POPULAR Computing WEEKLY

5 August 1982 Vol 1 No 16

35p

Hunter-killer on Spectrum

BBC graph plot

Robot Nim

Astro Invaders

Space-saving on PC1211

Spectrum machine code tips

ZX Spectrum
20 Programs £6.95

The ZX Spectrum has brought advanced computing power into your home, The Cambridge Colour Collection, a book of 20 programs, is all you need to make it come alive.

No experience required. Simply enter the programs from the book or load them from tape (£2.95 extra) and run.

Amazing effects. All programs are fully animated using hi-res graphics, colour and sound wherever possible.

Entirely original. None of these programs has ever been published before.

Proven Quality. The author already has 30,000 satisfied purchasers of his book of ZX81 programs.

Hours of entertainment

- **Lunar Landing.** Control the angle of descent and jet thrust to steer the lunar module to a safe landing on the moon's surface.
- **Maze.** Find your way out from the centre of a random maze.
- **Android Nim.** Play the Spectrum at the ancient game of Nim using creatures from outer-space.
- **Biorhythms.** Plot the cycles of your Emotional, Intellectual and Physical activity. Some would say this is not a game at all.

Improve your mind

- **Morse.** A complete morse-code training kit. This program will take a complete beginner to R.A.E. proficiency.
- **Maths.** Adjustable to various levels, this program is an invaluable aid to anyone trying to improve their arithmetic.

Run your life more efficiently

- **Home Accounts.** Keeping track of your finances with this easy-to-use program will enable you to see at a glance where the money goes and plan your spending more effectively.
- **Telephone Address Pad.** Instant access to many pages of information.
- **Calendar.** Displays a 3 month calendar past or future, ideal for planning or tracing past events.

ORDER FORM:

Send Cheque or P.O. with order to:
Dept. F., Richard Francis Altwasser, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP

Please send me

☐ Copies Cambridge Colour Collection Book only £6.95 each.
☐ Copies Cambridge Colour Collection Book & Cassette £9.90 each

Name: _____

Address: _____

_____

Chrisalid - BERKHAMSTED'S COMPUTER STORE

Watch this space for the real computer BARGAINS every week:
EPSON MX80f/t **£355+VAT** — EPSON MX80 tractor only **£315+VAT**
VIC20 at **£173+VAT**
VIC cass unit **£39+VAT** — range of VIC software.
11 x 9½ fanfold paper at **£16.50** per 2000 sheets

CALL US FOR A QUOTE

GENIE 1 & 2 @ **£289+VAT** — All GENIE mods expansion/disks/mem.
CUMANA disk drives at **£199** single and **£369** double —
9" 12MHz monitors for only **£99+VAT** (metal).

OFFICIAL DEALERS FOR:
Nascom, Genie, Cumana, Vic, and lots more — RING US NOW on
BERKHAMSTED (04427) 74569 or **5704**

VISA

13 HIGH STREET
BERKHAMSTED HP4 2HY
HERTFORDSHIRE

We welcome Access

POPULAR Computing WEEKLY

BACK NUMBERS

MAKE SURE OF A REAL COLLECTORS' ITEM — THE FULL SET OF *PCW*

We will mail any of the numbers you're missing from Issue 1 to the latest — for just **50p** an issue, including p & p.

Send cheques/Postal Orders to:

Back Numbers
Popular Computing Weekly
Hobhouse Court
19 Whitcomb Street
London
WC2 7HF

POPULAR Computing WEEKLY

The Team

Editor
Brendon Gore

Reporter
David Kelly [01-930 3271]

Sub-editor
Peter Harvey

Editorial Secretary
Fiona McCormick

Advertisement Manager
David Lake [01-839 2846]

Advertisement Executive
Alastair Macintosh [01-930 3840]

Managing Editor
Duncan Scot

Publishing Directors
Jenny Ireland
Nick Hampshire

Popular Computing Weekly,
Hobhouse Court, 19 Whitcomb Street,
London WC2
Telephone: **01-839 6835**

Published by Sunshine Publications Ltd.

Typesetting, origination and printing by Chesham Press, Chesham, Bucks

Distributed by S M Distribution
London SW9. 01-274 8611. Telex: 261643

© Sunshine Publications Ltd 1982

Subscriptions
You can have *Popular Computing Weekly* sent to your home: the subscription rate is **£19.95** per year, for addresses in the UK, **£37.40** overseas.

How to submit articles
Articles which are submitted for publication should not be more than 1000 words long.

All submissions should be typed and a double space should be left between each line.

Programs should, whenever possible, be computer printed.

At present we cannot guarantee to return every submitted article, so please keep a copy.

Accuracy
Popular Computing Weekly cannot accept any responsibility for any errors in programs we publish, although we will always try our best to make sure programs work.

This Week

Cover illustration by Ian Craig

News 5
Enter Sony, with a video link.

Letters 7
Pope blocks Fair deal.

Hunter-killer 8
Spectrum game by David Lawrence.

Street Life 11
David Kelly reports on the PATS Centre.

Reviews 12
Volcanic Dungeon, Robot Nim.

Copyright 13
How the law on software affects you, by Roger Pearson.

Open Forum 15
Six pages of your programs.

Programming 21
Space saving on PC1211.

Spectrum 22
Machine code tips.

Sound & vision 23
Graph plot on BBC micro.

Peek & poke 24
Your questions answered.

Puzzle 25
Cartoon.

Editorial

The future of home computers lies in telesoftware, according to Nigel Searle, head of Sinclair's computer division. That is a bold, not to say prophetic, statement, considering the conspicuous lack of interest so far engendered by Prestel, Ceefax, Oracle et al.

Certainly, the development of a low-cost Prestel adaptor (*PCW* July 29) would make a telesoftware scheme financially feasible. But, what benefits would it offer to the user?

The most obvious benefit is access to an extremely large data base. This would be useful for both educational and business applications.

Another benefit is immediacy. Programs and other information transmitted via Prestel can be constantly updated.

A further benefit is the possibility of interaction with other users. It would be possible for clubs and individuals to contact each other over the air. The first CB micro may yet appear.

But, if telesoftware is to be a success, systems such as Prestel will have to be a great deal more user-friendly than they are at present.

Next Week

Survival in post-holocaust London means gang warfare. Can you lead your men to victory? You'll find out in Street Alley — a new game for Vic20.

Classified

HAVEN HARDWARE ZX PRODUCTS
ZX REPEATING KEY MODULE. KIT £3.50. BUILT £4.95.
One of the most successful ZX products ever created. Essential for speedy editing etc. SEE REVIEW IN *Popular Computing Weekly*, July 24.
ZX81 INVERSE VIDEO MODULE. BUILT £5.95.
ZX PROGRAMMABLE CHARACTER GENERATOR. KIT £17.95. BUILT £22.95.
ZX KEYBOARD with REPEAT KEY etc. KIT £18.95. BUILT £22.95.
(Also has provision for SINGLE KEY RUBOUT and CURSOR CONTROLS.)
ZX 3K MEMORY. BUILT only £12.95.
ZX EDGE CONNECTOR (Gold Plated Contacts) **£2.29.**
Many other products for ZX80, ZX81, ZX Spectrum etc in stock.
S.A.E. for details (catalogue and order form).
Haven Hardware, 4 Asby Road, Asby Workington, Cumbria

ZX81 (16K, FREE PROGRAM). Send cassette and sae to Nick Godwin, 4 Hurkur Crescent, Eyemouth, Berwickshire.

