FROM THE MAN WHO GAVE YOU PET...
Sirius: The 3rd Generation Micro
MicroCentre introduce Cromemco's new System One computer, available with an integral 5 megabyte Winchester hard disk, at a new low price.

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

Call MicroCentre for Cromemco

MicroCentre Ltd
(Complete Micro Systems)
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.

### Introduction to Microcomputers

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.

### Micro-Pro Software Tools

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.

All courses provide access to an extensive range of micro hardware, software and expertise.

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

### Fundamentals of Programming in Basic

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.

### Training for Computer Professionals

Course in: Micro Technology for Management • Local Area Networks • Micros for Computer Professionals.

Courses are run at the Workshop or on site. Telephone or write for details.

### Micro Technology Workshop

Set in 8,500 sq.ft in Central London, the Workshop is a few minutes from Covent Garden, Trafalgar Square, Charing Cross, Embankment and Waterloo stations. Specialist areas include: Personal Computers, Technical Systems, Business Systems, 16 bit and Local Network Systems, Bookstore and Training Rooms.

### Booking and Fees

The fee for all courses is £80 per day plus VAT, payable 14 days prior to starting date.

### Booking Form

(Please complete in BLOCK capitals)

To Digitus Ltd, 10-14 Bedford Street, London WC2E 9HE. Tel 01-379 6968

0 Please send me further information 0 Reserve places as follows:

- **Name of delegate**
- **Date**

- **Name of delegate**
- **Date**

- **Name of delegate**
- **Date**

### Courses/dates

<table>
<thead>
<tr>
<th>Course</th>
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<td>Introduction to Microcomputers</td>
<td>Feb 8</td>
<td>Apr 19</td>
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<tr>
<td>Fundamentals of Programming in Basic</td>
<td>Feb 9/10</td>
<td>Apr 20/21</td>
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<td>Improve your Basic</td>
<td>Feb 11/12</td>
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<td>Wordstar Wordprocessing</td>
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<td>May 12</td>
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<td>DataStar Information Management</td>
<td>Feb 25</td>
<td>May 13</td>
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</table>

- **Company/address**

- **Name**
- **Position**

- **Signature**
- **Tel No.**
60 NEWSPRINT
All the micro computing news that's fit to print plus some that isn't; brought to you by Guy Kewney.

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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.

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Read how PCW publisher won a computer in an Asteroids tournament, plus the usual industry gossip, slander etc.
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 £4112 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.

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 worldwide 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.

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

Abderdeen Tyseal Office Equipment.
Bath Wilding Office Equipment.
Belfast Card Services Company.
Bolton Wilding Office Equipment.
Bournemouth South Coast Business Machines.
Brighton Office Machinery Engineering Co.
British Decimal Business Machines, Wilding Office Equipment.
Bury St Edmunds Wilding Office Equipment.
Cambridge W. Heffer & Sons, Wilding Office Equipment.
Canterbury R. E. Typewriters.
Cardiff Sigma Systems (Calculators).
Cardiff Thos. Hill International.
Coleheath 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.
Grimsby Trentdale Office Equipment.
High Wycombe Wilding Office Equipment.
Hornchurch Wilding Office Equipment.
Ipswich Anglo 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 Rockliffe Brothers.
London AEC-2 Sherwood High Street; City Business Machines-
-57 Houndsfitch, Bethnal Green Road; Concept Business Systems;
-Dixon's Photographics-123 Holborn, 64 New Bond Street;
-Euro-Calc-12/160 Curtain Road, 224 Tottenham Court Road;
-55 High Holborn; Landau Calculators- Bournes Oxford Street,
-227 Tottenham Court Road; McDonald Stores-
-78 Oxford Street; Mercylean-137 The Strand, 92 Victoria Street;
-Mountsaintmerle-22 Cornhill Street, Sumlock-Bondain-
-263-264 City Road, 360 Easton Road, Cannon Street Station;
-Wallace-Houston-127 New Bond Street;
-Wilding Office Equipment-37 The Avenue, Reading;
-Wrighton-wrighton-Thames Wilding Office Equipment.
Leeds Holdone; Wilding Office Equipment.
Leicester A. C. Barratt & Co.; Sumlock Services.
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-Wallace-Houston-127 New Bond Street;
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-Wrighton-wrighton-Thames Wilding Office Equipment.
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 London W1 01-486 1951

Please rush me details of exhibiting at the 5th Personal Computer World Show
10 Shops Nationwide

Birmingham
19/21 Corporation Street, Birmingham, B2 4LP. Tel: 021-632 6033. Manager: Peter Stallard, 305 yards from Bullring Centre.

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

Glasgow
22/24 West Nile Street, Glasgow, G2 2RF. Tel: 041-236 3549. Manager: Graham Jones. Debenhams, Edinburgh, EH8 9DS. Tel: 031-556 6217. Manager: Colin Draper, 4 St. James Centre, Edinburgh, EH1 3PR.

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 Bowles. Top of the Moor, opposite Town Hall.

Edinburgh

Liverpool
33 Dale Street, Liverpool, L2 2HF. Tel: 051-227 2535. Manager: Mark Butler. 14 Castle Street, Liverpool L2 OTA Telephone 051-227 2535.

Preston
1/4 Guildhall Arcade, Preston, PRE 1HR. Tel: 07727 592264. Manager: Jim Connors. Directly under Guild Hall.

London
42 Townsend Court Road, London, W1 9RD. Tel: 01-936 0845. Manager: Vas Demetriades. Between Holiday Inn and C & A.

Terms & Conditions

Our Conditions of Business

In addition to cash we accept Access, Barclaycard, Sterling, American Express, Visa and cheques covered by a bankers bond. Official orders over £50 are welcome, with normal 30 days credit extended to bona fide commercial and government organizations. All prices, specifications and terms are subject to change without notice at the discretion of the management, subject to availability.

All previous Laskys Advertising are superseded by this. Not all stores carry every advertised item. Prices correct at time of going to press. E & OE.

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 280 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.

Osborne 1 Computer

<table>
<thead>
<tr>
<th>NETT</th>
<th>V.A.T.</th>
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<tr>
<td>1250.00</td>
<td>187.50</td>
<td>1437.50</td>
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2 year parts and labour guarantee on all Apple products supplied by Laskys

APPLE

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<tr>
<td>2695.00</td>
<td>404.25</td>
<td>3099.25</td>
</tr>
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</table>

1.25% monthly, equivalent to an APR of 33.7%.

A Better Guarantee

The products are warranted against defects in material and workmanship for a period of one year from the date of purchase. This warranty is extended to cover each Apple and Apple product.

The warranty period extends for a period of one year from the date of purchase. 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.

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.

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 280 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.

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<tr>
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<td>3099.25</td>
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</table>

1.25% monthly, equivalent to an APR of 33.7%.
| **Vinyl Carrying Case** | 16.00 | 2.40 | 18.40 |
| **Apple Ties** | 6.00 | 0.90 | 6.90 |
| **Alf** | | | |
| MCI – 9 Voice | 99.00 | 14.85 | 113.85 |
| MCI-12 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-O3/4 Analog Output 4 Chan | 195.00 | 29.25 | 224.25 |
| AO-O3/8 Analog Output 8 Chan | 299.00 | 44.85 | 343.85 |
| A1-O2 Data Acquisition | 210.00 | 31.50 | 241.50 |
| D1-O9 Digital Interface | 235.00 | 32.25 | 267.25 |
| • A1-O3 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 |
| Visindex | 110.00 | 16.50 | 126.50 |
| Visplot | 98.00 | 14.70 | 112.70 |
| Vistrend/Plot | 140.00 | 21.00 | 161.00 |
| Visterm | 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 Windows 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 |
| Allen Rain/Typhoon | 15.43 | 2.32 | 17.75 |
| Sneakers | 16.30 | 2.45 | 18.75 |
| • Glogg | 16.30 | 2.45 | 18.75 |
| Galaxy Wars | 14.28 | 2.14 | 16.42 |
| Raster Blaster | 16.30 | 2.45 | 18.75 |
| A.B.C. | 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 |
## MICROCOMPUTERS

### LASKYS

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<th>Description</th>
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#### 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.

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### MZ 80B

#### MZ 80B Computer 64K

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## ATARI

- 400 16K Computer  
  - 300.00  
- 800 16K Computer  
  - 560.87  
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  - 43.48  
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  - 325.43  
- BBS 80 Column Printer  
  - 478.26  
- B50 RS 232 Interface  
  - 117.39  
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- Light Pen  
  - 39.13  
- Pair Paddles  
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- Pair Joysticks  
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- Hangman  
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- Blackjack  
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- Chess ROM  
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- Super Breakout ROM  
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- Assembler Editor ROM  
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- Pilot ROM  
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- Microsoft Basic  
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- Technical Notes  
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- Operating System Lists  
  - 9.52  
- DOS Lists  
  - 2.61  
- DOS 2 Manual  
  - 6.04

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- Diplomat Cord (Apple-Microline)  
  - 85.00  
- Microline Ribbons  
  - 2.25  

## MICROCOMPUTERS

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### Colour Monitors 14" New!

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<td>Paper 9½&quot; x 11&quot; 2000 Sheets</td>
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<tr>
<td>Paper Delivery</td>
<td>3.00</td>
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PCW 11
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.

The MicroValue price is £107.50.

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

The MicroValue price is £340 + VAT.

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!

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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
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**SOFTWARE**
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Nascom owners can now have a professional 80 x 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.

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Bits & PC's Prog. Aid
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*Savings*

**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.

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MX-80 II £399
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OKI MICROLINE 80 & 82A


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ML 82A £437

OKI MICROLINE 83A


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

TEC STARWRITER


Parallel Interface £1020
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Manager: Colin Draper.

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Manager: Lesly Jacobs. Corner of Deansgate.

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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.
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**QED Mains Interference Suppressor**

- For use when mains interference is causing your computer problems. Simply plug the equipment into the mains socket and the suppressor into the mains socket (see specification for maximum power). Where interference is severe, an alternative method of letting the equipment into the mains circuit of the appliance causing the interference, may prove to be more effective in some cases.
- For use when mains interference is causing your computer problems. Simply plug the equipment into the mains socket and the suppressor into the mains socket (see specification for maximum power). Where interference is severe, an alternative method of letting the equipment into the mains circuit of the appliance causing the interference, may prove to be more effective in some cases.
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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:
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3. Extensive menus — comprehensive prompting reduces the need to refer to the manual, and you can choose between one of four help levels.
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WordStar has been enhanced by other MicroPro products that work together to provide complete text and data-handling solutions for business:

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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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3. Tell HESPPELL to LEARN this word for future reference, with just one keystroke.

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Hexagon Systems is proud to announce another first in text checking — an everything checker. HESPPELL 2 checks not only dictionary words, but learns and checks codes, formulae and numbers which are so essential in many commercial and technical documents. With Hexpell 2 you define which characters make up a “word”; then teach HESPPELL the new “words” it needs to check your text. This advanced system builds on the unique features of the original HESPPELL (the first TRS-80 spelling checker).

When we introduced HESPPELL nearly a year ago, it was the world’s first adaptive learning spelling checker. HESPPELL constantly adapts its wordlist to your usage. No complicated editing of the wordlist. HESPPELL remembers words as long as you use them. If you never use a word again HESPPELL will eventually forget it to make room for new words. Extending this feature in HESPPELL 2 gives you a text checker that can learn to check everything that you write.

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TRAINS & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus 50p postage.
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
SOURCE
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.

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
PATCH
RS232
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 surprising 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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be set up to perform tasks normally associated with the following list.

DBMS2 is a record relational as well as a file relational database management tool that is names, telephone numbers, and what their salaries are as well as their salary if increased age, not married, of credit worthiness grade 1, with a car, prepared to travel, and find someone whose name begins with W, who is either in London or Birmingham, 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 you 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 9 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 80 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 wood 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).

<table>
<thead>
<tr>
<th>Accounting</th>
<th>Budgeting</th>
<th>Cashflow</th>
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<tbody>
<tr>
<td>Simulations</td>
<td>Time recording</td>
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<td>Hotel indexing</td>
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<td>General analysis</td>
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<tr>
<td>Answer what's</td>
<td>Employees records</td>
<td>Tabulation values</td>
</tr>
<tr>
<td>Print reports</td>
<td>Sort lists</td>
<td>Edit records</td>
</tr>
</tbody>
</table>

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 then provide 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 contracts, bought from supplier 52, allocated more than 20, rated for tax at 19% and weight less than 50 lbs. When you find such categorize then print a report showing the description, cost price, quantity on hand, time left for sale, 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 you 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 9 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 80 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.

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14 = Print supplier statements
15 = Print agent statements
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<th>Price</th>
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<tbody>
<tr>
<td>64K x 320K DISK</td>
<td>1850.00</td>
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<tr>
<td>64K x 420K DISK</td>
<td>2395.00</td>
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<tr>
<td>64K x 520K DISK</td>
<td>3950.00</td>
</tr>
<tr>
<td>64K x 620K DISK</td>
<td>4950.00</td>
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<tr>
<td>5.7 MG CORVUS DSK</td>
<td>2250.00</td>
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<tr>
<td>10 MEG CORVUS DSK</td>
<td>2200.00</td>
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<td>CORVUS Monitor</td>
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<td>CORVUS Mirror</td>
<td>750.00</td>
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<td>Advantage/Star</td>
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SYSTEM 1

<table>
<thead>
<tr>
<th>Model</th>
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<tr>
<td>64K x 750K DISK</td>
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<tr>
<th>PROCESSOR</th>
<th>RAM</th>
<th>I/O BOARDS</th>
<th>VIDEO BOARDS</th>
<th>DISK CONTROLLERS</th>
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<td>Z80 Starter Kit</td>
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- Stock Control
- Job Costing
- Estimating
- Payroll
- Word Processing

(automatic compilation, editing and production of repetitive letters and documents).

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<thead>
<tr>
<th>SYSTEM A</th>
<th>SYSTEM B</th>
<th>SYSTEM C</th>
<th>SYSTEM D</th>
</tr>
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<tbody>
<tr>
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<td><strong>APPLE II</strong></td>
<td><strong>SUPERBRAIN</strong></td>
<td><strong>RAIR</strong></td>
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<tr>
<td>£399</td>
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<th>CAPACITY</th>
<th>PRICE</th>
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<tr>
<td>1 x 40 TRACK DRIVE</td>
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<td>2 x 40 TRACK DRIVES</td>
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<td>1 x 80 TRACK DRIVE</td>
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<td>2 x 80 TRACK DRIVES</td>
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<td>2 x 40 TRACK DRIVES</td>
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<td>1 x 80 TRACK DRIVE</td>
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<tr>
<td>2 x 80 TRACK DRIVES</td>
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PCW 59
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 have never been 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 quite embarrassing to the people involved that I feel obliged to disguise the events, personalities, and factors.

A computer called The Honk Supplier Ltd had 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, Yolk, was very annoyed to find that Honk Supplier Ltd would not provide Bleat on the Superhonk, which was the deal 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 focusing pressure groups. It was the strange one of being as nice as possible, postponing them, and flattering them at every opportunity, with the eventual object of her coming so high on Honk's 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 sweeter tempered of two thoughtful bunch of gentle-folk 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.

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 to worry about, it must have seemed like the last straw to many Commodore dealers.

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.

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...
The bear is buried

The announcement that Newbury Laboratories is going to make its own micro is a startling turn of events 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 Newbrain, a subsidiary which sells micro-computers.

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 machine using a dual Z80 board built into the company’s 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 technology centres and in major organisations such as British Aerospace, Marconi, Plessey, Ferranti, Thorn EMX, Elektronics, the BBC, ITN Texas Instruments (or ‘Tube Investment”) and 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 Professional 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 Oyes 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 from organisations

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 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 (no ho).

Details from organisers MONTB 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.

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Details from organisations

Will it catch on?

I am just about as nervous to see all these micros with Mathematicians using 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 Postron, a new company’s design and aimed at the sophisticated viewdata users who want personal computing power.

The two founders of Postron are Peter Loftus and Peter Plinston. Both were IBM systems engineers before and both are impressed by the argument that a machine has to be able to run CP/M software: they both thought the 8080 was a better chip than the Z80 and backed their judgement.

‘We searched the need for a general purpose, personal workstation device,’ commented Loftus (marketing man). ‘It has colour as well as believe colour enhances the display of information, making it easier to understand. External communications we felt was important,
“Personal Computer World is the most consistent, intelligent, informative and irreverent publication on the subject available. It’s a pleasure to hear it thump through my letterbox every month.”

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

The machine backs up South West Technology's contention (see 'Communications' a couple of months back) that 68000 is neglected, but capable of doing things which normally are regarded as the job of 8-bit micros for example, running Unix (or Unix-like) operating systems. Position 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 bytes of internal RAM, and another 256 bytes of ROM providing high-resolution colour graphics and multi-user facilities.

The company was provided with a £250,000 cheque from the Anglo-American Venture Fund (which has government sponsorship) last year. Details on 01-226 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 BCC 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 text and text anywhere on the screen, or the ability to define your own character displays, or to have 'windows' of text. The text is full upper and lower case (with 256 character sets as on the standard Atom). To run this program, Computer Concepts says, you must have the extra 8k 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 D J Wynn, Chipperfield, Herstmonceux, Sussex.

