previous random number or,
;/          at the first call, a seeded number
;/OUTPUT: HL contains the new random number
          which must be saved for the next call
;/REGs USED: HL
;/STACK USE: 6
;/LENGTH: 18
;/TIME STATES: 144
;/PROCESSOR: Z80
;
RANDM: PUSH AF     ; save                          F5
       PUSH BC     ; registers.                    C5
       PUSH HL     ; save original (HL).           E5
       LD H,L      ;                               65
       LD L,+10    ; HL ← 256*(HL) + 10.           2E OA
       POP BC      ; BC ← original (HL).           C1
       OR A        ; clear carry.                  B7
       SBC HL,BC   ; HL ← 255*(HL) + 10.           ED 42
       ADD HL,HL   ; HL ← 510*(HL) + 20.           29
       ADD HL,HL   ; HL ← 1220*(HL) + 40.          29
       SCF         ; add 1.                        37
       POP BC      ; restore                       ED 4A
       POP AF      ; registers.                    F1
       RET         ;                               C9
```

Ramm check

Here's an odd idea from Edmund Ramm of Kaltenkirchen, West Germany. Most small memory test programs have the disadvantage of not being able to test the locations they occupy themselves. Edmund gives the code in Listing 1, for his Sharp MZ-80K, to test all RAM. It does this because it is stored and executed from the video RAM, which doesn't need testing by program, as faults there are apparent from faulty display.

```
RAMCHK:REL   D000H
RAMSTA: EQU  1000H
RAMSIZ: EQU  C000H
INIT:   XOR  A              ; clear A.          AF
LOOP1:  LD   HL, RAMSTA     ; pointer.          21 00 10
        LD   BC, RAMSIZ     ; counter.          01 00 CO
LOOP2:  LD   (HL),A         ; write data.       77
        CP   (HL)           ; check OK.         BE
        JR   Z,OK           ;                   28 06
FOUND:  LD   (ADRSTO),HL    ; "display"         22 22 D1
        JP   MLOOP          ; faulty addr.      C3 82 00
OK:     EX   AF,AF'         ; save A.           08
        XOR  A              ; clear A'.         AF
        DEC  BC             ; counter —1.       0B
        CP   B              ; checked all RAM?  B8
        JR   NZ, NEXT       ; no.               20 07
        CP   C              ;                   B9
        JR   NZ, NEXT       ; no.               20 04
        EX   AF,AF'         ; yes-restore data  08
        INC  A              ; add 1 and         3C
        JR   LOOP1          ; try again.        18 E3
NEXT:   INC  HL             ; next location.    23
        EX   AF,AF'         ; restore data      08
        JR   LOOP2          ; try next loctn.   18 E5
DUMMY:  DEFS 100H           ; make screen room
ADRSTO: DEFS 2              ; display addr.
        END
```

Listing 1

Edmund advises that the Sharp 'ASCII' has little — and the display code nothing — in common with standard ASCII code, so the displayed address of a faulty location would be represented by a character according to the Sharp display code table. Sharp users, apparently, are accustomed to this code mixing and will make light of translating the address. 'Snow' on the screen during execution is caused by the repeated access to the memory chip. To get out of the program, one must actuate the hardware reset.

You can try this on an unexpanded Nascom 1. I did, storing the program from address OA8AH and checking the RAM from address OC8OH for 038OH bytes. The amount of 'snow' generated is quite spectacular. The address of a faulty memory location can not always be shown correctly from the Nascom by a LD (ADRSTO), HL instruction, since the most significant bit of a byte is not used in standard ASCII and such bits in the address will be ignored in generating the characters displayed. To simulate a faulty memory location by testing into EPROM, increase the memory size to 0381H bytes.

Strange things happen on my Nascom when a HALT (76) instruction is executed from a video RAM instead of the JP MLOOP into the monitor. The HALT superimposed a matrix of 16 x 24 dots over the screen or, sometimes, a less regular pattern, when a different address for ADRSTO was used. Does this happen on your Nascom and can you explain why? A HALT executed from other RAM works correctly.

Find FOWIA

FOWIA (see *PCW* April and June 1981) is the two-byte Z80 routine to give the current instruction address in HL. Roger Hargraves points out that the two bytes (E1 and E9) are in locations 000BH and 000CH of the TRS-80 (and Video Genie) level II. Microsoft Basic ROM. Let us know of anywhere else you find it.

Improve and correct

Background correspondence has led to some clarification of the use of September's DIVNM for the M6809. Richard Crane uses DIVNM in a signed number environ-

PCW SUBSET

ment where a previous routine handles the signs and formatting of the numbers. Hence only positive values are passed to DIVNM. The first line of DIVNM's description should therefore be replaced by 'Divides one positive integer by another'.

My mistake in December's Datasheet CVBA omitted the machine code displacement F9 at the DJNZ CVB1 instruction. The routine length is 16 bytes and the last five bytes are 10 F9 C1 F1 C9.

6502 32-bit arithmetic

Dennis May of London SE1 has sent in the 6502 equivalents of SNEG4, SBAD4, SADB4, SMUL4 and SDIV4, Z80 32-bit arithmetic routines printed in last June's Sub Set. This gives us another chance to compare two processors working at the same task.

Remember that 'Sub Set' standards for 6502 code allow for 16 bytes, designated MO to MF, reserved in zero page memory and note that Dennis's routines depend in many cases on some of these locations being contiguous. This month we are printing Datasheets SNEG46 and SBAD46. The rest will follow later.

The Class 2 SNEG46, saving no registers, does in 20 bytes and 92 T states what the Class 1 Z80 version does in 23 bytes and 255 T states.

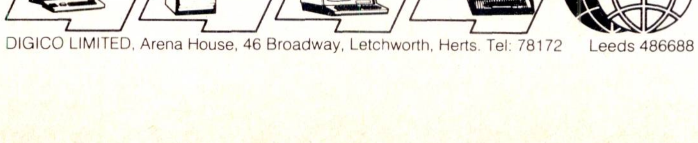
Datasheet

```
;= SNEG46 — Negate 4 bytes
;/ CLASS: 2
;/ TIME CRITICAL?: No
;/ DESCRIPTION:    Negates (2's complement) 4 bytes in zero page
;/                 with the Cy copying the sign of the result
;/ ACTION:         Byte count ← 4
;/                 Byte pointer ← 0
;/                 Cy ← 1
;/                 Loop until byte count zero
;/                 Byte ← 0 — byte — Cy
;/                 Byte pointer ← byte pointer + 1
;/                 Byte counter ← byte counter — 1
;/                 Loop end
;/                 Cy ← sign of result
;/ SUBr DEPENDENCE: None
;/ INTERFACES: None
;/ INPUT:     Locations M1 — M4 contain a signed 32-bit number with
;/            the most significant byte in M4 and the least
;/            significant in M1
;/ OUTPUT:    Locations M1 — M4 are negated and the carry is set
;/            to the resultant sign
;/ REGs USED: A,X,P,M1 to M4 and ME
;/ STACK USE: None
;/ LENGTH: 20
;/ T STATES: 92
;/ PROCESSOR: 6502
;
SNEG46:    LDA  £4       ; byte count              A9  04
           STA  ME       ; to memory.              85  ZZ
           LDX  £0       ; RAM point.              A2  00
           SEC           ; set carry initially.    38
SNG1:      LDA  £0       ; subtract byte           A9  00
           SBC  M1,X     ; from zero and           F5  ZZ
           STA  M1,X     ; store back to RAM.      95  ZZ
           INX           ; point to next byte.     E8
           DEC  ME       ; all done?               C6  ZZ
           BNE  SNG1     ; jump if not.            D0  F5
           ASL  A        ; cy = sign.              0A
           RTS           ;                         60
```

The Class 2 SBAD46, again saving no registers, does in 73 bytes and a maximum 13,007 T states what the class 1 Z80 version does in 66 bytes and a maximum 25,244 T states. Being without a 6502 processor, between returning a borrowed VIC-20 and not receiving delivery of my own BBC Micro, SBAD46 has been checked out by Mark Langham in North London. Mark also recovered an instruction that had slipped from Dennis's typewriter.

Datasheet

```
;= SBAD46 — 32-bit binary to ASCII-Decimal conversion
;/ CLASS: 2
;/ TIME CRITICAL?: No
;/ DESCRIPTION:    Converts a signed 32-bit binary number to an
;/                 ASCII-Decimal string.
;/ ACTION:      Make value absolute.
;/              If negative put "—" to RAM.
;/              Divide number by ten
;/              put remainder onto stack
;/              increment number of digits
;/              repeat until number = 0.
;/              Pop digit off stack
;/              convert to ASCII and load into RAM.
;/              Decrement number of entries
;/              repeat until number of entries = 0.
;/              Put ASCII CR into RAM for terminator.
;/ SUBr DEPENDENCE: SNEG46
;/ INTERFACES: None
;/ INPUT:       M1-M4 contains the signed 32-bit number for conversion
;/              with the least significant byte at M1 and the most
;/              significant at M4.
;/              MA,MB contain the RAM start address of the result.
;/ OUTPUT:      MA,MB are unchanged.
;/              The ASCII string equivalent is in RAM starting at
;/              the address given in MA,MB.
;/ REGs USED:      A,X,Y,P,M0 to M4,MA and MB.
;/ STACK USE:      10 maximum.
;/ LENGTH: 73
;/ T STATES: 13,007 maximum
;/ PROCESSOR: 6502
;
SBAD46:    LDY  £0       ; RAM point.                  A0  00
           BIT  M4       ; test sign.                  24  ZZ
           BPL  SBD1     ; skip if positive            10  08
           LDA  £$2D     ; else put "—"                A9  2D
           STA  (MA),Y   ; to RAM,                     91  ZZ
           INY           ; point to next RAM           C8
           JSR  SNEG46   ; and negate number           20  XX  XX
SBD1:      STY  M0       ; save RAM point.             84  ZZ
           LDY  £0       ; number of digits = 0.       A0  00
SBD2:      LDX  £32      ; bit count = 32.             A2  20
           LDA  £0       ; zeroise accumulator         A9  00
SBD3:      ASL  M1       ; shift                       06  ZZ
           ROL  M2       ; number                      26  ZZ
           ROL  M3       ; left                        26  ZZ
           ROL  M4       ; into                        26  ZZ
           ROL  A        ; accumulator                 2A
           CMP  £10      ; is acc less than 10 ?       C9  0A
           BCC  SBD4     ; skip if so, else            90  04
           SBC  £10      ; subtract ten                E9  0A
           INC  M1       ; and set a result bit.       E6  ZZ
SBD4:      DEX           ; repeat                      CA
           BNE  SBD3     ; 32 times.                   D0  EC
           PHA           ; save digit.                 48
           INY           ; increment no of digits.     C8
           LDA  M4       ; check                       A5  ZZ
           ORA  M3       ; if number                   05  ZZ
           ORA  M2       ; is zero                     05  ZZ
           ORA  M1       ; and                         05  ZZ
           BNE  SBD2     ; repeat if not.              D0  DC
           TYA           ; transfer                    98
           TAX           ; Y to X.                     AA
           LDY  M0       ; restore RAM point.          A4  ZZ
SBD5:      PLA  ;        ; pop digit off stack,        68
           CLC           ; convert it                  18
           ADC  £$30     ; to ASCII                    69  30
           STA  (MA),Y   ; and put into RAM.           91  ZZ
           INY           ; increment RAM point.        C8
           DEX           ; get next                    CA
           BNE  SBD5     ; digit, else                 D0  F6
           LDA  £13      ; load ASCII CR               A9  0D
           STA  (MA),Y   ; and put it to RAM.          91  ZZ
           RTS           ;                             60
```



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This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 – including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 *and* the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.

Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

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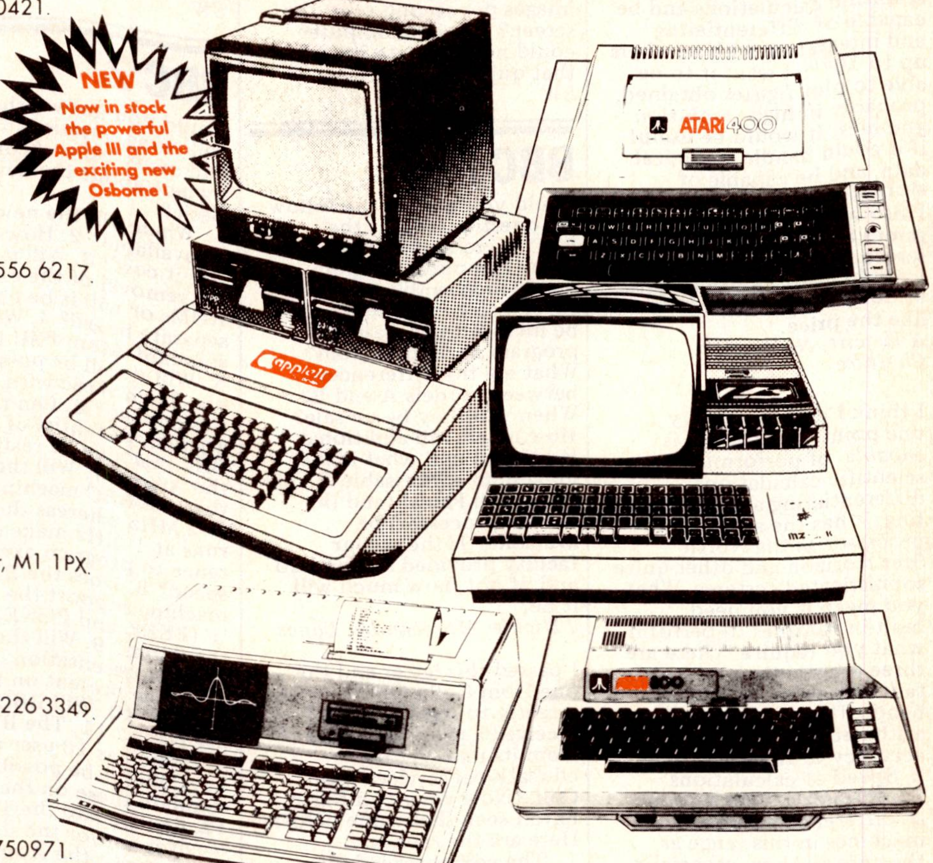

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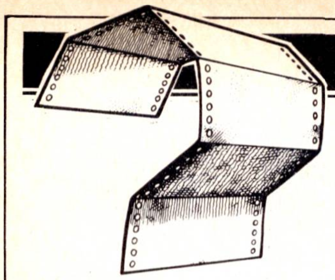
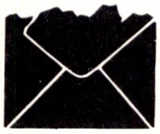


COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.



Cruncher Wanted

I own a ZX80, and now want a bigger and better system. I require it to perform scientific calculations and be capable of differentiating and integrating with numbers up to 10^{30}. I want it to be able to plot figures obtained, probably in high resolution graphics. It would be useful if it could handle statistical data, and be capable of storage and retrieval on tape. I also want to be able to play games and flash images on the screen for millisecond periods. I would dearly like an Apple or Sorcerer but wouldn't like the price.

A Hewitt, Northwick, Cheshire

I think I'd better clarify one point: your ZX80 is *capable* of performing scientific calculations, differentiating and integrating; it has the same microprocessor as the North Star Horizon and other quite sophisticated systems. What you mean is you need built-in routines to perform what you require. There are three aspects that are important to you: 1. Ability to handle floating point arithmetic; 2. The range and accuracy of the arithmetic; 3. Speed of calculations – there is not a huge amount of difference between machines in this range as they are all slow, especially in Basic. The Apple and Sorcerer are not outstanding in this field and much cheaper systems such as the Video Genie are perfectly suitable. You would probably be best to look at a system that allows 'double precision' arithmetic, or, at a bare minimum, one that uses five bytes rather than four to store numeric variables. I know of no system that has built-in calculus facilities, although subroutines exist for Simpson's method of integration and Runge-Kutta for differentiation. There are plenty of numerical analysis books available to help you.

As for statistics, there is no need to waste your money on an Apple when all you require are good file handling facilities built-in to Basic. This rules out the Video Genie and TRS-80, and Apple. The PET/VIC range has good file handling and uses five bytes per numeric variable. Hopefully the BBC micro will also offer all that you require — and high resolution graphics too.

Finally your question about subliminal flashing. No system that I know of can do that. Most phosphors on a TV screen have a persistence ten times longer than the times you want. Why do you want to flash 1000 images per second onto the screen? A microcomputer could not generate images that quickly anyway.

SW

BBC I

Could you answer the following questions about the BBC Micro and BBC Basic? Is the computer programmable in assembler and, if so, can assembler routines be included in a Basic program as on the Atom? What are the differences between models A and B? When will they be on sale? How much will additional RAM cost and what is the maximum addressable RAM? When will Pascal (and the second processor) be available? Is the colour facility provided as standard and, if not, how much will it be?

J Dickie, Morecambe, Lancs

I passed this letter and the one from Colin Grant directly to Acorn where I received a prompt answer from its manager of educational services John Coll. (Now where on Earth have I seen that name before?) Here are the replies:

1. The computer is fully programmable in 6502 assembler language; and this can be freely mixed with the Basic as in the Atom; however there is improved labelling in that labels can now consist of a string of alphanumeric characters.
2. You should send off to BBC Microcomputer System, PO Box 7, London W3 6XJ for their 'little red book', which describes the differences fully. Briefly, though, the B system is a very worthwhile starting point if you can afford the extra cost. It has an extra 16k RAM, serial (RS423) interface, Centronics-type parallel port, 8-bit I/O port, four 12-bit analogue input channels, Teletext expansion, RGB sync for colour, plus sockets for all interfaces. All the eight graphics modes are available, too.
3. Delivery started in early December 1981.
4. Maximum addressable RAM is 32k, but it is possible to expand externally up to about 8Mb of RAM. It is *not* possible to purchase a RAM expansion without upgrading to model B.
5. Pascal will be available about the middle of 1982, and there is likely to be more than one version.
6. Colour is provided as standard.

SW

BBC 2

Could you answer the following questions for me and many other Acorn Atom owners about the new BBC Basic?

1. When will the new Basic be available? 2. How much will it cost? 3. Will it require the removal of the existing ROMs or will it be on a separate board? 4. Will the standard Atom PSU be okay? 5. Will it still be possible to use Atom Basic with the BBC Basic fitted? 6. Can the full graphics potential of the BBC machine be realised on the Atom? 7. Will the fact that the BBC machine runs at 2 MHz whereas the Atom runs at 1 MHz make a difference to program execution speed? 8. Does the BBC machine support the '?' and '!' (PEEK and POKE) as does the Atom? 9. Will the shorthand representation of keywords be present on the BBC system? 10. Will BBC Basic use labels? 11. The BBC machine has 10 user definable keys. Will it be possible to simulate these on the Atom? 12. Can we add the Teletext receiver and/or the second processor to the Atom? 13. Will the present Atom colour board support all the colour modes of the BBC system? 14. Will the additional ROM socket still be available for use? 15. I cannot get my Seikhosha GP80 printer to produce graphics, can you help?

Colin Grant, Dumfries

As in the previous question, John Coll, Acorn's Manager of Educational Services, has provided all the answers:

1. New Basic for the Atom should be available in February 1982, rather ahead of the original schedule. 2. About £35. 3. It will require the removal of the existing ROM and will be on a separate board which will plug into one of the existing ROM sockets. 4. Standard PSU is sufficient. 5. It isn't possible to use Atom and BBC Basic together. 6. It will not be possible to use all the graphics for the BBC machine on the Atom since the Atom cannot support more than 256 horizontal points. 7. The Basic will run more slowly in the Atom because of the slower clock rate. 8. BBC Basic does support '?' and '!'. 9. Shorthand representation of keywords is maintained on the BBC system. 10. BBC Basic does not permit labels for subroutines, but does permit labels in the assembler. However, procedures and functions can be called by name and this is considerably more flexible than the use of named GOSUBs. 11. User-defined keys on the BBC machine can hold a string of characters. The maximum number of characters held is 255. It is therefore not possible to simulate these keys, even using a control key. 12. I doubt if it will be possible to add the second processor to the Atom, though it might be possible to add the Teletext receiver. This isn't certain at this stage. 13. The Atom will not be able to support the wide range of colour graphics facilities, but some of these facilities will be available. 14. The new BBC Basic and operating system will completely fill the memory space, so it will not be possible to usefully fill the additional ROM socket. 15. Routines to drive the Seikosha printer were published in 'TJ's Workshop' last November and are available from Acornsoft as a single printed sheet.

SW

Club System

Can you advise me on which systems to buy? We have a bowling club with 3000 members, each member bowling in a different league and we want to maintain averages and pick players for matches based on those averages. What size memory would I need and do I need tapes or disks? Would an Acorn Atom, Video Genie or something larger like a PET be suitable?

M Pyke, London SE18

The first thing you should do is read all the back issues of *PCW* that contain the series 'Secrets of Systems Analysis' (now also available as a book, *Desk Top Computing*, for £2.25 — see page 197). From that you will see that I haven't got enough information to specify a system. Some of the details

I would need are: your budget; speed of response to an enquiry; what data on members you need to keep; do you need printouts?; precise method for selecting match players; league procedures/structures; are members subscriptions to be managed, etc?

It appears that your master file will be around 240k in size, but your requirements for main store will only be about 16k on top of Basic (if indeed you are to use Basic). So a minimum system would probably be, say, 16k PET, 4000 series disks and a printer. Total hardware costs — about £1700. Software is of course, another matter and you should investigate this before looking at hardware.
SW

Open question

The 'Open Question' (October *PCW)* was: could you suggest a method for obtaining a convincing RND product on MBasic 5.03? MBasic has been altered so that a 'seed' input is now required. My kids know the result of various seeds and the fun is spoilt as a result.

Mr Reason was the sole judge, as it was he who posed the question. He replies as follows:

'There were several replies in 'PET' Basic showing a solution using the GET statement. Unfortunately my MBasic doesn't have this function, just an INKEY$ function which works only when a key is pressed. I also received some machine code routines but really wanted one that would work in MBasic.'

The winner is Frank Woodcock of Redditch Worcs, whose reply is reproduced below. I have the same problem with my Microtan 65, using Microsoft Basic. However I discovered that the keyboard has two entry points in memory. Location 1 stores the ASCII value of the last key typed, while location 49039 is floating between 0 and 255 until a key is pressed, and holds the ASCII value only when a key is held down. The following exploits this characteristic:

```
10 FOR A=0 TO PEEK(49039)
20 X=RND(1)
30 NEXT A
```

Another solution is to use part of the input statements to provide a seed, eg, LEN(A$) will return the number of characters in a string. This combined with string handling using MID$ in a FOR loop will set the RND between RND(32) and RND(96), each RND returning a number between 0 and 1. For example:

```
10 FOR A=0 TO LEN(A$)
20 X=RND(ASC(MID$
   (A$,A))):NEXT A
```

or

```
10 FOR A=0 TO LEN(A$):
   X=RND(1):NEXT A
```

or

```
10 FOR A=0 TO ASC(MID$
   (A$,(RND(1)*LEN
   (A$)+1))
20 X=RND(1):NEXT A
```

So long as the string A$ is not fixed then the above will give various levels of security.

Well done Mr Woodcock. By the way, my solution would be:

```
10 PRINT"Please press any
   key"
20 A=INP(3):A=INT
   ((A—4*INT(A/4))/2)
30 X=RND(1):IF A=0
   THEN 20
40 rest of the program.
```

SW

Port problem

We were very interested in the article in October's *PCW* entitled 'Control your own Substation' describing the uses of the 80/81 port and we'd like to use it in conjunction with an electronic counter totalling up to 99.

Is it possible to program the ZX81 and port, and use one counter to refer to the ZX81 internal clock and provide totals per half, one, five seconds, five hours etc? Would any counts be lost while the ZX81 was doing calculations?
J Hopkins, Director, Hydrovac (Development) Ltd, Bournemouth

Yes, it is a relatively easy matter to achieve what you ask. Some of the eight input channels of the 80/81 port (see October and November *PCW*) can be connected directly to the registers of a counter which the ZX81 may read periodically without losing counts or losing track of time.

I have given a circuit using a couple of 74LS93 counter ICs connected to the input port. The ICs are powered by the port itself, so the only external connection required is to the input of the counter. In the circuit I have shown, this is connected to a switch so that the number of times the switch is opened and closed will be registered on the pair of counters (counting up to 255 before returning to zero). If your counting input is TTL-compatible rather than a switch, then simply remove the switch and the 1k resistor. As the counts are made they are recorded in the counting registers of the two ICs, and these registers may be read by the ZX81 through the input port. Simply executing PRINT PEEK 11000 will cause the count to be printed to the screen.

If you require a total number of counts per second or per half-second to be printed continuously this is easily achieved by software. Suppose that you require a screen printout every second, and the input count rate is less than 255 counts per second; the following program will achieve this:

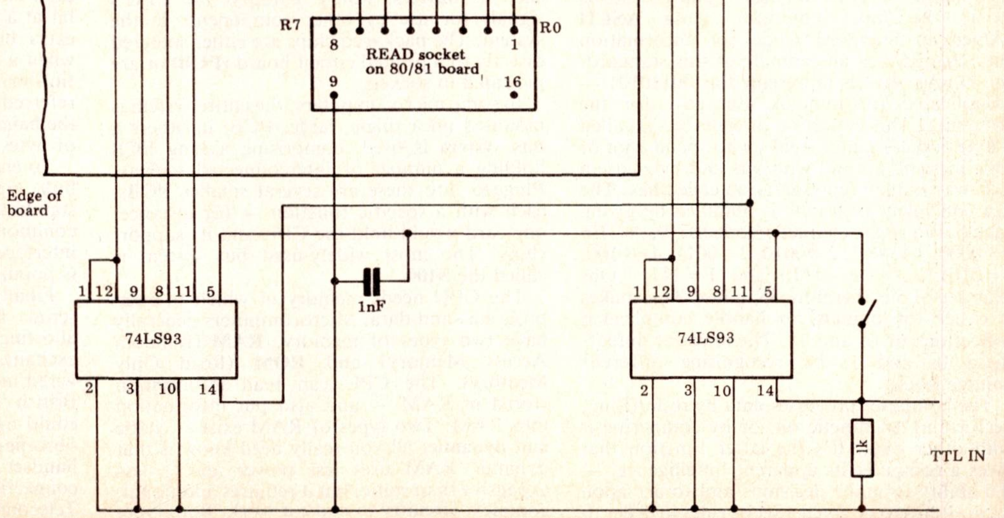
```
30 SLOW
40 LET Z=0
50 LET X=PEEK 11000
60 FOR I=1 TO 200
70 NEXT I
80 LET Y=PEEK 11000
90 LET W=Y—X
100 IF W<0 THEN W=W+256
110 LET Z=Z+W
120 LET X=Y
130 PRINT Z
140 GOTO 60
```

You will need to adjust the length of the loop in line 60 to give the exact timing required, but once you have done this, the arrangement will give accurate readings of input count, though a problem may be caused by the ZX81's irritating habit of executing PRINT PEEK X much faster when the result is zero than when it is another value. If you have a count rate much faster than 255 per second you will need to incorporate an updating routine for the count *within* the loop. This would check the value of the counter against the last value read in and, if it was less, then 256 would be added to the variable being used to keep track of the total count.

One further sophistication you may wish to add would be auto zeroing. If you disconnect both pins 2 of the counter ICs from ground, and connect them both to the W0 pin (pin 1) of the output port, you can use this to reset the counter. With this connection made, the counter will only function when W0 is low (this may be achieved by POKEing either zero or any even number to the output port at 11000). To reset the counter to zero, simply bring W0 high, and then low again. Thus the following simple program would set the counter to zero, then print the count after a given time delay, reset it to zero and repeat the exercise. Here, of course though, you could lose a count during the resetting procedure.