BBC MICRO GAMES. Cassette A (Models A & B): Space Invaders (machine code) Dodgems Breakout — £5 (inc). Cassette B (Model B only) Pacman (machine code) 3D Maze — £5 (inc). Both cassettes for £9 (inc). From B. Cridland, 8 Bowness Avenue, Fleetwood, Lancs, FY7 8PA.

P-E-P. The Program Enhancement Package for the ZX81 (16K). 7 fantastic new features for your basic programs. Only £5.95 from R. & R. SOFTWARE, 34 Bourton Road, Gloucester.

PECMAN & SKYSCRAPER CAPER. Tape 4, high resolution graphics for standard Vic20 £3 or sae for games available. M. Gardiner, 103 Holmes Chapel Road, Congleton, Cheshire.

ZX81 CONSOLE £17.50, case £27.50, securely mount computer, RAM, printer, recorder. No disconnections. Sae ZXBS, 14 Brookfield Gardens, Ryde. 0983 65897.

BBC DISASSEMBLER. All the features of more expensive disassemblers, runs in less than 4K, relocatable, £3.00 inclusive. Send cheque for quality cassette and full instructions to P. Mapstone, Stanhope Road, London N6 5AJ.

BBC SUPER STARTREK for Model B. All the features of regular Startrek plus extra asteroid storm and others, £4.50. T. Sato, 37B New Cavendish Street, London, W1M 8JR.

ZX81 VIDEO INVERTER PCB. Displays sharp white characters on solid black background screen. Kit £4, built £5, will fit inverter £7.50 (includes VAT + P&P, instructions). Send cheque/PO to D. Fritsch, 6 Stanton Road, Thelwall, Warrington, Cheshire, WA4 2HS.

ZX81, metal case, full keyboard, 16K, lots of tapes and books £90. Phone Coventry 591935.

VIC20. 24K RAM, cassette unit, programmers aid + Ratrace cartridge, plus other software and books, £295 ono. 021-747 4752.

SHARP PC1211 with printer and recorder, £109. Barry. 01-434 1365.

ZX81 16K with real keyboard, number pad and new case, various programmes, £120 ono. 0895 51690.

ATOM 12K + 12K FP, Rom, Toolbox, psu, 5 books, 16 cassettes including Chess, Galaxian. All issues of "The Atom" and lots of magagines, £140 ono. Hindhead 6224.

MZ80 B, A and K
INVOICES AND STATEMENTS
Ideal for the small business. A complete suite of programs together with generated customer file for producing crisp and efficient business invoices and monthly statements on your line printer. All calculations including VAT automatic and provision for your own messages on the form produced. **£19.95**
Access cards accepted. Send cheque or PO or credit card number to:
GEMINI MARKETING LTD
Quay House, Quay Road, Newton Abbot, Devon TQ12 2BU.
OR telephone us with your credit card order on Newton Abbot (0626) 62869. Despatch by return.

ZX81 16K plus £40 of software. Excellent condition £90. Tel: 01-504 0842.

VIC intro to Basic £7. Bug-Bytes, Asteroids, Vicmen, Alien, Blitz £4 each. 01-741 3361.

"STOCKTAKER" provides comprehensive stock control and valuation facilities for the ZX81, £6.50 to D. C. Roberts, 107A Royal George Road, Burgess Hill, Sussex.

SPECTRUM WORD PROCESSOR. On-screen edit-insert, replace, scroll, word-wrap, justification, double-space print, file-handling — cassette and instructions, £15. Brian Hebbes, 6a Newlands Avenue, Southampton.

TRS-80 16K level II cassette recorder, green screen VDU, covers, games, books, magazines (hardly used), £320 ono. Ring Mike: 061-764 7212.

SPECTRUM GAMESTAPE 1, includes Invaders, Othello, Combat, 3D 0 & Xs, Adventure, each with programming hints and tips, all for only £4.95. Kevin Porter, 2 Grove Road, Bristol.

ZX SPECTRUM 48K, new (two weeks old), cash needed, so ring Jeff with offers on Orpington 70428 evenings, or 01-689 222 days.

SPECTRUM GAMESTAPE 1: includes Invaders, Othello, Combat, 3D O & Xs, Adventure. Each with programming hints and tips. All for only £4.95. Kevin Porter, Raglands, 2 Grove Road, Bristol.

MZ-80K GAMES/UTILITY CASSETTE COLLECTION. Selling at £3 each. List: SAE. 38 South Parade, Bramhall, Stockport.

MZ-80K SOFTWARE. Send SAE for details. D. Adams, 91 Samuel Lewis Flats, Amhurst Park, London N16.

ZX PRINTER. Unused, fits ZX81 or Spectrum, £45. Stevenage 69612.

VIC20 (UNEXPANDED). Four fantastic games: UFO, Alien, Destroy, Pontoon, £3.95. D. Spencer, 230 Low Grange Avenue, Billingham, Cleveland.

ZX81 16K. New B&W portable TV, £110. Tel: Chris, 01-394 0458.

SPECTRUM PROGRAMS WANTED. Earn 40% royalties. Send software on cassette plus details to: Popular Software, 15 Nottingham Road, Barrow-Upon-Soar, Leicester LE12 8HZ.

ZX81 16K, tapes, Sinclair manual, £75. Tel: 01-554 9076, anytime.

SPECTRUM GRAPHIC GAMES, now available. SAE details: Mike O'Neill, 5 Castlefields Road, Cheltenham, Gloucester GL52 6YW.

VIC20, 5 months old, as new, plus 8K Ram, datassette, Vic-revealed, manual, 10 programs, £189. Telephone Bristol 876322.

ZX82 SPECTACULAR
Instant user defined graphics
The programme that designs, monitors, corrects, and saves **YOUR** graphics with X8 magnification and actual size display of all characters.
PLUS
hundreds of instant graphic symbols for your own programmes, including: Pakman, invaders, music, maths, gambling, 7 foreign alphabets, all on one cassette for 16K or 48K Spectrums.
ONLY £4.00 incl. UK p&p
AUTOMATA LTD
65 OSBORNE ROAD
PORTSMOUTH PO5 3LR

BBC MICRO. Keep it covered. Quality polyester/cotton microcover, fawn, £3. S. Aldridge, 2 Boston Close, Culcheth, Warrington WA3 4LW.

VIDEO GENIE 16K, complete with cover, leads, mags, books and programs, £210. Cambridge 872080.

VIC20, plus datassette, 8K Ram, superexpander, joysticks, Starbattle, manuals and tons of software: worth £415 — sell for only £299! Better than BBC effort! Phone 752162.