**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 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 turned out like that by University College in London. The geography department used the machine in a field exhibition and the thing worked defect-free, 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.'

**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 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 £80 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 magazine) 'wonder 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 confoundingly 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-
Sinclair Owners! We’ll give you £50 trade-in when you trade-up!

Our offer will be of special interest to those who’ve found the popular Sinclair a fine introduction to computing. True, there’s no better value at under £100. However, as your skills increase, you may find you need a microcomputer with greater memory, expansion capability and performance.

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*Offer applies only to Sinclair ZX80 and ZX81.*
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 $900 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 0223.

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 has no phone number. Address is PO Box 59, Royal Leamington Spa, Warwickshire W11 3QA.

Xerox software

Obviously taking its new dynamic role seriously, software supplier Lifeboat is adding to the list of CP/M software 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.

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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where teachers found Prestel useful, costs were not a problem, 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's Guide to 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 Hitch, 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 off into space by marauding Vocrons: instead, he ends up in a retired authority on the Welsh long-ho 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 of the 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 WC1 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 Good.

**Friend or foe?**

I'd like to go on record as heartily endorsing the show at the NCC's micro the program writing program. Of which The Last One is an interesting type of software, several brushes with a very interesting type of software, comments are provoked by publications, 240 High Holborn WC1 7DT.

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**PET links**

Up to 285 PETs can be linked together with a little board called Hydra, now available from Wordcraft Systems of Derby. The machines can communicate, load and save programs, and interchange screen display, says Wordcraft Systems. Messages are passing at a rate of 350,000 baud down a four-wire 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.

**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 edition of the NCC centre's Learning for Good.

**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.

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 edition of the NCC centre's Learning for Good.

**Atom database**

Ideal for storing a personal phone directory, says Acorn's Acomsoft, 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 organises 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.

**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
"Every PET owner should read it"

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.

Some of the topics covered:

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- PET's Video Logic
- Colour for PET: The Chromadaptor

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- Supercrash
- PET AID Do-It-Yourself Database
- What's Wrong with WORDPRO?
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- Commodore's Assembler Development System
- Programming Aids & Utilities Survey
- PET Games

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PCW 2/82
Hup, two, three, beep......

American cinemas have been rendered uneasy by the arrival of the alarm watch. All over the country, romance is derailed by the simultaneous sound of hundreds of bleeper 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 bleeper.

Now Casio tells us that it has launched a new function for the wrist watch. It is a novel 'pace mode' for joggers. Parked on the road, 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 increased running rate. 'Provided a jogger keeps pace with the pips and sets the speed just right, as the £100 watch offers the wearer a series of meaningful data for display - the speed 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. The £102 Smart Arm, as it's known, is an expensive joke, if silly rather than funny. I suppose companies everywhere 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 Visicale loaded into its capacitous stomach. The company claims that this increases the capacity from 1200 items of information to 8000, which is three times the capacity of comparable Visicale machines. Details on 01754 85532.

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 (they use the educational) from Systems Control. It has a micro in it - the original Acorn model - 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 movements, a turn out a metre, turn through 300 degrees with much greater precision, and lift 1.5 kg with a grip of 10 kg. It costs £2260. Details on 01930 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 computer. So it shouldn't be any surprise to find that this project is now planned to bring fruit until next year (1983) too.

More impressive, to my mind, is the news that ICL has received an order from Westinghouse for 100,000 software tapes — for the ZX81. Sinclair expressed concern that nobody had heard about ICL's involvement so maybe everybody else will be telling us that the training division of the computer giant had written training software for the little compactor 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's 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 use logic. They could connect transistors together to form gates. Then, because the chips 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 uncommitted — 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 producing all-purpose logic chips which the engineers can modify. They are logic arrays, either field-programmable, or uncommitted — and Sinclair used one very effectively in the ZX81, while the BBC microcomputer has two very powerful chips of this sort.

Intelligent design?

Intel is the company which gave us the microprocessor and which has, up till now, not have tried any of the following: turned it into a line dedicated to printed wiring board involving dramatic changes in skin resistance, programming your plant with the aid of our specialist software and 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 change in weight, monitoring and or controlling temperature-related functions in solar panel and heating, greenhouse control; monitoring mains power by successor to their monitoring the circuit and having the computer set off an alarm......

Details from Black Star, which sells the Saturns Model 2020 digital multimeter with interfaces to all the above micros, Price £115, details on (0480) 62440.

Easier formatting

Because Basic is inherently elementary (and often called the language 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. One such product is a piece of add-in software for CBasic, called Microscopes. According to the supplier, Microscopes '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 normal forms are validated on input.'

This facility is probably more important on CBasic than other forms of 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 editor first, and then re-interpret the code into the code, 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 characteristics into the program and they are all invisible. (Anybody who knows a way of going through a Wordstar program and re-setting the high bits, let me know, and I'll certainly give your code a plug.) The company Microscopes is in Wokingham on (0734) 79221 and the program costs £110.

Lie detector

You may possibly have heard 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............
When it comes to looking at what the incredible VIC-20 has to offer, there's one cost-free add-on it will pay you to consider right from the start. It's called The VIC Centre, and you'll find it at the Adda Home Computers shop in West London. Part of the successful Adda Computers group, The VIC Centre provides the kind of service you'll not find anywhere else in the country.

Our business is dedicated towards providing you with a “one-stop” source for the VIC-20, VIC-20 peripherals, and VIC-20 software. On the basis of a very simple philosophy: providing a friendly, fast and comprehensive service for the world's most user-friendly and helpful personal computer.

With its magnificent sound and colour capabilities, the VIC-20 makes it easy to learn all about computing. And as your knowledge grows, we can supply the software and peripherals which give the VIC-20 system unrivalled versatility in applications ranging from home budgeting and video games to business records and statistics.

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So if you want to get to the heart of what the VIC-20 system is all about, go straight to the centre—the VIC Centre.

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For up-to-date information on the VIC-20 system join our information service. Just complete the details on the FREEPOST coupon below and post it today, or telephone us on 01-992 9904.
steadfastly refused to give us a microcomputer. Instead, it has put its own chips inside a few highly crafted mini-computers and has (perhaps sensibly) steadfastly refused to compete with those of its customers who put them inside cheap micros.

There are some signs that this is changing. The company recently announced a 6 bit minicomputer, built around 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 halfway 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 hardware as they get 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 it are white-faced with shock at its sophistication and handcuffed in non-disclosure agreements.

Details are not available to any but the favoured few as yet. Whether this sophistication is really what the market wants remains to be seen. But if a 68000-based system is built, Intel can do it. And if 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 Micro-computerland, which turned out to be a subsidiary of a well-known UK software house, 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 Compeck, 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 package 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 RH (mini-systems) — 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 inverse the characters (black on white rather than the normal white on black) and provide a clearer display thereby.

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Sigh for Cifer

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 VIOs, to 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 £28 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.

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Sigh for Cifer

The name Series 1 normally applies to a rather old and somewhat strange IBM mini-computer, 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 1886 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
A NEW GENERATION OF NEC SPINWRITERS

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Or a terminal from a company that just makes lots of promises?

*subject to being in stock.

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Small, light, quiet, dot matrix printer. 40, 80 or 132 columns, 6 or 8 lines per inch, 96 ASCII characters plus 64 graphics characters, Centronics Int.

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Fully intelligent terminals with 24x80 display & dual intensity, blinking, reversed, underlining and protect fields, 96 ASCII chrs etc.

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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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Computer data and graphic displays never look better, brighter, sharper. Low cost, high resolution, high performance.

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Daisy wheel printer for word processing, professional results. Diablo compatible, suitable for most micro and mini computers.
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 sagaciously 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 will 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 governmental 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, as with anything, 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 existence, 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 machines, that are in areas where there are schools already using them, can gain...
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 reactor, solve simultaneous equations, make Space Invaders work.

'A couple of hours later I managed to get a small square on the TV screen and moved slowly down the line, square and moved slowly down the screen. What happened was that three small black squares appeared at the top of the screen and an X appeared. '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...'

So I was the big black monsters, id... With the kettles gone I turned to the equipment motionless piece of last year's 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.

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!

Did they tell me that in the magazine ad? Oh no. Nothing about buying one shiny new fantastic powerful wonderful magic FX89 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. 'Blow 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 appeared. '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...'

How were the big black monsters, id...? I felt brave enough to ask him. I asked him to explain more... 'I have no criticism of them at all. But selected are both very fine machines. Systems from indigenous manufacturers. Full employment for the people is a major vote-catcher - and I'm sure it is - then we will all look much happier. 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.'
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Our authors come in a variety of guises. Some are software houses who want to get their work to a big market, thereby boosting their name and revenues. Others are work-at-home professionals who steam over micros into the early hours. Members of universities, polytechnics, and colleges with clever ideas and programs are another valued source. And, of course, the micro has stimulated a new breed of imaginative user, specialists in particular disciplines who have produced new solutions to old problems.

We are looking for software which will cross international boundaries to the big markets in the USA, Japan and Europe. We do not want application packages peculiar to the UK. We do want Management and Productivity Aids and Systems Software.

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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 PBTs. 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 directly 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 Butler, 15 The Brow, Breeks, Rotherham, Rotherham S44233 (home) or Sheffield 446333 (office); Jim Turner, 63 Millaus 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 Jeffries writes from The National Federation of City Farms. Maybe this is the start of ComputerTown UK. Maggie can be contacted at 15 Wilkin Street, London, NWS 3NO. Telephone 01-267 9461.

Other enquiries this month came from Rochdale, National Westminster Bank’s Computer Users Group; 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.
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 sofware manual, but it all works perfectly. 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. Press 'ESC' will end insert mode as normal - old line number is no longer there. Press return;
6. Old line still exists in program plus.

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 $5 donation from everyone who finds this routine useful

P H Elliott, Thundersley, Essex

Atari interpreter

I was very interested in the article 'Inside the interpreter' by A 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 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: 0.16 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 variableZZZZ gave a speed improvement of 0.05 seconds - much less than the 50 percent improvement with Crystal statements.

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 from January 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 Superbrain 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. I'm damned if I can fathom the dBase II handbook. The Superbrain tome makes up in weight what it lacks in clarity.

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Speak no eval

I was interested to read your review of the programs using the EVAL function built into the BBC Microcomputer. Is this option available with all machines?

I have used VAL A$ on my Sinclair ZX81 to perform what seems to be essentially the same operation - eg, the program

10 PRINT VA$.

The program gives 4 (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; 'CALCULATOR'; TAB 41; '="="=
20 PRINT
30 PRINT $A$.
40 PRINT A$; "= "; VAL A$.

It is then input as the expression to be evaluated (which may contain any function, eg, SIN and indeed any 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 the simulation of flight, I know of three programs: 'Flight Simulator' from Instant Software, Dept HC-2, Peterborough, NH 03458, USA, cassette $9.95, for TRS-80 L1 and L2, Apple II 16k (Applesoft); 'Sublogic AFS1 Flight Simulator' from Sublogic, Box V Savoy, IL 61874, USA, disk $35.50, for Apple II (write-up of this program in July/August issue, Computers & Programming: Flight Simulation' from Eclomp, cassette $17.95, for Atari 800, Tandy Colour Computer 16k.

I have not used any of

PCW has always been aware of the riches 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
November over a problem simple. Having seen a form itself is relatively phrased and the explanatory tions are not always simply ment of the IR!) The ques- good reason and the agree- know it was late, but have transitional period. local income-tax during the and that the Inland Revenu should not be asked to handle system to computer is that conversion of the PAYE less) has stated categorically revenue for local authorities. system as a means of raising tax should replace the rating in the Inland Revenue. At "heavy" newspapers and other business press there 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 comfort-ably on the 'OL' 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 inconsistancy 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 McImoyle and Mr Steve Withers are unaware of this system - VERA, which is now in common use in several of the nationalized industries, local authori- ties and other offices. Mr Withers cites an article in which 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 exis-ting software which is obtain- able 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 acco-lades as 'As a programmable machine, it will be 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 pro-gramming' (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 pro-grams 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.
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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 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 opened 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...
and then pressing CTRL-L (mnemonic L) you define areas of text in words, sentences, paragraphs and larger blocks. Line centering is done by first entering the text 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 may also set up a margin if you go to the margin if you have columns of figures that run beyond the decimal point. By typing the tab marker '*' you have the option of either function with the same tab marker.

### Formatting

There are a number of ways of specifying how you want the text to be printed, the most obvious being to input special 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 affect and similarly for text to be right justified. One oblique coding 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 choosing 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 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 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.

### Printing

Whenever you try to print a document you will be presented with a print document menu which is specified 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 files 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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text with different 'variable' information in each case. Although this facility is most obvious useful to the small businessman who can generate much more effective mailshots by addressing them to named individuals, there are applications even to 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 and arrange for me to have one X of the number of predefined sums. You can also create a base document which contains wholly variable information, such as this one:

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 main problem here is somewhat complicated to use since you are empha-

ically ordered first to make your own copy of the dictionary onto a backup disk so that if 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 Scripsit dictionary is huge; it can catch up to 1500 misspellings in a single line entry for all commands that can be entered under Scripsit, and appears as some 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 automatic lag 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 systems require the user to look at the screen much, apart from 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 a '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. If 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 'i' 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-word-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 lag 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 repagination 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 daisy wheel): 37.4 cps
All times in seconds.

For an explanation of the Benchmarks timings see PCW vol 4 no 4 April 1981.
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 the micros killed off DEC or Data General. New companies have emerged to exploit 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 reappear 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 MiniMics 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 have to wait three to ten months, 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, math, and statistics applications, price range £500-2,500, examples: Apple, PET, Osborne, Tandy.

- **Level 3**: Tiny business systems, one-to-four users, 500k-20M on-line store, price range £2,500-15,000, examples: Altos, Dynabyte, Cromemco, Sirius, IMS.

- **Level 4**: Minicomputer replacement. multi-user machines, local area networks, 10-100M on-line store, price range £8,000-30,000, examples: Alpha Micro, Micromation, Nestar, Zilog.

Some mini manufacturers have produced good, low-cost input and output devices. Traditional, established manufacturers familiar to mini-computer users include CDC disks, Lear Siegler, Newbury, Hazeltine VDUs, Centronics, Texas, Diablo, DEC printers. New companies include Trendcom, Epson and Anadex low-cost printers, Volker Craig and Televideco 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 increases, notably for display screens, disks and daisywheel printers. As much as 50 per cent was chopped off in 1980 as new micro-controlled devices penetrated the market. 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 5in variety with typical capacities of ten and 20 megabyte capacities. These were followed by the 5in mini-winnies, five megabyte disks that take up the space of a 5in floppy disk drive but provide five to ten times the capacity. The Japanese and Americans are the big producers of Winchester disks — Fujitsu Seagate have a name for good quality products. Rodime is a new UK name in Winchester disk supply.

## Systems software manufacturers

Three companies are becoming 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 class. Each 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 C8 Cobol.

Systems software manufacturers are one of the most important elements in the micro computer industry. 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 8080/8086 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. 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 development PL/1 for micros. The IBM Display writer now has CP/M, as has the Wang.

## Some popular micros

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

<table>
<thead>
<tr>
<th>Grade 1: Home and Educational Devices</th>
<th>Grade 2: Personal Computers</th>
<th>Grade 3: Business Systems</th>
<th>Grade 4: Minicomputer Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acorn, Commodore, Sinclair, Tandy</td>
<td>Apple, Commodore, Intertec, Tandy</td>
<td>Altos, Cromemco, Dynabyte, NIMS, North Star, Vector Graphic, Sirius</td>
<td>Alpha-Micro, Nestar, Zilog</td>
</tr>
</tbody>
</table>

## Component members of the micro industry

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

<table>
<thead>
<tr>
<th>1</th>
<th>Semiconductor Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Board Manufacturers and Assemblers</td>
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<tr>
<td>3</td>
<td>Computer Manufacturers</td>
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<tr>
<td>4</td>
<td>Peripheral Manufacturers</td>
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<td>5</td>
<td>Systems Software Manufacturers</td>
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<tr>
<td>6</td>
<td>Application Software Manufacturers</td>
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<td>7</td>
<td>Software Publishers</td>
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<tr>
<td>8</td>
<td>Importers/Distributors</td>
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<tr>
<td>9</td>
<td>Computer Retailers</td>
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<tr>
<td>10</td>
<td>Microsystem Companies</td>
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<tr>
<td>11</td>
<td>Maintenance Companies</td>
</tr>
</tbody>
</table>
Since its introduction the Sharp MZ-80K has proved to be one of the most successful and versatile microcomputer systems around. Sharp now have a comprehensive range of products ready to make the powerful MZ-80K with its Printer and Disc Drives even more adaptable. Products include:- Universal Interface Card, Machine and 280 Assembler packages, CP/M* plus a comprehensive range of software.

* Trade mark of Digital Research Ltd.