```
20 POKE 11000,1
30 POKE 11000,0
40 FOR I=1 TO 400
50 NEXT I
60 PRINT PEEK 11000
70 GOTO 20
```

In both this and the other counting routine you could obviously make good use of the PRINT AT command in ZX81 Basic to achieve a digital counter effect anywhere on the screen, rather than have a scrolled printout with the programs as they stand.
D E Graham



ZX81 counter circuit (see Port Problem)

NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex.** The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 . . . . E=1110 and F=1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex **(machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU)**, a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic;** all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU)**, which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.

INSTORE

The star of the show this month is the ACT Sirius 1-a 16 bit machine with 128k RAM and 1.2 Mb floppy disk storage running CP/M 86 for just £2300! Acorn have recently announced a Prestel adaptor for the Atom which will cost you around £120 for the full kit. Please send any updates or additions to Dick Olney, 'INSTORE', PCW, 14 Rathbone Place, London W1P 1DE.

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 24 (£3195)	AI 09237-77139	64k RAM: Z80A: dual 5¼'' F/D (640k): 12'', 24 x 80 VDU: 2 x S/P: 2 x P/P	CP/M: *Basic: Cobol: Fortran: Pascal.*	BT 4/81 (S)
ABC 80 (£738)	Datormark Ltd: 97 44896	16-40k RAM: Z80A: C: 12'', 16 x 40 b&w VDU: 4680 bus: IEE 488: RS232 port.	DOS Basic (16k ROM: *Fortran: Pascal: A: Multi user Basic.*	Colour video graphics with UHF output. Viewdata compatible. Loudspeaker. Numeric keypad. Options: dual 5¼'' F/D (320k) £895: dual 8'' F/D (2 Mb). BT 1/80. (1)
ACT Series 800 (£3495)	ACT: 021-501 2284 (50)	48k RAM: 6502: dual 5¼'' F/D (800k): 12'', 30 x 64 VDU: 1 S/P: 1 P/P: Multi-screen int. Option: 10-20 Mb H/D	MDOS: Basic: A: *CBasic:* PL/M: *Forth: Fifth: Cesil: Pilot: Fortran.*	IBM compatible K/B High resolution graphics. Available with dual 8'' F/D (2.4 Mb) £4950 — 4.8 Mb maximum. BT 2/80(E).
ACT Sirius 1 (£2349)	As above	128-512k RAM: 8088: dual 5¼'' F/D (1.2M): 12'', 25 x 80 VDU: 2 x RS232 ports: 2 x P/P	CP/M 86: U: *Basic: Cobol: Fortran: Pascal*	High res graphics. Options: 10 Mb H/D: dual 5¼'' F/D (2.4 M).(S)
Adler Alphatronic (£1600)	Adler 01-250 1717	48k RAM: 8085 A single 5¼'' F/D (160k): 12'', 24 x 80 VDU: S/P: P/P	CP/M: *Basic: CBasic: Fortran: Cobol*	With 80 cps printer and dual F/D £2345 (inc CP/M). (S)
Alpha Micro (£5650)	Alpha Micro (UK) Ltd: 01-250 1616 (TBA)	64k — 1 Mb RAM: 16 bit: dual 8'' F/D 2.4 Mb): 6 S/P.	Multi-user OS: Basic: M/A: Pascal: U. *Fortran: Cobol*	Modular. Expands to 1200 Mb, 24 terminals or multiprocessor system. (E)
Altos ACS 800-2 £2995)	logitek: 02572 66803 (33)	64k RAM; Z80A; dual 8'' F/D (1 Mb): 2 x RS232 ports: 2 P/P.	CP/M: *Basic: CBasic: Cobol.*	Single user. Options: DMA. Floating point processor. Phototyping board.
Altos ACS 8000-10 (£6675)	As above.	280k RAM: Z80A: single 8'' F/D (500k): 10 Mb H/D: 6 x RS232 ports: P/P: network RS422 port: DMA	CP/M: *MP/M: Basic: Cobal: Fortran: APL: Pascal.*	Multi-user/multi tasking. Up to 4 users. Options: 10 Mb: mag tape backup (S + H).
APL Signet (£1750 or £130pm)	Micro APL: 01-834 2687	64k RAM: Z80A: dual 5¼'' F/D (380k): 2 x RS232 ports.	CP/M: APL: *Basic: U: Fortran: Cobol: Algol: Forth*	Desktop APL computer with self teaching course. (S)
Apple II (£695)	Microsense: 0442 41191 (190)	16-48k, RAM: 6502: 8 I/O slots.	OS: Basic: *Pascal: Fortran: Cobol: Pilot*	280 x 192 high resolution graphics: Option: single 5¼'' F/D (116k) £349.
Atari 400 (£345-16k)	Ingersoll: 01-226 1200 (40)	16k RAM: 6502: C int: cartridge slot: 12 x 20 TV int: RS232C port: touchpad k/b: Opt: C £40	OS (10k ROM): Basic (8k ROM). *Pilot: Forth.*	High resolution colour graphics. 4-channel sound. Four games controller/light pen sockets. BT 10/80. (I/B).
Atari 800 (£645-16k)	As above.	16-48k RAM: 6502: C int: 4 x cartridge slots: 12 x 20 TV int: RS232C port. Opt: single 5¼'' F/D (90k) £345: 16k RAM £65.	As above.	As above. Software & RAM on cartridge modules. Up to 4 disk drives. BT 10/80. (I/B).
Athena 8285 (£5694)	Butel-Comco Ltd: 0703 39890 or 01-202 0262 (TBA)	64k RAM: 8085A: dual 5¼'' F/D (644k): 12'' 25 x 80 VDU: 150 cps printer: RS232 port.	AMOS: T/E: Basic: *Cobol: Fortran: Pascal: APL: M/A.*	Extended ASCII K/B with numeric pad: graphics. Options: dual 8'' F/D (2 Mb): up to 1200 Mb H/D.
Atom (£120)	Acorn: 0223 312772 (35)	2-12k RAM: 8-16k ROM 6502: Full K/B: C int: TV int: 20 I/O lines: 1 P/P. Options: 80 col printer £199, Prestel adaptor £120.	Basic in 8k ROM: A Cass O/S.	High resolution graphics on bigger model: colour monitor O/P. Loudspeaker. Note also, systems based on Acorn SBC. BT 7/80(B).
Attache 201 (£8000)	COLT 01-572 3784 (10)	64k RAM: Z80: dual 8'' F/D (2.4 Mb): 12'' 24 x 80 VDU: 180 cps printer.	Basic: *Fortran: Cobol.*	Upgradable to multiuser system with 18 Mb H/D. Full range of business packages included software dealers TBA. (S)
BASF 7120 (£3600)	BASF: 01-388 4200 (12)	64k RAM: Z80A: 3 x 5¼'' F/D (480k): 12'', 24 x 80 VDU: RS232 port: P/P	DOS: (OASIS) *Ex Basic: Cobol U. A: CP/M*	H/D available soon. Also 7125 with *930k* F/D £4280 and 7130 with single F/D (430k) & 5Mb H/D £4950. Disk controller has own Z80A. BT 9/80
Billings BC-12 FD: (£3995)	Mitech: 04862 23131 (TBA)	64k RAM: Z80A: dual 5¼'' F/D (640k): 12'', 24 x 80 b&w (or b&g) VDU.	DOS: Basic: *Fortran: Cobol: A*	With dual 8'' F/D (2 Mb) £5995. Additional dual 8'' F/D £300 option: 50Mb H/D. (S).
C/09(£3500)	SWTP Ltd: 01-491 7507 7507 (16)	64k RAM: 6809: dual 5¼'' F/D (700k) 9'', 24 x 80 VDU: 2 S/P: 1 P/P.	TSC FLEX: *Basic: Fortran Pascal: A: Dis A: T/E: U.*	Expandable to S/09 UniFLEX *32 user system. (H)*
Canon BX-3 (£4250)	Canon 01-680-7700.	32k RAM: 6809: dual 5¼'' F/D (640k): 28 char display: 80 cps printer: 3 x RS232 port: P/P.	OS: Basic: A. *Cobol: Pascal*	Fully integral unit. Extensive applications support offered on all Cannon Machines. Options: dual dual 5¼'' F/D (640k) £1500.

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Canon CX-1 (£6000)	As above.	128k RAM: 6809: dual 5¼" F/D (640k): 12", 24 x 80 VDU: 180 cps printer: 3 x V24 ports: P/P: light pen.	OS: Basic: A: *Cobol: Pascal*.	Price includes installation & training. Extensive application support offered. Options: dual 8" F/D (1Mb) £3300.(S)
Canon TX-25 (£1600)	As above.	16-32k RAM: 6809: C: 20 char display: 26 col, 2.4 lps printer. Option: 2 x RS232 port.	Basic: A	Fully integral unit. Cassette is Cannon's own design (8k). Can be used with communications. (S).
Challenger IP & C4P (£220 & £395)	CTS: 0706 79332 Millbank Computing: 01-549 7262. Mutek: 0225 743289. U-Microcomputers: 0925 54117 Watford Elec: Watford 40588 (18)	4.32k RAM: 6502: C int: RS232 port. Options: dual 5¼" F/D (160k) £550: for C4P dual 8" F/D (1.15 Mb) and 20MB H/D	O/S: Basic (8k ROM) *Ex Basic:* A.	D/A conv: colour capability. Runs OSI business software on 8" F/D Plato educational software avail soon. BT 4/80. (S).
Challenger 2 (£150)	As above	48k RAM: 6502: dual 8" F/D (0.5 Mb): RS232 port.	OS65U: Ex Basic: A.	Designed as low cost business system (S).
Challenger C3 (£2334)	As above	32-56k RAM: 6502: 6800: Z80: dual 8" F/D (1.15 Mb): 2-16 S/P.	OS65U: Basic: *CP/M: Fortran: Cobol*	Expandable to multi-user (8) system. Options: C3B & C3C H/D units, 74 Mb for about £8500. (S&H).
Clenlo Conqueror (£2475)	Clenlo Computing Systems Ltd: 01-670 4202 (TBA)	64k RAM: Z80: dual 8" F/D (1 Mb): 3 S/P: 2 P/P.	CP/M: CBasic-2: Pearl 1: *U Fortran: Cobol: Pascal*	With 2.4Mb F/D £2950. Also H/D systems with 10 Mb H/D & tape drive £5430.
Comart Communicator (£1995)	Comart 0480 215005 (25)	64k RAM: Z80A: dual 5¼" F/D (780k): 2 S/P: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal*	With 1.5 Mb F/D £2295. With 4.8 Mb H/D & 790k F/D £3795. Option: 18 Mb H/D. £3395 (S).
Compucolor II (£1175)	Dyad Developments: 08446 729 (TBA)	16-32k RAM: 8080: 13" 32x64 8-colour VDU: single 5¼" F/D (5lk): RS232 port.	DOS (ROM): Ex-Basic (ROM): A. *M/A: T/E: Fortran: U*	32k version £1295. High resolution graphics. 6-month subscription to user magazine inclusive BT 9/79. (S).
Compucorp 625 (£6000)	Compucorp: 01-952 7860 (17)	48-60k RAM: Z80: dual 5¼" F/D (630k): 9". 16x80 VDU: 40 col printer: RS232 port, P/P.	Basic: A: *Fortran: Pascal:* U	IEEE-488 Controller and S100 int. Many applications packages avail. (E).
Compucorp 655/ 665/675/685 (from £5050)	As above	60k RAM:. Z80: Up to 4x5¼" F/D(160k-2.4 Mb): 9", 20x80 or 12" 20x80 or 20" 60x80 VDU: 40-col printer: RS232 port.	As above	Prices incl installation and training. Opt: 10-20 Mb H/D
Computermart 2000 DS (£1500)	Computermart: 0603 615089	32-256k RAM: 8085: dual 8" F/D (1-2 Mb): S/P: P/P.	CP/M: *Cis Cobol: Basic: Fortran*	Expandable to multi-user, multi-tasking,, multi-processor 96 Mb H/D system (around £15000).
Cromemco System Zero/DDF, System 2, System 3, System Z2H. (£2627/£2873/ £4893/£6118).	Datron: 0742 585490. Comart: 0480 215005 MicroCentre: 031-556 7354 (18)	64k RAM: Z80: dual 5¼" F/D (346k) on System Zero, System 2 & Z2H: dual 8" F/D (1.2 Mb) on Sys 3: 10 Mb H/D on Z2H: S/P: P/P.	CDOS: *Basic: Cobol: Fortran: RPG II: Lisp: A: W/P: Multi-user Basic. Cromix.*	System 2 & 3 expandable to Multi-user (max 7) £8373 System 2: £10252 Sytem 3. Options: dual 8" F/D (996k): 11.2Mb H/D. BT 10/79 (E).
DAI (£998-48k)	Data Applications (UK): 0285 2588 (7)	48k RAM: 8080: C int: 24x60 VDU int: RS232 port: over 20 industrial ints.	Basic (ROM): U	Colour graphics up to 255 x 335: 3 notes & noise generator: PAL O/P to TV: Paddle int: H maths option. (1). BT 10/80.
Diablo 3000 (£6950) (TBA)	Business Computers Ltd: 01-207 3344	32k RAM: 8085: dual 8" F/D (1.3 Mb): 12", 24x80 b&w VDU: 45 cps printer.	DOS: Basic: DACL: A: U.	Selection of business packages included (S).
Digital Microsystems DSC-3 (£3530)	Modata: 0892 41555 (14)	64k RAM: Z80A: dual 8" F/D (1.14Mb): 4xRS232 ports: EIA port.	CP/M: CBasic: *Cobol: Fortran: Pascal: PL/I*	Expandable to multi-user system with 10-28 Mb H/D. Extensive software avail. (S).
Digital Microsystems DSC-4 (£4395)	As above	128k RAM: Z80A: single 8" F/D (500k): 11 Mb H/D: 4x RS232 ports: 2 P/P.	CP/M: Basic-E: CBasic: *Cobol: Fortran: Pascal.*	Also DSC-3 with 64k RAM. Options: 128k RAM £1295: up to 4 Mb F/D and 20 Mb. H/D. (H).
Durango F-85 (£4995)	Comp Ancillaries: 0784 36455 (12)	64k RAM: 8085: dual 5¼" F/D (1 Mb): 9", 16x64 green VDU: 132 col 165 cps printer: N/P.	O/S: D Basic: *CP/M: CBasic: Micro Cobol.*	Up to 5 work stations: fully integrated system. Options: additional dual 5¼" F/D (1 Mb): 12-24 Mb H/D.(S).
Dynabyte 5200 5900 (£2600)	Metrotech 0895 57780(15)	64k RAM:. Z80: S100 bus: 2 ser ports: 1 par port: any com of 5¼" F/D (630k), dual 8" F/D (1Mb), 9/27/45 Mb H/D, 32/64/96 Mb Cart Module Disk.	CP/M: MP/M: CP/Net, CBasic, MBasic Cobol, Fortran, Pascal, PL/1-80	All systems expandable to multi-user and net working: CP/M inc in base price for F/D system, MP/M for H/D systems.
Equinox 200 (£7500)	Equinox: 01-739 2387 (N/A)	64-512k RAM: Z80: 10 Mb-1200 Mb H/D: 6xS/P: 1 P/P.	CP/M: CBasic: *Cobol: Fortran.*	Multi-user MVT/FAMOS available in place of CP/M. 16-bit version (Equinox 300) £10,000. (S&H).
Exidy Sorcerer (£695)	Liveport Data Products: 0736 798157 (27)	48k RAM: Z80: RS232 port: 1 P/P: S100 connector: 30x64 VDU int. N/P.	O/S: Basic (ROM): *T/E: A: CP/M: Algol: Fortran: Basic: 80. Pascal: W/P.*	High-resolution graphics capability: user programmable character set, Option: single 5¼" F/D (316k) £600
Gemini 801 (£1075)	Gemini: 02403 22307 (7).	64k RAM: Z80A: Single 5¼" F/D (315k): 25x80 VDU int: RS232 port. P/P.	*CP/M Basic: Cobol: Fortran: Pascal: A: T/E.*	Up to two integral & two external F/D. Graphics. With no F/D and C int. £750. (S).

List of Abbreviations

A	Assembler
BT	Bench Tested
C	Cassette
E	Extensive
F/D	Floppy disk
G/C	Graphics card
H	Hardware
H/D	Hard disk
I	Introductory
Int	Interface
M/A	Macro assembler
N/A	Not available
N/P	Numeric pad
O/S	Operating system
P/P	Parallel port
S	Software
S/P	Serial port
T/E	Text editor
TBA	To be announced
U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Gimix System 68 (£2000)	SEED: 05433 78151: Windrush 0692 505189	16-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2xRS232 ports.	OS-9: Flex *Basic: Pascal: A: Dis A: T/E:U*	With dual 8" F/D (2 Mb) £2900. Designed as development system for industrial control. (H).
Haywood 3000 (£1925)	Haywood: 01-428 0111. (TBA)	32-64k RAM: Z80A: dual 5¼" F/D (800k): RS232 port: P/P. Opt: 15" 28x80 VDU £799.	CP/M: *Basic: Cobol: Fortran: Pascal: W/P.*	Also system 7000 with 48-65k RAM and 8" F/D (2.5 Mb) £2999. (S).
HP 85 (£1830)	Hewlett Packard Ltd: 0734 784774 (16)	16-32k RAM: C.P.U.: 5", 16x32 VDU: C(200k): 64 cps printer: 4 P/P. Options: dual 5¼" F/D (540k) £1408: fusl 8" F/D (2.4 Mb) £3744.	Basic (ROM)	Full dot matrix graphics. Complete range of interfaces, peripherals and application packages avail. 16k RAM £222. (S).
IMS 5000 (£1500)	Equinox: 01-739 2387 (20)	16-56k RAM: Z80: dual 5¼" F/D (320k): 2xS/P: 1 P/P:	CP/M: C/Basic: *Cobol, Fortran.*	3 drives option: (S&H).
IMS 8000 (£2500)	As above	64-256k RAM: Z80: dual 8" F/D (1 Mb): 2xS/P: 1 P/P	CP/M: CBasic: *Cobol: Fortran: MicroCobol.*	Multi-user MVT/FAMOS available in place of CP/M. (S&H).
Intecolor 8000 (£2999)	Dyad Developments: 08446 729 (TBA)	8-32k RAM: 8080: 19", 80x48 colour VDU: single 5¼" F/D (90k): Option: up to 26 Mb H/D.	DOS(ROM): Ex-Basic: *A:M/A:T/E: Fortran: U*	High res graphics avail: Many options including size of F/D and VDU. (S).
ITT 2020 (£867)	ITT: 0268 3040 (15)	16-48k RAM: 6502	Monitor: A: ExBasic: Dis A.	360x192 high res graphics. Ex-Basic in 6k ROM: Options: single 5¼" F/D (116k): £425: 16k RAM, £110: RS232 port, £96: 32k system, £931: 48k system £995: (B).
Ithaca DPS1 (£3995)	Ithaca: 01-341 2447 (10).	64k RAM: Z80: dual 8" F/D (1 Mb): 2xRS232 ports: 4xP/P. Opt: H/D.	CP/M: *Basic: Cobol: Fortran: Pascal: A: U.*	Z8000 16-bit processor board avail. IEEE/S100 (8 or 16 bit) compatible. (E).
LX-500 (£3500)	Logabax Ltd: 01-965 0061 (13)	32k RAM: Z80: dual 5¼" F/D (180k): 12" 25x80 b&w VDU: 100 cps printer.	DOS: Basic: A.	Other printers available. (S).
LSI M-One (£4200)	LSI Computers: 04862 23411 (20)	8-16k RAM: 8080: dual 8" F/D (1.2 Mb): 12", 24x80 b&w VDU	FMOS: A	Choice of standard business packages included in price. (S).
LSI M-Two (£7900)	As above	64-128k RAM: 8085A: dual 8" F/D (1.2 Mb): 12", 24x80 VDU: 60 cps printer	Elsie: *CP/M: Basic: Cobol Fortran: Pascal: A: U*	Max 8 VDUs and 4 printers. Many applications packages available. Option: 10 Mb H/D £2600. (S).
Macro 1 (£3950 or £294 pm).	Micro APL Ltd. 01-834 2687 (TBA)	64k RAM: Z80A: dual 8" F/D (1 Mb): 4xRS232 ports.	CP/M: APL: U: *Basic: Fortain: Cobol: Word-2star Algo: Pascal: Forth.*	Designed as timesharing replacement. Macro 2 with 2 Mb F/D £4750 or £334 pm.
Megamicro (£6080)	Bytronix: 0252 726814(5)	56k RAM: Z80: dual 8" F/D (500k): 12", 20x80 green VDU: 180 cps printer: 2 S/P: 2 P/P.	CP/M: U: *Basic: A: M/A.*	Range of bus. packages now avail. from Ludhouse of Streatham. (H&B).
Micro Trainer 1 (£650)	Hewart: 0625 22030 (N/A)	16-32k RAM: 6800/6809: 10" 16x24 VDU: 2xC int: Opt: dual 5¼" F/D (160k) £595: 8k RAM £17.	Basic: A: *Pascal: PL/M: W/P*	SS50-based system. Graphics avail. Int card with real time clock £17. (1).
Microstar 45 Plus (£4800)	Data Efficiency Ltd: 0442 63561 (30)	64k RAM: 8085: dual 8" F/D (1.2 Mb): 3 S/P, RS232 port.	Stardos: CP/M: Basic: *Cobol: Fortran*	(E)
Microtan 65 (£69)	Tangerine: 0353 3633(6)	2k RAM: 6502: T Mint: Exp up to 277k RAM.	2k TANBUG monitor: 2k A, disassembler, cassette firm ware: *10k Microsoft Ex. Basic.*	Options: bulk I/O modules, hi-def graphics, CP/M, system racking, ASCII keyboard. Prestel adaptor (S&H).
Millbank Sys 10 (£2995)	Millbank: 01-788 1083(6).	65k RAM: Z80: dual 5¼" F/D (700k): 12", 24x80 VDU: 2x RS232 ports: RS4449 port: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal: PLI: W/P.*	One high level lang. included. 12-month warranty. Mainframe comm. package. H/D avail. soon. (S&H)
MS5001 (£7450)	BMG Ltd: 0793 37813 (N/A)	64k RAM: 8085: dual 8" F/D (1 Mb): 12", 80x24 VDU: 80 cps printer: RS232.	CP/M: *Basic: Cobol: Fortran: MP/M.*	Price includes desk mounting and one computer. Hardware & software support. Leasing arrangements available. (E).
MSI 6816 (£1200)	Strumech: 05433 4321 (5)	16-56k RAM: 6800: dual 9" 16x64 b&w VDU: C int: 1 S/P: 1 P/P.	Basic: A.	Graphics & PROM programmer available. (S&H).
MSI System 12 (£8000)	As above	56-184k RAM: 6800: 10 Mb H/D: single 8" F/D (500k) 24x80 VDU: 1 S/P: 1 P/P.	SDOS: Basic: CBasic: U.	As above. Business packages avail. Up to four terminals. (H&S).
NEC PC 8001 (£450)	NEC (UK)	32k RAM: Z80A: RS232 port: P/P Option: dual 5¼" F/D (574k) £675	*CP/M: Basic N: Fortran Cobol: Pascal*	Colour monitor £250 (low res) or £480 (high res) both 12", 25x80(E) BT 6/81
Newbrain MB (£199)	Grundy: 0223 350355 (TBA)	32k-2 Mb RAM: Z80A: Nat 420: 2xC int: TV int: 2xV24 ports.	CBasic (16k ROM): A.	Graphics. Battery or mains. Options: ½ Mb RAM £450 16 char display £30.(E).
North Star Horizon (£2230)	Comart: (7) 0480 215005. Comma: 0277 811131. Equinox: 01-739 2387(20)	48-56k RAM: Z80A: dual 5¼" F/D (360k): 15", 24x80 VDU: 150 cps printer: 2 S/P: 1 P/P.	DOS: Basic: CP/M: *Cobol: Fortran: Pascal.*	Options: 18 Mb H/D.

List of Abbreviations

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T/E	Text editor
TBA	To be announced
U	Utility

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Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Oki if 800 (£400)	Encotel.	64k RAM: Z80A: 2k ROM: dual 5¼" F/D (560k): 12", 24x80 VDU: 80 col printer: loudspeaker: RS232 port: 20k ROM cartridge.	Basic: A: *CP/M Cobol: Fortran:*	Fully integral unit. Graphics. Options: dual 5¼" F/D (560k): RS232 port: PP. (1). BT 10/81
Onyx C8000 (£6875)	Onyx Dist Ltd: 0734 664343 Colt 01-577 2150. (TBA)	64k RAM: Z80: 12 Mb Cartridge: 10 Mb H/D: 4 S/P: P/P	CP/M: *MP/M Oasis: Unix: Fortran: Pascal: W/P*	C8001 with 128k RAM £8220. Multi-user version avail. using Oasis.(E) BT 3/81.
Oscar (£2560)	IDS Ltd: 0908 313997(30)	64k RAM: Z80: dual 5 ¼ F/D (800k): 12", 25x80 VDU: RS232 port: 1 P/P	CP/M: *Basic: Pascal Fortran: Cobol: W/P:A*	Also avail. with dual 5" F/D(1.6Mb) £2905 and 8" F/D(2 Mb) £3380. Advanced video board. S&H).
Panasonic JD 800U, JD840U (£4275, £4950)	Panasonic Business Equipment: 0753 75841 (10 regional dist)	56k RAM: 8085A: 12-4k PROM: dual 8" F/D JD800U (500k): JD840U (2 Mb): 12", 24x80 green VDU: 3xRS323 ports.	CP/M: Basic: *Micro-Cobol.*	Also available with 5¼" F/D: JD740U (570k) £4095. H/D avail soon. BT 3/80 (S).
Pascal Microengine (£2295)	Pronto Electronic Systems Ltd: 01-554 6222	64k RAM: MCP 1600: 2x RS232 ports: 2 P/P.	Pascal.	CPU instruction set is P-code: no interpreter needed. Available with dual 8" F/D (2 Mb) £3900.
Pasca 640 (£3700)	Westrex Ltd: 01-578 0957 (TBA)	64k RAM: Z80A: dual 8" F/D (512k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: A: W/P: U*	Maintenance contracts avail. 10 Mb H/D avail. soon. (S) BT 5/18
Periflex 630z564 (from £2250)	Sintrom: 0734 85464(5)	64k RAM: Z80: dual 5¼" F/D(1.2 Mb): 2xRS232 ports. 1 P/P.	CP/M: *Basic: Fortran: Cobol:A*	One-day installation training on site included in price. Option: dual 5¼" F/D(630k) £464, dual 8¼" F/D(1 Mb) £1025. 35 Mb H/D. BT 6/80 (S&H).
Periflex 1024/64 (from £2750)	As above	64k RAM: Z80: dual 8" F/D (1.2 Mb): 2xRS232 ports: 1 P/P.	As above	As above
PET 16k, & 32k (£550, £695)	Commodore: 0753 79292 (150)	16-32k RAM: 6502: C: 9" 25x40 VDU: IEEE-488 port: Options: dual 5¼" F/D (353k) £695: same but (950k) £895	O/S: Basic (in 8k ROM): *Forth: Pilot: Pascal: Comal: Lisp: A*	8032 with 80-col screen (32k) BT 12/80. £895 Field service avail. (1).
Philips P2000 (£2444)	Philips Data	16-48k RAM: Z80: dual 5¼" F/D (140k): 12", 24x80 VDU: RS232 port.	PDOS: UCSD p-system: *Pascal: Basic Fortran:A.*	With 48k RAM, Pascal and Basic £3300: BT 12/81.(S).
Powerhouse 2 (£1125)	Powerhouse Micros: 0422 48422 (TBA)	32-64k RAM: Z80A: 5" 29x96 VDU: RS232 port: external bus.	4k Monitor: *FDOS: Basic: ExBasic (14k EPROM)*	VDU has flexible screen logic. Options: FDOS & Basic £210: graphics card £200. (H).
Powerhouse 3 (£2600)	As above	32-64k RAM: Z80A: dual 5¼" F/D (350k): 5", 29x96 VDU: RS232 port: external bus.	As above	VDU as above. With 1.2 Mb F/D £3500. ExBasic & FDOS in 14k EPOMs £300. (H).
Prince (£3045)	Digico: 04626 78172 (TBA)	48-64k RAM: 2xZ80: dual 5¼" F/D (800k): 2xRS232 port: 12", 24x80 VDU	CP/M: *Basic: Pascal: Fortran: Cobol: W/P:A:* T/E:U	High res graphics. Options: single 5¼" F/D (400k) £600: dual 8" F/D(2 Mb) £2000. Rentals avail. (S).
Raannd SPI (£4500)	Raannd: 0506 33372 (TBA)	64k RAM: MCP 1600: dual 8" F/D (2 Mb): 12", 24x80 VDU: RS232 port: P/P	Pascal *ADA: Basic*	Based on Microengine (with integrated P-code). Up to 4 F/D drives. 64k RAM expansion avail. BT 12/80. (S).
Rair Black Box 3/30 (£3750)	Rair: 01-836 6921 (N/A)	64-512k RAM: 8085: dual 5¼" F/D (260k): 10 Mb H/D: 2xRS232 ports.	CP/M: Basic: Cobol: Fortran: M/A	64k RAM expansion £500. 256k RAM £1250. Up to 16 RS232 ports.
Research Machines 380Z (£895)	Research Machines: 0865 49791 (N/A)	16-56k RAM: Z80A: 2xC: RS232 port. P/P.	ExBasic: A: T/E: U: *CP/M: Fortran: Cobol: Algol: Cesil: Pascal.*	High res colour graphics. Many possible systems. With 48k RAM & dual 8" 'FD (1 Mb) £3394.
S/09 (£7000)	SWTP Ltd: 01-491 7507(16)	128k RAM: 6809: dual 8" F/D (2 Mb): 12", 24x80 VDU: 2xS/P: 1 P/P.	UniFLEX: *Basic: Pascal: Fortran: A: Dis A: TIE:U.*	Expands to 32 users, 768k RAM, 90 Mb H/D, UNIX 'look alike'. (S&H).
Saracen (£1925)	Bytronix 0252 726814 (TBA)	32-64k RAM: Z80: dual 5¼" F/D (800k): 2xRS232 ports.	CP/M: *Basic: Cobol: Fortran: Pascal: A:*	Applications packages & maint. contracts avail. With dual 8" F/D (2 Mb) and 64k RAM, £2676. (E).
SBS 8000 (£1449)	Manhattan Skyline Ltd: 0801 3442: C Itoh 01-353 6090 (TBAz7	64k, RAM: Z80A: 12", 16 x 64 VDU: 1 P/P: RS232 port (extra £133)	ExBasic (24k ROM): *DOS*	Options disk control card £237: dual 5¼" F/D (368k) £795: dual 8" F/D (2 Mb) £1400. BT 11/80. (S)
SEED System 1 (£2000)	Strumech: 05433 4321 (5)	32-56k RAM: 6800: various disk options: 12", 24 x 80 VDU: RS232 port: P/P	DOS: Basic U: *Fortran: A: Pilot: Strubal: T/E*	Graphics. PROM programmer Also system 19 multi-user (£3000). (E)
Sharp MZ-80K (£460-34k)	Sharp Electronics (UK) Ltd: 061-205 2333 (22)	6-48k RAM: Z80: C: 10" 24 x 40 VDU: Option: dual 5¼" F/D (289k) £695	Basic, A. *CP/M: Pascal: Fortran: Forth*	Graphics: loudspeaker. BT 10/79 (B)
Sharp MZ-80B (£1095)	As above	64k RAM: Z80A: C: 9", 25 x 80 VDU: RS232 port: P/P.	Basic: *A: Pascal: FDOS*	High res graphics. Options: dual 5¼" F/D (560k) £800: 80 cps printer £415. (S)
Sharp PC3201 (£2995)	As above *CP/M: Cobol*	64k RAM: Z80A: dual 5¼" F/D (500k): C int: 12", 25 x 80 VDU: 70 1pm printer.	DOS: U: Basic: *CP/M: Cobol.*	Various expansion cards avail. BT 7/81 (I&B)

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Sinclair ZX81 (£50-kit, £70-built-prices inc VAT).	Sinclair: 0276 66140	1-16k RAM: Z80A: C int: TV inb: full K/B: 44-pin expansion port.	Basic (8k ROM).	Advanced 4-chip design. Printer now avail. BT 6/81
Signet 202 (£2145)	Interram 01-675-5325(N/A)	64k RAM: Z80A: dual 5¼" F/D (400k): 12", 24 x 80 VDU: 2 x RS232 ports: 80 col printer.	CP/M: *Basic: Fortran*	Options: dual 5¼" F/D (800k): dual dual 8" F/D (2M). (S)
Smoke Signal Chieftan (£1800)	Windrush 0692 405189: Seed 05433 78151 (TBA)	32-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2 x RS232 port.	DOS: *68/FLEX: Basic: Fortran: Cobol: A: Disc A: Pascal: U.*	With daul 8" F/D (2 Mb) £2600. Designed as development system for industrial control. (H).
Solitiare WP & BS200 (£6750 & £8200)	Solitaire KPG; 01-995 3573 (TBA)	64k RAM: 8085: 14" VDU (with own CPU): 45 cps printer: CPU port: dual 5¼" F/D (700k) 8" F/D (1.02 Mb) with BS200.	DOS: Basic	All solitaire systems are compatible: anmd can be upgraded to multi-user H/D system. (S)
Sord M100 ACE (£2339)	Midas Computer Services Ltd: 0903 814523 Exleigh Bus. Mach. 0735-66577.(10)	48k RAM: Z80: 8k ROM dual 5¼" F/D (245k): 24 x 64 green VDU: RS232 port: N/P	O/S: Basic: *A: Fortran: Pascal.*	Up to 3 drives possible. Colour graphics avail. Option S100 bus. (I)
Sord M223 Mk II-VI (£4078)	As above	64k RAM: Z80: 8k ROM: dual 5" F/D (700k): 12", 24 x 80 green VDU: RS232 ports: S100 bus: N/P	*O/S:* Ex Basic: *CBasic: Multi-User Basic: Fortran: Cobol*	Expandable to 4 Mb F/D. 32 Mb, H/D, 5 screens, 2 printers. M243 with 192k RAM & 1.4 Mb F/D £5087.
SPC/1 (£3770) (TBA)	Digital Data: 01-573 8854	64-1024k RAM: 8085 A-2: dual 5¼" F/D (90k): 12", 24 x 80 VDU: 2 x RS232 ports: Option: single 8" F/D (1 Mb) £1090:	Mikados, Comal: Pascal: A.	With 32k RAM and single F/D (Comal only) £1995. Expandable to multi-user system (8 users). BT 7/80 (S).
Superbrain (£1950)	Icarus: 01-485 5574 (45)	64k RAM: 2 x Z80: dual 5¼" F/D (320k): 12" 25 x 80 VDU: 2 x RS232 port.	CP/M: A: *Basic: Cobol: Fortran: APL: Pascal*	Limited graphis, Mainframe int avail. Full range of appliation packages avail. Also avail with 700k & 1.5 Mb F/D. BT 8/80. (S&H)
System 10 (£2995)	Millbank 01-788 1083 (TBA)	64k RAM: Z80: dual 5¼" F/D (700k): 12", 24 x 80 VDU: 2 x RS232 port: P/P	CP/M: *Basic: Fortran: Pascal: Cobol: PL/1: W/P*	12 month warranty. Maint. contracts. Applications packages avail. Choice of high level language in price. (E)
System 20 (£3500)	Extel: 01-739 2041 (TBA)	64-512k RAM: Z80A: dual 8" F/D (1 Mb): 12", 24 x 80 VDU: 3 x V2	CP/M:E Basic: *M Basic: Pascal: Cobol: Fortran*	Maintenance contracts avail (132 field service engineers). Expands to multi-user system. Options 13.7 Mb H/D £5799: 27.4 Mb H/D £6674. (S)
System 80 (£1355-48k)	Nascom: 02405 75155 (32)	16-48k RAM: Z80A: dual 5¼" F/D (560k): TV int: RS232 port.	CP/M: Basic (8k ROM)	EPROM firmware avail. Colour graphics card £165. Many configurations possible. (S&H)
Tandberg EC10 (£4000)	Tandberg: 0532 774844 (N/A)	64k RAM: 8080 A: single 8" F/D (250k): 12" 25 x 80 VDU: 7 x RS232 ports: printer int.	CP/M: Ex Basic (24k) *Multi-user Basic: Pascal: Cobol:* A: U:	Up to 7 terminals. Includes V28 comms port. (S&H)
Tandberg TG 8450 (£2200)	As above	64k RAM: 8085: single 5¼" F/D (77k): C int: 12", 24 x 80 VDU: RS232 port: P/P	TDOS: *Basic: Cobol: Fortran: Pascal.*	TDOS is CP/M compatible. Opt: single 5¼" F/D (77k) £250 (up to four): dual 8" F/D (2 Mb) £1800. (S&H)
Tandy TRS-80 Model 1 (£289)	Tandy: 0922 648181 (200)	4-48k RAM: Z80: C: 12", 16 x 64 VDU: RS232: P/P	Basic (4k ROM): A.	Fully expandable. Option: single 5¼" F/D (175k) £339 (up to 4). Many extras available. (I)
Tandy TRS-80 Model II (£2499)	As above	64k RAM: Z80: single 8" F/D (500k) 12" 24 x 80 VDU: 2 x RS232 port: P/P	Basic *M/A Fortran: Cobol*	Option: single 8" F/D (500k) £899 (subsequent £450, up to 4). 32k RAM £344.
Tandy TRS 80 Model 3 (£500-£1700)	As above	See Model I Levels I and II		Fully integral unit. Up to 2 integral and 2 external 5¼" F/D. BT 8/81
Tandy TRS-80 Colour (£349)	As above	4-16k RAM: 6809: 8-16k ROM: C: 16 x 32 TV int: RS232 port.	Colour Basic.	With 16k RAM, 16k ROM & Extended Colour Basic £449 (I). BT 9/81.
TECS (£1200)	Technalogics Computing Ltd: 061-793 5293 B&B Computers Ltd: 0204 26644 (TBA)	4-56k RAM: 8k PROM: 6800/6809: 2xC: TV int: 2xRS232 ports: internal viewdata modem & printer port.	FLEX: Basci: *Pascal: TDOS: A: T/E: Pilot: Fortran: Cobol.*	Fully viewdata compatible. Options — dual 5¼" F/D (320k) £850: dual 8" F/D £120 £1200. (S&H).
Terodec CPC-100 0 (£4095)	Terodec: 0734 664343 (8)	80k RAM: Z80A: single 5¼" F/D (819k): 2 S/P: 3 P/P	CP/M CBasic: *Fortran: Pascal: Cobol*	System with Okidata 80 printer: TV1 910 VDU: W/P and various application packages £5995 (S&H)
Terodec DPS 64/2M (£3598)	As above	64k RAM: Z80A: dual 8" F/D (2 Mb): 2 S/P: 3 P/P. Options: 10 Mb H/D: Tape.	CP/M: *MP/M: CP/Net: CBasic: Fortran: Pascal: Cobol: Basic.*	2 user system with 10 Mb H/D £7400 4 user system with 34 Mb H/D & tape back up £11981. (S&H)
TI 99/4 (£299)	TI: 0234 67466 (TBA)	16k RAM: 26k ROM: 9900: 2 x C int: 24 x 32, 16 colour TV int: 3 tones & noise: P/P.	OS: Basic.	12 month guarantee. Options 32k RAM: 2 x RS232: 3 x 5¼" F/D (92k each): Speech Synthesiser.
Tuscan CP/M Starter (£999)	Transam: 01-405 5240 (N/A)	24k RAM: Z80: single 5¼" F/D (190k): Cint: TV int: RS232 port: P/P: N/P.	CP/M: *Basic: Fortran: Pascal: Cobol:*	Options: single 5¼" F/D (190k) £155: single 5¼" F/D (370k) £285: 8k RAM £50. (S&H)
Tuscan Starter Kit (£299)	As above	8k RAM: Z80: Cint: 56-key K/B Options: Case £110: 5 x S100 sockets £20: TV int £3.50	8k Basic	Fully assembled version £499 BT 1/81 (H&S)
UDS 3000 (£2300)	Kemitron: 0244 21817. (TBA)	64k RAM: Z80A: dual 8" F/D 2 Mb: 2 x RS232 ports. Option: 10 Mb H/D	CP/M: *Basic: Cobol: Fortran: Pascal.*	Full range of industrial support cards, and applications software. (E)

List of Abbreviations

A	Assembler
BT	Bench Tested
C	Cassette
E	Extensive
F/D	Floppy disk
G/C	Graphics card
H	Hardware
H/D	Hard disk
I	Introductory
Int	Interface
M/A	Macro assembler
N/A	Not available
N/P	Numeric pad
O/S	Operating system
P/P	Parallel port
S	Software
S/P	Serial port
T/E	Text editor
TBA	To be announced
U	Utility

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Vector MZ (£2650)	Almarc: 0602 52657 (3)	56k RAM: Z80A: dual 5¼" F/D (630k): 3 S/P: 2 P/P.	CP/M: Basic: *Algol: Cobol: Pascal: Fortran: Coral: CBasic: A*.	High resolution graphics. Also system B with video board & terminal £3450. (E)
Vector System 2800 (£4600)	As above	56k RAM: Z80A: dual 8" F/D (2.4 Mb): 3 S/P: 2 P/P	As above	High-res graphics. Many Options. Fully expandable to 5005 multi-user system (max 5) £5400.
Vic 20 (£200)	Commodore: 0753 70292 (150)	5-32k RAM: 6502: Cint: 22 x 23 TV int: S/P: P/P: Games int.	Basic	Graphics 3 tone sound generator. Will interface to PET. Option: single 5¼" F/D (170k). BT 9/81(S).
VIP (£2650)	Almarc 0602 52657 (3)	64k RAM: 3k ROM: Z80B: single 5¼" F/D (630k): 12", 24 x 80 VDU: RS232 port, 3 x P/P	CP/M: *Basic: fortran: Cobol: Pascal: A*.	Up to 3 additional F/D drives. Options: dual 8" F/D (2 Mb) £1063, 32 Mb H/D (TBA). (H&S). BT2/81
Video Genie EG3003 (£300)	Lowe Electronics: 0629 4995 (N/A)	16k RAM: Z80: 500bps C: 16 x 64 TV int: extra C int: 1 P/P	Basic (12k ROM): *Pascal: A M/A: Fortran*	Graphics available with ex-Basic (13.5k) £3.50.
WH8 (£352)	Heath 0452 29451 (N/A).	16-64k RAM: 808A (or Z80): 4 S/P. Option: single 5¼" F/D (102k) £241.	OS: HDOS: CP/M: *Fortran: Pascal: Basic*	Kit. 3 drives max. Colour graphics avail. (S&H) BT 2/80.
Zentec (£4838)	Zygal Dynamics: 02405 75681 (TBA)	32-64k RAM: 2 x 8080: dual 5¼" F/D (256k): 15", 25 x 80 VDU: RS232 port.	OS/: A: U: *Basic:* Cis Cobol	User programmable character set. Option: dual 8" F/D (1 Mb). (S)
Zenith WH-11A (£2673)	Heath Ltd: 0452 29451 & 01-636 7349 (N/A)	LSI 11: 16-32k RAM: 25 x 80 VDU: S/P: P/P.	*O/S: Basic, Fortran:* A: U.	PDP 11-compat. Option: 2 x 8" F/D (1 Mb). £1717 (S&H).
Zenith Z89 £1570-£1710	As above	16-48k RAM: Z80: single 5¼" F/D (102k): 12" 24 x 80 b&g vdu: RS232.	*Basic: A: HDOS:* CP/M: *MBasic: CBasic: Fortran*.	3 x 5¼" F/D possible. Options: dual 8" F/D (1 Mb) £1717, 20 Mb H/D.
Zilog MCZ 1/05 (portable): MCZ 1/20A (£3250)	Memec: 084421 5471 (N/A)	64k RAM: Z80: dual 8" F/D (600k): RS232 port: MCZ1/20A only 1 P/P: Option: 10 Mb H/D £7100	RIO: O/S: *Cobol: Basic: Fortran: Pascal: M/A: U*.	Available desk top or rack mounted. Debug in 3k PROM. 1/20A runs multi-user Cobol, up to 5 terminals with 40 Mb H/D. (S&H).
Z-Plus (from £400)	Rostronics Ltd: 01-870 4805 (16)	64k RAM: Z80A: dual 8" F/D (0.5/1Mb): 12" 24 x 80 VDU: 4 S/P: 1 P/P	CP/M: MP/M: A: U: *Basic: Cobol: Fortran: Pascal: APL: PL/I: Algol*.	Complete with furniture. Various business packages avail. Option: 20 Mb H/D £4000. BT 12/79 (S&H)

SINGLE BOARDS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Acorn System 1-5 (£65-£1600)	Acorn: 0223 312772 (35)	11/8k RAM: 6502: EPROM socket: Hex K/B: C int: 8-digit LED display: up to 16 ports. Options: Eurocard 64-way connector: VDU card: full K/B card.	½k monitor: *Basic. Pascal: Forth: DOS*.	Kit. Programmable address linking. On-board 5 V regulator. linking. On-board 5 V regulator. Can be expanded to disk-based system. (S&H)
AEX-09 (£750)	Micro Design 0908 663655	8k RAM: 32k PROM: 6809: 16 I/O lines: RS232 port: RS422 port.	OS-9: *(Basic: Pascal: Fortran avail soon)*	Full A/D & D/A conversion facilities. 4 x 8 but outputs. (H)
Aim 65C (£259)	Pelco: 0273 722155(7)	1-4k RAM: Full K/B 2 x C: 20 char LED: 20 char thermal printer: RS232 port.	A. Disc A: T/E: 8k monitor: *Basic (8k ROM): PL65. Forth*	Expandable using RM65 models to full disk systems. (E)
Bigboard (£450)	Maclin-Zand 01-837 1165 (N/A)	64k RAM: Z80, F/D controller: 24 x 80 VDU controller	2k monitor: *CP/M: Basic: Fortran: Cobol: Pascal: A*.	Many options. Will support up to four 8" F/D drives. BT 3/81. (E)
Biproc (£119)	B L Micros: 0494 44307. (TBA)	1k RAM: Z80: TV int: RS232 port. Opt: 4k RAM £8: K/B £30.	2k Monitor: A.	With 9980 instead of Z80 £155 as well as Z80 £180. Kit. (H)
Cromeco SC (£355)	Comart: 0480 215005 (25) Datron. 0742 585490.	1k RAM: Z80A: 8k EPROM sockets: RS232 port: 3 P/P. Option: S100 bus.	Monitor: *Basic*.	5 program interval timers. Can put own Basic program in EPROM. (E)
Elf II (£50)	Newtronics: 01-348 3325 (N/A)	¼-64k RAM: RCA 1802: Hex K/B: 2-digit LED: TV int: C int: RS232. Options: Full K/B: VDU card.	1k monitor: A: Dis A: T/E: Elf-bug *Tiny Basic: Basic,*	TTY N-line decoders. Low resolution graphics (high res avail). Kits or built. Full range of peripherals. (H).
Explorer (£82)	As above	4-64k RAM: 8085: Full K/B. RS232 port: 6 x S100 bus: C int: 1k video RAM.	2k monitor: *Basic (8k) CP/M: Basic Fortran: Cobol*.	Supplied in kit or built. Full range of peripherals including F/D. (H)
Hewart 6800S (£299)	Hewart: 0625 22030 (N/A)	16k RAM: 6800: full K/B VDU int: 2 x C int: 1 S/P: 2 P/P: Option: 16k RAM £90	1k monitor: A: T/E.	Can be upgraded with 6809. (H)
Hewart 6800 Mk 111 (£152)	As above	1k RAM: 6800: VDU board	1k monitor.	Options: single 5¼" F/D (75k) £350: PROM programmer £32. (H)
Microaxis 1 (£250)	Micro Design 0908 663655 (N/A)	1k RAM: 1-8k PROM: 6809: 8 channel A-D system: 12 optically isolated I/O lines.	1k monitor	Designed for industrial control. Can be expanded to F/D system. (H)
MPC 09 (£750)	As above	17k RAM: 48k PROM: 6089: RS232 port: 50 I/O lines: 4 timers: 1 W audio amplifier.	1k monitor: *Multi-tasking OS*	As above. New 64k version avail.
Microtan 65 (£69)	Tangerine: 0353 3633 (6)	2k RAM: 6502: 16 x 32 TV int: Options: 64 Pixel graphics £6.50	2k monitor, *Basic*	TANEX expansion kit with 7k RAM: 4k EPROM sockets: 14k Basic: 4 S/P: 32 P/P £145. (E)

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N/P	Numeric pad
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SINGLE BOARDS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Nascom 1 (£125)	Nascom: 02405 75155 (20)	4k RAM: Z80: Full K/B: TV int: 2 P/P: 1 S/P. Options: 16k RAM £140: single 5¼'' F/D (250k) £240 (4 disk controller £127).	2k monitor: *B Basic: Tiny Basic: A: T/E: U.*	Kit. Built version £140. Also Nascom 2 with 8k Microsoft Basic in ROM £225 (no RAM). (S&H)
77/68 (£90)	Newbear: 0635 30505 (N/A)	4k RAM: 6800: LED: C int: VDU int.	1k monitor: *Basic*	Expandable to 64k RAM with F/D. (B)
79/09 (£65)	As above	1k RAM: 6809: P/P: S/P	2k Monitor.	Designed to upgrade 77/68. (H).
SBC 100 (£135)	Airamco: 0294 57755 (TBA)	1k RAM: Z80: 8k ROM: S100: 1 S/P: 1 P/P.	*1k monitor: DOS in ROM*	Kit. Available assembled £196. (E)
Superboard (£188)	(as Challenger)	4-8k RAM: 6502: 10k ROM: full K/B: VDU int: C int.	Basic (8k ROM)	Options: RS232 port: single 5¼'' F/D (100k) £316: 8k RAM £188. (S&H)
Smoke Signal SCB 68 (£181)	Windrush 0692 405189 (TBA)	1k RAM: 6800/6809: 8k EPROM: 1 S/P.	2k monitor	Fully expandable to 64k RAM with F/D. (H)
SYM-1 (£160)	Newbear: 0635 30505 (N/A)	1-4k RAM: 6502: C int: VDU int: 2 x 6522 ports. Option: TV int.	4k monitor: *Basic A.*	Expandable to 64k RAM with F/D. (B).
Tuscan (£299)	Transam 01-405 5240 (N/A)	8k RAM: 8k ROM: Z80A: 5 x S100 slots: RS232 port: TV int: C int: 1 P/P.	*2k monitor: 8k Basic: CP/M: Pascal*	High res graphics available. Can be expanded to F/D system. BT 1.81. (S&H)