VIC20, 8K, plus cassette unit, tapes, manuals and books. Worth £300, will accept £220 ono. Telephone 508 4915.

VIC20 COMPUTER, Arlon expansion unit plus lid, cassette recorder, cartridges. 8K Ram, 'superexpander', 'Super Lander', 'Road Race', joystick, intro to Basic, 5 games cassettes, Book: 'Vic Revealed'. Will sell together for £350 or separately. Ring Southend (0702) 66742 for prices.

ZX81 with 16K RAM and printer, software and Books. £110 ono. 22 Nursery Close, Shoreham , Sussex after 6 pm.

ZX81 16K with Defender, Asteroids. Cheap at £80. Frinton 2451.

BBC SOFTWARE (both models): Cave-Trails, Mini/Adventure, colour, sound and many hazards, £2.50 inclusive. S. Linter, 80 Gravesend Road, Strood, Kent.

VIC 1515 PRINTER + PAPER. Never used — still in box. Bargain, £215. Tel: Chepstow 5058 anytime.

ZX81, Sinclair built 16K RAM pack, Sinclair cassettes numbers 1, 2, 3 and 4. All in working order, £70. 0634 363319 evenings.

SPECTRUM SOFTWARE. City bomber, colour, sound, animated graphics, £3.75, amazing value. R. Hurley, 4 Hurst Gardens, Hurstpierpoint, Sussex.

ZX81, "Basic Extra" input (flashing cursor, prints on screen), read, restore, data, autoscroll routine (prevents errors), £4. M. Whitfield, 66 Bramblebury Road, London SE18. (SAE for details).

SHARP MZ80K 48 K, only five months old, £395 ono. Price includes £100-worth software (by Knight's Ltd, Aberdeen) on cassette. Kane, 66 Haw Road, Bushmills, Co Antrim BT57 8YJ.

ZX81 with 16K RAM pack and d'Ktronic graphic ROM, £100 ono. Phone 0953 860723.

SWAP CYBERNET BETA 2000, 40 channel C.B. for ZX81 16K. Tel: Fleetwood 4045.

ZX81 16K, + 3 tapes + 2 books + mags, under guarantee, £80. Tel: 061-707 3493.

ZX USERS

Join the National ZX Users' Club, and make the most of your ZX81, Spectrum or ZX80. Each month we publish the magazine INTERFACE, which contains a host of programs for each machine, as well as members-only offers, hints, tips, contact addresses and more. We'll also help you with your hardware or programming problems. Join the country's largest users' club. £1 gets you a sample copy of INTERFACE and full club details.
National ZX Users Club, Dept PC
44-46 Earls Court Road
London W8 6EJ

16K ZX SPECTRUM 48K
SPEC-MAN
Puckman, Pacman, Gobbler, Snapper and NOW FOR THE SPECTACULAR
ZX SPECTRUM
..... SPEC-MAN .....
True arcade display. Fast delivery. Mail order only. £5.50 payable to:
JEGA SOFTWARE, 27 HALLCROFT AVE., COUNTESTHORPE, LEICESTERSHIRE LE8 3SL
(SAE for ZX catalogue)

ZX81 16K JACKPOT. Fruit machine program, 15 symbols in view, full screen graphics, holds, nudge feature, nudges up/down, collect/gamble on nudges and wins, 52 winning combinations. Cassette £4.95. P. G. Curtis, 4 Stanwell Road, Ashford, Middlesex TW1S 3ER.

VIC20 CASSETTE UNIT. Several cartridges, books including VIC Revealed, £50 of programs worth £450, will accept £350 ono. Tel: 0656 50696.

VOLUME ONE (1981) "Your Computer" issues wanted. Ian Kirk, Blackpool 27612.

TANGERINE MICRON, 10K basic, Xbug, toolkit, 8K RAM. Many games plus full documentation, £260. Tel: Stafford 665360 after 8.00 pm.

VIC20 EXPANSION 16K (Afron Micro) brand new. Plus Star Quest adventure game. Unwanted gift, £65 ono. Tel: 848 4000.

Back Numbers
Make sure of a real collector's item — the full set of *Popular Computing Weekly.*
We'll mail any of the numbers you've missed – from issue 1 to the latest – for just 50p an issue, including P&P.
Send cheques/postal orders to: Back Numbers, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

ZX81 KEYBOARD BLEEPER
IMPROVES KEYBOARD CHEAPLY
FITS INSIDE
Simple plug-in, no soldering connections. All normal and shifted keys now bleep **£8.95** includes instructions.
T-Shirts black with Red "Sinclair ZX81. Also available "ZX Spectrum".
Sizes 24 to 44 in **£3.25.**
Sweat shirts as above **£6.99.**
Load Programs from cassette first time, every time, using ZX81 (ZX80) loading aid. **£9.95** (incl. instructions, p&p and VAT). Send SAE for details.
DON'T FORGET LONDON ZX MICROFAIR, AUGUST 21.
FULCRUM PRODUCTS, DEPT W, HILLSIDE, STEEP LANE, FINDON W. SUSSEX BN14 0UF

Enter Sony with a video-linked micro

SONY has made its long-awaited entry into the micro market with the new SMC-70.

The machine, with an optional video disc interface, is intended both for conventional computing and video applications.

The SMC-70, an 8-bit micro based around the Z80A processor, features 64K Ram, 16 colours and hi-resolution graphics. The machine uses a version of Basic designed by Sony and the CP/M® operating system.

It is the first micro to be designed specifically for use with a video disc player. Selected information can be lifted off the Sony video disc system and displayed — its format and content being determined by the user. The main application of this will be an educational one, being well suited for presenting all types of learning material.

To ensure that this video facility is useful the SMC-70 has advanced graphics capabilities. The 16-colour mode will display either four pages of 160 × 100 pixels or one page of 320 × 200 pixels. The hi-resolution black-and-white mode will display a page of 640 × 400 pixels.

Sony's SMC-70 microcomputer with dual disc-drive unit.

Other facilities include cassette, IEEE and RS232 interfaces, floppy disc control unit (for Sony's 3in micro-floppies), light-pen input and battery back-up unit.

Among the expansion options are a 256K cache disc unit and a 256K-1M 16-bit CPU adaptor unit.

The SMC-70 will go on sale in the US in September. The basic model will cost around £750 but a complete system will cost nearer £2500.

At present Sony has not announced any plans to sell the machine in the UK.

Primary schools get a £9m micro boost

KENNETH Baker, Minister for Information Technology, has announced details of the government's £9m "Micros in Primaries" scheme.

Under the plan, the government will contribute half the cost of putting a microcomputer in Britain's 27,000 primary schools. The other half of the cost will be met by local education authorities, parent/teacher associations and local interest groups.

Only three micros are eligible for the scheme — Sinclair's 48K Spectrum, Acorn's BBC model B with disc interface and Research Machines Link 480Z.

Each micro is available with a teacher training package. Two teachers from each participating school will be required to attend a short course on the use of micros in primary education.