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Neesco (DP) Ltd., Darlington. Tel: 0522 696940
ESSEN
Providue Ltd., Walsall-on-S sea. Tel: 021 332298
William Office Equipment. Final. Tel: 01 304 1122
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The Micro Shop, Redditch. Tel: 01 321 2322

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C.W. Clawson Ltd., Lichfield. Tel: 021 301 5222
Leicester Computer Centre, Leicester. Tel: 0533 35520

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Aquafish Ltd., Manchester. Tel: 061 2364737
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NMI

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NORTHERN-IRELAND
Brooke (N.I.) Co. Antrim. 028 9381 3934
O & M Systems, Belfast. Tel: 0232 43499

NOTTINGHAMSHIRE
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OXFORDSHIRE
Oxford Computer Centre, Southam London. Tel: 0295 49999

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Bellant And Bivamins Ltd., Edinburgh. Tel: 031 226 1545

ESCAL
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SUPER TRACE by I Trackman

Super Trace is a high-speed 6502 machine code utility routine for use in debugging Applesoft programs. As each of your program statements is executed, it is displayed at the bottom of the screen, together with the values of any variable types or functions that you may have pre-selected.

- Programs can be written, loaded and edited without affecting Super Trace.
- Does not interfere with DOS
- Can be invoked and disconnected as often as required during program run-time.
- Simple to use Run-time control by single keystroke.
- Optional display of all statements or only statements containing selected variable types or functions.
- Variables highlighted in inverse display and their values displayed.
- Normal screen display not affected.
- A run-time speed setting plus instantanous stop and single-step facilities, all available by keyboard control whilst program is running.
- Optional review of previous 10 program statements without destruction of screen display.
- Fully documented.

SYSTEM REQUIREMENTS - Apple, Apple Plus or ITT 2020. Applesoft/Palsoft in ROM

SYMDIS

Symdis is a symbolic disassembler for use by both competent 6502 assembly-language programmers and those less experienced.

Symdis will take a block of machine code from anywhere in ROM or RAM (except zero-page) and produce from it a disassembled source code with all relative branches and internal absolute address references converted to alphabetic labels. Every affected operand will be replaced by an address-related symbol and all target addresses will be labelled with their correct symbols.

The experienced programmer will be able to have access to machine code programs in a usable form, whilst the newcomer to assembly language can take a working program and teach himself how it operates by studying a properly labelled source file.

SYSTEM REQUIREMENTS - 48K of memory. One disk drive. DOS 3.3.

VISICALC UTILITIES

Visicalc Utilities Apple computer program includes Visiprint — Re-format the printout of your worksheets with variable column widths, additional text headings, dates, page control and numbering. If you have a clock card the date & time are automatically included in your printout. Visiprint format files can be saved to disc for future use.

Visiform — Enabling you to list out on your printer or VDU those formulae too wide for the Visicalc display area. Find routine allows you to trace calculation reference in worksheet.

Virtual Utilities Apple computer program includes Visiprint — Re-format the printout of your worksheets with variable column widths, additional text headings, dates, page control and numbering. If you have a clock card the date & time are automatically included in your printout. Visiprint format files can be saved to disc for future use.

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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 triumphantly Vision. 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 purchases. Once 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 Osborne Software Publishing Corporation of Grah 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 between the importer/wholesaler/distributor who buys in bulk, splits up and sells to dealers/OMEs/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, software bugs, US plugs still intact and an engineer is often required to put it all together.

Recently, some of the bigger manufacturers are taking an 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 new arrival 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 existing salesforce. This attraction is 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 Metropoly. 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.

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.

Some popular software

Operating systems
CP/M, MP/M
Univ derivatives
Language
Microsoft: Basic, Cobol, Fortran, Pascal
Micro Focus: C/S Cobol,
UCSD Pascal
Popular packages
MicroPro: Datastar, Wordstar, Mail Merge
Micro-AP: Selector IV
MicroProducts Software: AutoClerk, Autoindex, Ledgers
Personal Software: VisiCalc
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TRS 80 Levels I & II 16 K Tape
Video Genie 16 K Tape
The Newest and Most Astounding Arcade Game that TALKS has just Reached Planet Earth. You can't help yourself, you have to stop them at all cost. Don't let up. Written especially for high quality graphics you'll simply be dazed and excited by the action.

Attack Force

TRS 80 Levels I & II 16 K Tape
Video Genie 16 K Tape

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Your fighter appears below a convoy of Aliens! If you destroy them another set appears who seem to be slightly cleverer than before! Soon your space station rears but before you can dock the station comes under attack! Survival is up to you! The excitement is just beginning!!

Cosmic Fighter

SuperNOVA

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. Deathmaze and Labyrinth over 550 locations!

Asylum 1200

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, sneak 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.

TRS 80 Levels I & II 16 K Tape
Video Genie 16 K Tape

Now the amazing ASTEROIDS arcade game for your TRS 80! Your ship is floating in the middle of an asteroid belt! Your only escape is to destroy them and the crafty alien spacecraft! Blast them with your laser, thrust, rotate or hit hyperspace to survive!
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 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.

Typically, there are a range of commands which could be executed by the plotter, and some of these may be 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',CHR$(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 is 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), data commands (plotting straight lines, circles, etc), and symbol commands.

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 1.5 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.

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```
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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, spaced text! Characters can be rotated full possible, although tedious and of doubt-

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-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.

Document**ation**
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 com-

**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 £243.00
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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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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 microcomputers). To write an article by 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.

**CALCULATOR CORNER**

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, and the saving is obviously very significant. 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 sold 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 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 into headlong 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 the most time-consuming part of the process was the 'speed of light'. It took me some time to appreciate that this was not nearly as good as most pilots believe, and that major deviations from the correct route must be quite common. I had also been made aware of some of the other shortcomings of

GOTO page 188
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 it 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 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 way we proceed 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:

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Binary 1</th>
<th>Binary 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>000000</td>
<td>000</td>
</tr>
<tr>
<td>1</td>
<td>000001</td>
<td>001</td>
</tr>
<tr>
<td>2</td>
<td>000010</td>
<td>010</td>
</tr>
<tr>
<td>3</td>
<td>000011</td>
<td>011</td>
</tr>
<tr>
<td>4</td>
<td>000100</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>000101</td>
<td>101</td>
</tr>
<tr>
<td>6</td>
<td>000110</td>
<td>110</td>
</tr>
<tr>
<td>7</td>
<td>000111</td>
<td>111</td>
</tr>
<tr>
<td>8</td>
<td>001000</td>
<td>1000</td>
</tr>
<tr>
<td>9</td>
<td>001001</td>
<td>1001</td>
</tr>
<tr>
<td>10</td>
<td>001010</td>
<td>1010</td>
</tr>
<tr>
<td>11</td>
<td>001011</td>
<td>1011</td>
</tr>
<tr>
<td>12</td>
<td>001100</td>
<td>1100</td>
</tr>
<tr>
<td>13</td>
<td>001101</td>
<td>1101</td>
</tr>
<tr>
<td>14</td>
<td>001110</td>
<td>1110</td>
</tr>
<tr>
<td>15</td>
<td>001111</td>
<td>1111</td>
</tr>
</tbody>
</table>

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 in FORTRAN as would be necessary in assembly language, it is much easier to write. The attraction of this method is its simplicity and elegance. 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 probably 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 quicker than an array reference. Since Basic is interpreted, the cost of this can be approximately compared by counting the number of tokens, 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.

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 temperament 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.

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Binary 1</th>
<th>Binary 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0000</td>
<td>00</td>
</tr>
<tr>
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</table>

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 \( T_n \) is an item in the list for n bits, and \( S_n \) is an item for n-1 bits, the rule is:

\[
T_n = 2S_n + 1 \quad \text{for } n > 0 \text{ and } \left\lfloor \frac{n}{2} \right\rfloor
\]

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 both arrays 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.

2 and then shifting it right or left the correct number of places, which is easily done by division or multiplication.

For example, \((I \text{ AND } 2^3)\) 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.

Algorithmic method

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

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Binary 1</th>
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</tr>
<tr>
<td>15</td>
<td>1111</td>
<td>15</td>
</tr>
</tbody>
</table>

The total may be misleading. It hardly any difference. They have one sixteenth the effect they would have inside the inner loop.
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 say something about the random function used to plot the lines in descending value if 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 COLOURG statement.

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 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,
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 66 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 #BFEF, the top right (71, 64) at #BFEF-17, and the bottom left (10, 0) at #BFEF-64*24.

Each block of eight cells is represented by two bytes, two bits per cell. The top bit in each byte determines 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.

Control bytes          Margin          Main screen area  
BFEF                    BFEF-64*24      (71,64) Margin
BFEF-24                   BFEF-24         BFEF-17          2 bytes
                                   BFEF-24         BFEF-41
2 bytes 2 bytes 18 bytes for 72 cells All repeated for 65 lines 2 bytes
BFEF-64*24 (0,0)  BFEF-64*24 BFEF-64*24-17

Figure 3 — DAI Screen Map for MODE 2.

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**GUESTEL MAIL ORDER LIST**

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<tr>
<td>BMC 12&quot; Green Monitor</td>
<td>149:00</td>
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<tr>
<td>NEC 12&quot; Yellow monitor</td>
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<tr>
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</table>

All prices exclusive of VAT.

**GUESTEL MAIL ORDER FORM**

Goods required:

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**GUESTEL LIMITED**
MAIL ORDER DEPARTMENT
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EAST SUSSEX BN2 2QB
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Peter Rodwell tests the
ACT Sirius 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 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 for 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 5¼in 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 chattering, 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 machines emit weird clucking noises. 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 onboard 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 the machine emits weird clucking noises. 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.

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

---

### Memory Map of Basic 128k Sirius 1

<table>
<thead>
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<th>Area</th>
<th>Address</th>
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<td>Memory-mapped IO</td>
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<td>CP/M-86 &amp; BIOS</td>
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</tbody>
</table>

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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-sized keyboard, laid out (according to CP/M documentation) in IBM Selectric format; IBM seems to have changed its layout recently, if our new 1.5 point typewriter is anything to go by, but the differences are minimal.

At power-on the keyboard is in lower-case, although no warning light to show where your 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 the escape key. Whatever the user's doing and resumes the operation at a second touch, useful for stopping fast-scrolling text or listings while you read the manual.

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. Programming one 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 debounce and has a 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 (in the 480 point typewriter there are four different, keyed plugs, so it's impossible to get them mixed up or plug them in the wrong way up despite the lack of label on the sides 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. The 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 boot-up operation to begin, but any further action required from the operator. All that's missing is an 'Insert disk'... message on the screen, a la SuperBrain.

I'll give one example, comparing CP/M-86 with the older CDOS, to show what I mean about user-friendliness (after all, this doesn't mean that virtual keyboard 

PC/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 experience 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/MIDO 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 nitty gritty 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 handling floppy disks. The idea was to make life easier for the programmer; all these 'housekeeping' routines were supplied so that the programmer could concentrate on writing in a language (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, 8086 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. A huge 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 nauty habit of displaying uninterpretable error messages and stopping dead when something goes wrong.

In producing CP/M-86, Digital Research had the chance to make their 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 upwardly-compatible version of the original 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).

It's possible to write-protect a minifloppy disk by placing a sticky label over a plastic window. 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, Sector=0, Track=0, Sector=0: Error =32 Bdos Err on A:', 

Your disks are now write-protected.

The CP/M-86 system is noisy and it forms my only real irritation with the machine. I cured it by inserting a system disk immediately after boot-up the operating system loaded, 86 modified to run a voice program on SuperBrain. I found this disconcerting the first time, normally annoying the second time and very irritating thereafter; I cured it by simply erasing the voice program from the disk.

BENCHMARK TIMINGS

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

<table>
<thead>
<tr>
<th>Benchmark</th>
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<tr>
<td>BM1</td>
<td>2.0</td>
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<td>BM2</td>
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<td>BM5</td>
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<td>BM6</td>
<td>35.4</td>
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<td>BM7</td>
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BENCHMARK TIMINGS

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view, CP/M-86 is very similar to the 8-bit CP/M, but with added facilities; this, coupled with a lack of software house kits, inclined Digital Research 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 MDOS, 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 MPS BASIC. 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 escaping from BASIC to assembly language and requires a V key. This is provided by Microsoft Basic as a 'V' symbol. This isn't on the Sirius keyboard, although it's in the standard character set. The problem was solved by re-programming 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.

Basic 86 followed a fairly standard format and was relatively easy to use, 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 never quite get a 'proper' high-level language). I was pleased to hear this as, although many end users will simply be running pre-written 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 and have it translate to source code for an 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 Eoted, which enables the user to define or alter character sets. This I found a fascinating program indeed. Figure 1 shows the screen when Eoted is running; the character dot matrix is displayed, together with the full character set, and you can read in character sets from disk and write your own-developed set to disk. By using the numeric pad, you can manoeuvre a 'blob' (it's 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, bold, reverse and indexed versions and is updated as you build it up, as are any other occurrences of that character in the memory of the system. This means you can be working on a character in the set currently in use by the system.

Using Eoted, 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 Eoted, 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 V, Cobol, Pascal and PLI for the programmers and application packages such as ACT's Wordcraft, its Pulsar integrated accounts package and Micro Planner, available in March, called GW Basic (it's rumoured that this stands for 'Gee-Whiz' 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 pre-written packages (according to Chuck Peddle's obvious determination to win over 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. Digital Research's CP/M-86 manuals, one entitled 'System Guide', the other called 'Programmer's Guide'. In fact, both were rumoured to be coming out, 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 and the noisy fan excepted; I feel that any business manager or secretary, will feel at home with the Sirius as, once an application package is up and running the operating system is left behind, it reveals itself as a machine with very 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.
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PCW 3/82
Malcolm Peltu looks at the latest micro literature

Too much psychotech

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 blindly 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) are likely to be among those buying personal computers. People with high narcissist 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 technical side of computing. Christie stresses the key role of human factors in determining the ultimate effectiveness of a system.

There is a lot 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 wizardry 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 manufacturers. 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 human behaviour. But it would be very difficult 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 Behaviour is: 'If any two information 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 Law 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 taking up time and space.

At the start of the book, Christie has a number of quotes ranging from Pontius Pilot 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 argues 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 broader 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. Below that is a deeper level relating to human interaction, motivation, attitude and other psychological behaviour.

It was for me no easy task 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 (of which there can be described in terms of its values on a set of Dimensions (D) as follows:

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

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, so there was no limit to a computer's memory. If there was an infinite number, it would be very difficult to cope 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 jargon. Stripped of its 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 tried 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 artistic perspective to the computer 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.' It 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 'typographer' 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 typewriter.

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 YY 4 ME

From A for Accumulator to ZRTW 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 Composer). 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 abbreviation 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 skimpy-ness. 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?
that's the only word to really describe microcomputer system, the home computer which is compatible with the TRS 80, and ideal for enthusiasts, especially the committed.

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Gemini Multiboard is 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 stand-alone 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.

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 9845 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 dock 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 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).
GEMINI MULTIBOARD

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 others 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/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/O 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 Digitalkit 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.

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

GEMINI MULTIBOARD

GOT page 187
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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.

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 trapdoor 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

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Main board, memory modules, power supply and dinky CRT.
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Expansion ports are on OP-1 adaptor; PCB is connector for memory modules.
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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 phone sockets for connection to cassette or reel-to-reel tape recorder, one of which is a remote control line. In addition, the OP-I contains batteries and a real-time clock/calender 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, math 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 numerical 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 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 thin 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 arrays 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 redefined (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 slow 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 this is Basicorthodoxy because it's neither taut nor nor
listing. Certainly when permitted abbreviations such as P. for PRINT are used they are not replaced by the full word which is more saving in both memory and execution time accrue when they are used.

The graphics on the 9000 are one of its defining 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 reversed 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) 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 CGAD draw the corresponding figures. Both QUAD and CDRAW 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 m.

If this still doesn't make graph plotting simple enough for you then the functions CHGX and CHGY convert coordinates 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 the graph onto the screen. PLOT (x,y) is a flag which is true if dot x,y is illuminated.

Finally there are GINS 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 GINS reads 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 change any modes 0,1, and 2 which respectively write, overwrite, or are logically ANDed with the previous screen content. GOUT is used in a PRINT statement and when used with GINS 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 separated from disk files by a single GO collusion between 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 separate comments from executable code. A similar screen dump to the graphic printer is allowed. Password protection of program files is obtained which prevents listing, editing, saving or loading unless the password is entered.

RAM filing is a different can of worms. RAM filing is not as straightforward as it seems, as it is non-destructive. The requisite chapter of the manual appears to have been translated from Japanese to Maori or to Urdu and finally into a sort of English.

As I understand it, up to 29k 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 ware and other effects of commands when so specified. Each RAM file is subdivided into two 2k blocks. The files are numbered from lowest memory to numbers. Thus if you specify FILE 6 you are only protecting the top 8k, the rest being still available as workspace until you specify a lower FILE 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, which is 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 RAM the contents of file 5 which 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 RLST 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.

Finally there are RFILE number (draw a picture, it helps). You may now remove this pack with your RAM file, you are only protecting the workspace until you specify a lower RFILE number (draw a picture, it helps). The point is that the software allows you to corrupt RAM files regardless of whether they're safe or not, which is true if dot x,y is illuminated.

You can find 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

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 number, probably expens-

Document program. If a program exceeds 4k its 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 number, probably expens-

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To arrive there, it has to

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

RADER 1000 with Dual 5¼" drives  RADER 2000 with Dual 8" drives

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SEEING IS BELIEVING

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<th>ACT Sirius 1</th>
<th>Typical Personal Computers</th>
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<tr>
<td>Memory</td>
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<td>Microsoft BASIC</td>
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<td></td>
<td>Compiled BASIC</td>
<td>perhaps one or two others, eg PASCAL</td>
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<td></td>
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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, plot 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 280 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 PRINT for standard screen-dump print.