UK101 (£149)	Comp Shop: 01-441 2922 (4)	4k RAM: 6502: full K/B: 16 x 48 VDU or TV int: C int: RS232 port, Options: 4k RAM £16	2k monitor: 8k Basic: *Dis A: U.*	Graphics. Expansion & colour avail. Kit or fully assembled. (S&H)
Windrush 6801 (£175)	Windrush: 0692 405189	2k RAM: 6801/3/5: 12k EPROM: S/P: 3 P/P	2k Monitor	Designed for industrial control & dedicated small systems. (H)
ZCB (£260)	Almarc: 0602 625035 (3)	1k RAM: Z80A: 3 PROM sockets: RS232 port: 3 P/P	*Will take any 2708/16 = 32 software.*	S100 bus compatible. Expandable to full system. (E)

TRANSACTION FILE

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Tangerine ... Microtan, 8k Tanex, Xbug, Basic, Lower-case, graphics, RS232C, ASCII keyboard, P.S.U., cases, ddocumentation, £200. Casio FX502P and FAI adaptor, £60. All excellent condition. Telephone Blythe Bridge 8423.

Teleng/Rowtron home television entertainment centre, four cartridges, vigin 118

cartridges, giving 118 games, good condition and working order. A home programmer cartridge is available from manufacturers. £85 phone Bradford 832782.

Half price Smugart 8'' 2 drives, S.S.S.P. Fully aligned and tested. Can be seen working Posrt or collect. £180 each. Phone 076-727 427. Ev. Wknds.

Pet 3022 Tractor Printer, IEEE connector, dust cover, as new. £295. Tel. Heathfield (04352) 2499 day.

Video Genie ... 48K sound + keyboard mods. with manuals and software. Good condition £280. Ring Hartlepool 70755 or write. S Sharpe, 18, Gulliver Road, Hartlepool, Cleveland.

TRS-80 16k L2. With cables power supply and cassette recorder, plus over 60 computer mags, 4 books and some programs. £280 Tel. Geoff Wilkins Hornchurch 47809 after 6.

ZX80 ... complete with 8k Rom upgrade plus PSU, leads, manuals and three books £55. Telephone South Benfleet (03745) 54240.

Sharp PC-1211 ... Perfect condition everything included; manuals, overlays etc. £90 if new, first offer of £70 or around accepted. Tel. after 4.30 pm. Peter Galbavy. 01-723 9947.

TRS-80 ... 16k, Level II with lower case mod., cass, green VDU, many books and manuals, only 3 months old. £450 or offers. Tel. 02214 2638.

ZX81 ... Sinc. built as new. Leads, P.S.U. + Manual + "not only 30 pgros for your ZX81". All for £55. Phone Tony, Byfleet (09323) 45615 after 6pm.

UK 101, 8k Ram, cased, fan and sockets fitted, Ferguson Courier Batt/mains TV/monitor sits on case, Panasonic recorder, all leads, many games inc' space invaders, 3D noughts and crosses, etc. All perfect condition £300. Tel. Kelshall (Herts) 378.

TRS 80 16K L2 with numeric keypad + CTR 80A, Tandy modulator & £35 of Tandy Software. 2 months old. Not enought time to use. £295. Knutsford 3946. After 6pm.

Acorn Atom 12k + 12k inc. floating point. Little used, good cond. £200. Tel. Dave/Bry L/Spa. 38751.

Superboard II, cased modulator 8K Ram, 8K Rom, external P.S.U. excellent condition. Complete with manuals, leads, etc. games on tape including invaders £200 ono. Tel. Whitworth 2260 evenings.

Pet 32k new rom. Cassette Deck, speech output (infinite), Superchip, toolkit, picchip, reset swtich. 3040 disks (Dos 2.1), disk safety device, 30 + disks, hundreds of progs. Games & utilities, only £1300. Tel. 0442 49762.

TRS-80 ... Level II 16k with VDU, cassette, editor/assembler, T. bug, tiny pascal, microchess. Plus lots more software. Also technical handbook, assembly language book only £350. Phone Padiham (0282) 74487.

For sale 80/80V mains power units small switch mode type S/C current limit and crowbar trip £15. Mr Adamson, Woodend, Victoria Road, Wingsdown, Deal, Kent. Tel. Deal (03045) 3788.

TRS80 Level II 16k — £339, level I 4k — £229. Both with power supply and modulators. Original packing and unused. 2 St Martins Street, Millfield, Peterborough (0733) 45731 or 222588.

"Wanted" microchess for 8k Pet. PCW vol. 3 no: 1-2-7 and 8. Write to: Arne Karlgaard, Hovedstasjonen NSB, N-7000 Trondheim, Norway.

ZX81 ... Factory built complete with leads etc and under guarantee plus compatible recorder, "ZX81 companion" and Sinclair cassette. £85 for the lot, ono, or will split. Winchester 51965.

Nascom II 48k ... 3A PSU, 5¼ SSDD Drive (200K), CPM, Nassys3, Zeap, CBASIC II, Sound board (AY-3-8910), manuals, grotty box, £800. will separate. Unused I/O Hi-res Graphics board £55. Tel. (0403) 60734.

Acorn Atom, 12k Ram, 8k Rom. Acorn built and tested, as new. All leads and manuals. Needs external regulated PSU. Bargain £150. Write: Ian Paton 39 Yates Street, Liverpool L86RD.

ZX81 16k ... Manual, getting acquainted and mastering machine code. Sinclair Software and others including 'invaders' and 'defender'. Custom plug-in games controller. Leads, power unit. As new £95. Telephone Gloucester 423439.

Pet 8k ... Old Rom, Integral cassette deck, Small keyboard, with games and tutorial programs £325. Tel. Danbury (Essex) (02451) 4158 Evenings & weekends.

Video genie 32k, colour, control keys, sound; as new, with printer interface. Software including; other languages (Pascal, assembler, forth) and most popular games. Books. £375 ono. Tel. 021-440 4721.

Swap — complete Nikon camera kit. FM Body, standard and zoom lenses, computer flash, intervalometer, motor-drive, cases, metal case etc. Worth £300+, for pet, Mz-80 similar value. Reading (0734) 411333.

ZX81 + 16k Ram. Sinclair built including power supply, manual, all leads & much software. Very good condition and in perfect working order. £100 ono. Tel. Edinburgh (031) 449 2582.

ZX80 ... Sinclair built, complete with 3k additional RAM, PSU, manual. Leads, Magazines and games tape cost £130 will accept £69 ono. Tel (0827) 62714.

Video Genie 16k current model. Sound, extra shift key, controls at front. Leads, manuals, software incl. games, Editor-assembler (microsoft) & books. Value £380: accept £325 ono. Chambers 01-828 9811 x 2440 (day).

ZX80 ... Sinclair built, boxed complete with manual, PSU, leads. Little used £35. Tel: Paul 01-841 4268.

Sharp PC1211 ... with manuals, overlays, cassette interface, all in good condition will accept £65. Tel. Kiddeminster 67802 after 5.

Atari 800 32k. Cassette player, 1 cassette game, 2 cartridge games, 'Le Stick' joystick £775 and ZX80 1k. Sinclair built leads adaptor etc. £45 and 12'' portable b/w TV. £40. Tel. 731 5512 after 8.30 pm.

Prinztronic Chess traveller ... battery operated but supplied with mains adaptor. Hardly used, ideal Xmas present. Costs £55 new £35 wanted. No offers. Tel: Langley Mill 62635 after 6pm.

Heathkit HM800 Manual set. New unused. Comprising assembly, operation, schematics for H8, H9, H10, H8-1, H8-2, H8-5. As Heath sells for £59. All for £15. Pract. Computing Oct. 78 — July '81. £10. Tel (0553) 86618.

TRS-80 ... 48K (model 1) one disc, lower case mod. Will add approx. 100 programmers eg. N.D.80, visicalc profile etc. £1000. Tel: 0733 270477.

ZX80 with 4K and 8K Roms, all factory replacements, used twice. 16k RAM pack, one year's INTERFACE, sync magazines; program listings, articles. £95. Tel: Bury St. Edmunds, Suffolk (0284) 61864.

Exchange DAI colour graphics computer 48K for VT100 or other dec equipment or best offer over £500. Phone Hythe (0303) 66963.

DIRECT ACCESS

TRANSACTION FILE

PET — 8K old Rom. Small keyboard, integral cassette. Programmers toolkit and 'Pet Revealed'. Several games including Star Trek. £230 ono. 01-897 9998.

Personal Home Computer for Sale — 32K New Rom Commodore Pet with sound box and 3600 BAUD cassette rom with repeat key and commodore cassette. £425 o.n.o. Appley Bridge 3428 after 5.30 pm.

Business Genie System ... 48K, 2 disk drives, expansion box, special green monitor, cables, leads, manuals, dos, one month old, cost £1,390. Any offers? Phone 05432-55022 (Graham). May split. Printer available.

Acorn Atom ... 12K Ram, 8K Rom, Acorn Built, recently serviced, Basic and Assembler, PSU, 192 x 256 resolution graphics: Invaders tape, manuals. £235. Tel. Wolverhampton 780659, after 5pm.

Sinclair ZX81 with leads and manual. Brand new, still in box. A real bargain at only £50. Phone 0382 74559 after 6.30 pm.

Superboard II . . . good condition, with Cegmon monitor, and 5 user group newsletters. (Home Made Case, P.S.U. and modulator) expanded to 8K RAM. Working. Tel. 051-480 1979 after 6. S. Macnaughton, offer around £140 o.n.o.

ZX81 + 16K RAM ... sinc built, all leads, mains adaptor, 2 game cassettes, and 2 Hartnell books. Ideal Christmas gift. A snip at £80 + postage. Yeovil: 0935-22724 (after 5pm)

For sale Apple Integer card £50. Apple/ITT Communications (RS232) card. Aplle Dos 3.3 card & manual £50. Brand new: 01-249 9895.

Video Genie EG3003 ... 16K RAM, latest keybaord and VU meter. In perfect condition, complete in original parking. Extra manuals. Good reason for sale. £285. Tel: 01-680 2775 (Croydon).

ZX81 16K, Sinc built, fullsize keyboard, perfect working order, leads, manuals, adaptor, £125. Tel: 01-393 1313 (Robin).

UK101 20K, Cegmon, TWD power supplies. Smart 2, P.E. interfacing boards with PIA/PSG DA/Etc. Exmon, Toolkit, in Eprom SW cass baud 300/600/1200 uprated basic's 1,3 and 4 cooling fan cased manusl £315. Wokingham 784897.

ZX81. Factory built, 16K Ram, PSU, manual, 16K games tape, compatible cassette recorder, magazines etc., £120 ono. Ring Worcester (0905) 357208 after 6 pm.

Acorn Atom ... 12K Ram, 8 Krom, PSU, Leads, lots of software, 2 books, 11 months old, £165. Tel: Portsmouth (0705) 372828 (after 6pm).

Pet 4000 32K. Toolkit TK4.0. Dual disk drive 4040, Pet revealed, Pet subroutines, memory maps, user manuals, dust cover, as new trials welcome. £110 o.n.o. Phone Binbrook 378.

ZX.81. factory built. 16K Ram. 2 sinc cassettes + programmes (breakout and Invaders). Mains adaptor, leads and manuals. £110. Tel. Ilkley (0943) 608091.

Sinclair ZX81 + 16K Ram Sinclair built 2 books & 2 Sinclair cassettes 6 months old all original packing £100. Phone Princes Risborough (08444) 3182 Bucks.

VIDEO GENIE 16K ... 6 months old perfect condition, with leads & manuals. Many games inc. Space Invaders: £300. Tel. Dursley 3883 after 4pm.

ZX81 ... Factory built, 16K ram pack, leads & books, lots of software. Altogether worth £140. Quick sale required, hence £99. Tel. Biggin Hill 72263 and ask for Alan.

Acorn Atom perfec condition, fully expanded; 12K + 12K. PSU leads, manusl. Acornsoft packs 1, 5, Startrek, Magic Book, £190. Tel. Edinburgh (031) 5564406 eve, (delivery within 15 miles).

Superboard 2. 8K Ram. Intamon monitor, case and P.S.U. — £125. Also, ASR 33 type teleprinter with punch/reader — £30. Tel. 061-338 4167.

ZX81 sinc. built, inc. leads, manual, adaptor, 5 months old. Complete with £12 software inc. Invaders, etc. for the 1K machine. All boxed. £67. Tel. Arun 0632-731204.

ZX80 8K ROM and Video upgradekit (Compshop) (allows use of fast and slow mode) 4K Ram. 5 books (software and programming) interface magazines. Bargain at £80. Phone Swindon (0793) 36829.

2 5K XZ81's for sale perfect working order sinclair built plus software £69 each phone David Kingswinford 292407 after 4pm.

Nascom II ... 32K Ram. Graphics, 3 amp PSU. Runs at 4 MM2 without wait. £300 o.n.o. Tel. Nottm. 841831.

Acorn Atom 12K + 12K £250 o.n.o. Includes leads, PSU, printer interface, software, Acornsoft word-processor package. Also Monitor £40. Ring 01-934 5217 (day) or 0525-372141 (evenings).

Apple Hardware with documentation. Eurocolor card £60, Parallel Printer card £65, Hi. Speed serial card £65, Communications card £65, Programmers Aid No. 1 £20, Auto. start Rom £25. Tel. 0223 (Cambridge) 833772.

Apple Pascal Language System complete and never used. Yours for only £200. A Ram card costs £110 and no Dos 3.3 Roms or Pascal. Tel. 0223 (Cambridge) 833772.

Software for Apple ... as new with documentation. Visicalc £50, Visilist £10, Desktop plan £40, CCA Data Management £40, Hi. Tech. Dbms. £35, Appleplot £25. Tel. 0223 (Cambridge) 833772.

Software for Apple ... as new with documentation. Easywriter (40 col.) £30, Trendisk/1 database £20, Act Database £25, Whatsit (48k) £50, Stats Pack (Chas. Mann) £25. Tel. 0223 (Cambridge) 833772.

TI-59 programmable, mag. cards, charger, case, manuals, original box, mint £79; Motorola MEK-6800-D2 kit, complete, unused £69; Intel 8086 Chip set, memory & bus chips £50; Reading 697886 pm/W/ends.

Wanted Computer, Disks, Tapes, Printer, etc working or not anything considered phone Leeds (0532) 792163 after 6.00 pm or daytime. J. Spence 631478.

Acorn Atom. 8K Rom + 11K Ram. Acorn built. manuals. P.S. U. + leads £170. tel. Lulsgate 2802 (Bristol) after 4pm.

Pet 2001 — 8K. Manuals old Roms. + Games including micro chess £290. Tel. Lulsgate 2802 (Bristol) after 4 pm.

ZX81 Sinclair built, with 16K memory, leads, manual, program book, 2 Sinclair tapes. £100. N. Cook, 37, Queens Road, Windsor, Berks.

Something different ... Neat Motorola 'Exorciser' system. CPU. 16k RAM, 16k Basic/Assembler/ Editor EPROM, VDU controller, 5" monitor, keyboard, cassete interface, PSU. Cost £700 — gift at £300 o.n.o. Hunt, 21 Green St. Milton Malsor, Northampton.

Atom 21K Ram + 12K Rom manu. built, colour board + 6522 + progs, books + 5V5A boxed PSU £320 words £420 + 18" colour TV £100 all fully op. as seen. Lorne. Windsor 69884 9-10 pm.

6809 ... Single board S100 processor, 2K Rom, 1K Ram £140. 64x16 VBI S100 video board £60. PBI S100 Errom programmer & 4K/8K Eprom board £70. Full documentation ring 01-959 4851.

ZX81 ... Perfect working order, power supply, leads and manual. Still in box, many games on cassette including Sinclair games Pack 1. Ideal Xmas gift. — £65. Phone Southend (0702) 47211.

Centronics microprinter P1 + spare rolls paper. As new £100 o.n.o. Sharp MZ80K interface unit — absolutely brand new — £80.00. Sharp PC1211 + cass int — £80.00 o.n.o. Sinclair ZX81 P.S.U. £6.00. Brighton 423021.

ZX80 + 8K Rom ... 3K Ram, cassette recorder & interface, saves/loads first time, all on a board, £100 o.n.o., tel: Winsford (06065) 53885.

For sale Acetronic T.V. Game ... 10 cartridges including space invaders, soccer, blackjack, tank/ plane battle, etc. cost £250, would accept £150 o.n.o., tel: Winsford (06065) 53885.

Nascom 2 ... 16K memory board, 3A PSU, graphics, assembler, cased, £325 for quick sale, ring Esher 62597.

Cromemco ... PR1 S100 printer interface card & manual, Centronics par + ?daisywheel ints, £90 ono. Tel. Peter 01-631 1433 10 am — 6 pm. weekdays.

Sharp MZ-80 ... 48 K, Basic plus Knight Commander, manual, etc, good condition, 12 mths faultless working, owner upgrading, £400 ono. Will deliver up to 25 miles. 01-642 8019 (eves).

Acorn Atom ... 12K + 12K, PSU. manuals, leads. Prof. built. Printer int (Via). Progs. Asteroids, Star trek etc. £199. Tel: Kings Langley 62306 eves.

ZX 81... with 16K Ram plus manual and all leads, 20 tapes (some with programmes), 3 programme books, Interface magazines, no waiting for delivery. £120.00 ono. Phone 01-337 5302.

Microtan 65 ... Tanex, 8K Ram, X-Bug, AscII keyboard, 8-bit DAC, Manuals and PSU. Many programs including asteroids, invaders and DAC waveform generator. Worth £350, accept £215 Tel. Ascot 21210.

Nascom 1 ... cased, working, with 3 amp. psu and Nas-Sys 2k monit monitor plus documentation and Z80 manuals, £140 ono. Phone Maidenhead (0628) 23930, (evenings & we).

ZX 81 ... Sinc built, as new + Not only 30 progs, £60. Tel. Woking 73891.

Pet 32k ... New ROM, with Tensai cassette deck, manuals, dustcover and large quantity software, £500. Computhink 400k disk drive, almost new, £500. Commodore 3022 Tractor Drive Printer, £325. C.J. Blunt, Ashtead (03722) 74909.

Seikosha ... GP 80 printer as new, complete with handbook, cost £230 new, selling for £195. Genuine reason for sale. Tel: 0242 76994 (6-7 pm).

Pet 32k ... Basic 4 with cassette, many games tapes, inc Cosmiads, Petchess, Hich-Hikers guide etc, as new with Green screen, dust cover and Soundbox. £625 ono. Tel Alec, Preston 54821 ext 2289 day.

ITT 2020 ... 48 k, disk drive, DOS 3.3, DOS tool kit, paddles, software, colour, new last Xmas, games, assembler, editor etc.etc. Orig. doc. and packing, as new, cost £1250, sell £795. Tel: (0432) 58127 evngs or weekends.

Casio FX502P ... prog. calc. and Fai cassette interface including manuals, program library and tape of programs — £50 ono. Ring Northallertow (0609) 2147 after 5.30 pm.

ZX80 — As sent. Built by Sinclair — £35. Including power supply. Phone Woking (04862) 20818.

ZX81 ... factory built with 16k RAM, leads, mains adaptor, manual, and book of games, £110.00 ono. Tel: Paul Sharp at Burgh Heath 61142.

Pet 8K ... built-in cassette, new ROM, + manuals. 75 programs (inc. Space Invaders). £380. Phone Hartlepool (0429) 60498 after 4pm.

Atari Video Computer — complete system plus following cartridges:- Combat, Invaders, Chess, Bowling Excellent condition, 11 mths old. Worth £180, only £110. Tel. Codsall (09074) 6560 after 6pm.

Casio fx502p ... as new in perfect order with orig. box, wallet, overlay, manual and program library. £50 ono. Tel: Lymm 3131 eves.

ZX 81 Sinc. built 4 months old perfect working order with manual, accessories, games, cassette, boxed, as new. £55. Tel. Leyland (07744) 32104. Eve.

ZX81 ... Sinc. built inc. all leads, manual, power supply and 8 month Sinclair guarantee, V.g.c. only £60 ono. Phone 01-894 9747 after 4 pm.

Free ... Astrological computer worth £29.95, if you buy my Voice Chess Challenger (worth) £245) for £119.50, incl. Black Attache case, lock, all leads, P.S.U., Transformer, Magnetic Hand Carved wooden pieces, Board overlay, Rules. Also Videoscore Colour TV game only £19.50. 01-446 3798 after 6 pm.

Acorn Atom ... 24k, PSU, manual, leads, colour board, exc. cond. and value. £200 ono. Tel. 01-561 4176 weekends only.

Superboard II ... 16k with 610 extension board, Cegmon and numeric keypad, PSU and modulator, cased, leads, manual, games. £260 ono. For quick sale. Tel. Pontefract (0977) 704418.

ZX80 ... Ik, factory built, PSU, all leads, manual, nothing missing. Very good condition. Perfect for expert or beginner. £55 ono. Tel. 051-924 9042 (after 5, weekends)

FREE! ... Casio fx 502p prog calc, in wallet, with manuals when you buy my OSI built Superboard II, with manuals, all leads PSU, modulator, 8K ram, 48x32 display + Cegmon (prof fitted), some tapes, VGC, at £270. Tel. Paul Marning 01-778 6402 (after 6).

Video Genie EG3003 used for less than 50 hours. Some books, software and all accessories worth £50 sell all for £285, or exchange with 80 column printer. Tel. 01-947 6673.

Printer?... Cheap reliable ASR33 Teletype gives you Printer, RS232 Terminal, plus ridiculously cheap off-line storage on paper tape. Good working order. Only £99.00. Tel. 0494 25938.

Trendcom printer (similar to Microhush) complete with Apple interface card and lrge supply of thermal paper. Original cost £300. Will accept £150. Telephone Liphook 722960.

Sharp PC1211 pocket computer, complete with cassette interface. Original cost £120, will accept £60. Telephone Liphook 722960.

Sorcerer 56k £550, disk unit £500, macro assembler £40, Algol £50, WP pac £80, B/W monitor £75, ICL Printer £200, Teletype 33 £100, Alan Knifton, 0629 83 4426 after 5 pm.

Sharp MZ80k ... 36k Ram basic plus Tookkit. Over 100 programs plus literature, pet program conversion details etc. Dust cover included £395. Tel: Peter Howard Stratford/Avon 298187 or Wrexham 263123.

TRANSACTION FILE

DIRECT ACCESS

Hewlett-Packard HP-67 card programmable with case, charger, user handbook, standard pac and manual plus 10 spare cards in wallet. £130. (0908) 640053 evenings/weekends.

MZ80 ... 36k with disks + i/o unit £995 (inc. stock control program) Epson printer MX80 FT/I £375. Interface for above £85. All 6 months old. Tel. 07677 503.

ZX81 + 16 RAM, PSU, Manual, Leads, Sinc. cassettes 4 and 5, Sinc built, perfect, £100 the lot. 01-870 5753.

ZX81 ... Sinclair built. Complete with 16K Ram pack, PSU, leads and manual. As new. £100. Tel: Maidenhead 27854.

Superboard 2 ... 16k RAM, 48x32 character display, Cegmon monitor prog. sound generator, PIA, metal cased, fan cooled, with 10A fan cooled PSU, various software. £270. Tel. Cambridge 311028.

ZX81 ... plus 16k RAM, all Sinclair programs. Many books. £110. For the lot ring 01-852 5935.

ZX80 ... Ik sinc. Built exc. cond. with all leads, PSU, manual and Hartnell's "Making the most of", + book of 30 progs also cassette including Flicker free games. £70. Tel. (0334) 53434.

Seiko world timer alarm watch. Touch a button and a map of the world is shown. Immaculate still under guarantee. Boxed. £35. Tel. Earlswood 2143 after 6pm.

Pet 32k computer ... as new, full manuals plus many extras. UK delivery possible. £495. Telephone 0403 (Horsham) 731650.

Acorn Atom ... 12k Ram, 12k Rom, 6522 Printer interface, inc. manual, mains adaptor, tapes (Invaders, Asteroids, soft V.D.U. etc), Magic book, User Group News Letters £235. Tel: (0242) 510525 (Cheltenham).

Nascom 2. 32k, Graphics, basic screenplus, fully cased, port status indicator. Tapes: programmers and, Pascal, Assembler, games. Full documentation on above. Cost £650, accept around £450. (07816) 6028 eve).

ACC NEWS

News from the Amateur Computer Club, the national club for all amateur and personal computer users.

This month has been pretty busy, particularly in London. Before I tell you what has been happening there, can I remind the rest of you to write to me with your club news for inclusion in this spot; if you don't, the London bias will continue!

Once again, our friends in the North London Hobby Computer Club make the news. At their recent AGM, they re-elected Robin Bradbeer as chairman and decided to become a BBC referral point. Also at that meeting, they decided to become the ACC's first fully affiliated club by adopting the ACC Block Membership Scheme. The exact details haven't been finalised, but the gist is that they will pay the ACC a per capita fee, somewhat less than the normal ACC membership, and that all their members will become affiliate members of the ACC. The North London Club will handle distribution of *ACCumulator* (the ACC's newsletter) to their members, possibly inserting their own flysheet giving local news and times of meetings; any articles will be submitted to *ACCumulator* and published by the ACC. If necessary, *ACCumulator* will be expanded to cater for the increased contributions.

The ACC is very pleased that the scheme (which in October was merely a twinkle in my eye) was adopted by North London without opposition on 25 November 1981, and that this extension to the ACC's services was kicked off by the affiliation of such a large group (approx 250 members). Please get in touch with me to discuss terms if your Club or User Group is interested in full affiliation.

Speaking more generally, the ACC is improving the communications with local clubs and user groups. We are offering a £2 subscription to *ACCumulator* for a single person (the chairman or his nominee) from each club or group; we hope that many clubs will take up this offer so as to improve communication between clubs and the ACC. It is hoped that the communications will be two way as we want information from the clubs, as well as sending out *ACCumulator* to them. Write to: Vernon Gifford, 111 Selhurst Road, London SE25 6LH, for the details of this offer. We hope that you will take this up, and that the copies of *ACCumulator* will be useful if you consider full affiliation for your club.

The ACC database now contains well over 200 clubs and user groups, *Please* make sure that your club or group is on it, and that your entry is correct. We give out club information to many people at the exhibitions that we attend (eg, *PCW*, Breadboard) and we'd hate to miss you out or tell lies about you. Write to: Derek Fordred, 72 Mill Road, Hawley, Dartford, Kent, with full details and he'll put you online. We are hoping to have the database out on Prestel early this year, possibly with some telesoftware (ie, software that you can load into your machine from the telephone line). As soon as we know the page number, it will be published in 'ACC News'.

Further to Busby's computing interests, two other items have cropped up this month. Firstly, there will be a conference at Easter this year, organised jointly by the ACC and ALCC (Association of London Computer Clubs), on the subject 'Computers and your Telephone'. This will include discussions of networks, telesoftware, bulletin boards, etc. It will not be about £999,999.99 phone bills. Please write to me if you are interested. Secondly, British Telecom is offering a £1000 prize to the inventor of the best system for downloading telesoftware into a Sinclair ZX81. Further details are available from the Prestel department of British Telecom.

On 28 November, the ACC held its first National Conference. This was held at Imperial College, London and over 60 delegates came to discuss 'Practical Micro-Robotics'. The evening was a great success; the delegates included university lecturers, computing professionals, robotics specialists, electrical engineers and students. There was a great kindred spirit of people looking to learn about micro mice, small robots and intelligent machines. The morning session was devoted to micro-mouse, while the afternoon concentrated on more general aspects.

The conference was opened by Vernon Gifford of the ACC, who chaired the morning session. He introduced the first speaker, David Woodfield from GKN, David had won the 1981 micromouse competition with his machine 'Thumper', which talked as it went. He was joined on the platform by Andrew Keatley of Alan Martin Electronics and they gave a brief introduction to the principles behind mice. Next to speak was Eddy George, of the ICI Amateur Computer Club. He stressed the importance of the low level hardware, such as sensors, and pointed out that a little hardware can sometimes be easier (and much quicker) than a whole lot of software. He demonstrated a 'brainless mouse' that worked without a computer at all.

Nick Smith, the winner of 1980 Micromouse with 'Stirling Mouse', then discussed the various types of maze and how they could be solved, including how to get out of Hampton Court. He stressed the difference between mice and men: some human solutions aren't suitably applied to a micro mouse, while some techniques used by micro mice will lose humans (even those with good memories). Finally, he considered the ideas used in the maze designs and the kinds of trap put in them.

The last speaker of the morning was John Billingsley of Portsmouth Polytechnic, who is responsible for designing mazes for micro mice to solve. He showed some video recordings of micro mouse contests and made some suggestions as to the kind of problem a micro maze-solver will have to face.

After lunch, Mr Beresford-Hartwell took the Chair, and the conference turned its attention to more general robots. The discussion was kicked off by Douglas Urquhart of ICL Bracknell, who talked about Cuthbot, an early mobile robot. This was followed up by Peter Matthews of Colne Robotics, who discussed 'Armdroid', a simple robot arm which sells for under £200 in kit form. He felt that the opportunities were wide open in this area and that Britain was the world leader in the field of personal robotics. Tim Orr, of Powertran Cybernetics, then demonstrated a more powerful robot arm, 'Genesis', which was hydraulically operated and optimised for easy computer interfacing. Alan Dibley wound up by giving a discussion on building economical robots (ie, how to get started in robotics without seeing your bank manager).

Because of the enormous interest shown by the delegates at the conference, the ACC has agreed to set up a micro-robotics study group to encourage and further hobbyist interest, holding meetings and providing information. Vernon Gifford has the details of this.

Rupert Steele

Details of the ACC can be obtained from Rupert Steele, Membership Secretary, ACC, St John's College, Oxford OX1 3JP

NETWORK NEWS

Here is a list of all British (and one Dutch) personal computer networks. As more networks appear — and as more facilities are added to existing ones — we'll report them in this section, which appears monthly.

Forum-80 Hull. . . Operator: Frederick Brown, tel 0482 856169. Facilities: electronic mail, software up/down loading, Forum-80 Users' Group, PET users' section, shopping list. Hours: 7 days/week, midnight-0800, Tues & Thurs 1900-2200, Sat & Sun 1300-2200.

Forum-80 London. . . Operator: Leon Jay, tel 01-286 6207. Facilities: electronic mail, program downloading. Hours: Tues, Fri, Sat & Sun 1900-2300.

80-NET . . . Operators: Leon Heller & Brian Pain, National TRS-80 Users' Group, tel 0908 566660. Facilities: electronic mail, software for downloading, newsletter, TRS-80 information. Hours: 7 days/week, 1900-2200.

CBBS London. . . Operator: Peter Goldman, tel 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Forum-80 Holland. . . Operator: Nico Karssemeyer, tel 010 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

CTUK! CENTRES

Here's an updated list of people organising ComputerTowns. Don't forget to enclose an SAE if you write to your nearest 'Town for details.

Lyn Antill,
1 Defoe House,
Barbican,
London

Peter J Kiff,
52 Stone Road,
Broadstairs,
Kent CT10 1DZ

Patrick Colley,
52 Queensway,
Caversham Park Village,
Reading,
Berks RG4 0SJ

Pete Shaw,
15 St Vincent Road,
Clacton-on-Sea,
Essex C015 1NA

Steven Christian,
51 Burnstones,
West Denton,
Newcastle-on-Tyne NE5 2DF

Derek Moody,
2 Victoria Terrace,
Dorchester,
Dorset DT1 1LS

David Tebbutt,
7 Collins Drive,
Eastcote,
Middx HA4 9EL

Vernon Gifford,
111 Selhurst Road,
Croydon,
London SE25 6LH

John Stephen Bone,
2 Claremont Place,
Gateshead,
Tyne & Wear NE8 1TL

Mike Baker,
5 Edinburgh Road,
Hanwell,
London W7 3JY

Vernon Quaintance,
50 Beatrice Avenue,
Norbury,
London SW16 4UN

R L Saunders,
14 St Nicholas Mount,
Hemel Hempstead,
Herts.

Pete Rowan,
10 Lambton Road,
Jesmond,
Newcastle-on-Tyne NE2 4RX

Steve Haynes,
5 Guinea Street,
Kingsholm,
Gloucester GL1 3BL

Ted Broadhead,
27 Cardinal Road,
Leeds LS11 8EY

Andrew Holyer,
10 Masons Field,
Mannings Heath,
Horsham, Sussex RH13 6JP

Brigitte Gorton,
18 Purbright Crescent,
New Addington,
Croydon CR0 0RT.

Susan Kelly,
Head of Reference Services,
PO Box 4,
Civic Centre,
Harrow,
Middlesex.

Bill Gibbings,
3 Longholme Road,
Retford,
Notts DN22 6TU

Philip Joy,
130 Rush Green Road,
Romford,
Essex.

Richard Powell,
22 Downham Court,
South Shields,
Tyne & Wear

Derrick Daines,
18 Cuttings Avenue,
Sutton in Ashfield,
Notts

Keith Taylor,
Carter Hydraulic Works,
Thornbury,
Bradford BD3 8HG

Roger Shears,
18 Woodmill Lance,
Bitterne Park,
Southampton SO2 4PY

Alan S Waring,
50 Drayton Gardens,
Winchmore Hill,
London N21 2NS

Alan Northcott,
Rushmoor,
464 Reading Road,
Winnersh,
Wokingham,
Berks RG11 5ET

Alan Sutcliffe,
4 Binfield Road,
Wokingham,
Berks RG11 1SL

Tony Cartmell,
54 Foregate Street,
Worcester WR1 1DX

Tom Graves,
19a West End,
Street,
Somerset BA16 0LQ

USER GROUPS INDEX

INTERNATIONAL

Pascal Z User Group (Europe) Affiliated with Pascal Z USA. 12 user disks available plus newsletter. Contact: George Brooke, Sebattian Bauerstrasse 20c, 8000 Munich 83, West Germany.

REGIONAL

Scottish Amateur Computer Society. Meetings 1st Weds monthly, Claremont Hotel, Claremont Crescent, Edinburgh from 7.30 onwards. Meetings include talks and demonstrations. Contact: P Lindsay (Top right flat), 1 Lower Gilmore Place, Edinburgh. Tel 031-229 6841

COUNTY

Mid Kent TRS-80 User Club. Users and potential users of TRS-80 and Video Genie welcome. Meetings fortnightly at Kent Micro Services, 53 High Street, Maidstone, Kent. Contact Mike Mariott also John Rayfield, 22 Beaconsfield Rd, Sittingbourne, Kent.

North Lancs User Group, meets monthly in Blackpool. Contact: John Robinson, 0253 67091 or Mick Fordham, 0253 891769.

TOWNS

Dalton-In-Furness Computer Club. Recently formed. Contact: A H Gay, 24 Rusland Crescent, Ulverston, Cumbria, LA12 9LX. Tel: 0229 52854.

Folkestone needs a computer club. I'm willing to start one but I need some help. Please write or call any evening. Ray Milton, 94 Linden Crescent, Folkestone, Kent.

Glasgow area ZX80/81 User Group, presently being formed. Main aim is to promote computer literacy. Will eventually include BBC Micro. Write or phone: Ian Watt, 107 Greenwood Road, Clarkston, Glasgow, G76 7LW tel: 041 638 1241.

Glossop (Derbyshire) — is anyone interested in forming a computer club in this area? If so, please contact Neil Jenkinson on Glossop 66027.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Tokyo, Japan	Data & Telecommunications Exbn. Contact: Cashners Exposition Group, Guildford 38085.	20-23 Jan
San Diego, CA, USA	Pacific Computer Expo. Contact: Judco Enterprises (Arizona), (602) 990 1715	21-23 Jan
Eindhoven, Holland	Int Microelectronic Subsystems Trade Fiar	27-29 Jan
Cheltenham	(Queens Hotel) Computer Open Day Exbn. Contact: Couchmead Communications Ltd, 01-653 1101	27 Jan
London	(Barbican) Information Technology & Management Exbn & Conf. Contact: BED Exbns Ltd, 01-647 1001	9-12 Feb
Harrogate	(Majestic Hotel) Computer Open Day Exbn. Contact: Couchmead Communications Ltd, 01-653 1101	10 Feb
Dublin, Eire	Int Computing Exbn. Contact: SDL Exbns Ltd, Dublin 763871	16-19 Feb
London	(West Centre Hotel) Microsystems Exbn. Contact: IPC Exbns Ltd, 01-643 8040	24-26 Feb
Swansea	(Dragon Hotel) Computer Open Day Exbn. Contact: Couchmead Communications 01-653 1101	24 Feb

LEISURE LINES

by J J Clessa

Perhaps the November Puzzle was more difficult than usual, since the response was less than I would have thought. However, almost 60 readers sent in answers, of which more than 50 gave the correct answer — the sheep is in pen C.

The winning entry was from a young (?) lady (?) (I'm guessing from the handwriting), Sandra Manby of Southampton. Congratulations, Sandra — your prize will be on its way shortly.

Meanwhile, may I re-emphasise that only entries on postcards will be accepted — no letters. If you don't have a postcard, then write on the back of a sealed empty envelope and send that.

Quickie

A snail climbs up a greasy flagpole 20 feet high. He climbs three feet each day but slips back two feet each night. He starts at daybreak on 1 February. When does he reach the top?

Prize puzzle

This month's prize puzzle should be within the compass of those readers with micros or programmable calculators: if you divide 2519 by 10, there is a remainder of 9; if you divide 2519 by 9, there is a remainder of 8; if you divide 2519 by 8, there is a remainder of 7; and so on. Can you find two other numbers with the same property?

Answers on *postcards*, please, to: February Prize Puzzle, *PCW*, 14 Rathbone Place, London W1P 1DE to arrive no later than 28 February.

PROGRAMS

We are interested in Basic or Pascal programs for any of the popular micros — please specify which one you wrote your program on and how much memory it uses up. Assembler language subroutines are covered in 'Sub Set'. We'd also prefer more 'serious' software: games are all very absorbing, but the programs section of PCW *does seem rather one-sided. Make sure programs submitted are fully debugged before they're sent in, preferably on cassette with a clear listing enclosed. A short explanation of your program's function would also be desirable. If you want it returned, enclose an SAE and write your name and address on each piece of paper you send. Don't worry if you don't hear anything for a month or two — programs take a long time to evaluate. And we pay for all programs we print. Send contributions to* Maggie Burton, PCW *Programs, 14 Rathbone Place, London W1P 1DE.*

In *PCW*'s November and December issues the unforgivable sin of printing incorrect listings was committed. Appropriate grovelling apologies to all our readers who tried and failed to run TRS-80 Sheepdog Trial and ZX81 Battleships and Cruisers. Atonement is as follows:

Battleships and Cruisers contained several typing errors: line 181 should have been 818 and if line 702 is numbered 700 that solves the mystery of all those GOTO 700s in the listing. Line 780 should read:

```
PRINT AT 13—Y, X+ (K*16) — 14; "*"
```

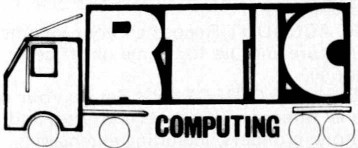
Line 800 should read:

```
IF N(K,Z) <>0 THEN GOTO 850
```

TRS-80 Sheepdog Trial seems to have several line endings missing. I have recently run the program from cassette and it works. Once the problem of the missing characters is solved the program should work from the listing as printed. Here are the offending lines:

```
Line 50: OF=0: FOR N=L TO U:
IF PEEK (DP+N)>32 AND PEEK
(DP+N) <>128 OF=1
Line 220: B$=" ": B1$=" ":
S$=CHR$(131)+CHR$(175)+CHR$
(143)+CHR$(175)
Line 230: D$=CHR$(131)+CHR$
(173)+CHR$(140)+CHR$(156)+
CHR$(129): P=15360: K=0
Line 600: FOR N=0 TO 2: IF
SX(N)>34 AND SX(N)<46
```

cont p 187



MICROMART

the HP-85 does more, it also costs an arm, a leg and several back teeth. If, as rumoured Casio, gets the '9000 out at less than £500 it could give HP a hard time in these days of dwindling research budgets.

As to expansion, little is revealed beyond hints in the manual of disk drives, a cheap electrostatic miniprinter, an RS232 interface and the existing Epson graphic printer. For its intended market, one would also want IEEE 488 for instrument control and a plotter, which are not mentioned. If I were in Casio's design team I'd rip out the RAM ports and whack in two Sony micro-floppy drives, so there!

At present the only ROM software available is the Matrix pack, though I expect more sci/tech packages will emerge in due course.

Conclusions

Although I may appear to have been harsh in my criticism of the RAM file system, I still found the '9000 a likeable machine. In the weeks during which it sat on my office desk it found constant use as a calculator and for trying small programs and it took up so little room that one forgot it was there. For the biochemist it could gobble up statistics or for the engineer take the agony out of eigenfunctions. If Casio does decide to introduce it here it is likely to be considerably cheaper than any comparable device, but I think that many professional users will want disks rather than RAM packs.

Benchmark timings

BM1	2.5
BM2	9.0
BM3	24.0
BM4	24.0
BM5	26.0
BM6	42.0
BM7	60.0
BM8	36.5

All timings in seconds

SPECIFICATIONS

Processor:	Z80-compatible, 2.75 MHz
Memory:	4k RAM expandable to 32k (up to 16k non-volatile CMOS). 12k ROM expandable to 24k.
Display:	5.5in green CRT, 32x16 characters, 255x127 dots for graphics
Cassette:	User's own cassette or reel-to-reel with remote control, requires OP-1 expansion unit.
Keyboard:	Calculator-style, 67 keys inc numeric pad and four cursor controls, upper case only and single-stroke Basic words.
Ports:	OP-1 expansion has parallel and serial printer ports plus phono cassette. OP-2 (not tested) adds RS232.
Language:	CA-Basic in ROM, Extended Matrix Basic in ROM.

GEMINI MULTIBOARD

and ordered access to machine code routines. The CPU board requires only a power supply to operate in this form.

The user who would like to drive the system from a terminal via the RS232 port is at present only partly catered for as the RS232 port must start at 300 baud and is initially configured for input to the CPU board only. The software to run a terminal could easily be written, but Gemini does not provide it.

In conclusion, I was most impressed with the behaviour of the Multiboard system; and the costs, board by board, compare very favourably with the equivalents for the S100 bus.

Prices

CPU board	£125.00
RAM board	£140.00
Video board	£140.00
Disk controller	£140.00
ROM board	£65.00
EPROM programmer	£29.50
Keyboard	£57.50
Pertec twin disk drives, cased	£550.00
Veroframe box	£32.50
Kenilworth case	£49.50

The multiboard system as reviewed is also available as a complete, cased unit for £1450

All prices exclude VAT.

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ZX81
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from pg187

```
390 @"    4  A semi","5  Terraced","6  A bungalow"
400 @"    7  A flat","8  A cottage","9  A cave" : @
410 INPUT"What's your choice? ",A$
460 A1=VAL(A$) : IF A1=0 OR A1<1 OR A1>9 THEN 410
490 @ : @"Now tell me which price range this place is in:"
500 @ : @"       1  Under 10,000 pounds"
510 @"        2  10,000 to 20,000"
520 @"        3  20,000 to 30,000"
530 @"        4  Over 30,000"
540 @ : INPUT"Enter the appropriate number: ",A$
550 A2=VAL(A$) : IF A2<1 OR A2>4 THEN 540
560 @CHR$(12);
600 IF A1=7 THEN 690
610 @"Now think of the garden and give me:" : @
620 INPUT"The number of large trees there: ",A$
630 A3=VAL(A$) : IF A3=0 THEN 620
635 INPUT"Now tell me how many small trees there are: ",A$
640 A4=VAL(A$) : IF A4=0 THEN 635
645 INPUT"And how many bushes are there? ",A$
650 A5=VAL(A$) : IF A5=0 THEN 645
670 IF A1<3 AND A2>3 AND A3>100 OR A1=9 AND A2<>1 AND A3>50 THEN 2300
680 @CHR$(12);
690 @"OK, now I'd like you to envisage a cup.  Is it:"
700 @ : @"       1  Decorative" : @"       2  Plain"
710 @"       3  Squarish" : @
720 INPUT"Well? ",A$
730 A6=VAL(A$) : IF A6<1 OR A6>3 THEN 720
740 @ : @"Is there a saucer with the cup? "
750 INPUT"Type 'Y' for YES, 'N' for NO: ",A3$
760 IF A3$<>"Y"AND A3$<>"N"THEN 750
770 @ : @"As you look at the cup, is the handle on the right,"
780 @"left or centre?"
790 INPUT"Type 'R', 'L' or 'C': ",A1$
800 IF A1$<>"R"AND A1$<>"L"AND A1$<>"C"THEN 790
805 @CHR$(12);
810 @ : @"Is the cup:"
820 @"       1  Empty" : @"       2  Half full" : @"       3  Full".
830 @ : INPUT"Well? ",A$ : A8=VAL(A$) : IF A8<1 OR A8>3 THEN 830
1010 @CHR$(12);
1020 @"Now, think of a stream.  Is it:"
1030 @ : @"       1  Deep and murky"
1040 @"       2  Shallow and clear"
1050 @ : INPUT"Well? ",A$ : A9=VAL(A$) : IF A9<1 OR A9>2 THEN 1050
1060 @ : @"Are there any bridges and/or stepping-stones across"
1070 @"the stream?"
1080 INPUT"Type 'Y' for YES, 'N' for NO: ",A2$
1090 IF A2$<>"Y"AND A2$<>"N"THEN 1080
1170 @CHR$(12);
1180 @"Now imagine a 14ft high wall.  How would you get to"
1190 @"the other side of it?" : @"       1  Walk"
1200 @"       2  Climb" : @"       3  Use a rope"
1210 @"       4  Use a ladder" : @"       5  Stand on a box"
1220 @"       6  Jump over" : @"       7  Smash through"
1230 @"       8  Fly over" : @
1240 INPUT"Type the appropriate number: ",A$
1250 A0=VAL(A$) : IF A0<1 OR A0>8 THEN 1240
1260 @CHR$(12); : @"Having reached the other side of the wall,"
1270 @"you find yourself face to face with a large and"
1280 @"very angry bear.  Would you:" : @
1290 @"       1  Stay put and let it kill you quickly"
1300 @"       2  Try to run away from it"
1310 @"       3  Try to fight the bear"
1320 @
1330 INPUT"Type the appropriate number: ",A$
1340 B1=VAL(A$) : IF B1<1 OR B1>3 THEN 1330
1350 ON ERROR GOTO 1400
1360 SET 5,80 : @CHR$(12); : @"Thank you - that was most interesting!"
1370 @"Just a moment while I think about this."
1380 INPUT" ",A$
1385 SET 5,0
1400 @CHR$(12);
1510 REM CUP
1520 F=A6+11
1530 GOSUB 2240
1540 @"You are ";G$;" person."
1550 REM SAUCER
1560 IF A3$="Y"THEN F=15
1570 IF A3$="N"THEN F=16
1580 GOSUB 2240
```

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PROGRAMS

```
1590 @"There is ";G$;" person in your life."
1600 REM CUP  FULL
1610 IF A3$="N"THEN 1690
1620 IF A8>1 THEN 1650
1630 @"You do not love this person."
1640 GOTO 1690
1650 IF A8=3 THEN 1680
1660 @"You do not love this person very much."
1670 GOTO 1690
1680 @"You love this person."
1690 REM  HANDLE
1700 IF A1$<>"R"THEN 1740
1710 F=18
1720 J$="You are probably "
1730 GOTO 1770
1740 IF A1$="L"THEN F=19
1750 IF A1$="C"THEN F=20
1760 J$="You may be "
1770 GOSUB 2240
1780 @J$;G$;"."
1790 REM BRIDGES
1800 IF A2$="N"THEN 1830
1810 @"You may have - or have had - a problem such as"
1820 @"  serious illness in your life."
1830 REM HOUSE  &  PRICE
1840 T=0
1850 IF A1<3 OR A1>8 THEN F=A1
1860 IF A1>2 AND A1<9 THEN F=(A2+2)
1870 T=T+1
1880 GOSUB 2240
1890 @"You are ";G$;"."
1900 IF T=2 OR A1>8 OR A1<7 THEN 1930
1910 F=A1
1920 GOTO 1870
1930 REM GARDEN
1940 IF A1=7 THEN 2070
1950 IF A3<=10 THEN F=10
1960 IF A3>10 THEN F=11
1970 GOSUB 2240
1980 @"You have ";G$;" close friends."
1990 IF A4<=10 THEN F=10
2000 IF A4>10 THEN F=11
2010 GOSUB 2240
2020 @"You have ";G$;" friends."
2030 IF A5<=10 THEN F=10
2040 IF A5>10 THEN F=11
2050 GOSUB 2240
2060 @"You have ";G$;" acquaintances."
2070 REM STREAM
2080 F=A9+20
2090 GOSUB 2240
2100 @"You find it ";G$;" to see through your problems."
2110 REM BEAR
2120 IF B1=1 THEN F=27
2130 IF B1>1 THEN F=28
2140 GOSUB 2240
2150 @"You tend ";G$;" give in easily."
2160 REM WALL
2170 IF A0=1 THEN F=23
2180 IF A0>1 AND A0<6 THEN F=24
2190 IF A0>5 AND A0<8 THEN F=25
2200 IF A0=8 THEN F=26
2210 GOSUB 2240
2220 @G$;"."
2230 @ : INPUT"Press RETURN when you've read this. ",A$
2235 @CHR$(12); : GOTO 2500
2240  FOR I=1 TO F
2250  READ K$
2260  NEXT I
2270 G$=K$
2280 RESTORE
2290 RETURN
2300 @CHR$(12);
2310 @"Look, you don't appear to be taking this very seriously."
2320 @"Do you want to continue?" : @
2330 INPUT"Type 'Y' for YES or 'N' for NO: ",B$
2340 IF B$<>"Y"AND B$<>"N"THEN 2330
2350 IF B$="N"THEN 2500
2360 GOTO 680
2500 @ : END
```

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PET Haemophilia Simulation

By B Thorpe