The scheme, which will run from October 1 this year to the end of 1984, is an extension of the existing secondary schools grants system.

Some 5200 secondary schools have benefited so far, to the tune of £3m.

"Our objective is to enable teachers to get started in giving all young pupils — the five-to ten-year-olds — experience with technology," concluded Kenneth Baker.

And they're off . . . looking for their Spectrums?

Clive shows his pace in Cambridge race

THE first Sinclair Cambridge half-marathon, held on July 18, has been won by Ian Thompson.

The former British, European and Commonwealth champion completed the course in 1hr 5mins 17secs.

Of more than 1300 hopeful competitors exactly 1000 finished the 13.1-mile route. The race, sponsored by Sinclair Research, was the first of its kind to be included in the Cambridge Festival Calendar.

Clive Sinclair and Nigel Searle were among the large contingent of Sinclair staff taking part.

Clive finished 699th in a time of 1hr 51min 41sec.

The three-lap race through the streets of Cambridge was organised by the city council in conjunction with the Festival. Cambridge City council's Brian Allinson said: "We were particularly delighted with the very festive crowd which gathered around the course."

Unemployed to learn computing skills

AN Information Technology Centre has opened in Camden, London.

At the centre, the first of 10 soon to be opened, 50 unemployed school-leavers each year will be taught a range of computing skills.

Hitachi at IBM secrets hearing

HITACHI has announced its intention to "voluntarily appear" before a US court to hear charges relating to the IBM secrets case.

It is alleged that nine Hitachi and four Mitsubishi employees were involved in illegal purchases of stolen IBM computer secrets.

Both companies deny that they acted illegally.

Hitachi itself and its nine employees in Japan have received summonses to attend the hearings. These orders issued by the US Embassy in Tokyo were delivered by Japan's Foreign Ministry.

No Hitachi executive is expected to attend the hearing at the North California district court in San Jose. The company will be represented by one of its US lawyers.

A spokesman for Hitachi has said that it will "in no way interfere" with the decisions of its nine employees whether or not to attend the San Jose hearings.

Spectrum game

QUICKSILVA has now produced its first Spectrum software game.

Space Intruders costs £5.95 and is available from Quicksilva at their new address — 92 Northam Road, Southampton.

Further QS Spectrum cassettes are to follow shortly.

An exciting new Commodore peripheral

Own or use a Pet or a Vic?

Fed up with being ignored by all the traditional monthly magazines?

Fed up with listings, which are too simple or simply do not work?

You need *Commodore Computing,* the new monthly magazine. *Commodore Computing* is published by Nick Hampshire, author of *The Pet Revealed, Pet Graphics, A Library Subroutines* and *The Vic Revealed.*

Each issue is packed with advanced advice on how to make the most of your computer, whether you use a Pet of a Vic.

Each issue covers a host of applications – software, hardware, machine code, games, business use – whatever it is you'll find it in *Commodore Computing.*

If you want to learn more about your computer, take out a subscription to *Commodore Computing.*

That's the only way to get it, and get it straight.

Send £12.50 for 1 year's subscription (10 issues) to:

Commodore Computing,
Magsub, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH

Letters

write to Letters, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2

Hey! Where's ma Spectrum?

It is nine weeks today since I sent off my order for a Sinclair ZX Spectrum. It is seven weeks since my cheque was cashed.

If, as appears in a recent edition of your magazine, 17,000 Spectrums have been ordered at an average price of say £145, then Clive Sinclair is holding on to £2.465m of other people's money. The interest accruing at Building Society Rates, say 13 per cent, for a seven-week period is over £43,000.

With £10m profit and an additional £43,000 of our money, the least I would have expected would be a letter of explanation.

Michael Diamond
20 Thorncliffe Gardens
Glasgow G41 2DE

Another Beeb fan bytes the dust

I am glad that *PCW* has got nearer the truth about BBC computer deliveries after the totally fallacious story of June 10 that "Acorn had cleared its backlog of orders". My order of November 28, 1981, is still outstanding, even though it is a re-order of a requisition made the previous June. Frankly, I don't call a year's delay "clearing the backlog of orders".

I won't bore you with the tale of frustrating phone calls trying to get information, nor of the sadly lacking "customer relations" on the part of a number of Acorn representatives. John Coll did offer to help back in February, when there was a need to use the BBC computer to consider its use in a £16,000 computer package for the local comprehensive school. Sadly, the sales department were unaware of the offer when I phoned them in a fit of frustration in May.

In response to their request to send a copy of John Coll's letter, so that they could know what was going on, they sent me a cyclostyled form to confirm delivery in "June/July".

The local computer committee met last month to consider its deliberations. By this time the school had had a visit from the Acorn caravan to demonstrate the Econet system. It didn't work, even though it stayed in the school for over a week. We were told that there was a fault in the network using BBC computers which had yet to be solved.

In response to a reminder that a rather important order was involved (from the school's point of view, at least), Acorn's representative replied that £16,000 was "peanuts" to them.

I was appalled with this attitude. How insignificant an order for a mere one-off computer must be. Other customers beware! Frankly, even if the problem is only a duff cassette recorder, any reputable firm should surely show concern.

Our committee showed its concern by confirming an order for the latest Nascom System. It actually works and will be installed in July. Despite my firm advocacy for the Acorn BBC computer throughout the committee's deliberations, I could not maintain my support when the company's confused state pulled the rug out from under their own feet.

David Tall
21 Laburnum Avenue
Kenilworth CV8 2DR

While another gets a bit miffed

One, if not the only frustrating element in purchasing your magazine is that you are too biased to ZX81 and Vic (see *PCW* July 15).

Owning a BBC micro, I feel really "had" by the now 35p price tag. So how about fair shares for all, or are you paid by the ZX81 reference?

D Nevard
1 Sands Lane
Carleton-le-Moorland
Lincoln LN59 HJ

If you look at *PCW* July 22, you will see that we are not biased against the BBC micro. That issue contained a cover story (Voyager on BBC) and three Open Forum programs written specifically for the BBC micro.

However, there are approximately 300,000 ZX81s in the UK as against some 20,000 BBC micros. While we try to provide a balanced coverage of different micros, we also try to reflect the interests of our readers.

Pope is unfair competition

Having read the article in *PCW* June 24, regarding the first ZX Fair to take place outside London, I feel (like many ZX users in the north) that I must comment on the reasons for the attendance being "down to few more than 2000 for the two days".

First of all, having spoken to users who did not even know the show had taken place, I feel that the publicity was very poor. The only advertisement I have seen for the show was a small advertisement for one week in your own magazine. There was no mention of it in *Sinclair User* which I am sure many ZX users read.

Secondly, it was unfortunately held on the worst weekend of the year, when, owing to the once-in-a-lifetime visit of Pope John Paul II there was no parking in a 50-mile radius of Manchester (a slight exaggeration, but I am sure it did not help).

As one of the 2000 or so who attended the fair, may I please say do not let it put you off holding another one in the future. We thought it was super, only next time let more people know about it.