The luminance output is the sum of the red, green and blue signals.

Prices

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SID 1 graphics board</td>
<td>£390</td>
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<tr>
<td>Colour monitor</td>
<td>£328</td>
</tr>
<tr>
<td>Graphics package</td>
<td>£689</td>
</tr>
<tr>
<td>XBASIC</td>
<td>£195</td>
</tr>
<tr>
<td>SID 1 + monitor</td>
<td>£689</td>
</tr>
</tbody>
</table>
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.

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-based system to give a professional quality display 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 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 data is in the form of ASCII character codes. The main timing generation logic in the

![Fig 1 Raster scan pattern.](image1)

![Fig 2 Composite video signal.](image2)

![Fig 3 High-density VDU card block diagram](image3)
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 accessed without upset 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 (decimal 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 rate signal H5 (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 rate signal H5 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 character output counters 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 character 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 4k of extra continuous RAM for user programs.

![Fig 5 Line rate timing](image)

![Fig 7 Character line rate timing](image)
of circuitry that will be described, the video RAM onto the video data bus
the required row of the pattern is selected by the scan line address bits PO - 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 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 – VIDY, are latched into the 8-bit latch IC33 by the character load pulse CHLD. The seven l.s. bits from IC33 are latched into the 8-bit ASCII data bytes on the video data bus, character font and serial converter logic.

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 PO – 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

The final sections of circuitry to be described are those responsible for placing display data into the video RAM at permissible 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 ORing the HS and VS timing signals (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.

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, i.e. 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 resynchro-

nised 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 permissible 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 ORing the HS and VS timing signals (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.

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HIGH DENSITY VDU CARD

The access control signal X/ISEL is used for a number of purposes: first, it controls the 2114 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 generator 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 | 3 Inverters
17 | 74LS02 | 14 | 7 |
4 | 74LS04 | 14 | 7 |
28 | 74S04 | 14 | 7 |
1 | 7406 | 14 | 7 | 2 o.c. Inverters
9,30 | 74LS08 | 14 | 7 | 1.2 l/p And.
11 | 74LS10 | 14 | 7 | 1.3 l/p Nand.
13 | 74S20 | 14 |
20 | 74S27 | 14 | 7 | 1.3 l/p Nor.
29 | 74LS32 | 14 |
2,14,19 | 74LS74 | 14 |
18 | 74LS86 | 14 | 7 |
38,39,40 | 74LS139 | 16 | 8 |
6,8,10,12 | 74LS161 | 16 | 8 |
31 | 74166 | 16 |
5 | 74S168 | 16 |
26,27 | 74LS243 | 14 | 7 |
33 | 74LS273 | 20 | 10 |
15,16 | 74LS393 | 14 |
21,22,23,24 | 74LS157 | 18 |
34,35,36,37 | 74LS161 | 18 |
32 | 2716 | 24 |

Fig 12 IC power pins

ICs
IC1 | 7406 |
IC2,14,19 | 74LST4 |
IC3 | 74LS00 |
IC4 | 74LS04 |
IC5 | 74S168 |
IC6,8,10,12 | 74LS161 |
IC7,13 | 74LS20 |
IC9,30 | 74LS06 |
IC11 | 74LS05 |
IC15,16 | 74LS393 |
IC17 | 74LS20 |
IC18 | 74LS86 |
IC20 | 74LS27 |
IC21,22,23 | 74LS139 |
24,35,36,37 | 74LS243 |
IC25 | 74LS04 |
IC26,27 | 74LS32 |
IC28 | 74LS273 |
IC29 | 74LS157 |
IC30 | 74LS393 |
IC31 | 74LS157 |
IC32 | 74LS273 |
IC33 | 74LS157 |
IC38,39,40 | 74LS157 |

Resistors
All 1/4 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 | 0.1 µF Ceramic |
9,10,11,12 |

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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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 - some gross extension of Space Invaders sound effects - and, hardly surprisingly, found themselves consigned to the bottom drawer.

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 the computer has to deal with this in real-time. 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 synthesis (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 Music System. 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...
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 column 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 column 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 AD7574) 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 note’s characteristic bending from vibrating air columns, strings or whatever, don’t lead such a normalised existence. The average note produced by an average instrument consists of a wide 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 are integrated 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-scanning 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 cliché 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. Micro-products provide a ‘quick and dirty’ operational and capability test that converts an off-tape numeric 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 (Fs-Fw) between the sample rate (Fs) and waveform frequency (Fw). 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, i.e., 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](PCW 139)
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 music-related functions: the creation of music-related applications, it strikes me as being especially when it’s for the sake of a ha’p’orth of tar?

Overall, I find 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.

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what the Compiler thought of 'Boogie': some beats out of place but no errors as such, space bar and because the two misses encountered in putting Boogie to bed - 'Too few beats' and 'Too many beats' - are treated as warnings rather than errors, while the other II 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 Music System.

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 snap decisions about the outputs. Of the two demo scores included on the Music II disk, only 'Fanfare for the Uncommon Apple' (yuck) would load successfully, and was heard to be an extremely uninspired version of Aaron Copeland's 'Fanfare for the Common Man' complete with lots of noise, glitches and clicks before the 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 bouncing real drum/percussion sounds into EPROMs.

All this produces jolly sounds like clicks, whistles, claps, snatches of guitar, 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' Freqout program is all about.

![Freqout](https://via.placeholder.com/150)

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:

1. 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 15,384 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 graphs informing you of where you are in the sample set. The combination of right arrow, left arrow and CR enables you to advance through the data points 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 exactly match the frequency 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 resumption of sample data in an abbreviated format suitable for instrument definitions. The other two Freqout routines apply Fast Fourier Transform (FFT) analysis to the sample 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 frequency 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 A/D and A/D hardware/Music II software (£187.50) and Freqout software (£31.50). 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!
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 its 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, 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 modules.

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

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 AS="ABCD\EFG"  
20 BS=AS(2:5)

Here, the bracketed qualifier specifies characters 2 through 5; thus BS becomes 'BCDE'. Qualifiers may also appear to the left of an assignment, eg,
30 AS(2:3)=AS(4:6)

would set positions 2 and 3 of AS to 'DEF', resulting in the value 'ADEFDEFG'. To save you the trouble of writing the Microsoft equivalent, it is:
30 AS=LEFT$(AS,1)+(MIDS(AS,4,3)+RIGHT$(AS,4))

ANS also has a concatenation operation '&', together with string functions, the main ones being:
CHR$(N)  
ORD$(X$)  
LWRC$(X$)  
UPRC$(X$)  
STR$(N)  
VAL$(X$)  
LLEN$(X$)  
POS$(X$, Y$)  

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)
d) character string arrays exist as in Microsoft, but ANS allows their use in MAT statements, eg,
70 MAT A$=A" & ";
would put '.' at the end of every string element of array A$.
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How the ZX81 compares with other personal computers

<table>
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<tr>
<th>SYSTEM IDENTIFICATION</th>
<th>ZX81</th>
<th>ZX80</th>
<th>ACORN</th>
<th>APPLE II</th>
<th>PET</th>
<th>TRS 80</th>
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| COMMANDS | LIST, LOAD, NEW, RUN, SAVE |
| STATEMENTS | PRINT, INPUT, LET, GOTO, GOSUB/RETURN, FOR/NEXT IF/THEN |
| ARITHMETIC | ABS, RND |
| FUNCTIONS | INT, ATN, COS, EXP, LOG, SGN, SIN, SQR, TAN, ARCSIN, ARCCOS |
| STRING FUNCTIONS | CHR$, LEN, ASCII, STR$, VAL, INKEYS |
| NUMBERS | FLOATING PT±10±38, INTEGERS |
| NUMERIC VARIABLES | A-Z, AA-ZO, An-Zn, n=any alphanumeric string |
| STRING VARIABLES | A$ to ZZ, An8 to ZZ 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) |

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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+S, 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 AS

This set AS 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 in-comprehensible 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?
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 is one of the 'favourite tips 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).

<table>
<thead>
<tr>
<th>Figure 1: Basic Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 DIM L$(15)</td>
</tr>
<tr>
<td>20 DATA &quot;0&quot;,&quot;1&quot;,&quot;2&quot;,&quot;3&quot;,&quot;4&quot;,&quot;5&quot;,&quot;6&quot;,&quot;7&quot;,&quot;8&quot;,&quot;9&quot;,&quot;A&quot;,&quot;B&quot;,&quot;C&quot;,&quot;D&quot;,&quot;E&quot;,&quot;F&quot;</td>
</tr>
<tr>
<td>30 FOR I = 0 TO 15</td>
</tr>
<tr>
<td>40 READ L$(I)</td>
</tr>
<tr>
<td>50 NEXT</td>
</tr>
<tr>
<td>60 PRINT @ 130, &quot;ENTER START ADDRESS&quot;</td>
</tr>
<tr>
<td>70 FOR I = 0 TO 15</td>
</tr>
<tr>
<td>80 READ L$(I)</td>
</tr>
<tr>
<td>90 PRINT @ 150, A$</td>
</tr>
<tr>
<td>100 PRINT @ 156, &quot;DATA&quot;</td>
</tr>
<tr>
<td>110 A = A + 1</td>
</tr>
<tr>
<td>120 PRINT @ 275, A$</td>
</tr>
<tr>
<td>130 PRINT @ 295, A$</td>
</tr>
<tr>
<td>140 D = X * 16</td>
</tr>
<tr>
<td>150 PRINT @ 290, &quot;DATA&quot;</td>
</tr>
<tr>
<td>160 PRINT @ 295, A$</td>
</tr>
<tr>
<td>170 PRINT @ 296, A$</td>
</tr>
<tr>
<td>180 GOSUB 310</td>
</tr>
<tr>
<td>190 A$ = INKEY$(1)</td>
</tr>
<tr>
<td>200 GOTO 190</td>
</tr>
<tr>
<td>210 A = A + 1</td>
</tr>
<tr>
<td>220 D = X * 16</td>
</tr>
<tr>
<td>230 PRINT @ 290, &quot;DATA&quot;</td>
</tr>
<tr>
<td>240 PRINT @ 295, A$</td>
</tr>
<tr>
<td>250 D = X * 16</td>
</tr>
<tr>
<td>260 PRINT @ 296, A$</td>
</tr>
<tr>
<td>270 PRINT @ 295, A$</td>
</tr>
<tr>
<td>280 PRINT @ 296, A$</td>
</tr>
<tr>
<td>290 A = A + 1</td>
</tr>
<tr>
<td>300 GOTO 300</td>
</tr>
<tr>
<td>310 A$ = INKEY$(1)</td>
</tr>
<tr>
<td>320 IF L$(I) = A$ GOTO 360</td>
</tr>
<tr>
<td>330 IF L$(I) = A$ GOTO 360</td>
</tr>
<tr>
<td>340 NEXT</td>
</tr>
<tr>
<td>350 GOTO 310</td>
</tr>
<tr>
<td>360 A$ = INKEY$(1)</td>
</tr>
<tr>
<td>370 RETURN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Figure 2: Machine code example</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORG 4A38H</td>
</tr>
<tr>
<td>LD HL,300H</td>
</tr>
<tr>
<td>STRT OF SCREEN</td>
</tr>
<tr>
<td>BYTEs TO FILL</td>
</tr>
<tr>
<td>ASTERISK</td>
</tr>
<tr>
<td>D,2H</td>
</tr>
<tr>
<td>INC B</td>
</tr>
<tr>
<td>INC BC</td>
</tr>
<tr>
<td>ADJUST COUNT</td>
</tr>
<tr>
<td>GET MS BYTE</td>
</tr>
<tr>
<td>MERGE</td>
</tr>
<tr>
<td>JP NZ,NZLOOF1</td>
</tr>
<tr>
<td>RETIF NOT DONE A43E</td>
</tr>
<tr>
<td>C240A</td>
</tr>
<tr>
<td>LD B,C</td>
</tr>
<tr>
<td>SET DELAY</td>
</tr>
<tr>
<td>A439</td>
</tr>
<tr>
<td>010000</td>
</tr>
<tr>
<td>LD A,B</td>
</tr>
<tr>
<td>GET MS BYTE</td>
</tr>
<tr>
<td>A43C</td>
</tr>
<tr>
<td>78</td>
</tr>
<tr>
<td>JP NZ,NZLOOF3</td>
</tr>
<tr>
<td>RETIF NOT DONE A43B</td>
</tr>
<tr>
<td>C284A</td>
</tr>
<tr>
<td>LD HL,300H+381</td>
</tr>
<tr>
<td>LINEs</td>
</tr>
<tr>
<td>D,10</td>
</tr>
<tr>
<td>LDI B</td>
</tr>
<tr>
<td>D,25H</td>
</tr>
<tr>
<td>PERCENT</td>
</tr>
<tr>
<td>A456</td>
</tr>
<tr>
<td>1625</td>
</tr>
<tr>
<td>INC HL</td>
</tr>
<tr>
<td>BUMP POINTER</td>
</tr>
<tr>
<td>A459</td>
</tr>
<tr>
<td>23</td>
</tr>
<tr>
<td>D,E</td>
</tr>
<tr>
<td>JP NZ,NZLOOF3</td>
</tr>
<tr>
<td>RETIF NOT DONE A45B</td>
</tr>
<tr>
<td>C284A</td>
</tr>
<tr>
<td>STOP</td>
</tr>
<tr>
<td>STOP</td>
</tr>
</tbody>
</table>

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 in 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 15000 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 PEEL MACHINE CODE to print decimal equivalents of hex code as input, or it would be possible to PEEL MACHINE CODE.

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 the 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
**ZX81 TIPS 1**

Machine code users might like to know that you can reset RAMTOP without clearing the memory (useful if you suddenly remember you have n'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 variable 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' AND (X=1);
20 IF X>0 THEN PRINT 'NO' AND (X<0);
30 IF Y>D THEN PRINT 'FALSE';
40 IF S=C THEN PRINT 'TRUE';
50 IF S=C THEN PRINT 'FALSE'.

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?

**ZX81 TIPS 2**

I have noticed a few useful features of the ZX81 logical operators. 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 Figures 1 and 2. Care must be taken when mixing arithmetic 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

**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 I 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
- OE: needs Vcc when programming, 0 volts when reading
- CE: needs Vcc when programming, 0 volts when reading
- PGM: requires a 50 millisecond 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 data pins (1-8, 22-23 & 19)
4. Apply the data required to the data pins (9-11 and 13-16)
5. Apply a 50 millisecond 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 5 milliseconds 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 $8E821 and $8E823.

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 milliseconds 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 something wrong, 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:

![Truth Table](image-url)
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 extremely 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.

Table 1 Memory map for the 2716 Eprommer

<table>
<thead>
<tr>
<th>Address</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0000 - $13FF</td>
<td>Data for transfer</td>
</tr>
<tr>
<td>$0B25 - $0B70</td>
<td>M/Code for checking</td>
</tr>
<tr>
<td>$0A80 - $0B24</td>
<td>M/Code for programming</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Address</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0000 - $13FF</td>
<td>Data for transfer</td>
</tr>
</tbody>
</table>

The programs are

ZERO ($0AC0) — this puts A and B to logic '0'; CLEAR ($0A8D) — puts A and B to logic '1' to produce a '1' from an AND gate to clear the 7493s;

CLOCK ($0A8E) — 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.

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 $0A9D 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 $0A9D 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. 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 '0'.

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 $0A90 inverts the data before it leaves the PET and another inversion occurs at $0B42 when checking the data. If 8T26s are used these should be amended accordingly.

The circuit diagram of the device is shown at Figure 3. J D Beaven
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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 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’ 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 Gulech from the Pacific. Typically, Jim decided to design his own office/home 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/library half overlooking 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. Every one gets along well together and, I suspect, if they don’t then they probably drift away on 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 was very happy that they 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 to 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 outrageous 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 very bright, but often rejected by his peers.’ Following school he spent two and a half years at college but before his course was complete he left to teach computer science 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 would up chairing it. He expanded and revitalised the organisation and ended up with a few National Science Foundation grants — two for the Mathematics, Medical Information Systems and Artificial Intelligence. In context 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 wander 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 found 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, frontiers, 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 the way they want to and in the way 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 and 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 ran stories. One of the (San Francisco) Bay Area newspapers featured Jim in a story where he explained how he had set up the parties 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 was too expensive 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. Every year 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 hours Jim spent nothing like 60 hours a week working on the schedule that would cripple most people; Jim would claim that he works '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 at all.' 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 Faire, Jim got a newspaper. Jim's paper is called the Silicon Gulch Gazette, and Jim is the editor. Even Mr Warren got tired of the mnemonic and renamed it the Intelligent Machines Journal. Tom Williams had been thinking of founding IMJ ever since it was 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 editorialship of Creative Computing to become IMJ's publisher, the paper was renamed Computer.ibm, and it is now an immensely popular source of fast intelligence about the microcomputer industry.

Dr Dobbs and the Computer Faire

Jim migrated from consultancy into the editorship of Dr Dobbs Journal. He was the first editor and, according to a recent survey, it still bears the impression of his personality. At the time that Jim got involved with the magazine, he was on point of completing his PhD dissertation. It seems that he was enjoying the magazine so much that the doctorate was never completed. The 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 announcements were adequate 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 was too expensive 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.