```
100 FOR I=1TO4
110 READ S$(I)
120 NEXT
130 DATA "XY","XX","[RVS]X[OFF]Y","[RVS]X[OFF]X"
140 PRINT"[CLS]     TRANSMISSION OF HAEMOPHILIA"
150 PRINT"     [8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8]
[8][8][8][8][8][8]"
160 PRINT"[CD][CD][CD]TO LEAVE OUT INTRODUCTION PRESS 'P',"
170 PRINT"[CD]OTHERWISE ANY LETTER."
180 GET A$:IF A$="" THEN 180
190 IF A$<>"P" THEN GOSUB 1660:GOTO 480
200 REM
210 REM EXPLANATION IN DATA STATEMENTS FOR METAPRINTING ROUTINE IN 20000-
220 REM
230 GOTO500
240 DATA "[H]AEMOPHILIA IS CAUSED BY A  DEFECTIVE"
250 DATA "X CHROMOSOME  RESULTING IN THE BLOOD"
260 DATA "HAVING A POOR CLOTTING ABILITY."
270 DATA "[T]HIS MEANS A DISTRESSING TENDENCY"
280 DATA "TO LOSE MUCH BLOOD FROM RATHER"
290 DATA "INSIGNIFICANT CUTS, AND MORE"
300 DATA "SERIOUSLY, TO BLEED INTERNALLY FROM"
310 DATA "BODY BLOWS."
320 DATA "   "
330 DATA "[I]N THE FOLLOWING SIMULATION, YOU CAN"
340 DATA "MATE THE CHILDREN OF TWO FAMILIES;"
350 DATA "THE MOTHER OF ONE IS A CARRIER, THE"
360 DATA "PARENTS OF THE OTHER ARE NORMAL."
370 DATA "[I]T IS USEFUL TO MATE THE SAME CHILDREN"
380 DATA "MORE THAN ONCE, TO OBSERVE THE "
390 DATA "OPERATION OF THE LAWS OF CHANCE."
400 DATA "[N]OTE:  UNLESS BOTH X CHROMOSOMES ARE"
410 DATA "DEFECTIVE, GIRLS CARRY BUT DO NOT "
420 DATA "SUFFER THE DISABILITY; BOYS, HAVING"
430 DATA "JUST ONE X CHROMOSOME, ARE AFFECTED IF"
440 DATA "THE MOTHER TRANSMITS A FAULTY ONE."
450 DATA "   "
460 DATA "PRESS ANY KEY TO GO ON"
470 DATA "END"
480 GET A$:IF A$="" THEN 480
490 POKE 59468,12
500 X=RND(-TI):  PRINT"[CLS]     TRANSMISSION OF HAEMOPHILIA"
510 PRINT"     [8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8][8]
[8][8][8][8][8][8]"
520 PRINT:PRINT:PRINT
530 REM
540 REM PRINTS PARENTS OF 2 FAMILIES
550 REM
560 PRINTTAB(5);"JOHN[C][C][C][C]MARY";TAB(25);"PHIL[C][C][C][C]JOAN"
570 PRINTTAB(5);" XY    [T]  [RVS]X[OFF]X";TAB(25);" XY    [T]  XX"
580 PRINTTAB(5);"       [T]";TAB(25);"       [T]"
590 PRINTTAB(5);"[E][E][E][E][E][E][E][E][E][E][E][E]";TAB(25);"[E][E][E][E][E]
[E][E][E][E][E][E][E]"
600 REM
610 REM PRINTS 2X4 VERTICAL LINES
620 REM
630 T=4
640 FOR J=1TO30 STEP 4
650 PRINTTAB(T+J);"[B]";
660 IF J=13 THEN T=8
670 NEXT
680 PRINT
690 GOSUB 1320 NORMAL CHILDREN
700 GOSUB 1520 H-CHILDREN
710 REM
720 REM CHILDREN BECOME NEW PARENTS
730 REM READY FOR LINE 1310
740 REM
750 FOR I=1 TO 8
760 P$(I)=C$(I)
770 NEXT
780 REM
790 REM PRINTS NEW GENERATION OF 4
800 REM CHILDREN FOR EACH FAMILY
810 REM
820 T=3:C=0
830 FOR J=1 TO 30 STEP 4
840 C=C+1
850 PRINT TAB(T+J);C$(C)
860 PRINT TAB(T+J)C
870 IFJ=13 THEN T=7
880 PRINT"[CU][CU][CU]"
890 NEXT
900 PRINT"[CD][CD][CD]ENTER NUMBERS OF PAIR TO BE MATED;"
910 PRINT"EG. 18 FOR 1 AND 8 . IF ALL CHILDREN ARE"
920 PRINT"SAME SEX, TYPE 'R'.   ";
930 INPUT"   [?][CL][CL][CL]";Q$
940 IF Q$="[?]" THEN GOSUB1450:GOTO900
950 IF Q$="R" THEN 500
```

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PROGRAMS

```
960 A=VAL(LEFT$(Q$,1)):B=VAL(RIGHT$(Q$,1))
970 IF RIGHT$(P$(A),1)<>RIGHT$(P$(B),1) THEN 1010
980 PRINT"[CD]STERILE MATCH: TRY AGAIN!"
990 FOR XX=1TO500:NEXT
1000 GOSUB 1450:GOTO 900
1010 IF B<5 THEN PRINT"HIGHLY IRREGULAR, BUT....":FORXX=1TO500:NEXT
1020 GOSUB 1450 CLEAR LOWER SCREEN
1030 REM
1040 REM PRINTS EXTENDED FAMILY TREE
1050 REM
1060 PRINT
1070 PRINTTAB(15);A;TAB(21);B
1080 PRINT TAB(15);P$(A);"[C][C][C][C]";P$(B)
1090 PRINT TAB(19)"[T]"
1100 PRINT TAB(13);"[C][C][C][C][C][C][C][C][C][C][C][C]"
1110 PRINT TAB(13);"[T]   [T]   [T]   [T]"
1120 IF LEFT$(P$(A),2)<>"[RVS]X"THEN GOSUB 1320:GOTO 1180
1130 REM (AVOIDS N-PARENTS > H-CHILDREN)
1140 GOSUB 1520 H-CHILDREN
1150 REM
1160 REM THIRD GENERATION
1170 REM
1180 FOR K=S TO F
1190 PRINT TAB(12);C$(K);"  ";
1200 NEXT K
1210 PRINT
1220 PRINT"[CD][CD][CD]PRESS 'M' FOR ANOTHER MATING,"
1230 PRINT"OR 'R' FOR NEW CHILDREN"
1240 GET A$:IF A$="" THEN 1240
1250 IF A$="R" THEN 500
1260 IF A$="M" THEN GOSUB1450
1270 IF A$<>"R" AND A$<>"M" THEN 1240
1280 GOTO 900
1290 STOP
1300 REM SUBROUTINES
1310 REM
1320 REM NORMAL OFFSPRING
1330 REM 50/50 CHANCE BOY/GIRL * LAST HALF OF C$() STORES 4 N-CHILDREN
1340 REM
1350 S=5:F=8
1360 FOR K=5 TO 8
1370 IF RND(1)>.5 THEN Z=2:GOTO1390
1380 Z=1
1390 C$(K)=S$(Z)
1400 NEXT K
1410 RETURN
1420 REM
1430 REM CLEAR LOWER SCREEN
1440 REM
1450 PRINT"[HOME][CD][CD][CD][CD][CD][CD][CD][CD][CD][CD][CD]"
1460 FOR Y=1TO12
1470 PRINT"                                      "
1480 NEXT
1490 PRINT"[HOME][CD][CD][CD][CD][CD][CD][CD][CD][CD][CD][CD]"
1500 RETURN
1510 REM
1520 REM BLEEDERS/CARRIERS
1530 REM 4 CHILDREN (1/4 CHANCE OF H-CHILD) STORED IN 1ST HALF OF C$()
1540 REM
1550 S=1:F=4
1560 FOR K=1 TO 4
1570 R=INT(RND(1)*4)+1
1580 IF R=3 AND P$(A)=S$(R) AND P$(B)<>S$(4) THEN 1570
1590 REM AVOIDS H-FATHER+N-MOTHER > H-SON (IMPOSSIBLE)
1600 C$(K)=S$(R)
1610 NEXT
1620 RETURN
1630 REM
1640 REM METAPRINTING ROUTINE
1650 REM
1660 PRINT"[CLS]":POKE 59468,14
1670 READ L$
1680 IF L$="END"THEN 1790
1690 P$=L$
1700 GOSUB 1720
1710 GOTO 1670
1720 LX=LEN(P$)
1730 IF LX/2<>INT(LX/2)THEN P$=P$+CHR$(32):LX=LX+1
1740 FOR IX=1 TO LX/2
1750 PRINTTAB(20-IX)MID$(P$,LX/2+1-IX,1)CHR$(145)
1760 PRINTTAB(19+IX)MID$(P$,LX/2+IX,1)CHR$(145)
1770 NEXT IX
1780 PRINT
1790 RETURN
```

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PROGRAMS

TRS-80 Extra

By Francis Butters

```
10 '    TAB
20 '
30 CLEAR500
40 GOSUB110
50 FORX=1TO55:LPRINTCHR$(138):NEXT
60 GOSUB110
70 FORX=1TO7:LPRINTCHR$(138):NEXT:END
80 '
90 '    PRINTING GOSUB
100 '
110 A=10:LPRINTSTRING$(3,32);:FORX=1TO7:LPRINTSTRING$(2,32)"5"STRING$(3,32)A;:A=
A+10:NEXT:LPRINTCHR$(13)
120 FORX=1TO8:LPRINT"*"STRING$(9,".");:NEXT
130 RETURN
```

PC1211 Exam Questions

By J Chaplin

```
  1:PRINT "NOT A
     VALID":
    PRINT "ANSWE
    R-TRY AGAIN"
    :GOSUB 4
  2:GOSUB 4:
    INPUT B:IF (
    B>3)+(B<1)
    GOTO 1
  3:PRINT "YOUR
    ANSWER-";B:
    GOSUB 4:
    RETURN
  4:FOR F=1TO 3:
    PRINT " ":
    NEXT F:
    RETURN
  5:PRINT A;"WHA
    T IS LETTER"
    :RETURN
  6:"A"D=0:PRINT
    "AFTER EACH
    REPLYPRESS /
    ENTER/.":
    PRINT "SIGN
    YOUR NAME  H
    ERE":GOSUB 4
  7:PRINT "AND E
    NTER YOUR  N
    UMBER:-":
    INPUT L:
    PRINT L:
    PRINT "ANSWE
    R EACH     Q
    UESTION BY
  8:PRINT "TYPIN
    G 1,2 OR 3":
    PRINT "UNLES
    S A WORD   I
    S ASKED FOR"
    :GOSUB 4
 10:FOR A=1TO 7:
    G=10*(A+1):H
    =G+1:GOSUB G
    :GOSUB H:IF
    B=CLET P=1:
    GOTO 14
 12:P=0
 14:A(17+A)=P:
    NEXT A:GOTO
    250
 20:C=2:RETURN
 21:PRINT A;" TH
    E CALLING  A
    ND DISTRESS
       CHANNEL I
    S:":PRINT "(
    1) 12":PRINT
    "(2) 16":
    PRINT "(3) 2
    8"
 22:GOSUB 2:
    RETURN
 30:C=3:RETURN
 31:PRINT A;"THE
     COASTGUARDC
    HANNEL IS:":
    PRINT "(1)
    8":PRINT "(2
    ) 27":PRINT
    "(3) 67":
    GOSUB 2:
    RETURN
 40:C=1:RETURN
 41:PRINT A;" CH
    ANNEL 4 IS (
    1) PUBLIC
       CORRESPON
    DENCE  (2)SH
    IP TO SHORE
 42:PRINT "(3)SH
    IP TO SHIP":
    GOSUB 2:
    RETURN
 50:C=1:RETURN
 51:PRINT "IN TH
    E INTERNAT.P
    HONETIC ALPH
    ABT":GOSUB 5
    :PRINT "D":
    GOSUB 4
 52:INPUT O$:B=0
    :PRINT "YOUR
     ANS.";O$:IF
    O$="DELTA"
    LET B=1:
    GOSUB 4:
    RETURN
 60:C=1:RETURN
 61:GOSUB 5:
    PRINT "R":
    GOSUB 4:B=0:
    INPUT O$:
    PRINT "YOUR
    ANS.";O$:IF
    O$="ROMEO"
    LET B=1:
    GOSUB 4:
    RETURN
 70:C=3:RETURN
 71:PRINT A;" WH
    AT IS THE  F
    REQUENCY(MHZ
    )  OF CH.16?
    ":PRINT "(1)
     156.25":
    PRINT "(2) 1
    56.35"
 72:PRINT "(3) 1
    56.8":GOSUB
    2:RETURN
 80:C=3:RETURN
 81:PRINT A;" TH
    E MAXIMUM  T
    RANSMITTER
       POWER IS"
    :PRINT "(1)
     5 WATTS
    (2) 10 WATTS
 82:PRINT "(3) 2
    0 WATTS":
    GOSUB 2:
    RETURN
250:PRINT "ANY C
    ORRECTIONS?Y
    /N":INPUT I$
260:IF I$="Y"
    GOTO 280
270:PRINT "EXAM
    OVER!":END
280:PRINT "QUEST
    ION NO?":
    INPUT J:
    PRINT "Q.";J
    :IF (J=4)+(J
    =5)LET G=10*
    (J+1):A=J:
    GOSUB G:G=G+
    1:GOSUB G:K=
    B:GOTO 285
281:GOSUB 10*(J+
    1):PRINT "AN
    SWER?":INPUT
    K:PRINT K:
    GOTO 285
285:IF K=CLET P=
    1:GOTO 300
290:P=0
300:A(17+J)=P
310:PRINT "ANY O
    THERS?Y/N":
    INPUT I$:IF
    I$="Y"GOTO 2
    80
320:GOTO 270
500:"B"FOR J=1TO
    7:D=D+A(17+J
    ):NEXT J
510:PRINT USING
    "####";100D/
    7;"% RIGHT"
520:PRINT "WRONG
     ANS.":FOR A
    =1TO 7
530:IF A(17+A)=0
     PRINT A
540:NEXT A
545:PRINT USING
    ;"EXAM NO.";
    L
550:END
```

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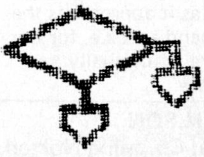

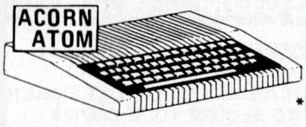

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PET Cheese

by Paul Bradshaw

A game to run on 'new ROM' or 'Basic 4.0' PETs in 8k.
Instructions are in the game.

```
120 A=RND(0)
130 Z$="000000":HS$="00000"
140 GOSUB1180:REM * INSTRUCTIONS *
150 GOSUB640:REM * READ MOVEMENT DATA *
160 PRINT"□"
170 GOSUB1390:REM * INSTAL MACHINE CODE *
180 CC=18:REM * CHEESE COUNTER *
190 GOSUB480:REM * INITIAL DISPLAY *
200 POKE59464,0:POKE59467,16:POKE59466,15:REM * INIT. SOUNDBOX *
210 REM *** INITIAL CAT POSITION ***
220 C=32768+INT(RND(1)*1000):IFPEEK(C)<>32THEN220
230 POKE16,INT(C/256):POKE15,C-256*PEEK(16):POKEC,81
240 POKE177,2:REM * 2=CAT SPEED-CAN BE ALTERED *
250 SYS826:REM * INIT. MACHINE CODE FOR CAT MOVEMENT *
260 MC=0:SC=0
270 FORDL=1TO1000:NEXT
280 GOSUB740:MD=0:F=0:Z=M:M=M-M(D)
290 REM *** INITIAL WARNING ***
300 MC=MC+1:FORJ=1TO50:POKEZ,160:POKEZ,96:POKE59464,200-J*2:NEXT
310 POKE59464,0
320 REM *** MOVE MOUSE ***
330 Z=M:M=M+M(D):MD=MD+1
340 IFPEEK(M+1)=32ANDRND(1)>.98THENM=M+1
350 IFPEEK(M+1)=160ANDPEEK(M)<>160THENM=M+1
360 IFPEEK(M-1)=160ANDPEEK(M)<>160THENM=M-1
370 IFPEEK(M)=32THEN440
380 IFPEEK(M)=81THENPOKEZ,32:GOSUB790:GOTO270
390 IFPEEK(M)<>160THEN430
400 POKEZ,32:POKEM,32:CC=CC-1:GOSUB910
410 IFCC=0THEN1030
420 GOTO270
430 IFPEEK(M)=255THENGOSUB980:M=Z:GOTO330:REM * REBOUND *
440 IFF=1THENPOKEZ,32:REM * DELETE OLD MOUSE *
450 F=1
460 POKEM,46:REM * INSERT NEW MOUSE *
470 GOTO330
480 REM *** INITIAL DISPLAY ***
490 PRINT"□"
500 FORJ=32768TO32807
510 POKEJ,255:POKEJ+40,255:POKEJ+920,255:POKEJ+960,255
520 NEXT
530 FORJ=32768TO33728STEP40
540 FORK=0TO2
550 POKEJ+K,255:POKEJ+39-K,255
560 NEXT
570 NEXT
580 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒";
590 FORJ=1TO3
600 PRINTTAB(17)"▒
610 NEXT
620 PRINT"▒"TAB(6)"▒SCORE: 00000      HIGH: "HS$
630 RETURN
640 REM *** READ MOVEMENT DATA ***
650 FORJ=1TO4:READM(J):NEXT
660 DATA39,41,-39,-41
670 REM *** READ SOUND EFFECTS DATA ***
680 FORJ=1TO4:READS(J):NEXT
690 DATA254,200,170,127
700 REM *** REBOUND DATA ***
710 R(1)=2:R(2)=1:R(3)=4:R(4)=3
720 Q(1)=4:Q(2)=3:Q(3)=2:Q(4)=1
730 RETURN
740 REM *** RANDOM MOUSE STARTING POSITION AND DIRECTION ***
750 IFRND(1)>.5THENM=32851+INT(RND(9)*34)-800*(RND(1)>.5):GOTO770
760 M=32851+INT(RND(1)*21)*40-33*(RND(1)>.5)
770 D=INT(RND(1)*4+1):IFPEEK(M+M(D))<>32THEN770
780 RETURN
790 REM *** MOUSE EATEN ***
800 FORJ=1TO4
810 POKE59464,S(J)
820 FORK=1TO50:NEXT
830 NEXT
840 POKE59464,0
850 S1=INT((SC+450-MD*5)/10)*10
860 IF S1>SCTHENSC=S1
870 S$=MID$(STR$(SC),2)
880 L=LEN(S$):IFL<5THENS$=LEFT$(Z$,5-L)+S$
890 PRINT"▒"TAB(6)"▒SCORE: "S$"      HIGH: "HS$
900 RETURN
910 REM *** CHEESE EATEN ***
920 FORJ=0TO200STEP20
930 POKE59464,J
940 FORK=1TO10:NEXT
950 NEXT
960 POKE59464,0
970 RETURN
980 REM *** REBOUND ***
990 POKE59464,128
```

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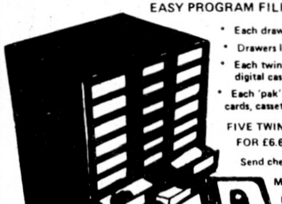

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```
1000 IF(M-32850)/40=INT((M-32850)/40)OR(M-32885)/40=INT((M-32885)/40)THEN1020
1010 D=Q(D):POKE59464,0:RETURN
1020 D=R(D):POKE59464,0:RETURN
1030 REM *** GAME OVER ***
1040 POKE59467,0:REM * DEACTIVATE SOUNDBOX *
1050 SYS849:REM * DISABLE CAT *
1060 FORDL=1TO2500:NEXT
1070 PRINT"J"TAB(12)"*** GAME OVER ***
1080 PRINT"QQ"TAB(5)"ALL THE CHEESE HAS BEEN EATEN!"
1090 PRINT"QQ"TAB(12)"YOUR SCORE:"SC
1100 IFSC>HSTHENHS=SC
1110 HS$=MID$(STR$(HS),2)
1120 IFLEN(HS$)<5THENHS$=LEFT$(Z$,5-LEN(HS$))+HS$
1130 PRINT"Q"TAB(12)"HIGH SCORE:"HS
1140 PRINT"QQ"TAB(6)"PRESS ANY KEY TO PLAY AGAIN.
1150 POKE158,0
1160 GETH$:IFH$=""THEN1160
1170 GOTO180
1180 REM *** INSTRUCTIONS ROUTINE ***
1190 PRINT"J"TAB(17)"CHEESE":PRINTTAB(17)"‾‾‾‾‾‾"
1200 PRINT"QQTHE OBJECT OF THE GAME IS TO PREVENT
1210 PRINT"QTHE MICE ('.') REACHING THE CHEESE.
1220 PRINT"QQYOU CONTROL A CAT ('●') AND MAY MOVE IT
1230 PRINT"QWITH THE KEYS 8 (UP), 2 (DOWN), 4 (LEFT)
1240 PRINT"AND 6 (RIGHT). TO CATCH A MOUSE YOU MUST
1250 PRINT"INTERCEPT IT, IN WHICH CASE IT WILL RUN
1260 PRINT"QINTO YOUR JAWS.
1270 PRINT"QQPRESS SPACE TO CONTINUE...
1280 GETH$:IFH$<>" "THEN1280
1290 PRINT"JTHE GAME ENDS WHEN ALL THE CHEESE HAS
1300 PRINT"QBEEN EATEN. YOU SCORE POINTS FOR EACH
1310 PRINT"QMOUSE YOU EAT: THE QUICKER YOU EAT A
1320 PRINT"QMOUSE, THE MORE YOU SCORE FOR IT.
1330 PRINT"QQPLUG IN A SOUNDBOX IF YOU HAVE ONE!
1340 PRINT"QQPRESS 'R' TO READ THE INSTRUCTIONS AGAIN
1350 PRINT"OR SPACE TO BEGIN THE GAME..."
1360 GETH$:IFH$<>" "ANDH$<>"R"THEN1360
1370 IFH$="R"THEN1180
1380 RETURN
1390 REM *** INSTAL MACHINE CODE ***
1400 REM    (USED FOR CAT MOVEMENT)
1410 S=0:FORJ=826TO1002
1420 READX:POKEJ,X:S=S+X:NEXT
1430 IFS<>20252THENPRINT"JTYPING ERROR: RECHECK LAST 23 LINES.":END
1440 RETURN
1450 REM *** MACHINE CODE ***
1460 DATA165,177,133,0,120,165,144,133
1470 DATA192,165,145,133,193,169,226,133
1480 DATA144,169,3,133,145,88,96,120
1490 DATA165,192,133,144,165,193,133,145
1500 DATA88,96,173,18,232,201,239,208
1510 DATA16,169,0,141,75,232,165,192
1520 DATA133,144,165,193,133,145,108,192
1530 DATA0,198,0,208,249,165,177,133
1540 DATA0,165,15,133,1,165,16,133
1550 DATA2,165,151,201,18,240,15,201
1560 DATA42,240,25,201,41,240,34,201
1570 DATA50,240,39,108,192,0,165,1
1580 DATA24,105,40,133,1,144,2,230
1590 DATA2,76,199,3,198,1,165,1
1600 DATA201,255,208,2,198,2,76,199
1610 DATA3,230,1,208,2,230,2,76
1620 DATA199,3,165,1,56,233,40,133
1630 DATA1,176,2,198,2,160,0,177
1640 DATA1,201,32,208,16,169,32,145
1650 DATA15,165,1,133,15,165,2,133
1660 DATA16,169,81,145,15,108,192,0
1670 DATA160,0,169,81,145,15,76,92
1680 DATA3
READY.
```

ACT Sirus 1

Continued from page 109

this price range and indeed, given that the Sirius will have communications packages available to facilitate links to other computers, it would make a very cost-effective alternative to an ordinary graphics terminal.

Programmers will love the Sirius, too, as there's so much which is directly under software control and so many interesting features to liven up otherwise rather boring applications packages. I sincerely hope that programmers will make the effort to produce packages for MSDOS, if it's as good as it's said to be, instead of taking the easy way out and converting 8-bit CP/M packages to run under CP/M-86. And I'll give a free year's subscription to *PCW* to the first person to write a program which plays a recognisable tune of more than 20 seconds' duration on the disk drives!

Future expansion

As I've already mentioned, users will be able to expand the RAM up to half a megabyte internally by plugging in 128k RAM cards and an external expansion unit will be available later in the year to take this up to the full megabyte. If you want more than that you'll have to wait for an 8086 machine but most people should find the basic 128k machine enough for many applications.

Double-sided floppy drives will be offered as an option, but many will probably prefer to wait until a promised 10 Mbyte winchester drive becomes available — this will directly replace one of the floppy drives and sit inside the main cabinet. A tape streamer for backing up the hard disk is also mentioned in the preliminary Sirius documentation.

Two add-ons are already in the pipeline: a clock card, due to be announced at this Spring's Hanover Trade Fair, and a thing called a Mouse, apparently a little box which you push around on a table top to move the cursor around the screen; this should also be on show at Hanover. A graphics tablet will also be developed and should be available in the second half of this year.

Other hardware add-ons mentioned in the Sirius documentation but as yet unscheduled include a modem card, a colour display and a network interface card, although at the time of writing no decision had been taken as to which network will be used.

On the software side, all the major language and applications packages should be available by March this year, including MSDOS, a single-user, multitasking version of MP/M-86, a package to read CP/M-86 files from MSDOS and a package to allow the transfer of files, by direct hook-up, between the Sirius and the IBM Personal Computer — the Sirius is 'upwards compatible' from the IBM, says Chuck. Various communications packages, including TTY and Telex emulation and assorted big machine protocols (all right, IBM 3276 and 307B) are also on their way.

Summary

Chuck Peddle set out to design an office tool which would be easy to use, ergonomically satisfactory and provide 16-bit computing power at a low cost. He has succeeded; the Sirius is one of the few micros which has been designed completely with the user in mind and its astonishingly low cost (achieved by mass production) makes it about the best value for money on the micro market today.

Chuck perceives its market slot as slightly above the IBM Personal Computer, which, in the States, is being aimed at the very top end of the home market and the middle-to-low end of the business area. In Britain the IBM still isn't officially on sale; it is available from one enterprising importer at £2,700 for less memory (64k), smaller capacity disk drives and lower resolution graphics. It's likely that the machines which will really feel the pinch as a result of the Sirius are those such as the Apple III and the SuperBrain-type configurations, most of which are either more expensive or less powerful or offer fewer facilities, or all three.

As some computer manufacturers have found out the hard way, software sells hardware. The fact that ACT is importing the Sirius and selling it through its dealer network means that there should be a useful range of software available pretty quickly.

In summary, the Sirius is a neat, well-made machine with considerable potential and great appeal, especially in view of its very competitive price. If I were looking for a general purpose business micro, I'd be hard put to find an excuse for not putting this machine at the top of the list.

Prices

ACT Sirius 1 with 128k RAM, 1.2 Mbyte disk, CP/M-86, MSDOS, Basic-86, utilities, documentation	£2395
As above but with 256k RAM	£2890
With 512k RAM	£3890
125 cps, 132 col dot matrix printer	£695
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ACT Pulsar package	£295
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Technical specifications

CPU:	8088, 5 MHz
Memory	128k (64k dynamic RAM chips) internally expandable to 512 kbytes; external module to expand to 1 Mbyte
Keyboard	95 keys inc 7 prog function keys, numeric pad, cursor control, editing, screen & loudspeaker control, all software re-definable.
Screen	80 char x 25 lines; hi-res graphics, 800 x 400 bit-mapped, user-definable character sets.
Disk drives	2 x 5¼in single-sided, high density, 600 kbytes per unit.
Ports	1 Centronics/IEEE-488 printer port, 1 RS232 printer port, 1 RS232 communications port.
System Software	CP/M-86 and MSDOS
Languages	Basic 86; Graphics & character set packages. Assembler, Fortran, Cobol, Pascal, PL-I, Extended business Basic compiler, various applications software.

PROGRAMS

```
and SY(N)=576 AND S(N)=0
S(N)=1
```

Hopefully that should rectify any problems encountered with these. If you do discover a bug in a *PCW* program, please write to me — do *not* phone — explaining what the error is.

Now onto this month's offering. Basic Personality Test by Roy Peters would, I think, be perfect for breaking the ice at parties! The computer asks you some questions similar to those a psychiatrist would ask (nb, I'm not speaking from personal experience) and then gives you a personality analysis from your answers. It's written in Cromemco 16k Basic which is pretty standard apart from the following: it uses the @ sign for PRINT; PRINT CHR$(12) clears the screen; Cromemco Basic allows you to impose a time limit when awaiting an input: this is used in lines 1360-1380 to cause a delay of about ten seconds, giving the impression that the computer is thinking. This can be replaced by a FOR. . . NEXT loop; Strings have to be DIMensioned in Cromemco Basic — see lines 15 and 16 — which isn't necessary in many other Basics.

Recently I have had a fair number of requests for listings on programmable calculators. PC1211 Exam Questions by J Chaplin should fulfil some, at least, of those requests. It sets the user a number of questions and them marks them. Answers may be either numeric or alpha and a facility is included for the 'candidate' to correct (alter?) any answer. Shift 'A' starts the program and shift 'B' prints out the results and lists any incorrect answers. These particular questions relate to Marine VHF radio but they could be changed to suit any other subject. Seven questions of this particular length fill the available memory.

PET Haemophilia Simulation by B Thorpe is not a game for the sick-minded but is a demonstration of how the disease Haemophilia is passed from generation to generation. Full instructions are included in the program. It was written on a 'new ROM' PET but the POKE instructions are simply for shifting between upper and lower case on the screen. These can be omitted for 'old ROM' PETs. The listing was done on a printer that cannot cope with PET graphics, so [CU] = cursor up; [CD]= cursor down; [CR]=right; [CL]=left. A single number of letters in square brackets simply means the shifted version of that character.

Finally, a small program for TRS-80 users by Francis Butters. This one is for Tandy's Printer II (80 columns) but could easily be adapted for other machines — it's the thought that counts! It gives a numbered scale at the top and bottom of a specimen sheet of paper which means you can plan your tables and printouts and fitting in the tabs becomes simplicity itself.

Basic Personality Test

By Roy Peters

```
 15 SET 5,0 : DIM G$(30),K$(30)
 16 DIM J$(20)
 20 DATA"extremely ambitious"
 30 DATA"very ambitious"
 40 DATA"unambitious"
 50 DATA"semi-ambitious"
 60 DATA"ambitious"
 70 DATA"very ambitious"
 80 DATA"a solitary person with few or no friends"
 90 DATA"a contented person"
100 DATA"a contented, unambitious person"
110 DATA"few","many","an artistic","a practical"
120 DATA"a very logical","another","no other"
130 DATA"an illogical","heterosexual","homosexual"
140 DATA"bisexual","difficult","easy","You are lazy"
150 DATA"You do things the difficult way"
160 DATA"You are impractical"
170 DATA"You fantasize","to","not to"
300 @CHR$(12);
310 @TAB(16);"****PERSONALITY ANALYSIS****"
320 @ : @ : @
330 @"This personality is not a game - it should be used"
340 @"seriously.  However, please note that it does not"
350 @"claim to analyse you with perfect accuracy."
360 @ : INPUT"Press RETURN when you're ready...",A$
370 @CHR$(12); : @"First, I want you to envisage a house.  Is it:"
380 @ : @"  1  A castle","2  A mansion","3  Detached"
```

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CALCULATOR CORNER

Continued from page 99

the system I was using.

The area navigation programs had an irritating lack of order about them. Though the most urgently required output is the required track to destination, it was always necessary to calculate and display the distance first. A great deal of unnecessary accuracy had been built into the XY pairs specifying waypoint locations, which were calculated to ten significant figures. Other minor improvements suggested themselves, too, but of course the module programs cannot be altered. The area navigation program most commonly used was downloaded for study, and listed. Among the more interesting alterations made to it were the complete excision of 26 unnecessary steps and thanks to an idea suggested by N Harwood's article 'More Miles per Texan Stetson's (*PCW* November 1980), the XY pairs were data-packed to reduce data register requirements from 88 to 44. It slowed things down a little but the improvements made it well worthwhile.