S Metcalfe
21 Sherwood Avenue
Radcliffe
Manchester M26 0LE

Upon the merits of competition

Re Mr Robert Lober's slight criticism of the ZX Spectrum in *PCW* July 1, may I reply on behalf of many of us waiting for our Spectrums to arrive.

Even the novices to the computing field, myself included, probably accept that the BBC micro is indeed a fine computer with many good features, and that many people would like to own one. But, he has answered his own comparison query by stating that his satisfaction has been met by the expense of £600.

Bearing in mind the basic 16K Spectrum is only £125, one does not seem to get much extra value for the additional £475. Also, how many newcomers can afford this kind of money, however advanced the equipment may be?

Having said that, is not the BBC micro model B approximately £400, if you can get one that is.

While writing, could I perhaps make a suggestion to the editorial team. Could you make your competitions available sometimes to those of us not yet able to invent programs? There are many of us who buy your magazine who would like to enter these competitions.

Robin Window
18 Easthams Road
Crewkerne
Somerset

Good news from the Beeb, at last

Just a line to send my apologies to your news editor concerning your editorial on Acorn's backlog. I accused him of not getting his facts right when, in point of fact, it was me who had the facts wrong.

Even though the girls at Kettering's telephone department told me that my expected delivery date was September, and that they had not cleared their backlog, yesterday my BBC micro was delivered. Once again, I therefore apologise for the comments I made.

May I also compliment you on a very interesting and topical magazine which I now subscribe to every week.

F Wright
7 Eastbourn Street
Lincoln
Lincolnshire

Please keep your letters as brief as possible.

COVER STORY

Hunter-Killer

A new game for Spectrum
by David Lawrence

As the moon slipped behind a cloud, a lone figure fell silently from the plane. Suddenly a parachute blossomed and the plane banked away sharply.

The soft velvety landscape of dense Amazon jungle drew nearer with upper branches and creepers apparent more than 80 feet above the ground.

This lush cushion rushed up as the intruder crashed into the trees. Painfully suspended on the lines from the 'chute, the suffocating heat engulfed him as branches closed overhead.

A quarter of a mile away, the small supplies package broke through the green surface and fell to the ground. Immediately it began sending its radio signal so that the killer could be reunited with his weapons.

In Catrillia, the arrival had not gone unnoticed.

Zironas turned to Epa "He is with us" he said. "We have no choice now. You must go, and go quickly." Epa nodded, stern faced, and Zironas continued: "He comes with evil intent. Though it offends our code to send you, we can do nothing else.

"If he comes to kill, he will be killed. In these times any measures become acceptable. One orders actions, without second thought, that before would have seemed too appalling to contemplate.

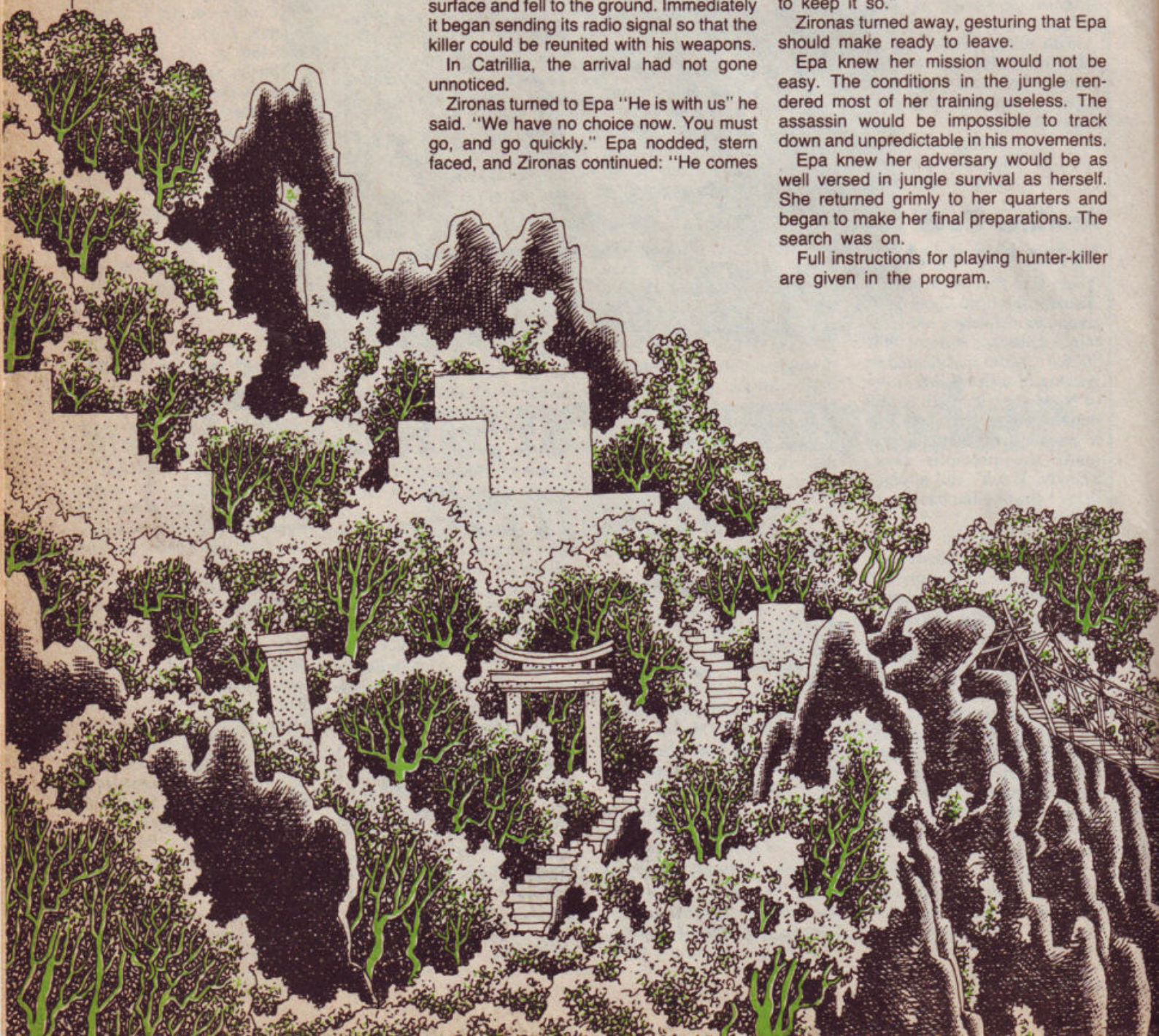
"But it must be. Our country has lived in peace for 40 years now — and we will kill to keep it so."

Zironas turned away, gesturing that Epa should make ready to leave.

Epa knew her mission would not be easy. The conditions in the jungle rendered most of her training useless. The assassin would be impossible to track down and unpredictable in his movements.

Epa knew her adversary would be as well versed in jungle survival as herself. She returned grimly to her quarters and began to make her final preparations. The search was on.