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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 one of those relatively few 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. We feel 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 quite 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. This puts into 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 paying attendees. In the past the talks have been given by a variety of people, unprompted talks and the speaker is oblivious to whether 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 Faire; and 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
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 = 2^16-1 (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 is a good random number routine, be such that 'potency' can be tested if you read Alan Toothill (1220 (HL) + 40).

These 'a's' satisfy Brian Steel's conditions they occupy themselves.

Andrew now gives us his routine, Datasheet RANDM, based on the formula:

X_n+1 = 1021 X_n + 41 mod 65536

Again 'a' satisfies Brian Steel's requirements, giving a potency of 8 and being able to test the location of a faulty location. The number of 'a' in a good 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 Sutcliffe’s ‘Patterns’ in the November 81 issue of PCW.

Randm 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 advises that the Sharp ‘ASCII’ code little — 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 activate the hardware reset.

You can try this on an unexpanded Nascom 1. I did, storing the program from address OAAH and checking the RAM from address OC80H for 0380H 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), HI 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 the 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 super-imposes 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 Hargreaves points out that the two bytes (E1 and E9) are in locations 000BH and 000CH of the TPRS-50 (and Video Genie) level II. Microsoft Basic PCW Subset
More useful assembler code subroutines from Alan Toothill

Datasheet
={["RAMDN - 16-bit pseudo random number generator","CLASS:","EXTERNAL CRITICAL? : No","DESCRIPTION: Generates a 16-bit random number from the series X_n+1 = 1021 X_n + 41 mod 65536","ACTION: See program comments","SUB 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","REGU USED: HL","STACK USE: 6","LENGTH: 18","TIMES STATES: 144","PROCESSOR: 28000","Randm: PUSH AF ; save F5
PUSH BC ; registers. C5
PUSH HL ; save original (HL). E5
LD HL,* ; HL + 256*(HL) + 10. 2E 0A
POP BC ; BC + original (HL). C1
OR A ; clear carry. B7
SBC HL,HL ; HL + 255*(HL) + 10. ED 42
ADD HL,HL ; HL + 510*(HL) + 20. 29
ADD HL,HL ; HL + 1220*(HL) + 40. 29
SCC ; add 1. B7
POP BC ; restore ED 4A
POP AF ; registers. F1
RET ; C9

Randm Check: REL D000H
RAMSTA: EQU 1000H
RAMBIZ: EQU C000H
INIT: XOR A
LOOP1: LD HL, RAMSTA
LOOP2: LD HL, A
SHR (HL) ; check OK. BE 0B
JR Z, OK
FOUND: LD (ADRSTO), HL
"display" ; faulty addr. C3 82 00
OK: EX AF, AF
XOR A
DEC BC
JR NZ, NEXT
CP B
JR NZ, NEXT
EX AF, AF
A DR STO, HL LOOP1
NEXT: INC HL
EX AF, AF
ADD HL, BP LOOP2
DUMMY: DEFS 100H
ADRSTO: DEFS 2
END

Listing 1

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.

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 DIVM for the M6809. Richard Crane uses DIVM in a signed number enviro-
ment where a previous rou-
tine handles the signs and
formatting of the numbers.
Hence only positive values
are in zero format.

**6502 32-bit arithmetic**

Dennis May of London SE1 has sent in the 6502 equivalent
of SNEG4, SBD4, SBD4B, SML4 and SIV4, 280 32-bit arithmetic rou-
tines printed in last June’s Sub Set. This gives us another chance to compare two pro-
cessors working at the same task.

Dennis’s routines depend
in many cases on some of
these locations being conti-
uous. This month we are
printing Datasheets SNEG46
and SBD46. The rest will
follow later.

The Class 2 SBD46, saving no registers, does in 20 bytes and 92 T states
what the Class 1 280 version does in 23 bytes and 255 T states.

---

**Datasheet**

<table>
<thead>
<tr>
<th>SNEG46:</th>
<th>Negate 4 bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLASS:</strong> 2</td>
<td></td>
</tr>
<tr>
<td><strong>TIME CRITICAL?</strong> No</td>
<td></td>
</tr>
<tr>
<td><strong>DESCRIPTION:</strong> Negates (2’s complement) 4 bytes in zero page with the Cy copying the sign of the result</td>
<td></td>
</tr>
</tbody>
</table>
| **ACTION:** 
| Byte count = 4
| Byte pointer = 0
| CY = 0
| 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** |
| **SUB-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 |
| **REG-USED:** (A) (M1) to M4 and ME |
| **STACK USE:** None |
| **LENGTH:** 20 |
| **T STATES:** 92 |
| **PROCESSOR:** 6502 |

---

The Class 2 SBD46, again saving no registers, does in 73 bytes and a maximum
13,087 T states what the class 1 Z80 version does in 66 bytes and a maximum
25,244 T states. Being without a 6502 processor, be-

---

**Datasheet**

<table>
<thead>
<tr>
<th>SBD46:</th>
<th>23-bit binary to ASCII-Decimal conversion</th>
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</thead>
<tbody>
<tr>
<td><strong>CLASS:</strong> 1</td>
<td></td>
</tr>
<tr>
<td><strong>TIME CRITICAL?</strong> No</td>
<td></td>
</tr>
<tr>
<td><strong>DESCRIPTION:</strong> Converts a signed 32-bit binary number to an ASCII-Decimal string.</td>
<td></td>
</tr>
</tbody>
</table>
| **ACTION:** 
| M1 - M4 contains a signed 32-bit number with the most significant byte in M4 and the least significant in M1 |
| **INPUT:** 
| M4 - M1 contains 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 |
| **REG-USED:** (A) (M1) to M4 |
| **STACK USE:** None |
| **LENGTH:** 19 |
| **T STATUSES:** 73 |
| **PROCESSOR:** 6502 |

---

VIS-20 and not receiving
delivery of my own BBC
Micro, SBD46 has been checked out by Mark Lang,
ham in North London. Mark
also recovered an instruction
that had slipped from Dennis’s
typewriter.
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 other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions. Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80— if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented with a 16K-byte add-on RAM pack.

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)

ORB1T— 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.

WOLF PACK— 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 is wrong—the solution is explained.

TRAIN— multiplication tests against the computer. The train’s rear reaches the station first.

FRACTIONS— fractions explained at three levels of difficulty. A ten-question test completes the program.

ADD/ SUB—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 customised 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— select 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 Black Jack.

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?

SUB STRIKE— 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 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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Simply use the order form below, and either enclose a cheque or give us the number of your Access, Barclaycard or Trustcard account. Please allow 28 days for delivery. 14-day money-back option.

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<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
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<th>Manager</th>
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<tbody>
<tr>
<td>Birmingham</td>
<td>19/21 Corporation Street, Birmingham, B2 4LP</td>
<td>021-632 6303</td>
<td>Peter Stallard</td>
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<tr>
<td>Bristol</td>
<td>16/20 Penn Street, Bristol, BS1 3AN</td>
<td>0272 20421</td>
<td>Peter Stallard</td>
</tr>
<tr>
<td>Chester</td>
<td>The Forum, Northgate Street, Chester, CH1 2BZ</td>
<td>0244 317567</td>
<td>Jeremy Ashcroft</td>
</tr>
<tr>
<td>Edinburgh</td>
<td>4 St James Centre, Edinburgh, EH1 3SR</td>
<td>031-556 6217</td>
<td>Colin Draper</td>
</tr>
<tr>
<td>Preston</td>
<td>1/4 Guildhall Arcade, Preston, PR1 1HR</td>
<td>0772 59264</td>
<td>Jim Comisky</td>
</tr>
<tr>
<td>Manchester</td>
<td>12/14 St. Mary’s Gate, Market Street, Manchester, M1 1PX</td>
<td>061-832 6087</td>
<td>Lesly Jacobs</td>
</tr>
<tr>
<td>Glasgow</td>
<td>22/24 West Nile Street, Glasgow, G7 2PF</td>
<td>041-226 3349</td>
<td>David Livingstone</td>
</tr>
<tr>
<td>Sheffield</td>
<td>58 Leopold Street, Sheffield, S1 2GZ</td>
<td>0742 750971</td>
<td>Justin Rowles</td>
</tr>
<tr>
<td>Liverpool</td>
<td>33 Dale Street, Liverpool, L2 2HF</td>
<td>051-236 2828</td>
<td>Mark Butler</td>
</tr>
<tr>
<td>London</td>
<td>42 Tottenham Court Road, London, W1 9RD</td>
<td>01-630 0845</td>
<td>Vass Demosthenis</td>
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**New Apple II**

<table>
<thead>
<tr>
<th>Description</th>
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<tr>
<td>Apple II + 48K</td>
<td>675.00</td>
<td>0.25</td>
<td>676.25</td>
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<tr>
<td>Disk Drive Plus Controller (3.3)</td>
<td>375.00</td>
<td>0.25</td>
<td>379.25</td>
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<tr>
<td>Disk Drive</td>
<td>295.00</td>
<td>0.25</td>
<td>339.25</td>
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</tbody>
</table>

**MZ 80K**

- Deservedly popular
- Comes with 48K of RAM, built in screen and cassette

<table>
<thead>
<tr>
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<tr>
<td>MZ 80K Computer</td>
<td>347.00</td>
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<tr>
<td>ROM Drawer</td>
<td>29.73</td>
<td>0.00</td>
<td>29.73</td>
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</table>

**Atari 400**

- Ideal for the home
- Features colour and sound

<table>
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<th>Description</th>
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<tr>
<td>400 16K Computer</td>
<td>300.00</td>
<td>0.00</td>
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<tr>
<td>410 Tape Recorder</td>
<td>43.48</td>
<td>0.52</td>
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**Atari 800**

- The big brother of the 400
- Shares all the star features

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<tr>
<td>800 16K Computer</td>
<td>560.87</td>
<td>0.13</td>
<td>565.00</td>
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<td>Disk Drive</td>
<td>300.00</td>
<td>0.25</td>
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<td>Thermal Printer</td>
<td>230.43</td>
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**Hewlett Packard HP 85**

- Scientific and technical professionals favour the HP 85
- Being joined by increasing numbers of business professionals

<table>
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<th>Description</th>
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<td>16K Memory Module</td>
<td>194.88</td>
<td>0.23</td>
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<td>ROM Drawer</td>
<td>29.73</td>
<td>0.00</td>
<td>29.73</td>
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</table>

Laskys, the retail division of the Ladbroke Group of Companies

PCW 161
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 functions up to $10^6$. I want it to be able to plot figures obtained, preferably with labelled graphics. It would be useful if it could handle statistical data, and be capable of handling questions 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 1**

Could you answer the following questions about the BBC Micro and BBC Basic?

1. The computer is fully 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 (RS432 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.
4. Maximum addressable RAM is 32k, but it is possible to expand 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? How much will it cost? 3. Will there be the removal of the existing ROMs or will it be on a separate board? 5. Will the standard ATT PSU be okay? 5. Will the system 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 `P and `!' (PEEK and POKE) as does the Atom? 9. Will the short-hand representation of key words 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 Seikosha GP90 printer to produce graphics, can you help?

Colin Grant, Dunmury

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 than at the original schedule. About £35. 5. It will require the removal of the existing ROM and will be on a separate board. 7. It is 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 there are many examples of information to specify a system. Some of the details...
Open question

The 'Open Question' (October PCW) was: could you suggest a method for obtaining a source 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 spell 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 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 Worcesters, whose reply is reproduced below. I have the same problem with my Microtan 65, using MicroBasic. 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 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):NEXT A
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 use 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 output 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 not 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 seconds 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, a number to the output port at 11000. 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 any where on the screen, rather than have a scrolled printout with the programs as they stand.

D E Graham
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 are represented by binary digits or bits as accepted and output by the computer" 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 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 010101 in ASCII.

Moving on to hardware, this means 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 several ways. 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 byte at a time along a single piece of wire, with extra bits added to indicate the receiving device when a byte is about to start and when it has finished. The baud rate divided by ten equals the baud rate. The baud rate is referred to as the baud rate and, very roughly, is the number of characters that can be transmitted in one second. A modem must be able to communicate with the computer and the general standard is 300 baud. A modem connects a computer via a serial interface to the telephone system allowing two computers with modems to exchange information. You could 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. Therefore, it isn't up to anything of these...
# INSTORE

The star of the show this month is the ACT Series 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 adapter for the Atom which will cost you around £120 for the full kit. Please send any updates or additions to Dick Oiney, 'INSTORE', PCW, 14 Rathbone Place, London W1P 1DE.

<table>
<thead>
<tr>
<th>Machine</th>
<th>Price (FB)</th>
<th>Main Distributors (No. of Dealers)</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adler Alphatronic (E1600)</td>
<td>Adler 01-250 1717</td>
<td></td>
<td>48k RAM: 8085 A single 51/4&quot; F/D (460k): 12&quot;, 24 x 80 VDU: 5 S/P: 2 P/P:</td>
<td>CP/M: Basic: CBasic:</td>
<td>With 80 cpm printer and dual F/D £2345 inc CP/M. (S)</td>
</tr>
<tr>
<td>Atom (£120)</td>
<td>Acorn: 0223 321727</td>
<td>(15)</td>
<td>2-12k RAM: 8-16k ROM 6502: Full K/B: C: int: TV int: 20/10 lines: 1 P/P: Options: 90 screen printer £199, Prestel adapter £120.</td>
<td>Basic in 8k ROM: A: Cass O/S:</td>
<td>High resolution graphics on bigger model: colour monitor O/P. Loudspeaker. Note also, systems based on Acorn SBC. BT 7/80(B).</td>
</tr>
<tr>
<td>Attache 201 (£8000)</td>
<td>COLT 01-572 3784</td>
<td>(10)</td>
<td>64k RAM: Z80: dual 8&quot; F/D (2.4 MB): 12&quot; x 24 x 80 VDU: 180 cpsi printer.</td>
<td>Basic: Fortran: Cobol:</td>
<td>Upgradable to multiuser system with 18 Mb H/D. Full range of business packages included software dealers TBA. (S)</td>
</tr>
<tr>
<td>Billings BC-12 FD- (£3995)</td>
<td>Mitech: 04862 23131 (TBA)</td>
<td></td>
<td>64k RAM: Z80A: dual 51/4&quot; F/D (640k): 12&quot;, 24 x 80 b/w (or b&amp;g) VDU.</td>
<td>DOS: Basic: Fortran: Cobol:</td>
<td>With dual 8&quot; F/D (2 Mb) £5995. Additional dual 8&quot; F/D £800 option: 650 Mb H/D. (S)</td>
</tr>
</tbody>
</table>

### List of Abbreviations

- **A**: Assembler  
  - **G/C**: Graphics card  
  - **M/A**: Macro assembler  
  - **N/A**: Not available  
  - **S**: Software  
- **BP**: Bench Tested  
- **C**: Cassette  
- **D**: Disk  
- **E**: Extensive  
- **F/D**: Floppy disk  
- **H**: Hard disk  
- **I**: Introductory  
- **O**: Operating system  
- **P/P**: Parallel port  
- **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.
### Machine (Price from)

<table>
<thead>
<tr>
<th>Main Distributors (No. of Dealers)</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
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</thead>
<tbody>
<tr>
<td><strong>Canon TX-5</strong> (£1600)</td>
<td>As above.</td>
<td>16-32k RAM: 6809: C: 20 char display: 26 col, 2.4 ips printer: Option: 2 × RS232 ports.</td>
<td>Basic: A.</td>
</tr>
<tr>
<td><strong>Challenger C1 (£3334)</strong></td>
<td>As above.</td>
<td>32-56k RAM: 6502: 6000-6800: dual 8” F/D (1.15 Mb): 1-16 S/P.</td>
<td>O/S64: Ex Basic: A.</td>
</tr>
<tr>
<td><strong>Compucorp 655/665/685 (from £5000)</strong></td>
<td>Computerart: 0503 615809 (7)</td>
<td>60k RAM: Z80: Up to 45½” F/D (640k-2.4 Mb): 9”: 20x80 or 12” 20x64 or 20” 60x60 VDU: 40-col printer: RS232 port.</td>
<td>Hi-res resolution graphics. 6-month subscription to user-magazine inclusive BT 9/79. (S).</td>
</tr>
<tr>
<td><strong>Diablo 3000 (£6500)</strong></td>
<td>Business Computers Ltd. 01-207 3344 (TBA)</td>
<td>32k RAM: 8085: dual 8” F/D (1.3 Mb): 12”: 24k 80x6w VDU: 45 4cm printer.</td>
<td>DOS: Basic: DACL: A: U.</td>
</tr>
<tr>
<td><strong>Equinox 200 (£7500)</strong></td>
<td>Equinox: 01-739 2387 (N/A)</td>
<td>64-512k RAM: Z80: 10 Mb: 1200 Mb H/D: 665/P: 1 P/P.</td>
<td>CP/M: CBasic: Cobol: Fortran: Multi-user MVT/FAMOS available in place of CP/M: 16-bit version (Equinox 300 £10,000. (S&amp;H).</td>
</tr>
</tbody>
</table>

### List of Abbreviations
- A: Assembler
- BT: Bench Tested
- C: Cassette
- E: Extra
- F: Floppy disk
- G: Graphics
- H: Hardware
- HD: Hard disk
- Int: Interface
- M/A: Macro assembler
- M/S: Microcomputer
- N/P: Not available
- O/S: Operating system
- P/P: Parallel port
- P: Parallel port
- S: Software
- T/P: Text editor
- TBA: To be announced
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<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMS 5000 (£1500)</td>
<td>Equinox: 01-739 2387 (20)</td>
<td>16-64K RAM: Z80: dual 5¼&quot; F/D (320k): 2xS/P: 1 P/P:</td>
<td>CP/M: C: Basic: Cobol, Fortran.</td>
<td>3 drives option: (S&amp;H).</td>
</tr>
</tbody>
</table>

List of Abbreviations
- A: Assembler
- BT: Bench Tested
- C: Cassette
- E: Extensive
- F/D: Floppy disk
- G/C: Graphics card
- H: Hardware
- I: Introductory
- Int: Interface
- M/A: Macro assember
- M: Main
- N/A: Not available
- N/P: Numeric pad
- O/S: Operating system
- P: Parallel port
- P/S: Serial port
- T: Test 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.