As an aside, if any pilot is thinking of using Polar to Rectangular conversion for navigation purposes, a neat trap has been prepared for you. By mathematical convention, angles are measured anti-clockwise from the 12 o'clock position. To fool your calculator into giving you the right answer, change the sign of the bearing or angle and add 90 to it before starting. It will save you two-and-a-half days of frustration if precedent can be taken as a guide.

The system worked very well once I was used to it. While I could never prove quantitatively the value of the system, it was subjectively an obvious improvement. This was emphasised for me when an unexpected headwind left me too short of fuel to continue legally to my destination. An en-route refuelling stop was necessitated by the fuel shortage, but a last minute direct routing brought the destination just within lawful reach again. I would not have felt it prudent to guesstimate that last leg for stakes like that, but the confidence given me by the area navigation system made the decision to continue easy and well-justified. That day the TI-59 paid for itself and the printer several times over.

So, I was convinced, and I had found that there were several other obvious uses for it. By the end of the year I had written programs for the calculation of aircraft trim, for pre-flight fuel calculation and for a different kind of area navigation. But I had also found some fairly severe limitations of the system.

The TI-59 display is quite invisible in strong light — such as one commonly finds at 33,000ft. Its rechargeable battery is good for about three hours and my flights sometimes lasted four hours — one way. Card reading and writing was uncertain and often required several current-consuming attempts. Battery retaining clips broke off twice because they are not robust enough to take repeated use of the print cradle. Two or three identical digits would sometimes appear no matter how staccato I tried to make my data entry, due to the lack of keyboard debouncing.

The Aviation Module, too, has some limitations, partly in the programs themselves and partly in the concepts used in designing the whole package. Having once recovered from one's initial admiration at the range and number of the programs presented, it was possible to wonder why some of them had been written at all. There is a strong bias toward American-owned light twin-piston-engined aircraft, but it is apparently neither aimed exclusively at them, nor wholly satisfactory for any other category. The Aztec owner will be supremely uninterested in his new-found ability to calculate Mach number and any jet pilot will be frustrated by the trim calculations which allow him to calculate the effect of varying fuel load only if he uses petrol.

Sorriest of all, however, is the unnecessary clash of flags and data register allocations. With any type of navigation and any type of aircraft, the calculation of True Airspeed will sooner or later be required. If the Aviation Module is used for this purpose while area navigating, one flag and three data registers are overwritten, possibly ruining the area model. The rhumbline track and distance program

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CALCULATOR CORNER

(which is used to find the way between two positions spelled out in latitude and longitude) is even worse because it quite gratuitously wipes out all of the data registers and thus the all-important route model. These related functions ought to be capable of operating without mutual interference.

It was with these thoughts that I recommended to my company that the programmable calculator looked promising for the area navigation task. I had read Dick Pountain's description of the HP-41C (*PCW* April 1980) and discovered its larger brother the HP-41CV in the shops. This calculator had so many characteristics which improved on my TI-59 that I asked the airline to let me carry out a trial on it. The idea was to quickly translate a few of my existing programs into HPese, test them and try them out with some of my colleagues. After some very hard talking and an unusually successful demonstration flight I was given the money to buy two HP-41CVs, two card readers and a printer, with appropriate supporting stationery. With an astonished gasp or two, a colleague and I began work in June 1981, formally equipped and formally tasked (on an unpaid basis) to write a report by the end of October.

JIM WARREN

Continued from page 156

as a series of printed publications. The broadcast system will work by transmitting digital information to the programmable receivers which can be instructed to search for words and phrases of interest. In this way articles can be plucked out of the air to meet your specific needs. Data will be transmitted at 960cps — that's about 2500 newspaper pages per 24-hour day. This is more than all the daily information from AP, UPI and Reuters.

Jim is also quite passionate about the development of alcohol fuels as an alternative to petroleum. At the moment it's on the back burner (so to speak). He feels that there's no great profit in it but, since it has already been proved viable for personal transportation, we might one day be seeing private stills in people's back yards. Inevitably, I suppose, Jim is wondering whether to hold an alternative fuels fair. Why should Jim give away this idea? In his words: 'I want to see this occur. I don't care that much whether I do it or somebody else does, as long as it gets done. It's a potential service to the entire society and it needs to be done.'

So that's the story. Jim Warren has played a key part in a number of microcomputer industry developments — *Dr Dobb's Journal*, *Infoworld* and the West Coast Computer Faire. With signs that he will maintain his high profile in areas like data broadcasting and alternative fuel fairs, I'm sure we'll be seeing a lot more innovation from this incredible man.

The 1982 West Coast Faire will be held in San Francisco on 19, 20 and 21 March. Serious enquiries to: 333 Swett Road, Woodside, CA 94062. Telephone (415) 851 7075.

BOOKFARE

Continued from page 110

Wiley And Hayden

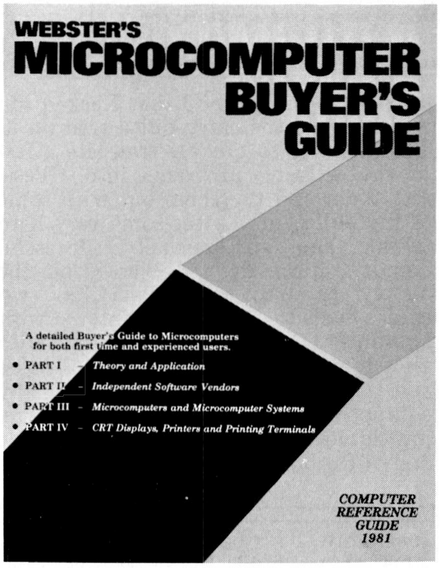
In October and December 1981 Bookfares I referred to three books published by the Hayden Book Company of New Jersey. If you had trouble finding them, it may be because I should have said they were distributed by John Wiley & Sons. Sorry, John.

The books were: *Problem Solving Principles for Basic Programmers* by William C. Lewis, *The Joy of Minis and Micros* by Philip Stain and Howard Shapiro, and *Beat the Odds* by Hans Sagan.

Please note, however, that there is a Heyden & Son publishing books in the UK, Germany and the US, such as one reviewed this month (note the different spelling of Heyden).

Buyer's Guide

About 75 per cent of the 300+ pages of *Webster's Microcomputer Buyer's Guide* is devoted to descriptions of specific American and Japanese microcomputer hardware and software. The rest of the book is a highly condensed, hardware-oriented introduction to microcomputing and microprocessing theory and applications.



The exclusion of British suppliers immediately reduces its value to UK readers. As the 1981 guide was published in the UK in November 1981, there are also inevitable omissions and out-of-date information. While the book provides a useful round up of the specs of many systems, it cannot be relied on to be comprehensive, accurate and up-to-date.

I recommend the Direct Access section of *Personal Computer World* for more relevant and more contemporary information on what's available. It may be more abbreviated than Webster's specs but it is cheaper and of more immediate use.

In this month's Bookfare were:
Face to File Communication — A psychological approach to information systems by Bruce Christie (John Wiley & Sons, £14.50)
Word Processing — A guide to typography, tests and in-house graphics by Rod Van Uchelen (Van Nostrand Rheinhold, £6.75 paperback, £12.70 hard)
Introducing Word Processing by G L Simons (National Computing Centre, £8.50)
Computer Acronyms, Abbreviations, ETC by Claude P Wrathall (Petrocelli/ Van Nostrand Rheinhold, £8.45 paperback, £14.90 hard)
Webster's Microcomputer Buyer's Guide by Tony Webster (Hayden Book Company/John Wiley & Sons, £19.50)

FRAMES OF REFERENCE

Continued from page 91

Micro systems companies

Some of the older software houses have set up micro divisions and some new specialist microsystems companies have emerged to market off-the-shelf equipment and packages, supply turnkey systems and develop special software and hardware. Because they take turnkey responsibility, microsystems companies are generally more alert to the frailties of equipment and software than distributors or shops. They frequently advise large companies' DP departments on selection and standards, as well as designing multiple micro and network systems. Microsystems companies order equipment to meet particular requirements, test systems on their own premises, install on the customer site, interface hardware and configure software, train and hand-hold users during the early days of micro computing. They are constantly evaluating new hardware and software and do not invest in bad products.

Maintenance companies

Maintenance companies are the last, vital link in the chain of micro supply. The best microcomputers are reliable but even these break down occasionally, while peripherals in heavy use break, invariably at inconvenient moments. Several maintenance companies cover microcomputers, including Computer Field Maintenance and DDT. Because engineers' time and travel is no cheaper than when maintaining bigger machines, the percentage costs can be higher — around 12–20 per cent per annum. Equipment is generally replaced while repair is effected. Return to depot with a 24-hour turnround at lower percentage cost is growing in popularity where micros are not on time-critical applications. It is sensible to have a single maintenance contract on peripherals and processors to avoid the 'it's not my processor, it's your peripheral' conflict.

Component supply problems

Some benefits associated with the component makeup of the industry are:

low cost, diversity of supply, variety of products, choice of suppliers. Problems include poor quality control, interfacing difficulties (hardware), configuring difficulties (software), confused and changing supply channels. Because of the exponential growth of the industry and the remoteness of manufacturers from their end users, a number of fly-by-night companies have grown up. But there *are* those who provide a quality of service almost disproportionate to the one-off value of the goods they are selling. Quality control is a serious problem at every level, especially when a new component is introduced.

It can take two years for the bugs in a new piece of hardware or software to be ironed out. A thorough hardware checkout procedure will isolate equipment which is, a) dead on arrival, b) fails after two hours running, or c) fails or intermittently fails after 48 hours' running. A micro systems company will isolate the third level during systems development. Once the system gets through 48 hours' running, micros record an average of two failures per annum. Warranties are all return to depot, normally 90 days, frequently parts only, but commercial pressures are gradually improving these provisions. Sharp introduced its personal computer system with a 12-month warranty and its example was quickly followed by Apple. Day one maintenance is recommended as an insurance against problems and the inconvenience of return to depot. As for interfacing and configuring, unless you have time and the hardware and software expertise, you should ask your supplier and be prepared to pay extra to configure a hardware and software system.

Future supply

Over the next few years, a number of suppliers will become established leaders in hardware. For example, Apple Computer recently had a spectacular success with its public quotation. At the same time, a few existing suppliers will successfully get to grips with the market, eg, IBM, DEC and HP. Serious, high quality software producers will grow on a vast market. And the '80s will see the establishment of microsystems houses, similar in structure to the major software houses established in the '70s but very different in operation as software products come to largely replace tailored programs.

The second commandment of microcomputing

The second commandment of microcomputing is: *Thou shalt choose the company thou keepeth.* Choose the supplier not the supplies. A good supplier will look after you. A bad supplier will mess up even good products and is never available when things go bang in the night. Educated buyers should be prepared to spend a few pounds more up front for good hardware, software and, especially, services rather than get caught in the bargain basements of shoddy suppliers. On this subject you will have to take up the cudgels with your purchasing department, who may be inclined to look at price only and are not concerned with the aggravation you may have after they have negotiated service out of the contract.

BLUDNERS

First, last month's BBC Computer Benchtest was attacked by gremlins who neatly removed an entire line from the top of the second column on page 112. It should have read: '. . . copy of the cassette, we passed straight. . .'

And no, omitting the phone number of the BBC Computer supplier wasn't a mistake: they cannot handle phone calls so *please don't ring us to ask for the number!*

Finally, a couple of bugs crept into the Cubic Spline Curve program on page 132 of December's issue. Line 6050 has a (visually) ambiguous character which is in fact a W. The line reads:

```
6050 W(0)=C(0) : FOR I=1 TO N :
W(I)= C(I)– D(I) * W(I–1)/V(I–1)) :
NEXT
```

Also, line 45080 should be modified to FOR I=0 TO 49 if 50 data points are required and the array F in line 10 needs dimensioning accordingly.

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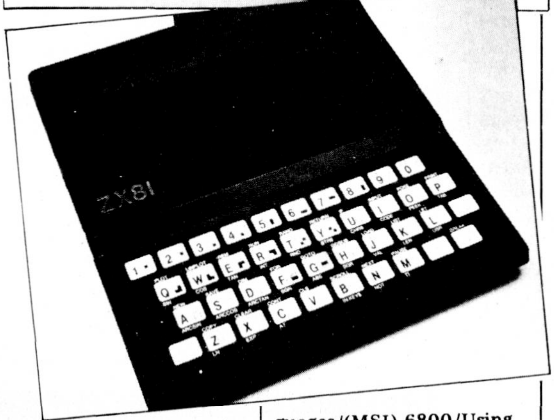

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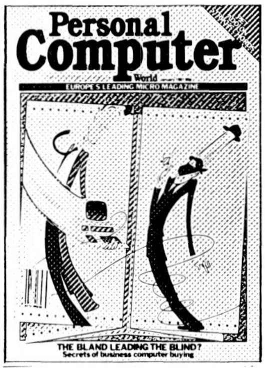
Benchtest: Compucolor II/Checkout: Heuristics Speech Lab/Testing Precognition/Pascal series — Part I/Programs: 6800 Time response, Apple memory test, Fx 201p spaceship, PET Orbit sim, PET digital clock, Acronyms.

Volume 3 No 6
June 1980
Benchtest: Tandy TRS-80 Model II/Benchtest: Sintrom Periflex 630/48 / Staff case study/Checkout: Softy Intelligent EPROM Programmer/Checkout: Exatron Stringy Floppy/Practical examples of the IEEE-488 bus use/Programs: Naming Nascom files, 380Z Pictures, Fuel tank calculations — PET, PET large numeral generator, PET tank battle, Basic string handling routines/Pascal: Final instalment.

Volume 3 No 12
December 1980
Benchtest: Microwriter/Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs: TRS-80 Tarot, PET Cat & Mouse, PET Rebound, MZ-80K Alligator Swamp, PET Connect, UK101 Minefield, PET Simon



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Benchtest: Transam Tuscan/Real-time control using trains — part 1/Recover from a data tape disaster/PET Music/Multi-user systems — part 1/Programs: TRS80 Four in a row, TRS80 Target Practice, PET Convoy, PET Wire, PET Maze Chase, PET Android Attack, PET Anagram

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Benchtest: Onyx C8002/Benchtest: Bigboard/Micro music software package/ALC circuit/Commons report/HP 34C/Programs: TRS80 Show Jumping, PET Grand Prix, PET Aircraft landing, PET Bouncy.

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Benchtest: Pasca 640/WP Benchtest: Magic Wand/PET colour/Low-cost digital tape system/Using calculator printers on micros/Apple music-making/Multi-user Benchtest: MVT-Famos/Programs: PET Grand Prix, PET Aircraft Landing, PET Bouncy.

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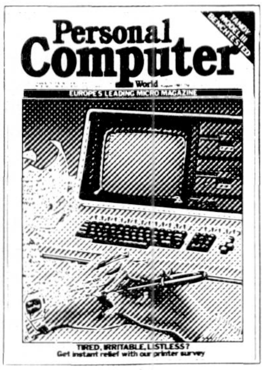
June 1981
Benchtest: NEC PC-8001/Multi-user Benchtest: MP/M/Benchtest: Sinclair ZX81/West Coast Faire report/Radio Teletype/WP Benchtest: Wordpro 4 Plus/Budget tape interface/Further Casio quirks/Programs: UK101 Zor, PET Chords.

Volume 4 No 7
July 1981
Benchtest: Sharp PC-3201/Multi-user Benchtest: Acorn Econet/ Case study: Accident investigation on TRS-80/Zilog Z8 family/WP Benchtest: Format-80/Pascal Benchmarks: readers' letters/Quicker Casio computations/Programs: ZX80 Sliding Letters, UK101 Car Rally, TRS-80 Calendar, UK101 m/c code to Basic converter, PET Exam Questions, MZ-80K Designer, ZX81 Sketch Pad.



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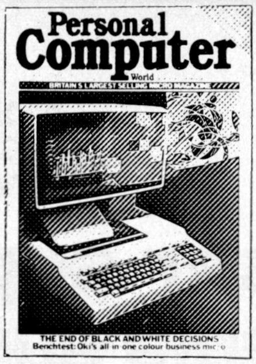

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Vol 4 no 11
November 1981
Benchtests: Osborne 01, IBM Personal Computer. Checkout: Sharp IQ3100 Microtranslator. Calc Corner: Casio fx702p. *PCW* Show report, Benchmark Summary, Euro Micro Chess Championship report. Programs: TRS-80 Sheepdog trial, ZX81 Sun and Planets.

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Benchtests: Sharp MZ-80B Philips P2000/School network/ BBC Micro inside story/ 'Turtle' Graphics for Apple/ Forth language/ Curve fitting/ Calc corner: HP14C review/ Programs: PET Fantasy, ZX81 Battleships and cruisers.

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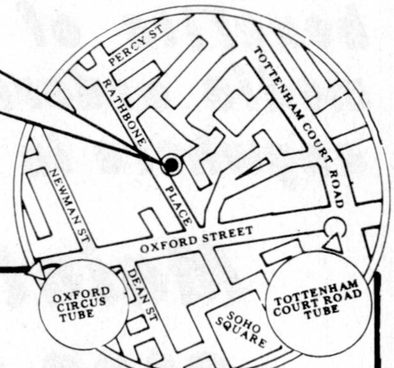

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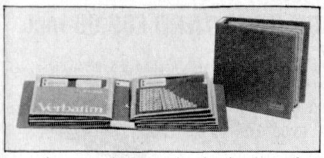

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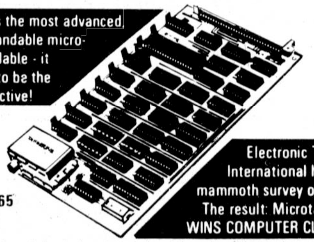
MICROTAN 65

Microtan 65 is the most advanced, powerful, expandable micro-computer available - it also happens to be the most cost effective!



Electronic Today International held a mammoth survey of kits. The result: Microtan 65 WINS COMPUTER CLASS!

MICROTAN 65 CONTENTS

High quality, plated thru hole printed circuit board, solder resist and silk screened component identification. 6502 microprocessor. 1K monitor TANBUG. Now with 'V' Bug. 1K RAM for user programme, stack and display memory. VDU alphanumeric display of 16 rows by 32 characters. MICROTAN 65 system file binder. 136 page, bound, users hardware/software manual with constructional details and sample programmes. Logic and discrete components to fully expand MICROTAN 65.

The MICROTAN 65 kit has won widespread acclaim for its superb presentation. We pay attention to detail!

KIT FORM £69.00 + £10.35 V.A.T., total £79.35

MICROTAN 65 assembled and tested.
Specification as above, but assembled and fully bench tested by ourselves.
£79.00 + £11.85 V.A.T., total £90.85

TANBUG V2.3 KIT (separately) £21.95 incl.

MICROTAN 65 OPTIONS

LOWER CASE PACK
Two integrated circuits which connect into locations on MICROTAN allowing 128 displayable characters.
£9.48 + £1.42, total £10.90

MINI MOTHER BOARD
Used to connect Microtan to Tanex.
Built **£10.00** + VAT

GRAPHICS PACK
Five integrated circuits which connect into locations on MICROTAN allowing the display of chunky graphics (64 x 64 pixels). What are chunky graphics? Well, imagine a piece of graph paper with 64 squares vertically and 64 squares horizontally, a total of 4096. Each square can be made black on white.
£6.52 + V.A.T. 98p, total £7.50

20 WAY KEYPAD
Inexpensive means of getting up and running. Uses 'Schoeller' key-switches, and connects to MICROTAN through a 16 pin D.I.L. plug on ribbon cable. Black anodised escutcheon, with TANGERINE legends, finishes off what must be the best value for money keypad available. Available assembled and tested.
£10.00 + V.A.T. £1.50, total £11.50

*Space Invaders game (for use with keypad only)
£15.22 + V.A.T. £2.28 total £17.50

POWER SUPPLIES

MPS 1: Input 120 or 240V AC. Output 5 Volts at 3 Amps Regulated. MPS 1 will power both MICROTAN and TANEX fully expanded. Built on the same size printed circuit board as MICROTAN etc. Available as a fully built and tested unit.
£23.00 = V.A.T. £3.45, total £26.45

X MPSZ +5V 6A, +12V, -5 and -12V switch mode system PSU
£69.13 + V.A.T.

MINI-SYSTEM RACK

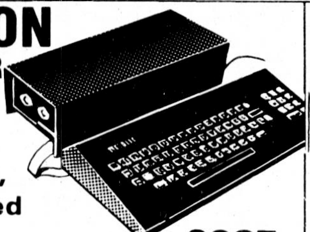
We have produced a mini-system rack which accepts MICROTAN 65, TANEX and our mini-mother board. It has an integral power supply, just plug it into the mains and away you go! Finished in TANGERINE/BLACK, it gives your system the professional finish. Front panel access for I/O cables. **AVAILABLE AS AN ASSEMBLED UNIT.**
£56.35 INCL.

FULL SYSTEM RACK

For the man that has everything! 19 inch wide system rack which accepts MICROTAN 65, TANEX, TANRAM, SEVEN FURTHER EXPANSION BOARDS, TANDOS and THE SYSTEM POWER SUPPLY. Available in many formats, e.g. Individual front panels, full width hinged front panel, back panel with or without connectors.
£49.00 + V.A.T. £7.35, total £56.35

MICRON COMPUTER

FULLY BUILT, TESTED, and housed



£395 inc V.A.T. P&P

System Rack Micron £550.00 incl.

6502 based microcomputer VDU alpha numeric display. Powerful monitor TANBUG. 8K RAM. 32 parallel I/O lines. 2 TTL serial I/O lines. Four 16 Bit counter timers. Cassette interface. Data bus buffering. Memory mapping contol. 71 key ASCII Keyboard, including numeric keypad. Includes power supply. Also includes the first "10K MICROSOFT BASIC" available in the U.K. All the usual BASIC commands.

Full manuals. Microtan, Tanex, Basic, X Bug All £5.00 each.

TANRAM

AVAILABLE NOW. TANRAM - 40K Bytes on one board!! Single board of bulk memory offering: 7K Static RAM (2114), and 32K Dynamic RAM (4116). Onboard refresh is totally transparent to CPU operation and is unaffected by normal DMA's. TANRAM fully expands the available address space of the 6502 microprocessor. MICROTAN, TANEX and TANRAM together provide 16K RAM, 48K RAM, and 1K I/O - that's a lot of memory and a lot of I/O! Built and tested. TANRAM ASSEMBLED.

40K RAM CARD with 16K DYNAMIC RAM £76 + VAT

CONTENTS: High quality plated thru hole printed circuit board, solder resist and silk screened component identification. Full complement of I.C. sockets for maximum expansion. 64 way D.I.N. edge connector. 1K RAM (2114). Data bus buffering. TANRAM users manual.

EXTRA RAM:
1K STATIC (2114) **£2.95** each. 16K DYNAMIC (4116) £1.50 each.

MEMORIES

EXPAND YOUR SYSTEM WITH OUR TANGERINE APPROVED CHIPS.

Discounts 10% for 4, 15% for 8, 20% for 16.

2102 1K x 1 Static RAM **80p**
2708 **£3.50**
2716 **£6.50**
MK 4116 16K x 1 Dynamic RAM **£1.50**
IM 6402 UART **£4.50**
2114 1K x 4 Static RAM **£2.95**
4118 1K x 8 Static RAM **£7.50**

All plus VAT

MONITORS (PROFESSIONAL)

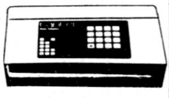
RECONDITIONED AND NEW - FROM £35.00 to £129.95

CENTRONICS PRINTERS

Ideal for Tangerine

SHEIKOSHA **£199** + VAT
Model 730 **£350** + VAT
Model 737 **£395** + VAT

NEW MICROTANTEL POST OFFICE APPROVED PRESTEL - VIEWDATA



• FULL COLOURGRAPHICS • CAN STORE PRESTEL • CAN BE USED AS AN EDITING TERMINAL • CAN BE INTERFACED WITH PET, APPLE etc.

£170 + V.A.T.

Just connect to the aerial socket of any colour or black and white domestic T.V. receiver and to your Post Office installed jack socket and you are into the exciting world of PRESTEL. Via simple push button use you are able to view 170,000 pages of up to the minute information on many services, order goods from companies - all this without leaving your armchair!

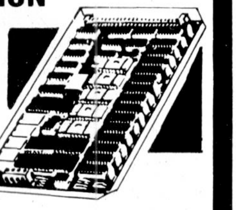
TANEX £43.00

Minimum Config Kit
+ V.A.T. £6.45, total £49.45

CONTENTS
High quality plated thru hole printed circuit board, solder resist and silk screened component identification. I.C. sockets for maximum expansion. 64 Way D.I.N. edge connector. 1K RAM, cassette interface, 16 parallel I/O lines, a T.T.L. serial I/O port, two 16 bit counter timers, data bus buffering, memory mapping, logic and discrete components for maximum expansion. TANEX users manual.

TANEX (Minimum configuration) Assembled
£53.00 + V.A.T. £7.95, total £60.95

TANEX EXPANSION



Expanded, TANEX offers: 7K RAM, locations for 4K EPROM (2716), locations for 10K extended MICROSOFT BASIC, 32 parallel I/O lines, two TTL serial I/O ports, a third serial I/O port with RS232/20mA loop, full modem control and 16 programmable baud rates, four 16 bit counter timers, cassette interface, data bus buffering, and memory mapping.

EXPANDED TANEX KIT (Excludes ROM, XBUG and BASIC)
£89.70 + V.A.T. £13.46, total £103.16

EXPANDED TANEX ASSEMBLED
£99.70 + V.A.T. £14.96, total £114.66

OPTIONS TO FULLY EXPANDED TANEX

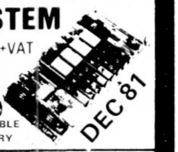
10K Extended MICROSOFT BASIC in EPROM (with manual)
£49.00 + V.A.T. £7.35, total £56.35

Extra RAM: 1K (2 x 2114) **£5.20** + V.A.T. 78p, total £5.98

SERIAL I/O KIT **£17.25**
6522 VIA **£8.00** + V.A.T. £1.20, total £9.20
XBUG £17.35 + V.A.T. £2.60, total £19.95
± 12V KIT **£9.20 incl**

AS YOU CAN SEE THE PRICES OF OUR EXPANSION COMPONENTS ARE VERY, VERY COMPETITIVE!

TANGERINE DISC SYSTEM



Z80 CONTROLLER CARD **£150.00** + VAT

DOUBLE SIDED DOUBLE DENSITY DRIVE **£215.00** + VAT

CP/M DISK OPERATING SYSTEM **£80** + VAT

Z80 AVAILABLE JANUARY

71 KEY ASCII KEYBOARD £69.95 incl.

NO EXTRAS NEEDED
Uses gold crosspoint keys. Includes numeric keypad and ribbon cable. Available as fully assembled and tested.

SUPER METAL CABINET IN TANGERINE/BLACK
£20.00 + V.A.T. £3.00, total £23.00

PROFESSIONAL ASCII KEYBOARDS

Ideal for Tangerine

£29.95 + VAT

- 52 key 7 bit ASCII coded
- Positive strobe +5V-12V
- Full ASCII characters
- Parallel output with strobe
- Power light on control
- Chip by General Instrument (G.I.) TTL output
- Superbly made
- Size 13 x 5.5 x 1.5 ins
- Black keys with white ledgens
- Escape shift return & reset keys
- Control repeat & bell
- Complete with DATA

ADD-ON KEYPAD

A compact 12 button keypad suitable for use with above keyboard to extend its functions plus four extra keys. Supplied brand new with with data. A 4 x 4 non-encoded single mode keyboard.

LIST PRICE £22.00
OUR PRICE **£7.95** + VAT

PLUS MANY NEW EXCITING PRODUCTS IN DEVELOPMENT AUTOMATICALLY AVAILABLE FROM US WHEN RELEASED BY TANGERINE LTD

All products are available

FULLY GUARANTEED · BUY WITH CONFIDENCE

BRITISH DESIGN & MANUFACTURE AND ON DEMONSTRATION IN OUR COMPUTER DEPT

NEW PRODUCTS (all inc. VAT)

System Motherboard (4 connector)	44.85	Parallel I/O Board Min (16 Lines)	54.63	Controller Card Full	138.00
System Motherboard (12 connector)	72.85	Parallel I/O Board Max (128 Lines)	99.48	Controller Card Min	69.00
Extra Edge connectors	3.50	32K Ramcard 16K Version	87.40	Cbug, Combined Tanbug & Xbug	T.B.A.
System Rack Front Panel	15.64	32K Ramcard 32K Version	115.00	2 Port Serial I/O Kit	T.B.A.
Serial I/O Board Min (2 Ports)	66.70	32K Romboard (Excl. Rom)	54.65	High Resolution Graphics	90.85
Serial I/O Board Max (8 Ports)	135.70	Aim/Kim Buffer	54.64	Aim TV Interface	79.35

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COMPUTER KIT LTD. (Principal Distributors in U.K.)
11/12 Paddington Green, London, W2. Tele: 01-723 5095
Telex: 262284 Ref. 1400 TRANSONICS

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All orders pre-paid and official advertised here to be forwarded DIRECTLY to
COMPUTER DEPT., 11/12 PADDINGTON GREEN. LONDON W2

THREE PET TITLES from Nick Hampshire

LIBRARY OF PET SUBROUTINES

A book which will save the software designer considerable time by providing 55 proven subroutines to integrate with his own programmes.

Each subroutine is preceded by a page of general information describing its purpose and implementation and possible problems that may arise. Basic, machine language and a combination of both, are used throughout this publication.

"... We like this book very much and thoroughly recommend it."
Printout

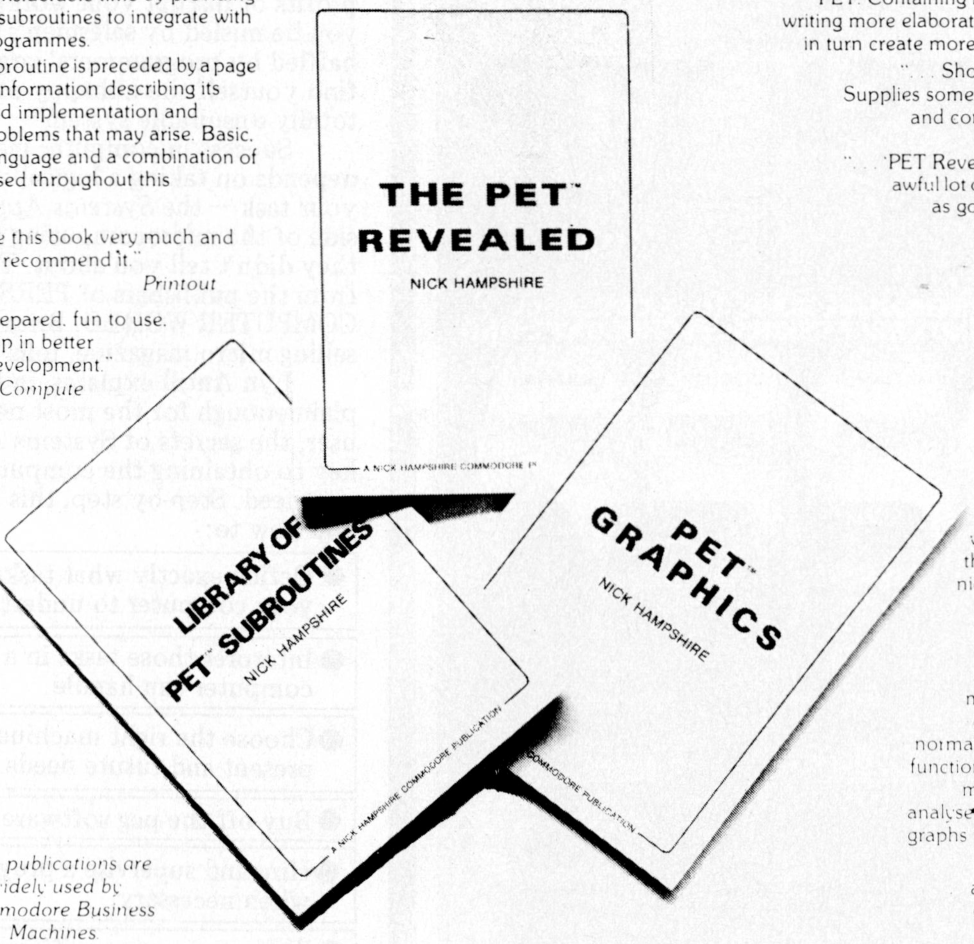
"... well prepared, fun to use, and will help in better program development."
Compute

THE PET REVEALED

A reference book which details everything you need to know about the workings of the PET. Containing information helpful to writing more elaborate programmes, which in turn create more interesting functions.