Full instructions for playing hunter-killer are given in the program.



```
1000 BORDER 0: INK 1: PAPER 7: PRINT AT 10,12;"TRACKER"
1010 INPUT "Do you want instructions? (Y/N)",O$
1030 CLS
1035 GO SUB 3010
1040 IF O$="Y" OR O$="y" THEN GO SUB 2370
1050 GO SUB 2670
1060 REM **************************
1070 REM VARIABLES
1080 REM **************************
1090 LET A=0
1100 DIM M(100,4)
1110 LET C=20
1120 LET C1=0
1130 LET T=0
1140 DIM O$(32)
1150 LET R1=6-INT (RND*13)
1160 LET R2=6-INT (RND*13)
1170 LET P1=INT (RND*18+1)
1180 LET P2=INT (RND*30+1)
1190 REM **************************
1200 REM INITIAL BOARD
1210 REM **************************
1220 CLS
1230 LET A$="123456789012345678901234567890": PRINT " ";A$
1240 FOR I=1 TO 18: PRINT A$(I): NEXT I
1280 GO SUB 1680
1300 REM **************************
1310 REM INPUT AND DIRECTIONS
1320 REM **************************
1325 INK 0
1330 LET T=T+1
1340 IF T>100 THEN GO SUB 2620
1350 LET Q$=""
1360 PRINT AT 19,23;"MOVE ";T
1370 PRINT AT 21,17;"(0 FOR REVIEW)"
1380 PRINT AT 19,1;"DOWN:";: INPUT M1: PRINT M1
1410 IF M1<19 AND M1>-1 THEN GO TO 1450
1420 PRINT ">OUT OF RANGE": PRINT AT 19,0;O$: GO TO 1360
1450 PRINT AT 20,0;O$
1460 IF M1<>0 THEN GO TO 1490
1470 GO SUB 2000
1480 GO TO 1330
1490 PRINT AT 21,0;O$
1500 PRINT AT 20,1;"ACROSS:";: INPUT M2: PRINT M2
1530 IF M2<31 AND M2>0 THEN GO TO 1570
1540 PRINT ">OUT OF RANGE": PRINT AT 20,0;O$: GO TO 1500
1570 PRINT AT 21,0;O$
1580 LET M(T,1)=M1: LET M(T,2)=M2
1600 IF M1<>P1 OR M2<>P2 THEN GO TO 1610
1605 GO TO 1940
1610 LET M3=(M1<P1)-(M1>P1)+1
1620 LET M4=(M2<P2)-(M2>P2)+2
1630 LET D=M3*3+M4
1635 IF D>4 THEN LET D=D-1
1640 LET M(T,3)=D
1650 GO SUB 1680: GO SUB 1850: GO TO 1330
1680 REM **************************
1690 REM PRINT BOARD AND MOVE
1700 REM **************************
1705 PAPER 5: INK 1
1710 FOR I=1 TO 9
1720 PRINT AT I*2-1,1;" ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■"
1730 PRINT AT I*2,1;"■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ "
1740 NEXT I
1745 INK 1: PAPER 7
1750 PRINT AT 19,0;O$;O$;O$
1760 IF T=0 THEN RETURN
1770 PRINT AT M1,M2;CHR$ (143+D)
1790 IF A<>1 THEN RETURN
1800 IF T/E=INT (T/E) THEN PRINT AT 21,0;"RANDOM MOVE FOLLOWS"
1810 RETURN
1820 REM **************************
1830 REM MOVE INCREMENT
1840 REM **************************
1850 LET P1=P1+R1: LET P2=P2+R2
1870 IF T/E<>INT (T/E) THEN GO TO 1910
1880 LET P1=INT (P1+RND*6+1): LET P2=INT (P1+RND*6+1)
1900 PRINT AT 21,0;"RANDOM MOVE"
1910 LET P1=P1+18*(P1<1)-18*(P1>18)
1920 LET P2=P2+30*(P2<1)-30*(P2>30)
1930 RETURN
1940 REM **************************
1950 REM SUCCESS AT LAST
1960 REM **************************
1970 PRINT AT 10,13;"GOT IT"
1980 INPUT "Another game? (Y/N)",Q$
1985 IF Q$="Y" THEN GO TO 1060
1990 STOP
2000 REM **************************
2010 REM REVIEW OF GAME
2020 REM **************************
2030 LET A=1
2040 PRINT AT 19,0;O$;O$;O$
2045 IF C1>=C THEN GO TO 2150
2050 PRINT AT 6,13;"[illegible]"
2060 PRINT AT 8,4;"REVIEW ALLOWANCE ";C;" MOVES"
2070 PRINT AT 10,6;"YOU HAVE USED ";C1
2080 PRINT AT 19,1;"LAST MOVE WAS No.:";T-1
2090 PRINT AT 21,1;"INPUT FIRST No. FOR REVIEW:";: INPUT T1: PRINT T1
2120 FOR J=T1 TO T-1
2130 LET C1=C1+1
2140 IF C1<=C THEN GO TO 2170
2150 PRINT AT 10,4;"[illegible]S EXHAUSTED"
2155 PAUSE 0
2160 GO TO 2280
2170 LET M1=M(J,1): LET M2=M(J,2): LET D=M(J,3)
2210 GO SUB 1680
2220 PRINT AT 19,6;"REVIEW OF MOVE: ";J
2230 PRINT AT 21,20;"(0 TO QUIT)"
2240 INPUT Q$: PRINT AT 19,0;O$;O$;O$
2260 IF Q$="0" THEN GO TO 2280
2270 NEXT J
2280 LET T=T-1
2290 LET M1=M(T,1): LET M2=M(T,2): LET D=M(T,3)
2330 GO SUB 1680
2340 LET A=0
2350 RETURN
2360>REM **************************
2370 REM INSTRUCTIONS
2380 REM **************************
2390 INK 3: PRINT AT 0,11;"[illegible]"
2400 INK 0: PRINT "This is a hunting game."''"The hunting ground is an 18 by"'"30 board."''"The quarry is invisible."
2410 PRINT '"Each turn the quarry makes a"'"secret move. This move does not"'"change during a particular hunt."
2420 PRINT '"The move can be up to six spaces"'"up or down and six spaces left"'"or right."
2430 PRINT '"Press any key for more"'"instructions."
2440 PAUSE 0
2450 CLS
2460 PRINT '''"Each turn consists of:"
2470 PRINT '"1) An invitation to input your"'"estimate of the position of the"'"quarry."
2480 PRINT '"2) An arrow will appear in your"'"specified square, indicating the"'"direction of the quarry."
2500 PRINT '"3) The quarry will move."
2510 PRINT '"Press any key to continue."
2520 PAUSE 0
2530 CLS
2540 PRINT ''"At the start of each turn you"'"have the opportunity to review"'"the hunt so far."
2550 PRINT '"This is done by entering 0 when"'"the DOWN co-ordinate is called"'"for."
2560 PRINT '"You can start the review at any"'"previous move but you are"'"limited to reviewing 20 moves"'"in any one hunt."
2570 PRINT '"These 20 reviews may be taken"'"all at once or in batches."
2580 PRINT '"Any key to start."
2590 PAUSE 0
2600 RETURN
2610 REM **************************
2620 REM HARD LUCK
2630 REM **************************
2650 CLS
2660 PRINT AT 10,0;"SORRY-CAN'T TAKE ANY MORE MOVES."
2665 STOP
2670>REM **************************
2680 REM SET DIFFICULTY
2690 REM **************************
2700 CLS
2710 PRINT '''"There is a difficulty factor"'"built into the game."
2720 PRINT '"This consists of an entirely"'"random move every so often."
2730 PRINT '"The difficulty factor ranges"'"from 0 to 10."
2740 PRINT '"0 means no random moves at all."
2750 INK 6: INPUT "Please input your desired"'"difficulty factor:",E
2760 LET E=(11-E)*2+2+100*(E=0)
2810 INK 0: CLS : RETURN
3000 REM **************************
3010 REM USR CHARACTERS
3020 REM **************************
3022 RESTORE
3025 FOR I=1 TO 8
3030 FOR J=0 TO 7
3040 READ B
3050 POKE USR CHR$ (143+I)+J,B
3060 NEXT J
3070 NEXT I
3080 RETURN
3090 DATA BIN 00000000,BIN 01111000,BIN 01100000,BIN 01010000,BIN 01001000,BIN 00000100,BIN 00000010,BIN 00000001
3100 DATA BIN 00001000,BIN 00011100,BIN 00101010,BIN 01001001,BIN 00001000,BIN 00001000,BIN 00001000,BIN 00001000
3110 DATA BIN 00000000,BIN 00011110,BIN 00000110,BIN 00001010,BIN 00010010,BIN 00100010,BIN 01000000,BIN 10000000
3120 DATA BIN 00010000,BIN 00100000,BIN 01000000,BIN 11111111,BIN 01000000,BIN 00100000,BIN 00010000,BIN 00000000
3130 DATA BIN 00001000,BIN 00000100,BIN 00000010,BIN 11111111,BIN 00000010,BIN 00000100,BIN 00001000,BIN 00000000
3140 DATA BIN 00000001,BIN 00000010,BIN 00000100,BIN 01001000,BIN 01010000,BIN 01100000,BIN 01111000,BIN 00000000
3150 DATA BIN 00001000,BIN 00001000,BIN 00001000,BIN 00001000,BIN 01001001,BIN 00101010,BIN 00011100,BIN 00001000
3160 DATA BIN 10000000,BIN 01000000,BIN 00100000,BIN 00100010,BIN 00001010,BIN 00000110,BIN 00011110,BIN 00000000
```