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* Graphics software supplied
Price £55 + 15% VAT (post free)

GRAPHICS BOARD SOFTWARE

* Lunar lander: £6 + VAT (post free)
* Graphdraw: £8 + VAT (post free)

DUNCAN

* Fast real time interpreter/control language for NASCOM 1 or 2 (please specify machine)
Price £12 + 15% VAT (post free)

MONITORS

* BMC 12" green phosphor
* 18 mhz bandwidth
Price £175 + 15% VAT (carriage extra)

MEMORIES

* 4116 - 150ns
* 95 pence each + VAT (min order 8)
* 64K - 200ns
* £10 each + VAT

SEND SAE FOR FURTHER INFORMATION

6 LALEHAM AVE, MILL HILL, LONDON NW7 3HL
TEL: 01-959 0106

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<th>Miscellaneous (Documentation)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>dual 5¼&quot; F/D (560k): 12&quot;,</td>
<td>Cobol: Forran:</td>
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<tr>
<td></td>
<td></td>
<td>24x80 VDU: 80 col printer</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>loudspeakers: RS232 port: 20k ROM</td>
<td>cartridge.</td>
<td></td>
</tr>
<tr>
<td>Onyx C8000 (£675)</td>
<td>Onyx Dist Ltd: 0734 6643349</td>
<td>64k RAM: Z80: 12 Mb Cartridge:</td>
<td>CP/M: MP/M Oasis:</td>
<td>C8001 with 128k RAM</td>
</tr>
<tr>
<td>Oscar (£2560)</td>
<td>IDS Ltd: 0908 319997(30)</td>
<td>64k RAM: Z80: dual 5 ¼ F/D (800k):</td>
<td>CP/M: Basic: Pascal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12&quot;, 24x80 VDU: RS232 port: 1 P/P</td>
<td>Forran: Cobol: WIP: A</td>
<td></td>
</tr>
<tr>
<td>Panasonic JD 800U,</td>
<td>Panasonic Business Equipment: 0753</td>
<td>56k RAM: 8058A: 12-4k PROM:</td>
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</tr>
<tr>
<td>(£425, £4950)</td>
<td>75841 (4 regional dist)</td>
<td>dual 8&quot; F/D ID800U (500k):</td>
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<td>JD8040 (2 Mb): 12&quot;, 24x80 green</td>
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<td></td>
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<td>VDU: 3xRS232 ports.</td>
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<tr>
<td>Pascal Microengine (£2995)</td>
<td>Pronto Electronic Systems Ltd: 01- 5548225</td>
<td>64k RAM: MCP 1600: 2x RS232 ports: P/P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacso 640 (£3700)</td>
<td>Westrex Ltd: 01-578 0957 (TBA)</td>
<td></td>
<td>CP/M: Basic: Cobol:</td>
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<td></td>
<td></td>
<td></td>
<td>Forran: Pascal: A: WIP: P: U:</td>
<td></td>
</tr>
<tr>
<td>Periflex 630/564 (from £2250)</td>
<td>Suntron: 0734 85464(5)</td>
<td>64k RAM: Z80: dual 5¼&quot; F/(1.2 Mb): 2x RS232 ports. 1 P/P</td>
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<td></td>
</tr>
<tr>
<td>Periflex 1024/64 (from £2750)</td>
<td>As above</td>
<td>64k RAM: Z80: dual 8&quot; F/D (1.2Mb): 2x RS232 ports. 1 P/P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rair Black Box 3/30 (£1750)</td>
<td>Rair: 01-836 6921 (N/A)</td>
<td>64-512k RAM: RO85: dual 5¼&quot; F/D (268k): 10 Mb H/D: 2x RS232 ports.</td>
<td>CP/M: Basic: Cobol: Forran: M/A:</td>
<td></td>
</tr>
<tr>
<td>Rair Black Box 3/30 (£1750)</td>
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<td>64-512k RAM: RO85: dual 5¼&quot; F/D (268k): 10 Mb H/D: 2x RS232 ports.</td>
<td>CP/M: Basic: Cobol: Forran: M/A:</td>
<td></td>
</tr>
<tr>
<td>Research Machines Research Machines: 0865 49791 (N/A)</td>
<td>Research Machines: 0865 49791 (N/A)</td>
<td>16-32k RAM: Z80A: 2x C: 64k: RS232 port: P/P.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S/09 (£7000)</td>
<td>SWTW Ltd: 01-491 75070(16)</td>
<td>128k RAM: 6089: dual 8&quot; F/D (2Mb): 12&quot;, 24x80 VDU: 2x RS232 port: 1 P/P.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saracen (£1925)</td>
<td>Byronx 0252 726814 (TBA)</td>
<td>32-64k RAM: Z80: dual 5¼&quot; F/D (800k): 2x RS232 ports.</td>
<td></td>
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</tr>
<tr>
<td>SBS 8000 (£1449)</td>
<td>Manhattan Skylene Ltd: 0801 3442: C 3401: 353 6090 (TBA)</td>
<td>64k, RAM: Z80A: 12&quot;, 16x 64 VDU: 1 P/P: RS232 port (extra £133).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sharp MZ.40K (£460-344)</td>
<td>Sharp Electronics (UK) Ltd: 061-205 2333 (22)</td>
<td>6-48k RAM: Z80: C: 10&quot;) 24 x 40 VDU: Option: dual 5¼&quot; F/D (289k) £695</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sharp MZ.80B (£1095)</td>
<td>As above</td>
<td>64k RAM: Z80A: C: 9&quot;, 25x 80 VDU: RS232 port: P/P.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sharp PC1201 (£2995)</td>
<td>As above</td>
<td>64k RAM: Z80A: dual 5¼&quot; F/D (500k): C int: 12&quot;, 25x80 VDU: 70 1p printer.</td>
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<td></td>
</tr>
</tbody>
</table>

List of Abbreviations:
- A: Assisted by
- B: Bench Tested
- C: Cassette
- E: Extended
- F/D: Floppy disk
- G/C: Graphics card
- H: Hardware
- Int: Interface
- M/A: Macro assembler
- N/A: Not available
- N/P: Numeric pad
- O/S: Operating system
- Parallel port
- P/P: Parallel port
- S: Software
- Serial port
- S/P: Serial port
- T: Text editor
- TBA: To be announced
- U: Utility
- VAT: Value added tax

Please note: Software items listed in italics are not included in the basic price of the equipment. All prices are exclusive of VAT.
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<tbody>
<tr>
<td>Sinclair ZX81</td>
<td>Sinclair</td>
<td>1-16k RAM; Z80A: C int: TV int: full K/B, 44-pin expansion port.</td>
<td>Basic (8k ROM).</td>
<td>Advanced 4-chip design. Printer now priced next to VAT.</td>
</tr>
<tr>
<td>Signet 202</td>
<td>Interim</td>
<td>64k RAM; Z80A: dual 51/4&quot; F/D (400k); 12&quot;, 24 x 80 VDU: 2 x RS232 ports: 80 col printer.</td>
<td>CP/M: Basic: Fortran</td>
<td>Options: dual 51/4&quot; F/D (800k); dual 8&quot; F/D (2M).</td>
</tr>
<tr>
<td>Solitaire WP &amp;</td>
<td>SPC/l</td>
<td>64k RAM: 8085: 14&quot; VDU (with own CPU): 45 cpm: printer: CPU port: dual 51/4&quot; F/D (700k); 1&quot; F/D (1.0 M) with SPC/l.</td>
<td>DOS: Basic</td>
<td>All solitaire systems are compatible: and can be upgraded to multi-user H/D system.</td>
</tr>
<tr>
<td>Tandy TRS-80 Model 1 (E2349)</td>
<td>Tandy: 9902</td>
<td>4-48k RAM: Z80C: C: 12&quot;, 16 x 64 VDU: RS232: P/P</td>
<td>Basic (4k ROM): A</td>
<td>Fully expandable. Option: single 51/4&quot; F/D (175k) £339 (up to 4). Many extras available. (I)</td>
</tr>
<tr>
<td>Tandy TRS-80 Model II (E2349)</td>
<td>Tandy: 644181 (200)</td>
<td>64k RAM: Z80: single 8&quot; F/D (500k): 12&quot;, 24 x 80 VDU: 2 x RS232 port: P/P</td>
<td>Basic M/A: Fortran: Cobol:</td>
<td>Option: single 8&quot; F/D (500k) £489 (subsequent £450, up to 4). 32k RAM £344.</td>
</tr>
<tr>
<td>Tandy TRS-80 Model 3 (E500 £1700)</td>
<td>as above</td>
<td>See Model 1 Levels 1 and 2</td>
<td></td>
<td>Fully integral unit. Up to 2 integral and 2 external 51/4&quot; F/D. BT 8/81</td>
</tr>
<tr>
<td>Terodec CPC-100-0 (E4097)</td>
<td>Terodec: 0734 644343 (8)</td>
<td>80k RAM: single 51/4&quot; F/D (819k): 2 S/P: 3 P/P</td>
<td>CP/M: CBC: Fortran: Compass: Cobol:</td>
<td>System with Okidata 80 printer: TV 1900 VDU: W/P and various application packages £5995 (S&amp;H)</td>
</tr>
<tr>
<td>Terodec DPS 64/2M (E3598)</td>
<td>as above</td>
<td>64k RAM: Z80A: dual 8&quot; F/D (2 Mb): 2 S/P: 3 P/P: Options: 10 Mb H/D: Tape.</td>
<td>CP/M: MP/M: CP/Ne: Compass: Fortran: Compass: Cobol: Basic.</td>
<td>2 user system with 10 Mb H/D £7400 4 user system with 34 Mb H/D &amp; tape back up E1981. (S&amp;H)</td>
</tr>
<tr>
<td>Tuscan Starter Kit (E999)</td>
<td>as above</td>
<td>8k RAM: Z80: Cint: 56-key K/B Options: Case E10: 5 x 160 sockets £20 TV int: £3.50</td>
<td>8k Basic</td>
<td>Fully assembled version £499 BT 1/81 (H62)</td>
</tr>
<tr>
<td>UDS 3000</td>
<td>Kemtron: 0244 21817 (TABA)</td>
<td>64k RAM: Z80: dual 8&quot; F/D (700k) 2 Mb: 2 x RS232 ports: 10 Mb H/D</td>
<td>CP/M: Basic: Cobol: Fortran: Compass:</td>
<td>Full range of industrial support cards, and applications software. (E)</td>
</tr>
</tbody>
</table>

List of Abbreviations

- **A**: Assembler
- **B**: Benchmark
- **C**: Compiler
- **E**: Editor
- **F/D**: Floppy disk
- **G/C**: Graphics card
- **H**: Hardware
- **I**: Interface
- **M/A**: Macro assembler
- **M/P**: MP/M
- **N/A**: Not available
- **N/P**: Numeric paper
- **O/S**: Operating system
- **P/P**: Parallel port
- **S**: Software
- **T/E**: Text editor
- **UC**: Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are exclusive of VAT.
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</thead>
<tbody>
<tr>
<td></td>
<td>As above</td>
<td>56k RAM: Z80A: dual 8&quot; F/D (2.4 Mb): 3 S/P: 2 P/P</td>
<td>As above</td>
<td>High-res graphics. Many Options. Fully expandable to 5003 multi-user system (max £5400). (E)</td>
</tr>
<tr>
<td></td>
<td>As above</td>
<td>64k RAM: 3k ROM: Z80B: single 51/4&quot; F/D (630k): 12&quot;: 24 x 80 VDU: RS232 port, 3 x P/P</td>
<td>As above</td>
<td>Up to 3 additional F/D drivers. Options: dual 8&quot; F/D (2 Mb) £1606, 32 Mb H/D (TBA). (H&amp;K). BT2/81.</td>
</tr>
<tr>
<td>Video Genie EG3003 (£300)</td>
<td>Lowo Electronics: 0629 49559 (N/A)</td>
<td>16k RAM: Z80: 5000ps C: 16 x 64 int: extra C: 1 P/P</td>
<td>Basic (12k ROM):</td>
<td>Graphics available with ex-basic (13k) £3.50.</td>
</tr>
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<tr>
<td>Explorer (£32)</td>
<td>As above</td>
<td>4-64k RAM: 805: Full K/B: RS232 port: 6 x 5100 bus: C: int 1k video RAM.</td>
<td>2k monitor: Basic (8k) CP/M: Basic: Fortran: Cobol:</td>
<td>Can be upgraded with 6809. (H).</td>
</tr>
<tr>
<td>Heward 6800 Mk 111 (£152)</td>
<td>Heward: 0925 22030 (N/A)</td>
<td>16k RAM: 6800: full K/B VDU int: 2 x C: int: 1 S/P: 2 P/P: Option: 16k RAM £90</td>
<td>1k monitor: A: T/E:</td>
<td>Designed for industrial control. Can be expanded to F/D system. (H).</td>
</tr>
<tr>
<td>Microaxis 1 (£230)</td>
<td>Micro Design 0968 66365 (N/A)</td>
<td>1k RAM: 1-k PROM: 6089: 8 channel A-D system: 12 optically isolated I/O lines.</td>
<td>1k monitor:</td>
<td>As above. New 64k version avail.</td>
</tr>
</tbody>
</table>

List of Abbreviations:
- A: Assembler
- B: Bench Tested
- C: Cassette
- E: Extensive
- F/D: Floppy disk
- G/C: Graphics card
- H: Hardware
- N/P: Numeric pad
- P: Parallel port
- T/E: Text editor
- Int: Interrupt
- Socket: 14k EEPROM

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<tr>
<td>Nascom (£12)</td>
<td>Nascom: 02405</td>
<td>4k RAM: Z80; Full K/B; TV int; 2 P/P; 1 S/P; Options: 16K RAM; £100; one single 1¼&quot; F/D (256k) £240 (disk controller £127).</td>
<td>2k monitor: B Basic; Tiny Basic: A: T/E: U.</td>
<td>Kit: Built version (140). Also Nascom with B Basic. In ROM £225 (no RAM). (SH)</td>
</tr>
<tr>
<td>7/8 (£60)</td>
<td>Newbair: 0635</td>
<td>4k RAM: 6800; LED: C int; 1 S/P; 1 P/P.</td>
<td>1k monitor: Basic (8k ROM).</td>
<td>Expandable to 64R AM with F/D. (B).</td>
</tr>
<tr>
<td>7/0/9 (£65) as above</td>
<td>1k RAM: 8689: P/P; S/P.</td>
<td>Options: ₹220 port; single 1¼&quot; F/D (106k) £36; 8k RAM; £188. (SH).</td>
<td>2k Monitor.</td>
<td>Designed to upgrade 77/68. (H).</td>
</tr>
<tr>
<td>SBC 100 (£135)</td>
<td>Aircom: 2094</td>
<td>1k RAM: Z80; 8k ROM: S100; 1 S/P; 1 P/P.</td>
<td>1k monitor: DOS in ROM.</td>
<td>Kit: Available assembled £196.</td>
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<td>35757 (TBA)</td>
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<tr>
<td>Superboard (£188)</td>
<td>(as Challenger)</td>
<td>4-8k RAM: 6520: 10k ROM: full K/B; VDU int; C int.</td>
<td>2k monitor: £55 Basic: CP/M: Pascal.</td>
<td>High res graphics available.</td>
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<tr>
<td>Smoke Signal (£400)</td>
<td>Windrush 0692 401589</td>
<td>1k RAM: 6000-6800; Bk: EPROM: 1 S/P.</td>
<td>2k monitor fully upgrade to 64k RAM with F/D. (B).</td>
<td>Graphics plus expansion £80. Kit of fully assembled.</td>
</tr>
<tr>
<td>SYM-I (£160)</td>
<td>Newbair: 0635</td>
<td>1-4k RAM: 6520: Cint; VDU: int 2 x 6522 options: Option: TV int.</td>
<td>4k Basic A.</td>
<td>Expandable to 64k RAM with F/D. (B).</td>
</tr>
<tr>
<td>Tuscan (£289)</td>
<td>Transmit 01-405</td>
<td>8k RAM: 8k ROM: Z80A: 5 x 100 slots: RS232 port: TV int: C int: 1 F/D.</td>
<td>2k monitor: £85 Basic: CP/M: Pascal.</td>
<td>Will take any 700k/ 16 = 32 software.</td>
</tr>
<tr>
<td>UK10 (£149)</td>
<td>Comp Shop: 01-441</td>
<td>4k RAM: 6522: full K/B: 16 x 48 VDU or TV int: C int: RS232 port: Options: 4k RAM £16.</td>
<td>2k monitor: Basic: OS: A: CU: A.</td>
<td>Will accept any 2708/-S100 bus compatible. Expandable to full system. (E)</td>
</tr>
<tr>
<td>Windrush 8601 (£175)</td>
<td>Windrush: 0692 401589</td>
<td>2k RAM: 6803/5: 12k EPROM: S/P: 3 F/P.</td>
<td>2k Monitor.</td>
<td>Designed for industrial control &amp; dedicated small systems. (B).</td>
</tr>
</tbody>
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**TRANSACTION FILE**

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Casio FX502P programmable calculator £150. RS232C and overlay, instructions and program (Bridgwater) £250, ono. Tel: 0322-896790.