"... Should be congratulated. Supplies some much needed, useful and correct documentation."
Compute

"... 'PET Revealed' will save you an awful lot of time. I rate this book as good value for money."
Printout



PET GRAPHICS

This book has two objectives. One, to provide the reader with an introduction to the programming techniques used to generate graphic displays. Two, providing the programmer with a complete package of machine code routines giving a wide range of normally unavailable graphic functions. The book contains many comprehensively analysed routines and photographs to illustrate the effects created.

"... an invaluable guide to graphics on the PET."
Micro Forecast

All 3 publications are widely used by Commodore Business Machines.

Please send me:

.... copy/ies of Library of PET Subroutines @ 10.00 each

.... copy/ies of The PET Revealed @ £10.00 each

.... copy/ies of PET Graphics @ £10.00 each

I enclose a cheque for £ .... payable to Computabits Ltd., P.O. Box 13, Yeovil, Somerset.

Name ....
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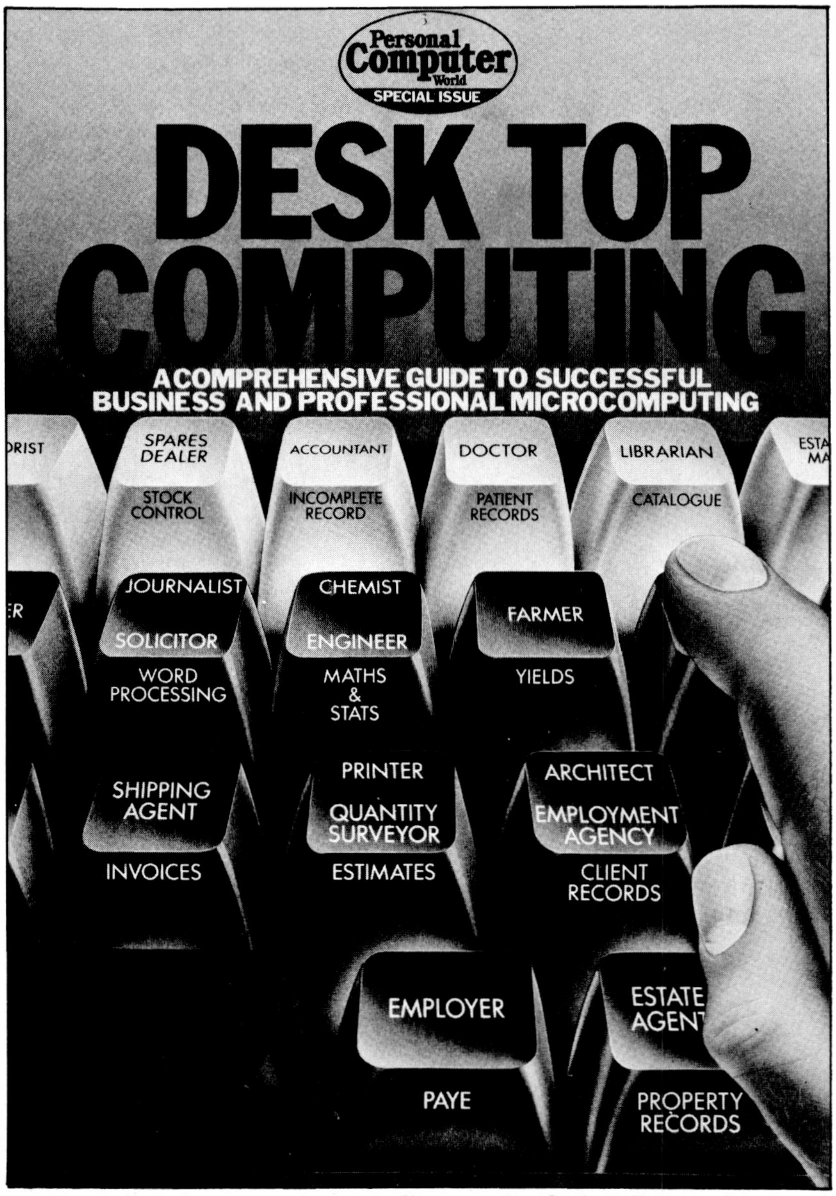
Postcode ....

DESK TOP COMPUTING

A COMPREHENSIVE GUIDE TO SUCCESSFUL BUSINESS AND PROFESSIONAL MICROCOMPUTING

We live in an age of cheap computing power. For the first time the cost of a computer is within the reach of the small businessman, the professional person or the private citizen. And in the present economic climate the pressure is on to increase productivity and efficiency using these electronic aids.



Also included are several case studies covering the installation of desk top computers in small businesses and for professional use together with a comprehensive listing of virtually every hardware and software system currently available in the UK.

But will your desk top computer be a boon or a curse? Will it increase your profits or disrupt your workplace? Will you be misled by salesmen's patter, baffled by programmers' jargon and find yourself the unhappy owner of a totally unsuitable system?

Success in computer installation depends on taking a logical approach to your task — the *Systems Approach*; the side of the microcomputing revolution they didn't tell you about. This book, from the publishers of PERSONAL COMPUTER WORLD, Britain's largest-selling micro magazine, tells you.

Lyn Antill explains, in language plain enough for the most non-technical user, the secrets of Systems Analysis, the key to obtaining the computer system you need. Step by step, this book tells you how to:-

- Define exactly what tasks you wish your computer to undertake.
- Interpret those tasks in a way the computer can handle.
- Choose the right machine for present and future needs.
- Buy off-the-peg software.
- Hire and supervise a programmer when necessary.
- Write program specifications tailored to *your* staff and working methods.
- Test programs and introduce them into your business smoothly with minimal disruption.
- Maintain and modify programs.

AVAILABLE NOW PRICE £1.95 FROM YOUR PCW NEWSAGENTS, THE PCW BACK ISSUES CENTRE OR BY MAIL ORDER. SEE COUPON ON PAGE 193.

Personal Computer World
SPECIAL ISSUE

CHROMASONIC electronics

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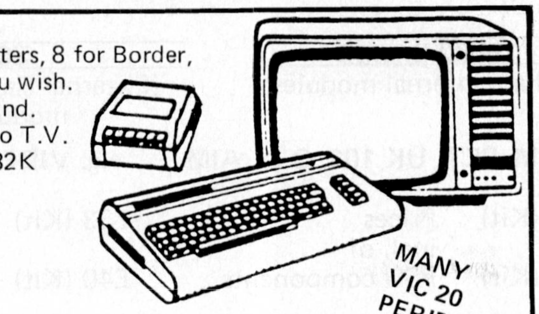
YOUR SOUNDEST CONNECTION IN THE WORLD OF COMPUTERS

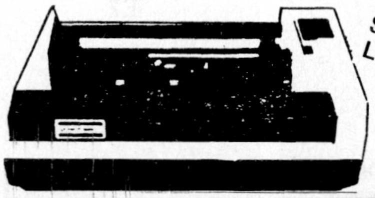
VIC 20

*24 Colours, 8 for Characters, 8 for Border, 16 for screen mixed as you wish.
*3 tone Generator for sound.
*Uses Pet Basic *Plugs into T.V.
*Memory expandable to 32K
*VIC complete with T.V. Modulator and Power Supply
ONLY £165.00

VIC Cassette Deck
ONLY £38.00

Available soon
VIC Dot Matrix Printer
80 Column, 30 CPS,
Tractor Feed
ONLY £199.95





MANY VIC 20 PERIPHERALS AVAILABLE SEND FOR LIST

UK 101

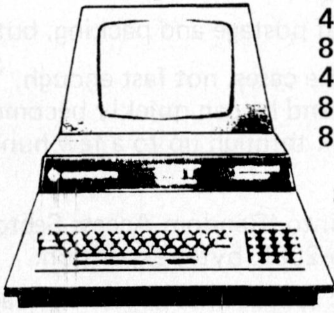
DOWN IN PRICE

UK101 Kit **inc 8K memory**	**£125**
Ready Built **inc 8K memory**	**£175**
Complete in case	£199
4K Expansion 8x2114	£10
Parallel Printer Interface	£24.50
Cases	£19.95
Chromasonics Sound Kit	£24.50
Colour Kit	£69.95

NEW NEW NEW

32K Dynamic Memory Board only	£89.95
P.I.O. and Eprom Programmer Kit only	£24.50

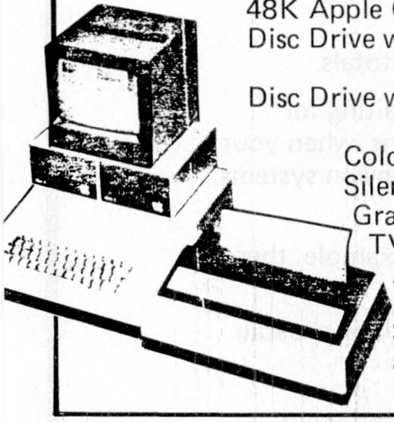
PET



4016 16K RAM	445.00
4032 32K RAM	569.00
8032 32K RAM	755.00
8096 96K RAM	960.00
4040 Disk Drive	585.00
8050 Disk Drive	755.00
4022 Printer 80 Col	357.00
8024 Printer 132 Col	975.00
8026 Printer/Typewriter	835.00
8027 Daisy Wheel	735.00

A range of PET Accessories and Software are available

APPLE II PLUS



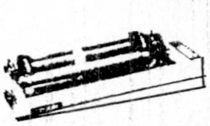
AUTOSTART "EUROPLUS"

48K Apple Computer	649.00
Disc Drive with Controller	349.00
Disc Drive without Controller	299.00
Colour Card	69.00
Silentype Printer	199.00
Graphic Tablet	425.00
TV Modulator	14.00

A range of Apple Accessories and Software are available

PRINTERS

INTERFACES AND CABLES FOR APPLE II, PET, TRS80, RS232, UK101, SHARP SUPERBOARD ALL AVAILABLE



EPSON MX80 £359
Dot-matrix printer with Pet graphics interface. Centronics parallel and serial. Pet and Apple compatible. True bidirectional, 80 cps.

EP80 MX82 £389
As MX80 plus high Resolution Graphics.

JUST PHONE FOR FURTHER DETAILS

EPSON MX80 FT/1£399
Dual single sheet friction and tractor feed, 9 wire head, true descenders.

EPSON-MX FT/2 £440
An FT/1 with high An FT/1 with high resolution graphics.

SEIKOSHA GP80A£199
Dot matrix 5 x 7, 80 columns, 30 cups graphics, double width characters.

VIDEO GENIE

£279 EG3003

Utilises Z80, 12 K level II Basic, Integral Cassette Deck, UHFO/P, 16K RAM, all TRS80 features. Simply plugs into monitor or UHF TV, With V.U. Meter.

PARALLEL PRINTER INTERFACE INC CABLE	33.00
CHROMASONICS PROGRAMABLE SOUND KIT	24.95
SOUND KIT (FITTING EXTRA)	7.00
LOWER CASE KIT (FITTING EXTRA)	27.50
COLOUR KIT (FIT)	
COLOUR KIT (FITTING EXTRA)	34.95
EXPANSION BOX WITH/WITHOUT RS232	215/185
16K/32K RAM CARD	94/129

MONITORS

		HITACHI PROFESSIONAL	
9" Green Screen	£99.00	9"	£99.95
12" Green Screen	£125.00	12"	£149.00
12" BMC Green Screen	£159.00		

TANTEL

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180,000 pages of information on Travel, News, Investment, Holidays, Hotels Etc., Etc.,

£170

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DEMONSTRATION AVAILABLE AT OUR SHOWROOM

BARCLAYCARD VISA

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. Official orders welcome.

We welcome Access

RAM EXPANSION 16K, 32K, 64K, 128K, 256K,

MEMORY UPGRADE	6502 BASED (all are internal modules) e.g. ATOM, PET, UK 101, O.S., AIM		Z80 BASED (External Ram Packs and internal modules available) e.g. VIDEO GENIE, ZX 81	
16K	£45 (Kit)	Prices incl. of PSU components	£33 (Kit)	Prices incl. of PSU components
32K	£52 (Kit)		£40 (Kit)	
Ready built charge:	£10		£7	
LARGER EXPANSIONS				
64K	£80 (Kit)		£70 (Kit)	
128K	£120 (Kit)	PSU not necessary	£110 (Kit)	PSU not necessary
256K	£200 (Kit)		Not yet available	
Ready built charge:	£10		£7	

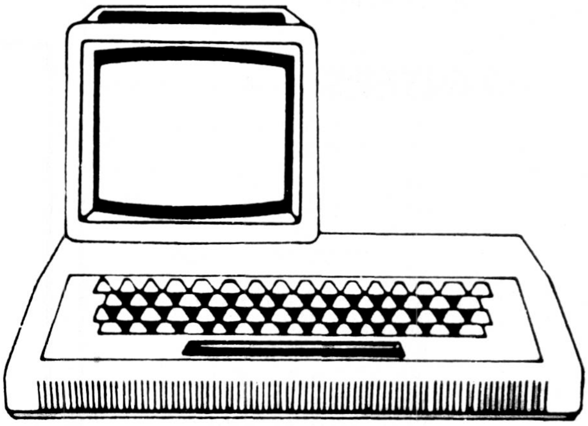
All prices are inclusive of postage and packing, but please add 15% VAT to all totals.

Discs are fast, but in some cases, not fast enough. You may have a customer waiting for details on the 'phone – and he can quickly become impatient. In such situations, when your computer has got to look through up to a few hundred files, our memory expansion systems really can help.

The memory is divided into 'Random Access Sectors' of 256 bytes each. For example, there will be 1024 sectors in a 256K bytes expansion.

We supply free the basic subroutines necessary. Each is roughly 180 bytes long and capable of handling one of the following functions:

1. READ/WRITE **program**
2. READ/WRITE **screen**
3. READ/WRITE **string and files**
4. READ/WRITE **numerical array**



Take as an example the READ/WRITE screen function for a PET. This literally treats the screen as a piece of paper on which you can draw or write whatever you like. When you have finished, SYS 940 will store the result in one of the 256 screen pages in just 18 milliseconds (the blink of an eye!) Another example: the READ/WRITE string and files function opens to your Micro as many as 1000 files at any one time! If you want the file 100, write string AS with the contents of file 100 – it will take only 8 milliseconds.

Another advantage of memory sectors is that any program can READ or WRITE into the memory so that several programs can share the same data base.

FOR FURTHER DETAILS (WE CAN SEND YOU FREE LITERATURE), PLEASE RING US ON SOUTHEND (0702) 613081, OR IF OUR LINE IS BUSY, WRITE TO:
AUDIO COMPUTERS, 87 BOURNEMOUTH PARK ROAD, SOUTHEND-ON-SEA, ESSEX

IBM PERSONAL COMPUTER

£2800+VAT

MICRO-COMPUTERLAND
TEL:01-637 4071

ZX81 SOFTWARE FROM VIDEO SOFTWARE LTD 1K & 16K

16K SOFTWARE

VIDEO-PLAN (ZX81 only). Performs the functions of an analysis book. Arithmetic functions include addition, subtraction, multiplication. Printer optional.

VIDEO-AD. Rotating display of 16 pages of advertising material. Set-up your own pages and change them as and when required.

VIDEO-GRAPH. Planning and design aid. Create pictures/charts/graphs and store within the program. Save on cassette. Combine pictures like an 'identikit'.

VIDEO-VIEW. Do it yourself teletext. Create pages of data. Store them within the program. Save on cassette. View on demand.

VIDEO-MAP. (ZX81 only). Educational game based on maps. Navigate your plane to its destination. Bomb the target and return to base.

FORCE-FIELD. (ZX81 only). Animated bombardment game. You control the force-field which protects your city against hostile UFOs.

SPACE-RACE. (ZX81 only). Party game for eight players. Rockets race to build stations in space. Winners gradually take over losers until only one winner remains.

FOOTBALL-LEAGUE. Realistic simulation of an entire season. Every match played and results shown with progressive league table. You give teams ratings for skill, effort, etc.

TEST-MATCH. Realistic simulation of a test match series. Dynamic scoreboard. Give each player your own ratings for skills, technique, etc.

STOCK-MARKET. (ZX81 only). An exciting game of skill and judgement. Buy and sell stocks and shares as prices change in response to world events.

PACK 1 – VIDEO-PLAN + VIDEO-AD.
PACK 2 – VIDEO-VIEW + VIDEO-GRAPH.
GAMESET – VIDEO-MAP + 5 GAMES.

NEWS FOR USERS

Those of you who have already voted with your cheque books may be interested in our 'top ten'. These are the best sellers so far:

1. VIDEO-VIEW
2. VIDEO-GRAPH
3. FORCE-FIELD
4. VIDEO-MAP
5. VIDEO-PLAN
6. FOOTBALL-LEAGUE
7. STOCK-MARKET
8. TEST-MATCH
9. SPACE-RACE
10. VIDEO-AD

Surprisingly some of the programs which we rate most highly are well down the list.

We expect our 1K programs to top this list soon. They are worth buying even if you have 16K.

VISIT US AT THE ZX MICROFAIR

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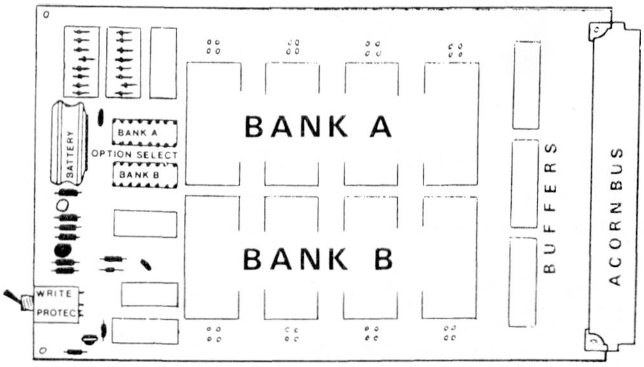

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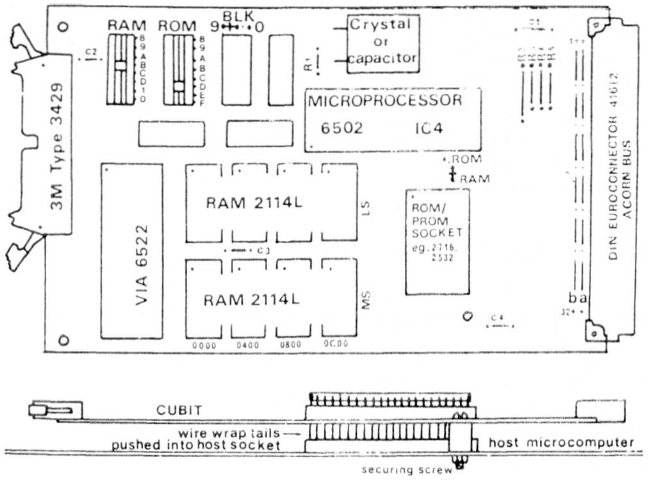

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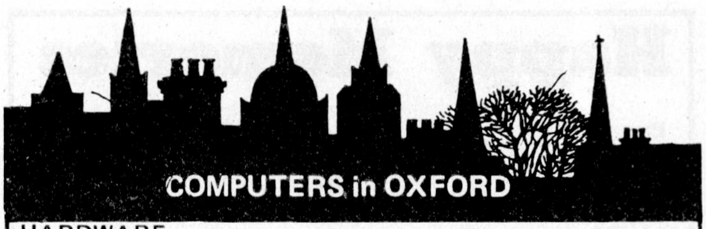

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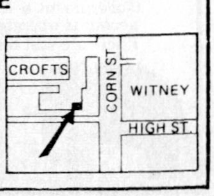

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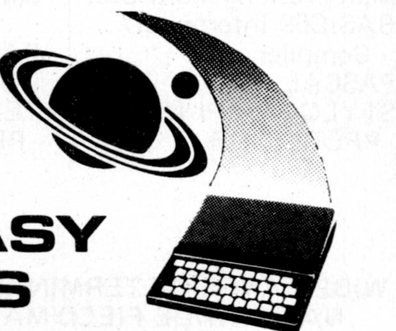

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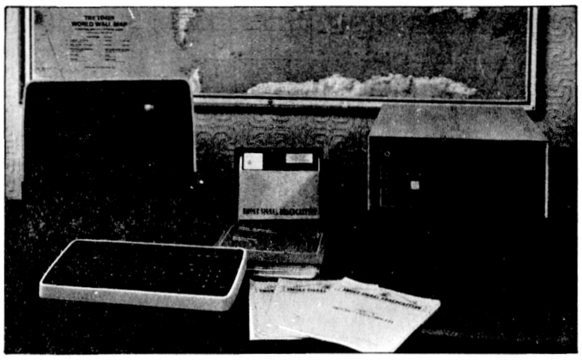

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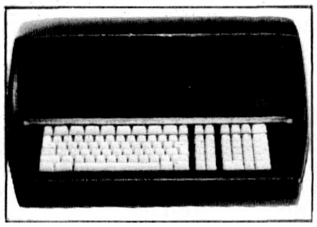

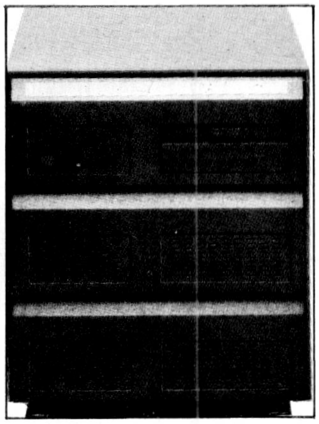

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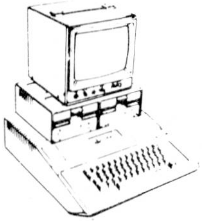

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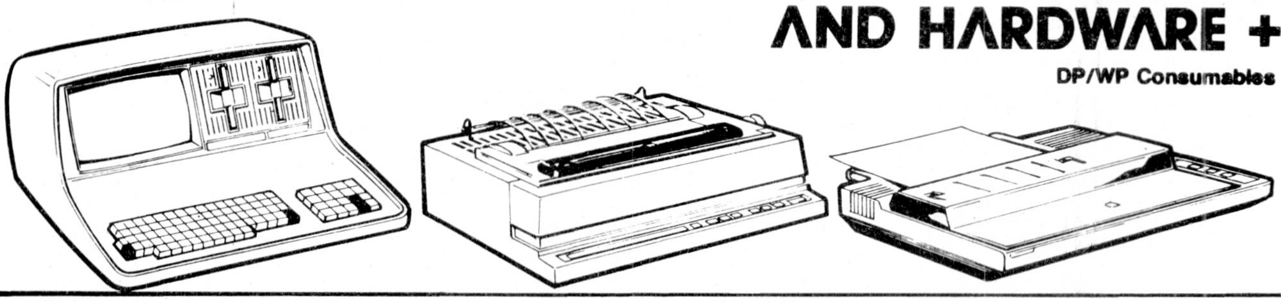

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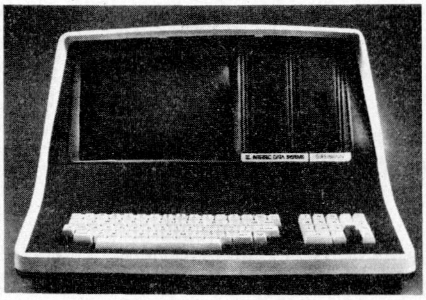

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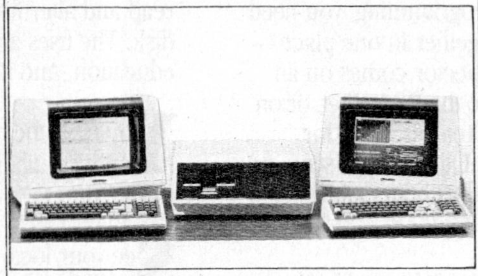

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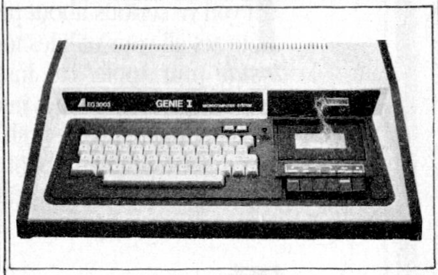

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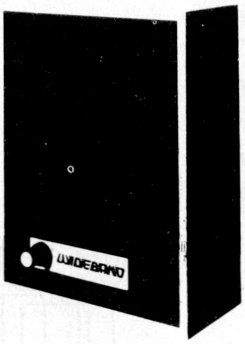
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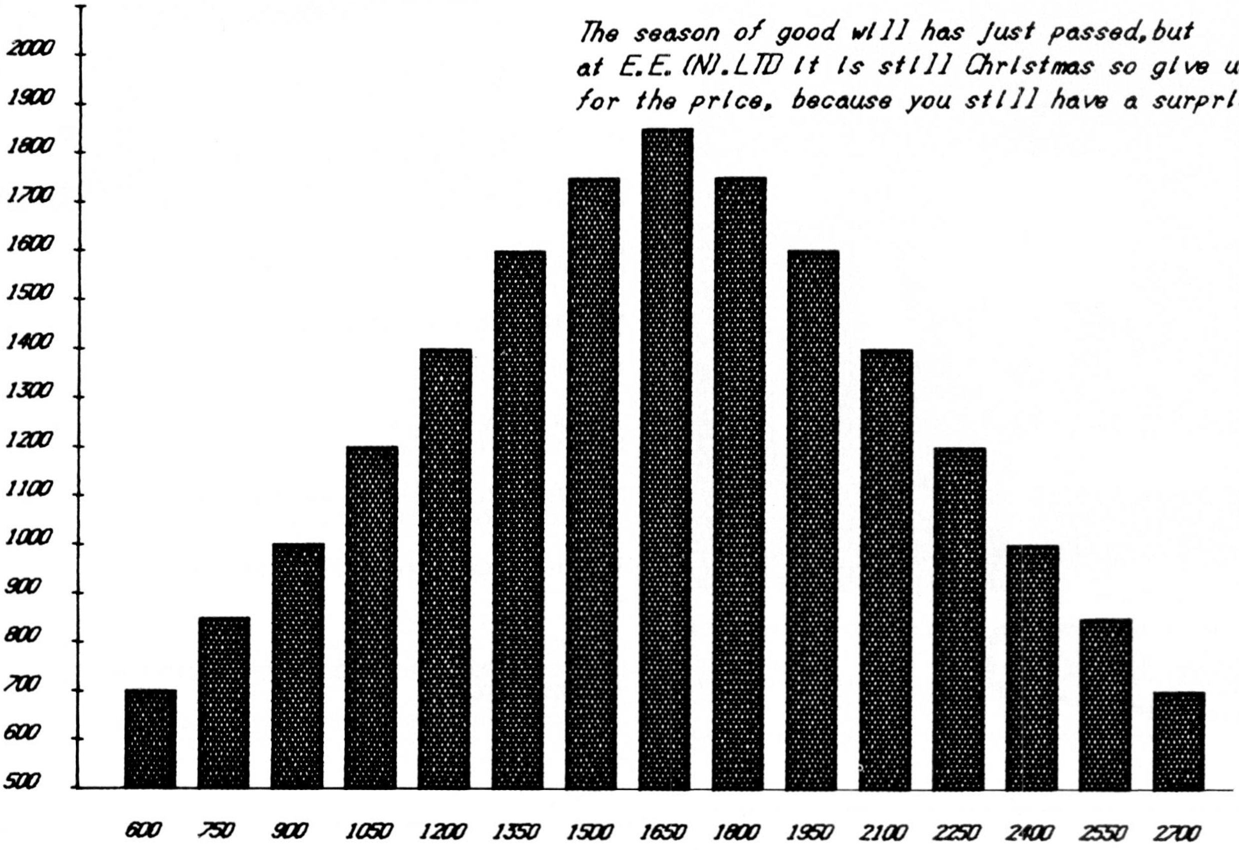

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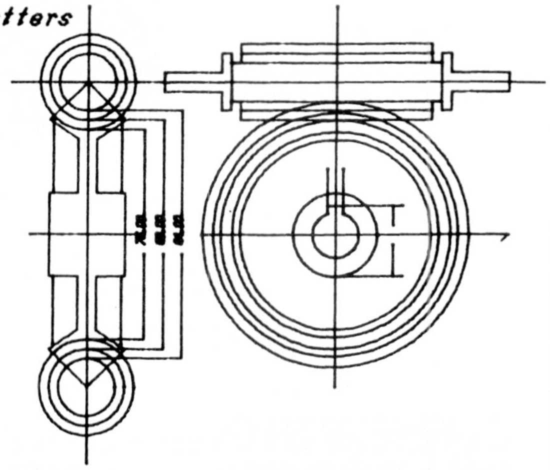

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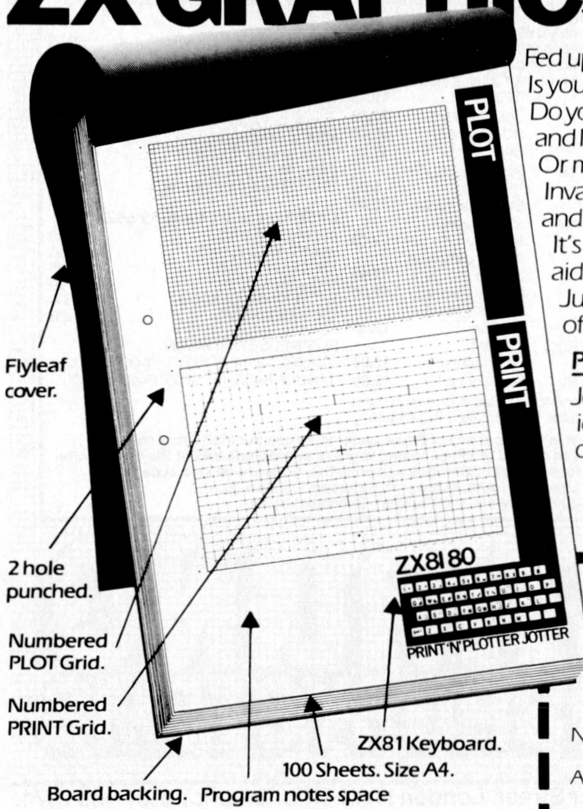

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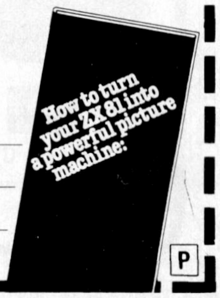

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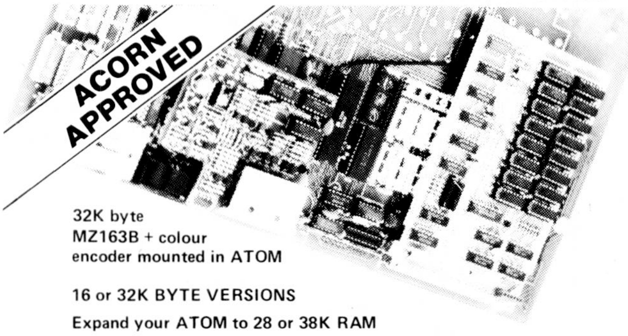

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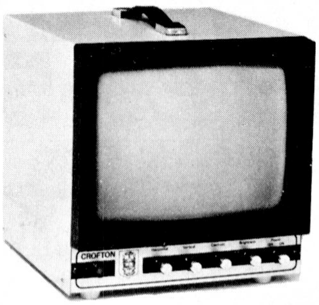

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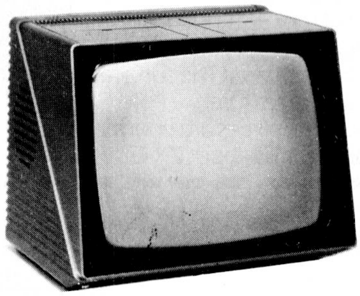