POPULAR Computing WEEKLY

Discount Club

SPECIAL OFFER

PCW has negotiated a special discount offer on four of the top games cartridges for the Commodore Vic20. The cartridges are manufactured by Audiogenic.

SAVE £7 on **Renaissance**

PCW price £17.99 (List price £24.99).
Renaissance is the ultimate Othello package for the Vic20. Use joystick or keyboard control to play against the Vic. There are eight levels of play. During the game you can change sides and playing level, take back moves, set up and play special games. You can even save and recall whole games to and from cassette.

SAVE £7 on **Meteor Run**

PCW price £17.99 (List price £24.99).
In **Meteor Run** you must pilot your spaceship through the Meteor belt, blasting your way through the rocks and Alien saucers. Similar to an Asteroids game it includes an early warning radar display.

SAVE £7 on **Spiders of Mars**

PCW price £17.99 (List price £24.99).
In **Spiders of Mars** you are a trapped fly. You must shoot your way across Mars avoiding the dreaded Spiders and the other flying creatures. Accompanied by classical music.

SAVE £3 on **Cloudburst**

PCW price £16.99 (List price £19.99).
In **Cloudburst** you must save the Earth from the downpour of Acid raindrops and the invasion of the mutant Cloud Hoppers. Speed and skill are essential. With original music and ten levels of play.

To have these top cartridges sent to your home all you have to do is fill in the form below and send it off to *Popular Computing Weekly*.

Discount Club Order Form

Quantity	Cartridge	Price
	Renaissance	£17.99
	Meteor Run	£17.99
	Spiders of Mars	£17.99
	Cloudburst	£16.99
	Total £	

I enclose a cheque, made payable to *Popular Computing Weekly* **Discount Club,** for £.....

Name.....

Address .....

.....

.....

.....

All prices are inclusive of VAT and postage.

Send this order form to *Popular Computing Weekly*, **Discount Club,** Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Once upon a time . .

. . . . in medieval days, there were dark, mysterious Forests, and within these Forests there lived mythical monsters called DRAGONS.

Now in 1982 when buying a computer you enter a technological Jungle; here within this jungle you will also find Dragons. But these Dragons are no myth.

DRAGON 32

ONLY £199.50 plus £3 p/p

The heart of the system is a 6809E microprocessor, a great advance on the still popular 6502, with a 32K Memory as standard, expandable to 64K. Uses **Extended Microsoft Colour Basic,** 9 colours available, 5 resolutions of graphics up to 256 x 192, displayed on TV set or composite colour monitor. Generates a full five octave sound range through the TV Speaker.
Unlike other systems in this price range it uses a conventional QWERTY Keyboard.

Standard connections include:—
ROM Cartridge
2 Joystick controllers
Remote cassette unit
Centronics Parallel printer

160 page "BASIC" Manual included with every system.

All this for the unbelievably low price of **only £199.50 inc. VAT. plus £3.00 p. & p.**

Computers for All

72 NORTH STREET, ROMFORD, ESSEX. TEL. 0708 752862

NAME .....
ADDRESS .....
.....
.....
.....

I enclose cheque/P.O. for £.....
or
Please debit my Access/Barclaycard No.

Please send me: TOTAL

_____ Dragon 32 @ £199.50 each
_____ Dragon Joysticks @ £19.95 pair

CARTRIDGES
_____ Ghost Attack @ £24.95 each
_____ Berserk @ £19.95 each
_____ Cosmic Invaders @ £19.95 each
_____ Meteoroids @ £19.95 each
_____ Household Budgeting @ £19.95 each