Tangerine... Microtack, 8k Tandy, Xylog, Basic, Lower-case, graphics, RS232C, ASCII keyboard, P.U., cases, documentation, £200. Casio FX502P and F140 adapter, £250. All excellent condition. Telephone Blythe Bridge 8423.

Teleng/Rowtron home television entertainment system £1500, four cartridges, 118 sketches.

Elnabased ZX81, complete with 8k Rom, 8k Ram, computer flash, inter- face. Software including: Tiny Pascal, microchess. Plus lots more software. Also technical handbook, assembly language book more software. Also technical tiny pascal, microchess. Plus lots more software. Also technical tiny pascal, microchess. Also, many games inc' space invaders, 3D noughts and crosses, etc. All many games inc' space invaders, 3D noughts and crosses, etc. All many games inc' space invaders, 3D noughts and crosses, etc. All

**SINGLE BOARDS**

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<tr>
<td>UK10</td>
<td>£149</td>
<td>COMP SHOP: 01-441</td>
</tr>
<tr>
<td>Windrush</td>
<td>£175</td>
<td>Windrush: 0692 401589</td>
</tr>
<tr>
<td>ZCB</td>
<td>£55</td>
<td>Almarc: 0602</td>
</tr>
</tbody>
</table>

**DIRECT ADVERTISEMENTS**

- **Software**
  - "Wanted!" microchess for 8k PET. Write: Arne Karlsgard, Caen Road, Westhoughton, Nr. 1-1000, Trondheim, Norway.
  - Sinclair ZX81, 3A PS/4, 5¼" SSD Drive (12000 K), CP/M.
  - Nascom 2 with 8k Microsoft BASIC in ROM f225 (no RAM).
- **Hardware**
  - TRS-80 16K LK with numeric keypad = CTR 80A, Tandy modulator for Tandy Software. 2 months old. Not enough time to use. £225.
  - Kentish 3946. 4.6kg.
  - Acorn Atom 12k + 12k inc. floating point. Little used, good cond. £200. Tel: Dave/Bry L/Spa.
  - Superboard II, cased modulator 8k RAM, 8k ROM, excellent P.S.U.
  - Compat with all manuals, leads, etc. games on tape including invaders £200.00. Tel: Whitworth 2360 evenings.
  - Pet 8k, Old Rom, Integral cassette deck, small keyboard, with games and tutorial programs. Tel: Danbury (Eames) (02451) 4158 Evenings & Weekends.
  - Video genie 32k, control keys, sound, as new, with printer interface. Software including (pascals, assembler, north) and most popular games books. £1375 ono. Tel: 021-440 1722.
  - Swap—complete Nikon camera kit. FM Body, standard zoom lens, computer flash, interf. voltmeter, motor-drive, cases, metal case etc. Worth £400+, for Pentax MI-80 similar value. Reading (0734) 111333.
  - ZX81 + 16k RAM, Sinclair built including power supply, manual, many software, original packing and unused. 2x St Martins Street, Millfield, Peterborough (0733) 45731 or 22258.
  - Sinclair built, complete with 3k additional RAM, PSU, manuals, leads, Magazines and games tape £350 will accept £169 ono. Tel: (0827) 627714.
  - Sinclair built, boxed complete with manual, PSU, leads, keyboard mods. £355 ono. Tel: Paul 01-841 4268.
  - Sharp PC1121,... with manuals, overlays, cassette interface, all in good condition will accept £65. £150. Mr Adamson, Woodend, Victoria Road, Wingsdown, Deal, Kent 733275.
  - ZX80 1k. Sinclair built, leads adaptor etc. £45 and 12" portable b/w TV. £40. Tel: 021-55122 after 8.30 pm.

**Miscellaneous**

- **Software**
  - Sinclair built, complete with 3k additional RAM, PSU, manuals, leads, Magazines and games tape £350 will accept £169 ono. Tel: (0827) 627714.
  - Sinclair built, boxed complete with manual, PSU, leads, keyboard mods. £355 ono. Tel: Paul 01-841 4268.
  - Sharp PC1121,... with manuals, overlays, cassette interface, all in good condition will accept £65. £150. Mr Adamson, Woodend, Victoria Road, Wingsdown, Deal, Kent 733275.

- **Hardware**
  - Sinclair Software and others acquainted and mastering machine code. Sinclair Software and others including 'invaders' and 'defenders'. Custom 'blue' in games controller. Leads, power unit. at new £495. Telephone Gloucester 42349.
  - Computers in total: £85 for the lot, ono, or will split.
  - Nascom 12k, 3A PS/4, 5¼" SSD Drive (20000 K), CP/M.
  - Nascom 2 with 8k Microsoft BASIC in ROM f225 (no RAM).
  - Nascom 12k, 3A PS/4, 5¼" SSD Drive (20000 K), CP/M.
  - Nascom 2 with 8k Microsoft BASIC in ROM f225 (no RAM).

- **Miscellaneous**
  - Dec equipment or best offer over £500. Phone Hythe (0303) 66963.
  - Computer 48K for VT100 or other suitable monitor. £270.
  - Hasselblad 500C with accessories £500.
  - Hasselblad 500C with accessories £500.
PET — 8K or Old Rom. Small keyboard, integral cassette. Possible to sell as set. Contact me or Ring Revealed. Several games including Star Trek. £230 ono. 01-897 9996.

PET... Wonderful! Day Sale — 32K New Rom Commodore Pot with sound box and 3600 BA Ultra disk drive (boxed). A great key and commodore cassette. £350. Tel. Sheffield Bridge 432 after 5.30 pm.

Business Genie System... 48K, 2 disk drives, expansion box, special green monitor, cables, leads, manual. £1,190. Tel. 01-631 8462. will accept £950. Possible to change for CBM80但他.

Acorn Atom... 12K Ram, 8K Rom. Acorn Built, recently serviced, Basic and Assembler. PSU, 12K 256 resolution graphics. Graphics invaders, tape manuals. £215. Tel. Wolverhampton 780659, after 5pm.

Sinclair ZX81 with leads and manual in box. A bargain at only £50. Tel. 0302 748774 after 5.30 pm.

Superboard II... good condition, with Cemgon monitor, and 5 user slots. Parrot (as new). Made Case. P.U. & modulator expansion box. Tel. 061-480 1979 after 6. S.McMunphry, offer around £140 o.n.o.

ZX81 + 16K RAM... sine built, all manuals. Also 32K RAM, 2 cassette, and 2 Harthill's books. Ideal Christmas gift. £80 o.n.o. Tel. Yeovil 0306-237724 after 6 pm.


Acorn Atom Perfect condition. fully working, 2K Rom, 12K + 12K, PSU, leads, manuals. Acornsoft packs 1, 2, 3 & 4. Statk 108102. £415. Tel. 01-336 3167.

Superboard 2... 8K Ram, Intammon monitor, case and P.S.U. + leads. Also, ASK 34 type printer card — £30. Tel. 061-338 4167.


ZX80 8K ROM and Video upgrade-kit (CompuPlus) (allows use of slow and fast mode) £25. Ram. 5 books (software and programming) manuals, cassette. Bargain at £80. Phone Swindon (0792) 472112.

Centronics microprinter P1 + special rolls paper, for the ZX81. £165 o.n.o. Sharp M280K interface unit (£125) for sale. £80.00. Sharp PC1211 + Cass int (V2.00) o.n.o. Sinclair ZX81 P.S.U. £6.00. Brighton 423021.

ZX81... 8K Ram, 3K cassette recorder & interface, saves/loads first time, on a board, £100 o.n.o. Tel. Winsford (06056) 53885.

For sale Acetronic T.V. Game... 1900 seeds, 4000 battle, invaders, soccer, blackjack, tank/plane battle, etc. cost £236. would accept £150 o.n.o. Tel. Winsford (06056) 53885.

Software... 16K memory board, 3A PSU, graphics, assembler, etc. £25.00 for quick sale, ring Essex 629257.

Cromemco... PR100 printer interface card & manuals. Cromemco par-1200 printer £90 o.n.o. Tel: 01-934 7202.

ZX81... 16K Ram plus memoryboard and all leads, 20 tapes (some with programmes), 3 programmes, interface manuals, no waiting for delivery. £120.00 o.n.o. Phone 01-337 3002.

Microplan... 65 - Tunes, 8K Ram, Z80, Asel. £25. Tel. Lulsgate 2802, (Bristol) after 4pm.

Software... for Apple as new with documentation. Visalain £50, Visalain 36K, desktop plan £40, 2400 Data Management £40, Bi. Tech. 196m. £45. Applequest £25, Tel. 0223 (Cambridge) 833772.

Software for Apple... as new with documentation. Eastwrite (40 col) £30, Trendik / database £30, Macpoint £25.25, £25 (48k) £50, Stats Pack (Char. 8024) £25. Tel. 0223 (Cambridge) 833772.

TI-59 programmable, mag. cards, chess £290. Tel. Lulsgate 2802.

3022 `Tractor Drive Printer, £325. Almost new, £500. Commodore Computhink 400k disk drive, almost new, £500, Commodore 780659, after 5pm.

PET... 25K XZ81's for sale perfect working order sinclair built plus software £69 each phone David Kingswinford 292407 after 4pm.


Quick sale required, hence £99. Tel. 01-947 9747 after 4 pm.

Free... Asteological computer worth £92.95, if you buy my Vizilist £15. Tel. 01-397 7345 for (15£) for £199.00, insert. Black Apple monitor. £85 o.n.o. Tel. 01-451 3506. P.S.U, Transformer, Magnetic Hard drive, £215. Tel. Winsford, 3rd floor office, Board overlay, Rule. Also Videocon colour TV game only £120.00. Tel. 01-479 4798 after 6 pm.

Acorn Atom... 24K, PSU, manuals, lead, board, exc. cond. and various Commodore peripherals. £199. Tel. 051-411 7476, weekends only.

Superboard II... 16K with 610 extension board. Includes numeric keypad, PSU and modulator, £250 o.n.o. Tel. Woking (04862) 23600. For quick sale. Tel. Pontefract (0977) 704418.

ZX81... 8K, built, PSU, built, all leads, manual, nothing missing. Very good condition. Perfect for expert or beginner. £55 o.n.o. Tel. 051-924 9042 (after 5, weekends)

FREE... Casio fx 5200 prog calc. In wallet, with manuals when you buy my OSI built Superboard II, with 4K Disk drive, 32K RAM, modulator, 8K ram, 64k display + Cegmon (prof fitted), some tapes, VGC, at £270. Tel. Paul Marning 01-778 6402 (after 6).

Software... Video Genie EG003 used for less than 50 hours. Software, all and accessories £50. etc all for £285, or exchange with 80 column printer. Tel. 01-947 6673.

Printer... Cheap reliable ASR33 Teletype gives your Printer, RS232 Terminal. Plus ridiculously cheap offline storage on paper tape. Good working order. Only £99.00. Tel. 0494 25938.

Trendcom printer (similar to Microline 500). Complete Apple interface card and interface software of the highest quality. £600. Will accept £450. Telephone Liphook 732960.

Acorn Atom... 25K, PSU, complete cassette, with complete interface. Original cost £120, will accept £60. Telephone Liphook 722590.

Sorcerer 96K £550, disk unit £150, IBM compatible, 5.25 inch (includes drives), £270. Allog 150, WP pas £80, B/W monitor, 32k Ram, 5.25inch, £215. Tel. Teletype 33 £10, Alan Knifton, 0625 6426 after 5 pm.

Spare M280K... 8K Ram based on M280K. Contains various programs plus literature, pet program construction & cassette interface covered included £390. Tel: Peter Howard Stafford/Avon 281187 or Wrexham 263123.
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. For the month of April, 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, and that 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 our members to be sent out ACCumulator to them. Write to: Vernon Gifford, 11 Sehurst Road, London NW5 3AH, giving 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 or tell lies about you. 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 Bushby’s computing interests, two other items have cropped up this month. Firstly, Nick Smith, the winner of the ACC’s Micromouse competition with his ‘Stirling Mouse’, then 1980 Micromouse with ‘Thumper’, which was a great kindred spirit of the former. Secondly, Mike Kneifel of Portsmouth Polytechnic, who is responsible for designing mazes for micro mice to solve. He showed some video clips of his latest competition contests and made some suggestions as to the kind of problem a micro maze-solver will have to face.

The last speaker of the morning was John Billingsley of Powertran, who is responsible for designing mazes for micro mice to solve. He showed some video clips of his latest competition contests and made some suggestions as to the kind of problem a micro maze-solver will have to face.

The conference was opened by Vernon Gifford of the ACC, who chaired the morning session. He introduced the first speaker, David Woodfield from GKN, who 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 micros. 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.

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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 will report them in this section, which appears monthly.

**CTUK CENTRES**

Here’s an updated list of people organising Computer Towns. Don’t forget to enclose an SAE if you write to your nearest ‘Town for details.

**USER GROUPS INDEX**

INTERNATIONAL

Pascal 2 User Group (Europe)
Affiliated with Pascal 5 USA.
15 user disks available plus newsletter. Contact: George Brooke, Sebastian Baurerstrasse 20c, 6000 Munich 83, West Germany.

REGIONAL

Scottish Amateur Computer Society
Contact: Brian Ainslie, 86 St Vincent Road, Clacton-on-Sea, Essex CO15 1NA.

Steve Christian, 51 Bunkstone, West Dinton, Newcaste-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 Seahurst Road, Croydon, London CR2 6LN

John Stephen Bone, 2 Claremont Place, Gateshead, Tyne & Wear NE1 1TL

Mike Baker, 5 Edinburgh Road, Hadleigh, London WN 7JY

Vernon Quinlan, 66 Boundary Avenue, Norbury, London SW16 4UN

R L Saunders, 14 St Nicholas Mount, Hemel Hempstead, Herts.

Peter Rowan, 10 Lambton Road, Jesmond, Newcastle-on-Tyne NE2 4RX

Steve Haynes, 5 Gunned Street, Kingston, Gloucester GL1 3BL

Andrew Holey, 10 Masons Field, Manning Heath, Horsham, Sussex RH13 6JP

Brigitte Gorten, 18 Forsyth Crescent, New Addington, Croydon CR0 4RT

Sue Kelly, Head of Reference Services, PO Box 4, Civic Centre, Harrow, Middlesex.

Bill Gibbons, 3 Longholme Road, Retford, Notts DN22 6TU

Philip Joy, 130 Rush Green Road, Romford, Essex.

Richard Powell, 22 Downham Court, South Shields, Tyne & Wear.

Derek Daines, 18 Cuttings Avenue, Sutton in Ashfield, Notts.

Keith Taylor, Carter Hydraulic Works, Thurnby, Stamford BD3 8HG

Roger Shearn, 18 Woodmill Lane, Bitterne Park, Southampton SO2 4PY

Lyn Antill, 1 Defoe House, Barbican, London.

Peter J Kiff, 52 Stone Road, Broadstairs, Kent CT10 1DZ

Patrick Colver, 52 Queenway, Carterton Park Village, Reading, Berks RG4 0JS.

Pete Shaw, 15 St Vincent Road, Clacton-on-Sea, Essex CO15 1NA.

Steven Christian, 51 Bunkstone, West Dinton, Newcaste-on-Tyne NE5 2DF

Derek Moody, 2 Victoria Terrace, Dorchester, Dorset DT1 1LS

United Kingdom

**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.

San Diego, CA, USA
Pacific Computer Expo. Contact: Jumbo Enterprises (Arizona), (602) 990 1715.

Eindhoven, Holland
Int Microelectronic Subsystems Trade Fair.

Cheltenham
(Queens Hotel) Computer Open Day Exbn. Contact: Couchmed Communications Ltd, 01-653 1101.

London
(Barbian) Information Technology & Management Exbn & Conf. Contact: BED Exbn Ltd, 01-647 1001.

Harrogate
(Majestic Hotel) Computer Open Day Exbn. Contact: Couchmed Communications Ltd, 01-653 1101.

Dublin, Eire
Int Computing Exbn. Contact: SDL Exbn Ltd, Dublin 763871.

London
(West Centre Hotel) Microsystems Exbn. Contact: IPC Exbn Ltd, 01-643 8040.

Swansea
(Dragon Hotel) Computer Open Day Exbn. Contact: Couchmed Communications 01-653 1101.