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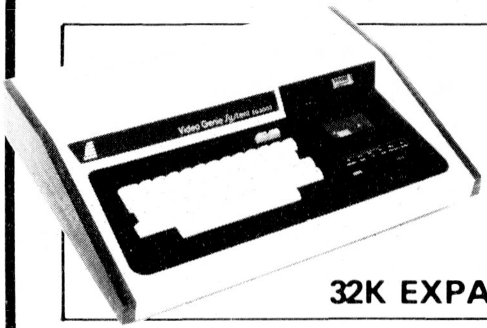

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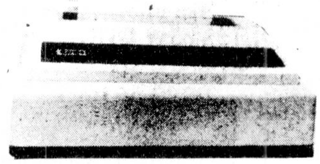

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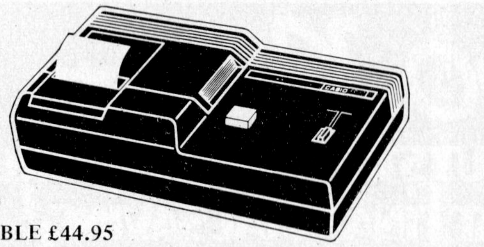

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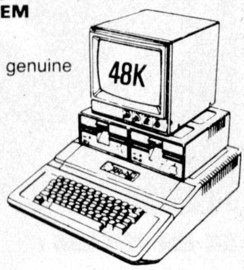

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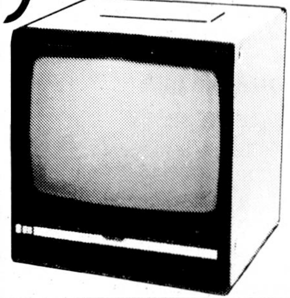

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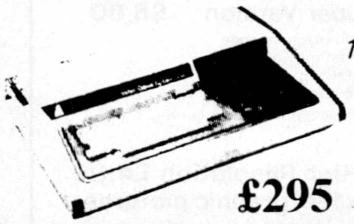

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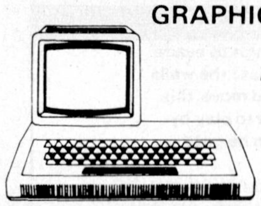

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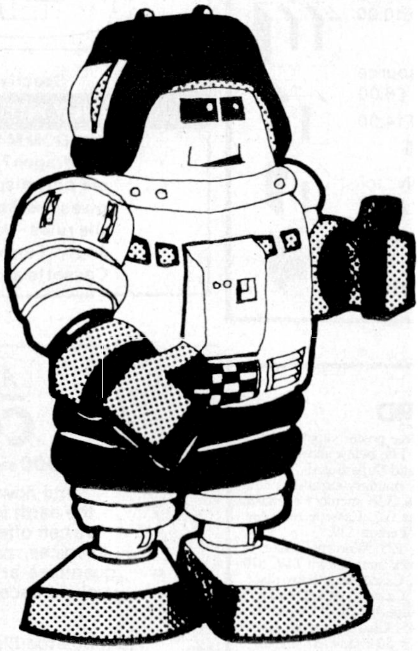

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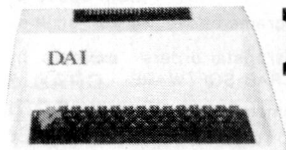

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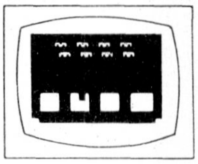

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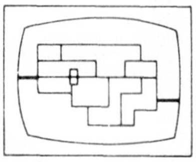

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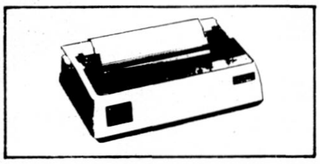

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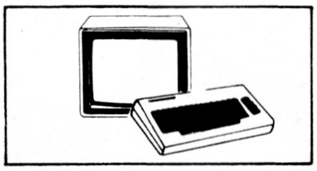

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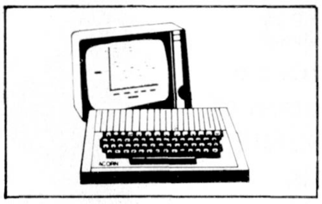

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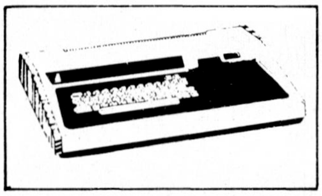

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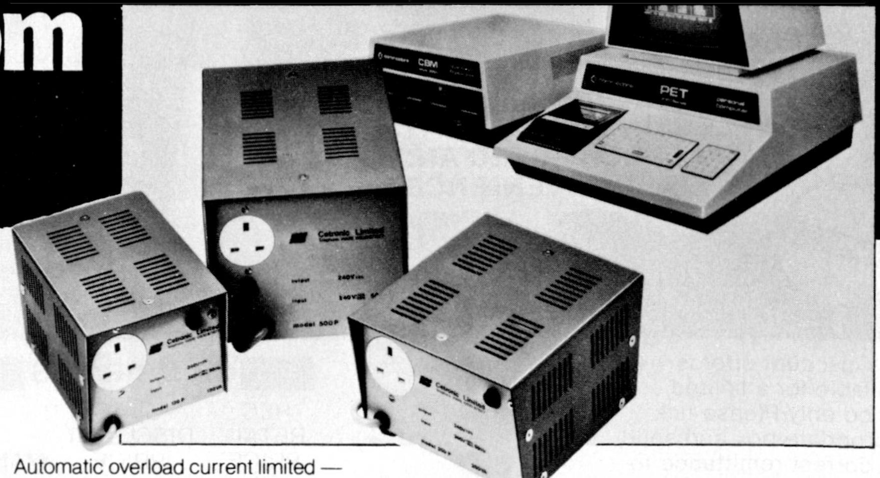

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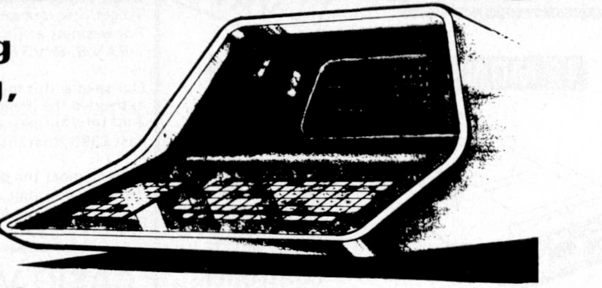

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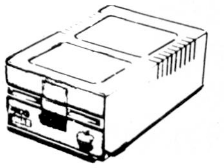

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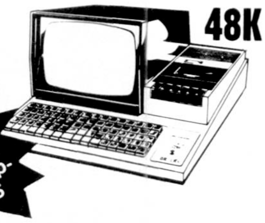

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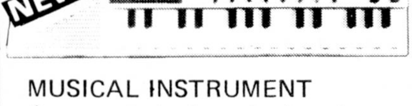

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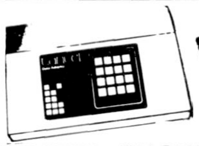

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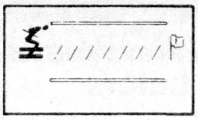

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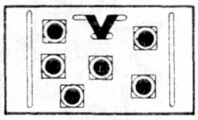

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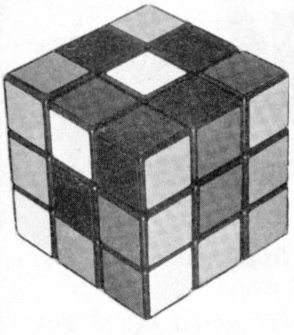

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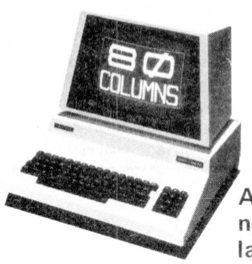

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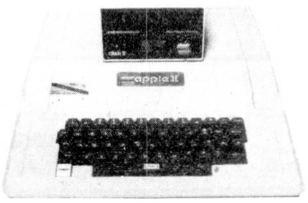

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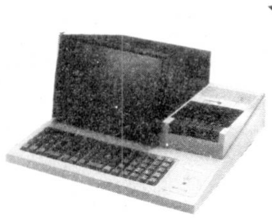

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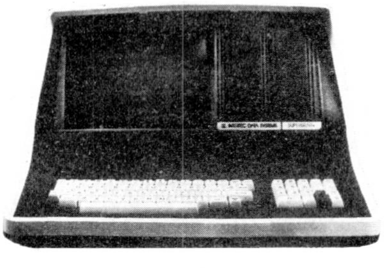

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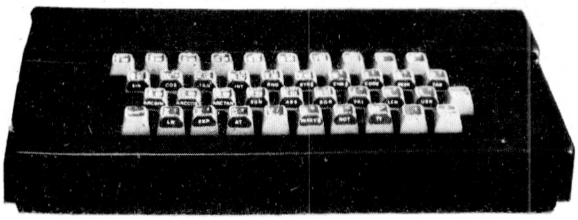

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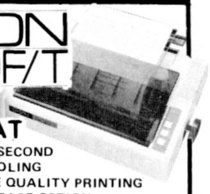

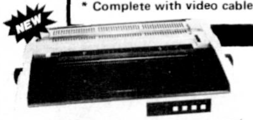
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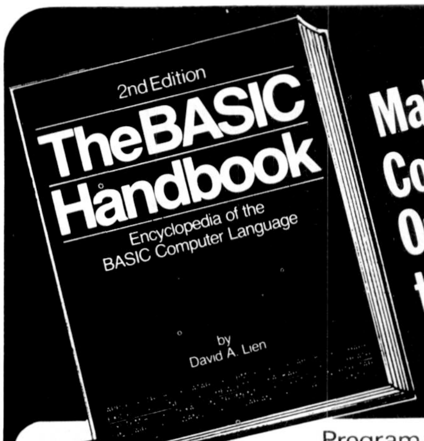
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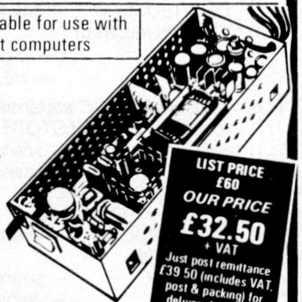

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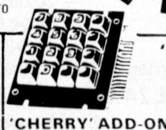

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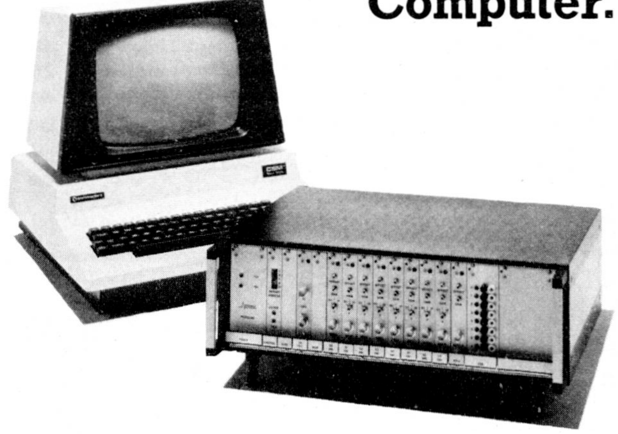

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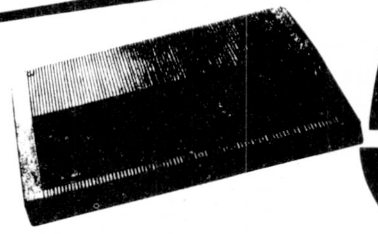

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LS293	46
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LS249	68
LS251	40
LS253	40
LS257	48
LS258	40
LS259	85
LS261	195
LS266	25
LS273	90
LS275	290
LS279	88
LS280	250
LS295	215
LS298	130
LS299	420
LS300	157
LS302	175
LS320	270
LS323	270
LS423	200
LS323	270
LS324	200
LS325	320
LS326	330
LS327	315
LS347	150
LS348	190
LS352	185
LS353	185
LS365	37
LS366	37
LS367	37
LS368	90
LS373	75
LS374	75
LS375	48
LS377	90
LS378	69
LS379	65
LS384	250
LS385	378
LS390	62
LS393	60
LS395	199
LS399	220
LS445	140
LS471	620
LS490	245
LS541	135
LS640	225
LS641	225
LS645	210
LS668	175
LS669	150
LS670	175
LS673	550
LS674	750

CMOS

4000	14
4001	14
4002	14
4006	66
4007	18
4008	62
4009	35
4010	40
4011	15
4012	18
4013	34
4014	75
4015	66
4016	32
4017	48
4018	68
4019	42
4020	61
4021	70
4022	66
4023	20
4024	45
4025	19
4026	130
4027	38
4028	58
4029	77
4030	50
4031	170
4032	125
4033	165
4034	195
4035	95
4036	275
4037	115
4038	110
4039	290
4040	59
4041	78
4042	60
4043	70
4044	65
4045	170
4046	75
4047	75
4048	55
4049	30
4050	30
4051	78
4052	78
4053	78
4054	125
4055	125
4056	120
4057	1915
4059	480
4060	90
4061	1225
4062	995
4063	99
4066	36
4067	399
4068	22
4069	20
4070	26
4071	20
4072	20
4073	20
4075	20
4076	60
4077	26
4078	26
4081	26
4082	21
4085	65
4086	70
4089	140
4093	43
4094	168
4095	90
4096	90
4097	320
4098	88
4099	95
4160	95
4161	99
4162	99
4163	99
4174	99
4175	105
4194	105
4408	790
4409	790
4410	725
4411	695
4412	800
4415	480
4419	280
4422	770
4433	770
4435	850
4440	999
4450	350
4451	350
4490	350
4500	675
4501	28
4502	90
4503	50
4504	105
4506	65
4507	40
4508	265
4510	68
4511	68
4512	75
4513	199
4514	195
4515	198
4516	75
4517	415
4518	42
4519	29
4520	78
4521	200
4522	125
4526	95
4527	115
4528	80
4529	150
4530	90
4531	130
4532	110
4534	500
4536	295
4538	115
4539	115
4541	140
4543	135
4544	150
4549	395
4553	299
4554	190
4555	50
4556	55
4557	320
4558	120
4559	395
4560	180
4561	104
4562	495
4566	175
4568	250
4569	175
4572	36
4580	460
4581	250
4582	99
4583	99
4584	48
4585	99
4597	330
4598	290
4599	595
40097	88
40100	215
40101	130
40102	180
40103	175
40104	95
40105	115
40106	75
40107	60
40108	450
40109	100
40110	300
40114	240

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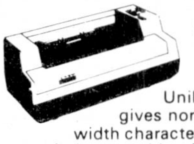

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100K Hz	270
200K Hz	295
455K Hz	370
1M Hz	295
1 28M Hz	392
1 6M Hz	395
1 8M Hz	395
1 008M	290
1 8432M	220
2 0M Hz	240
2 4576M	220
3 2768M	220
3 57954M	150
3 6864M	300
4 0M Hz	200
4 032M Hz	290
4 80M Hz	200
4 194304M	200
4 433619M	120
5 0M Hz	200
5 185M Hz	300
5 24288M	390
6 0M Hz	220
6 144M Hz	240
6 5536M Hz	200
7 0M Hz	200
7 168M Hz	250
7 68M Hz	200
8 0M Hz	200
8 867237M	240
9 00M Hz	200
10 0M Hz	200
10 7M Hz	220
10 24M Hz	200
12 0M Hz	290
14 31818M	320
16 0M Hz	275
18 0M Hz	240
18 432M	240
19 968M Hz	325
24 0M Hz	200
26 69M	290
27 648M	330
27 145M	240
38 66667M	290
48 0M Hz	270
100 0M Hz	375
116 0M Hz	300

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4 way	70
6 way	85
8 way	90
10 way	145

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12"	198p	215p	315p	490p
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16 pin	49
24 pin	88
40 pin	255

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14 pin	10p	35p
16 pin	10p	42p
18 pin	16p	52p
20 pin	22p	60p
22 pin	25p	70p
24 pin	25p	70p
28 pin	28p	80p
36 pin	–	105p
40 pin	30p	99p

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double type

	1	156
2 x 10 way	–	135p
2 x 15 way	–	140p
2 x 18 way	180p	145p
2 x 22 way	199p	200p
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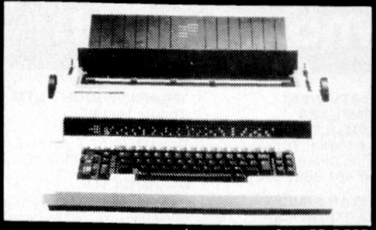

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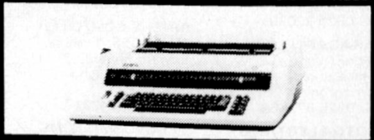
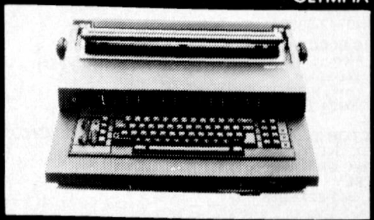


OLYMPIA



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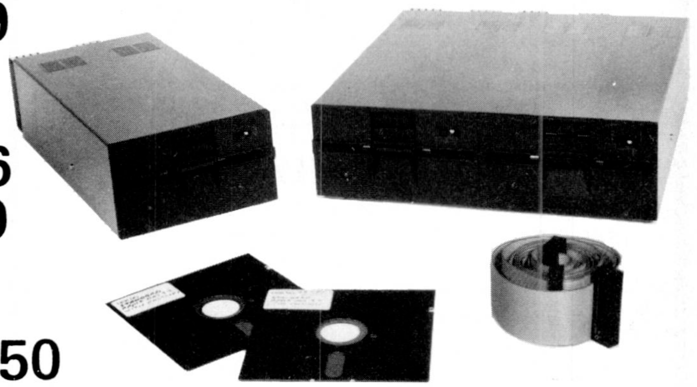

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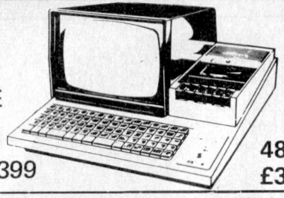

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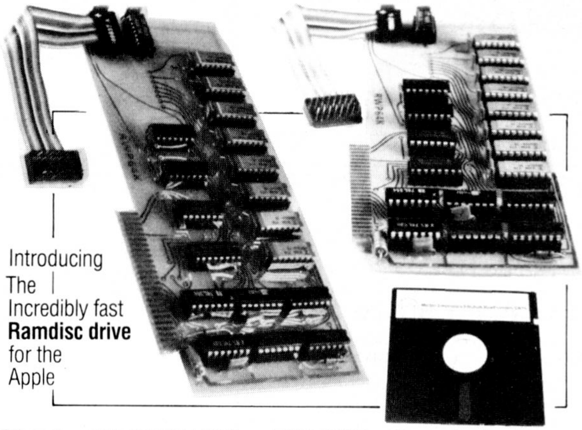
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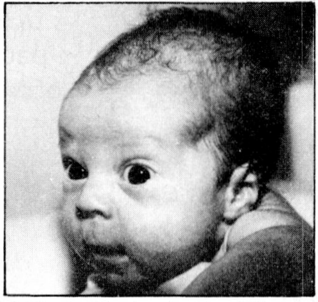

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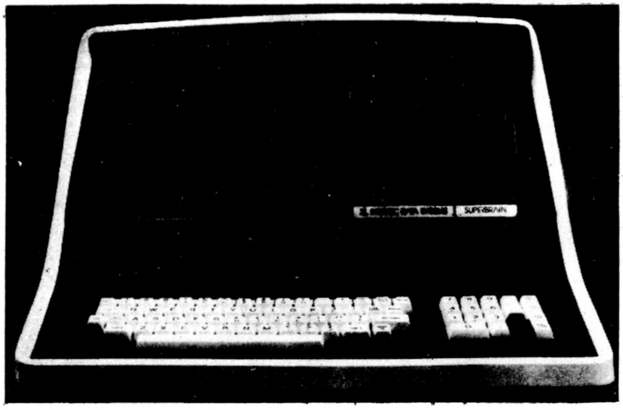

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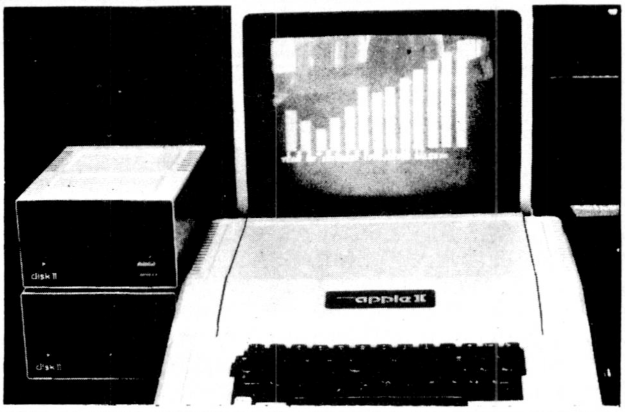

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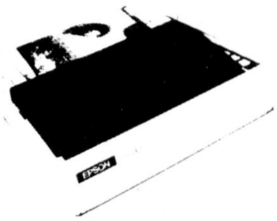

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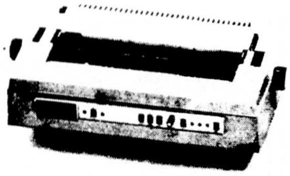

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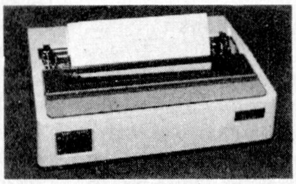

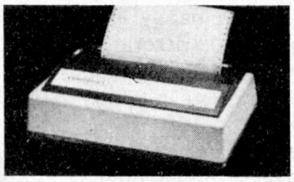


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The Sinclair ZX80 is innovative and powerful. Now there's a magazine to help you get the most out of it.

Get in sync

SYNC magazine is different from other personal computing magazines. Not just different because it is about a unique computer, the Sinclair ZX80 (and kit version, the MicroAce). But different because of the creative and innovative philosophy of the editors.

A Fascinating Computer

The ZX80 doesn't have memory mapped video. Thus the screen goes blank when a key is pressed. To some reviewers this is a disadvantage. To our editors this is a challenge. One suggested that games could be written to take advantage of the screen blanking. For example, how about a game where characters and graphic symbols move around the screen while it is blanked? The object would be to crack the secret code governing the movements. Voila! A new game like Mastermind or Black Box uniquely for the ZX80.

We made some interesting discoveries soon after setting up the machine. For instance, the CHR$ function is not limited to a value between 0 and 255, but cycles repeatedly through the code. CHR$ (9) and CHR$ (265) will produce identical values. In other words, CHR$ operates in a MOD 256 fashion. We found that the "=" sign can be used several times on a single line, allowing the logical evaluation of variables. In the Sinclair, LET X=Y=Z=W is a valid expression.

Or consider the TL$ function which strips a string of its initial character. At first, we wondered what practical value it had. Then someone suggested it would be perfect for removing the dollar sign from numerical inputs.

Breakthroughs? Hardly. But indicative of the hints and kinds you'll find in every issue of **SYNC**. We intend to take the Sinclair to its limits and then push beyond, finding new tricks and tips, new applications, new ways to do what couldn't be done before. **SYNC** functions on many levels, with tutorials for the beginner and concepts that will keep the pros coming back for more. We'll show you how to duplicate commands available in other Basics. And, perhaps, how to do things that can't be done on other machines.

Many computer applications require that data be sorted. But did you realize there are over ten fundamentally different sorting algorithms? Many people settle for a simple bubble sort perhaps because it's described in so many programming manuals or because they've seen it in another program. However, sort routines such as heapsort or Shell-Metzner are over 100 times as fast as a bubble sort and may actually use less memory. Sure, 1K of memory isn't a lot to work with, but it can be stretched much further by using innovative, clever coding. You'll find this type of help in **SYNC**.

Lots of Games and Applications

Applications and software are the meat of **SYNC**. We recognize that along with useful, pragmatic applications, like financial analysis and graphing, you'll want games that are fun and challenging. In the charter issue of **SYNC** you'll find several games. Acey Ducey is a card game in which the dealer (the computer) deals two cards face up. You then have an option to bet depending upon whether you feel the next card dealt will have a value between the first two.

In Hurkle, another game in the charter issue, you have to find a happy little Hurkle who is hiding on a 10 X 10 grid. In response to your guesses, the Hurkle sends our a clue telling you in which direction to look next.

One of the most ancient forms of arithmetical puzzle is called a "boomerang." The oldest recorded example is that set down by Nicomachus in his *Arithmetica* around 100 A.D. You'll find a computer version of this puzzle in **SYNC**.

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By selecting the ZX80 or MicroAce as your personal computer you've shown that you are an astute buyer looking for good performance, an innovative design and economical price. However, selecting software will not be easy. That's where **SYNC** comes in. **SYNC** evaluates software packages and other peripherals and doesn't just publish manufacturer descriptions. We put each package through its paces and give you an in-depth, objective report of its strengths and weaknesses.

SYNC is a Creative Computing publication. **Creative Computing** is the number 1 magazine of software and applications with nearly 100,000 circulation. The two most popular computer games books in the world, *Basic Computer Games* and *More Basic Computer Games* (combined sales over 500,000) are published by Creative Computing. Creative Computing Software manufactures over 150 software packages for six different personal computers.

Creative Computing, founded in 1974 by David Ahl, is a well-established firm committed to the future of personal computing. We expect the Sinclair ZX80 to be a highly successful computer and correspondingly, **SYNC** to be a respected and successful magazine.

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Right now we need all the help we can get. First of all, we'd like you to subscribe to **SYNC**. Subscriptions are posted by air directly from America and cost just £10 for one year (6 issues), £18 for two years (12 issues) or, if you really want to beat inflation, £25 for three years (18 issues). **SYNC** is available only by subscription; it is not on newstands. We guarantee your satisfaction or we will refund the unfulfilled portion of your subscription.

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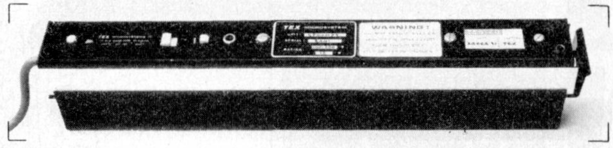


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CHIP CHAT

Hot on the heels of the ACT Sirius 1 comes news of a British rival — from British Micros and due out this Summer. It, too, is 8088-based, has 128k of RAM, a built-in clock/calendar and twin 350k of disks. Projected selling price is £2000, or £3000 if you'd like a 5 Mbyte hard disk. . . Stateside PET punters have been spared the awsome sight of CBM's global marketing supremo Kit Spencer staring at them from that company's ads. The latest ads feature Captain James T Kirk — sorry, actor William Shatner of 'Star Trek' fame, now looking much older — extolling the virtues of Commodore computers. Strange. One would have thought that after the hi-tech hardware aboard the Enterprise (direct voice input, planet scanning interfaces, auto Klingon alert, lots of lovely flashing lights), the CBM products would seem boringly mundane. . . Editor Rodwell thought he'd discovered a rival to the hated Rubik's Cube — putting a ZX Printer back together. After spending several weeks trying to cram all the bits back into the case, he was most annoyed to see nubile Programs Editor Maggie Burton establish the world record by re-assembling it in three minutes flat. And it worked perfectly. . . Reports of 'overwhelming success' reach us from the BBC after the 'Tomorrow's World' experimental software broadcast' Hundreds of viewers reported receiving and running the programs successfully, the youngest being a six-year-old, the most extravagant being the man who ran the program though his computer to a phototypesetting machine, and the most dedicated being the BBC TV engineer who built a TV sound-only receiver especially for the purpose. The reason why the Apple in the studio failed to receive the program was simple: in the tension of a live broadcast, presenter Sue Ingle pressed the wrong key and crashed it. . . Talking as we were earlier of British Micros, co-boss of that outfit, the unspellable Manas Heghoyan, set a record of sorts by being the first person from the entire British microcomputer industry to *win* money in Las Vegas during a recent trip there. On hearing the news, Editor Rodwell promptly packed his bags and jetted off to spend Christmas trying to do better than Manas's $100 win. He was last heard of sitting on the pavement outside the Golden Nuggett frightening passers-by with a tuneless rendering of 'Buddy Can You Spare a Dime'. . . Meanwhile *PCW*'s publisher, Felix Denis, has been reaping the reward of a misspent adulthood. While holidaying on the QEII (alright for some . . .) he won an Asteroids tournament against 11—16 year old opponents. First prize: an Atari 800! To them that hath, mumble, bitch, gripe. . . Finally, please, *please* will everyone stop ringing us for the phone number of the BBC Computer sales office — *there is no phone number.* You have to write to: BBC Microcomputer Systems, 14 Station Road, Kettering, Northants NN15 7HE. The BBC Computer is *only available by mail order* and, when we last heard (just before Christmas) there was a backlog of some 9000 orders, although hopefully this will have diminished by the time you read this. We're sorry if this sounds unhelpful but we just can't handle dozens of phone calls a day — we have a magazine to produce.

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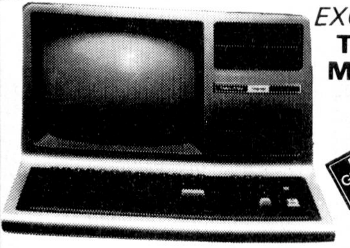

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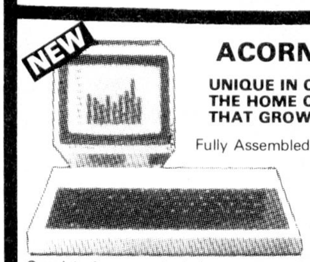

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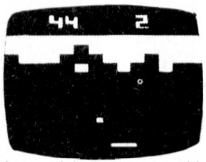

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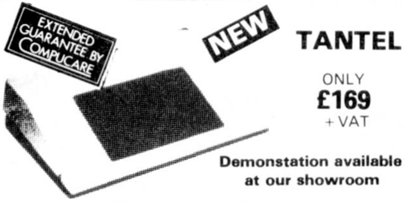

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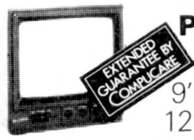

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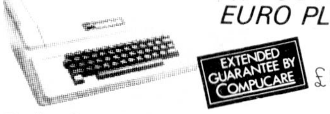

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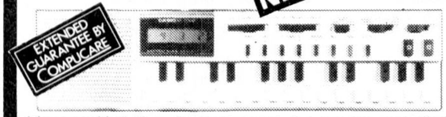

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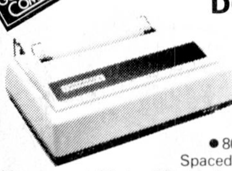

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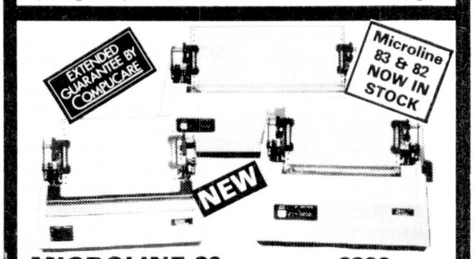

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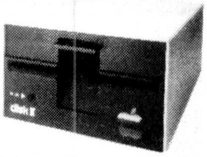

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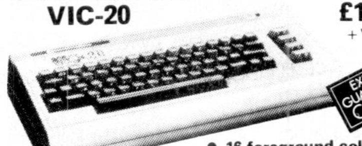

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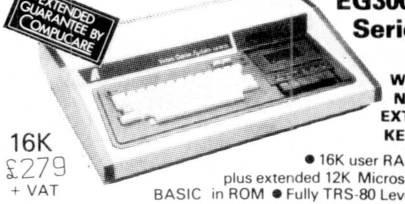

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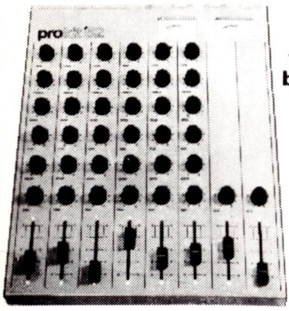

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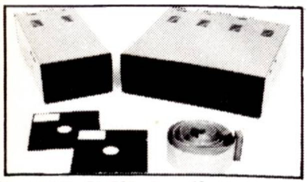

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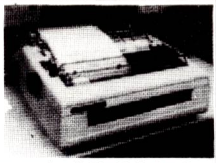

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