Glasgow area
ZX80/81 User Group, presently being formed. Main aim is to promote computer literacy. Will eventually include BBC Micro, Waffle or phone: Ian Watt, 107 Greenwood Road, Clarkston, Glasgow, G76 7LW Tel: 041 638 1241.

Glossop (Derbyshire) — is any one interested in forming a computer club in Glossop? If so, please contact Neil Jenkinson on Glossop 66027.
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 (4?) 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 11, there is a remainder of 10; if you divide 2519 by 12, there is a remainder of 11; 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.

Great products from Mutek
Tiny PILOT
Mutek's Tiny PILOT (MTP) is a small-scale yet comprehensive implementation of OSI, and comes complete with the relevant version of CEgeomon as well as the best use of MTP.

The EPROM package is available as ex-stock, and comes complete with fitting instructions, manual and reference card.

PILOT package £17.50 + VAT
CEgeomon package £29.50 + VAT

StarLink
Communications package
A complete comms. package for OSI systems, including:
- "Smart terminal" mode for link to external mainframe, mini or micro;
- half-duplex/full-duplex operation;
- transmittable prepared text or files (on-line/off-line preparation); direct upload/download of programs; 'indirect file' handling for transfer of programs/data between external computer, disk or ROM BASIC, full editing and many other features.

Available in EPROM in two versions:
StarLink I for disk or ROM BASIC systems, and StarLink II for non-disk operation of Superboard Series II.
Specify type required when ordering!

Starlink (either version) £17.50 + VAT

PET UPGRADE
We can upgrade your large keyboard PET at a fraction of the 'New Price' difference.

8K to 16K: ... £44.00
16K to 32K: ... £55.75
8K to 32K: ... £69.00

No extra charge if expansion area is completely used.

All new RAMs fitted with socket(s)
Fast 2 hours while you wait service.
Tel: Mick Bignell 01-953 8385.

PCW 177
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, at the 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 microfloppy 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.

### 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 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: £95.00
- EPROM programmer: £29.50
- Keyboard: £57.50
- Pertec twin disk drives, cased £550.00

The multiboard system as reviewed is also available as a complete, cased unit for £1450.

**EPSON MX80 PRINTER RIBBONS REINKED**

A new Epson ribbon costs around £10. We will re-ink your present ribbon for £5 incl. p&p and VAT.

Epson make printers under other names. If you have an MX80 based printer, we can re-ink your ribbon too. Cash with order. Cheques made payable to, Douglas Recordings.

Send your ribbon in its cartridge to—

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Telephone (0338) 64364.

### ZIP81 SOFTWARE

**CASSette ONE**

I had your Invaders/React cassette — I was delighted with this first cassette’— P. Rahbuck, London NW10

"Thanks for your Cassette One you sent me — some amazing games at a very reasonable price. I've ordered more." — P. Reesland, Leeds

"I have been intending to write to you for many days to say how much I enjoy the cassette on which you supplied me with earlier this month. Please let me into the secret of your first time load every time!" — E. H., London SW4

**CASSette ONE SIDE ONE 1K**

**MACHINE CODE PROGRAMS**

React, Invaders, Phantom aliens, Maze of death, Planet lander, Bug splat, Bouncing letters

**CASSette ONE SIDE ONE 1K**

**BASIC PROGRAMS**

Chess, Mastermind, Basic hangman, Robots

**CASSette ONE SIDE TWO**

has large screen versions of Invaders and Maze of Death, ready for when you get 1K. Previous customers who did not get the large screen versions can get free upgrade instructions by writing me a see.

**CASSette ONE**

costs £3.80 from Michael Orwin, 26 Brownlow Rd., Willesden, London NW10 9QL.

**MICROsoft**

**ZX81**

**CASAste ONE**

"I had your Invaders/React cassette — I was delighted with this first cassette" — P. Rahbuck, London NW10

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costs £3.80 from Michael Orwin, 26 Brownlow Rd., Willesden, London NW10 9QL.

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Cassette 2

BANK ACCOUNT Record all your income/ expenditure and use for home or office budgeting.

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Cassette 4: BREAKOUT

Cassettes 2-4 all £4 each.

Send SAE for full details of these and other programs.

**1 PURVES 12 Stobhill Road Gorebridge Midlothian EH23 4PL**
A new Forth compiler for NASCOM I/II or any 280-based micro. HULLFORTH is a structured high level language which runs over 10 times faster than BASIC.

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- Spills to cassette with full documentation
- Nascom users please quote NAS-SYS or NASBUG

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Hull, HU5 2BP

NASCOM BASIC
A breakdown of how it works
- How and where GOSUB, FOR/NEXT, variable and string information is stored.
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- Data areas in the ROM listed.
- Workspace, each byte is explained.
- The ROM is broken down into over 200 parts with notes on each part. PRICE £5.90
- Uses spare RAM 0800-1000.
- Nine functions including string array SAVELOAD and intelligent re-number.
- On tape for NAS 1 or 2, with demo program and instructions. State monitor and tape format, PRICE £6.
- A.S. WATKINS 7, WARWICK CLOSE, MAIDENHEAD BURSHEI. Tel. (0628) 30494.

SYSTEM SCIENCE

CP/M SOFTWARE

Microstat Interactive Statistics Package, Parametric & non-parametric tests. Requires MBasic and 46k RAM

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Reformatter disk transfer routines

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Sound-1000, way to using spelling error detection program, Effective dictionary of up to 50,000 words.

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**PROGRAMS**

- **1590** If there is "IS/IN" person in your life.

- **1600** REM CPU FULL

- **1610** IF A5<"N" THEN 1690

- **1620** IF A6<"W" THEN 1650

- **1630** If you do not love this person.

- **1640** GOTO 1690

- **1650** IF A8<3 THEN 1680

- **1660** If you do not love this person very much.

- **1670** GOTO 1690

- **1680** If you love this person.

- **1690** REM HANDLE

- **1700** IF A1<>"R" THEN 1740

- **1710** F+18

- **1720** Jk=9 "You are probably "

- **1730** GOTO 1770

- **1740** IF A1<>"L" THEN F+19

- **1750** IF A1<>"E" THEN F+20

- **1760** Jk="You may be "

- **1770** GOSUB 2240

- **1780** Jg="gk",

- **1790** REM BRIDGES

- **1800** IF A2<>"R" THEN 1830

- **1810** o "You may have - or have had - a problem such as"

- **1820** o serious illness in your life.

- **1830** REM HOUSE & PRICE

- **1840** T=0

- **1850** IF A1<3 OR A1>6 THEN F+4

- **1860** IF A1>2 AND A1<9 THEN F=(A1+2)

- **1870** T+1

- **1880** GOSUB 2240

- **1890** o "You are ".gk",

- **1900** IF T=2 OR A1<8 OR A1<7 THEN 1930

- **1910** F+4

- **1920** GOTO 1970

- **1930** REM GARDEN

- **1940** IF A1<>7 THEN T+1

- **1950** IF A5<>10 THEN F+10

- **1960** IF A3<>10 THEN F+11

- **1970** GOSUB 2240

- **1980** o "You have "Bk1 close friends.

- **1990** IF A4<>10 THEN F+10

- **2000** IF A4<>10 THEN F+11

- **2010** GOSUB 2240

- **2020** o "You have "Bk1 friends.

- **2030** IF A5<>10 THEN F+10

- **2040** IF A5<>10 THEN F+11

- **2050** GOSUB 2240

- **2060** o "You have "Bk1 acquaintances.

- **2070** REM STREAM

- **2080** F+7

- **2090** GOSUB 2240

- **2100** o "You find it ".gk1 to see through your problems.

- **2110** REM BE AT

- **2120** IF B1<>1 THEN F+27

- **2130** IF B1<>1 THEN F+28

- **2140** GOSUB 2240

- **2150** o "You tend ".gk1 give in easily.

- **2160** REM WALL

- **2170** IF A1<>1 THEN F+23

- **2180** IF A1<>1 AND A6<6 THEN F+24

- **2190** IF A1<>5 AND A6<6 THEN F+25

- **2200** IF A6<8 THEN F+26

- **2210** GOSUB 2240

- **2220** gk="gk",

- **2230** g: INPUT"Press RETURN when you've read this. ".gk

- **2235** aHS(112) : GOTO 2500

- **2240** FOR I=1 TO F

- **2245** READ ks

- **2250** xZ=I

- **2255** gks=ks

- **2260** RESTORE

- **2270** RETURN

- **2280** aHS(112)

- **2290** 3000 aHS(112)

- **2310** o "Look, you don't appear to be taking this very seriously.

- **2320** o "Do you want to continue? ": g

- **2330** INPUT"Type 'Y' for YES or 'N' for NO: ".gk

- **2340** IF g<"Y"AND g<"N"THEN 2320

- **2350** IF g<"N"AND g<"Y"THEN 2330

- **2360** GOTO 2500

- **2370** a = END

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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 live up to otherwise rather boring applications packages. I sincerely hope that programmers will make the extensive software 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

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**ACT Sirius 1**

Continued from page 109

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main cabinet. A tape streamer for back- ing up the hard disk is also mentioned in the preliminary Sirius documentation. Two add-ons are already in the pipeline: a clock and drive, 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, multi-tasking version of CP/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 Super-Brain 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 £2,395
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Technical specifications
CPU: 8088, 5 MHz
Memory: 128K (64K dynamic RAM chips) internally expandable to 512 kbytes, external modules 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.
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Hopefully that should rectify any
problems encountered with these.

To do discover a bug in a PCW pro-
gram, 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 (ib, I'm not
speaking from personal experience) and
then gives you a personality analysis
from your answers. It's written in
Pronemco 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 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 DIMen-
sioned 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. PCl211 Exam Questions by J Chaplin should fulfil some, at least, of
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-
medic, 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

1 5 SET 5,0 I DIM @([20),K[30])
16 DIM Z(20)
20 DATA"extremely ambitious"
30 DATA"very ambitious"
40 DATA"ambitious"

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"unusual", "difficult", "easy", "do it lazy"
150 DATA"You do things the difficult way"
160 DATA"You are impractical"
170 DATA"You fantasize", "to", "not to"
300 2CHR$(12)
310 ATAB(11) !"PERSONALITY ANALYSIS"#
320 § § ¡«
330 3"This personality is not a game - it should be used"
340 "seriously. However, please note that it does not"
350 aclaim to analyse you with perfect accuracy."
360 0 §"INPUT"Press RETURN when you're ready...",A
370 0CHR$(12)
380 0§"First, I want you to envisage a house. Is it:
390 0§ 0¿"A castle", "2 A mansion", "3 Detached"
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PL100: A Editor/vi editor switching unit with on -board supply. Relay rating is 1A at 30V DC/100V AC. Price: £50.00

PET HANDLING. Comprehensive and
to ZX81 BASIC:-

SCREEN HANDLING. Comprehensive and
in

CALCULATOR CORNER

Continued from page 99
### 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 discovered, it may be because I should have said petrol.

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 Fair will be held in San Francisco on 19, 20 and 21 March. Serious enquiries to: 333 Swett Road, CA 94062. Telephone (415) 851 7075.

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.’

---

### BOOKFARE

Continued from page 110

Wiley And Hayden

In October and December 1981 Bookfaires I referred to three books published by the Hayden Book Company of New Jersey. I had no 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).

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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.

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. While they take turnover 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.

FRAMES OF REFERENCE
Continued from page 91

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 turnaround 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:
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, e.g., IBM, DEC and HP. Serious, high quality software producers will grow on a vast market. And the '80s will see the establishment of micro-systems 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 keepest. 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.

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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.

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5. VIDEO-PLAN
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7. STOCK-MARKET
8. TEST-MATCH
9. SPACE-RACE
10. VIDEO-AD

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<th>No.</th>
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<td>1</td>
<td>SNAKE ISLAND, 10 PIN BOWLING, POKER</td>
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<td>2</td>
<td>COSMIC INVASION, SPA CE FIGHTER, PAPER</td>
<td>£5</td>
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<td>3</td>
<td>CASINO CHIPS, GORRI SPACE INVADERS</td>
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<td>4</td>
<td>SURVIVAL, STAMP OUT, OTHERHELLO</td>
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<td>5</td>
<td>SKI SLOPE, STARTREK, JUMPS</td>
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<td>6</td>
<td>HYPNO, 3D MAZE, OTHELLO</td>
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<td>7</td>
<td>TEACH MAJOR SCALPS: ORGAN KEYS</td>
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<td>8</td>
<td>EXPLODING ATOMS, STARTREK, 3D MAZE</td>
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<td>9</td>
<td>CO-ORDINATORS, STAMP OUT, SPACEFIGHTER</td>
<td>£5</td>
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<tr>
<td>10</td>
<td>LION TAMER, 10 PIN BOWLING, OTHELLO</td>
<td>£5</td>
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<td>11</td>
<td>DISASSEMBLER, MEMORY DUMPER, BYTE SEARCHER</td>
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<td>12</td>
<td>TEACH TABLES, and 6 programs</td>
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<td>13</td>
<td>DIRECTED NUMBERS, DIVISION, MORSE TUTOR</td>
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<td>14</td>
<td>SP5025 REMEMBER</td>
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<td>15</td>
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<td>16</td>
<td>CRIBBAGE, BACKGAMMON, POKER</td>
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<td>17</td>
<td>WIZARDS CASTLE – role playing adventure game plus TOWERS and GATOR EATER</td>
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<td>18</td>
<td>ARCADE ROAD RACE, LION TAMER, KAMIKAZE PILOT</td>
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<td>19</td>
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<td>CURVE FITTING calculates, intercept, slope, co-efficient, draws regression curves</td>
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<td>MACRO COMMAND – very fast</td>
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<td>25</td>
<td>UFO or someone says it is too fast, we refuse to slow it down</td>
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<td>26</td>
<td>SNAPPER – CRASH – HEAD ON</td>
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<td>27</td>
<td>KISS THE TEACHER biology was never like this</td>
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<td>31</td>
<td>ACCORDING TO SIMPSONS RULE GAUSSIAN</td>
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<td>32</td>
<td>LEGENDRE/LAGUERRE. Needs Pascal on the B or K. Supplied with 20 pages of instructions – draws great parametric curves</td>
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<td>33</td>
<td>KNIGHT DISK COMMANDER adds new commands to SP6015 Basic without taking extra memory. AUTO, BLOCK DELETE, JUMP, DEFINE KEYS, TRACE, REPEAT ON ALL KEYS, NUMERIC PAD, REMEMBER, SINGLE STEP etc</td>
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1. Introduction and overview: Plan of the book, sources of information and help, features and chronology of CBM hardware
2. BASIC and how it works: Storage of BASIC and variables; pointers, syntax; modifying, running, and optimising BASIC
3. Program and system design: What the equipment can do; charts, structured design, algorithms; estimating size, timing
4. Effective programming in BASIC: Subroutines, DATA, date handling, crashproof INPUT, packing, rounding, searching, etc.
5. Alphabetic reference to BASIC: Full descriptions, examples, notes for all keywords, plus DEL, OLD, POP, SORT, VARPTR, etc.
6. Disk drives: Descriptions; six file types and uses; CBM disk handling, direct access, machine-code; Compu/think; reliability, bugs
7. Alphabetic reference to disk BASIC: BASIC 4 disk commands with syntax, examples, and notes; earlier equivalents
8. Other peripherals and hardware: Cassettes; tape timing, storage, ROM routines; printers; keyboard programming; reset switches
9. Graphics and sound: Tables of character, graphics; CRT chip; 6502 animation, bar plots, 80 by 50 etc.; square-wave & 8-bit sound
10. Transition to machine-code: 8-bits and 16-bits; BASIC and 6502; use of monitors; Supermon listings; demonstrations
11. More 6502 machine-code: 6502 addressing, flags, PC, SP, etc.; how to compare, negate, add, subtract, multiply, divide, increment etc.
12. Alphabetic reference to 6502 opcodes: Examples, notes, full details on all opcodes from ADC to TYA
13. Using ROM routines: IRQ, NMI, RESET; BASIC, the kernel; modifications-LIST, PRINT USING, TRACE; writing relocating loaders
14. Effective 6502 programming: BASIC, CHRGET and wedges; assemblers; examples; PIA, VIA, IEEE, common mistakes
15. Index to BASIC ROMS and RAM: Memory map; the first four pages; comparisons and detailed explanations of BASICS 1, 2, and 4
16. Mathematical Programming: Accuracy; equations; statistics; simulation; finance; trigonometry; matrices; how ROM routines work
17. Business and education: Examples, applications, cautions; menus, users, input; packages; documentation; educational needs

Appendices: 6502 reference charts, tables, pseudo-opcodes, ASCII, glossary

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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. 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.

The exploration has begun. Join us. 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.

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Or consider the TLS 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.

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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.

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- Setup and Installation.
- Maintenance.
- Troubleshooting.
- Accessories.

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We have I.E.E.E. Interface, low cost serial, parallel interfaces, Doublevision 80 character card, numeric keypads, personal computer plotters, Paper Tiger printers and much more besides.

Whatever you need in computing, we will satisfy your requirements.

FROM PERSONAL COMPUTERS
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- Word Processing. Our Format 80 system is recognised as the best of its kind.
- Graphics. Pad to plotter software and low-cost plotter.
- Technical Support. Our knowledge of computer languages and application requirements is unrivalled. And we can supply either on-site or in-house maintenance.

Once again... Personal Computers Limited give the story a happy ending.

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