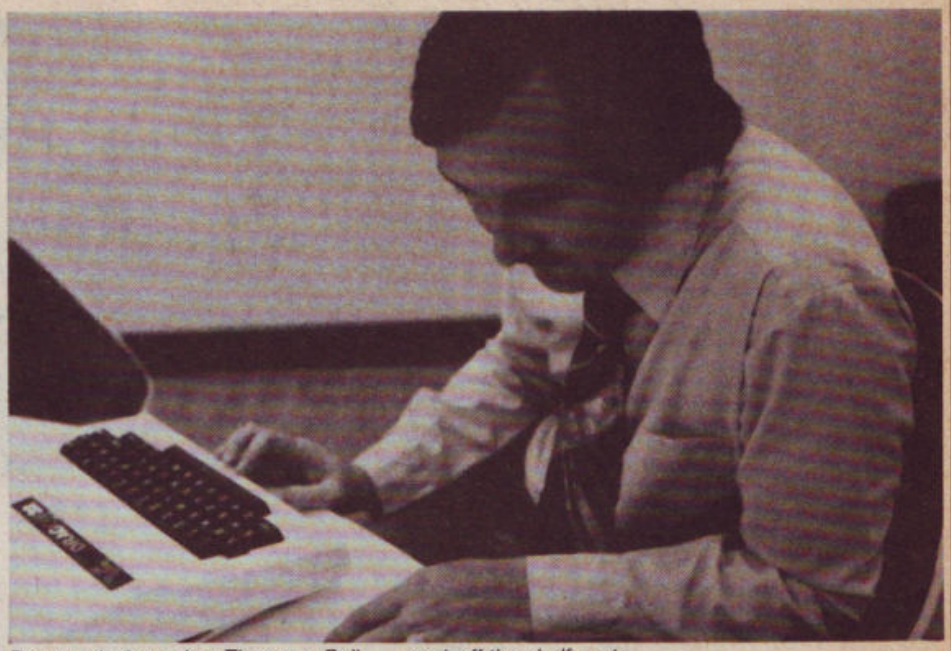
CASSETTES
_____ Compendium of Games @ £7.95 each
_____ Compendium of Applications @ £7.95 ea.
_____ Quest @ £7.95 each
_____ Madness and the Minotaur @ £7.95 each
_____ Computavoice @ £7.95 each
_____ Graphic Animator @ £7.95 each

TOTAL _____

Street Life

Breathing fire into the Mettoy Dragon

***David Kelly** visits the Patscentre and talks to the designer of the Dragon 32.*



Dragon designer Ian Thomson Bell . . . used off-the-shelf parts.

The Patscentre is a unique development facility. For each client they draw on expertise in many disciplines in order to produce an innovative and competitive product.

From the car park the building is invisible. Nearing the top of the steps the long workshop suddenly emerges. It is low-lying and futuristic.

Inside, primary-coloured tubular steel railings and plants vie for attention. Everyone carries an identity card and a bleeper.

It is in this environment that Ian Thomson Bell conceived and developed Mettoy's micro, the Dragon 32.

Mettoy's brief was precise. Ian began work on the project in October 1981. The first prototype was demonstrated to the Mettoy board by Christmas. The Dragon should be on sale in the shops from August 2.

Ian is not unused to working to such tight schedules. That is what the Patscentre is about. At any given time he can be working on up to three such projects, each at different stages of development.

He explains how the design of the Dragon progressed: "We chose Microsoft Basic because the timescale dictated an off-the-shelf interpreter. The 6809 chip was selected because it is the best 8-bit processor.

"As far as the CPU is concerned, the design was relatively straightforward. With the 8-bit, the SAM chip and the 6847 you have virtually a home computer in three chips.

"The difficult parts of the design were the Microsoft driver and the video conversion."

The Microsoft driver was developed by Duncan Smeed at the University of Strathclyde.

"When Duncan brought it down," said Ian, "we tried to find out why it was so slow. After all, the 6809 is very fast.

"We looked at the Tandy TRS-80 which also uses the chip and found that it too was comparatively slow. On the first version we designed a For/Next loop from 1 to 1000 which took two seconds to run.

"At first we thought it was because the Microsoft Basic was in some way cross-assembled from the Z80 Basic. Then we thought it could be a problem with the internal clock. Neither proved to be the case.

"We looked at the amount of time spent scanning the keyboard. Of the 2ms spent in each run of the loop, 0.7ms was spent in the keyboard checking that keys such as *Break* had not been pressed.

"We tackled it as a logic problem. Instead of scanning *each* key in turn, we designed it to check if *any* key had been depressed. This speeded up the software considerably — that is why the Dragon is so quick."

The problem with the video side of the circuit was that the SAM chip gives an output compatible with the American tv standard — NTSC — rather than the British PAL colour system.

"We were quite tempted to go to ULAs for the conversion chip, but the tight time-scale really precluded that. Instead, we took an existing Motorola circuit and redesigned it."

There is a fundamental resolution limit with a conventional tv. At the start of the signal of every tv line scan there is a reference burst. This corrects the incoming line information so that it has the same quality of colour and intensity as the preceding lines.

If the pixel width is less than one cycle of this reference-seeking circuit, then the tv will not recognise colour. Thus, the resolution limit for colour graphics is set by the tv rather than the micro.

Ian explains: "The Dragon has been designed to operate on this screen limit of 128 x 192 for colour and 256 x 192 for black-and-white."

When at college Ian played in a band and designed a mixing desk. When he left, he worked first for BAC and then Neve — a studio equipment manufacturer.

After building mixing consoles for the Who and the Kinks, he returned, briefly, to BAC before joining Patscentre International.

"It is good to see a thing through from the initial design to the finished product," he says. "The advantage of the Patscentre is that it has such a tremendous range of skills, all under one roof.

"One day we will tie up biotechnology with electronics on a molecular level to make a sort of living computer."

The centre is also working on what are called Thick Film Hybrid techniques — a way of producing a complete computer in one chip. "The whole shooting match would then fit in a match-box," says Ian.

Meanwhile, the Patscentre is continuing to extend the Dragon project.

Development is in hand for a mini-floppy disc system for under £250. Next year will also see the launch of an advanced Dragon — with 64K, enhanced graphics and a built-in disc operating system.

What's happening

East London micro users who are interested in getting together to exchange software and perhaps form a club should contact Noorel Haque, 35 Tunis House, Hartford Street, London E1.

Aylesbury ZX Computer Club now hold specific interest meetings (machine-code, hardware etc) each week at Quarrendon Youth Club, Aylesbury. General monthly meetings will recommence in October at Aylesbury College. Contact Ken Knight, 22 Mount Street, Aylesbury, Bucks.

Reviews
software

Robot Nim

A and F Software, 10 Wiltshire Avenue, Longsight, Manchester 12.
Atom, 5K test 0.5K graphics, cassette.
Price: £2.95.

This program is based on the old game of Nim where the aim is for two players, in turn, to remove matchsticks from a pile. The winner is the one who picks up the last matchstick.

Nim has always been a standard exercise for student micro programmers. All states of the game can be represented as nodes in a binary tree, such that the winning strategy is always clear. This means a computerised form is just about unbeatable — unless you, too, know the technique.

"I won . . . I usually do" crows the insufferable Atom at the end of each game in this version. Indeed, you little brat, I'll get you next time. This is one of the few programs that have caused me to laugh out loud. I love it.

The matchsticks in this implementation are cuddly little robots rather reminiscent of the Homepride flour men. You have the option of setting them up in rows totalling between nine and 35 targets. You have the option, too, of starting. In your move you specify the number of robots to be 'removed' and which row they are in. The robot executioner gallops off to do the dirty work for you and then for the computer.

Meanwhile, the non-exterminated robots visibly quail in fright. (A clever technique to stop you working out your strategy.) The robot next to be pulverised gains a look of terror and emits a terrified squeak. The sound in this program is as brilliant as the vision.

"I won . . . I usually do" indeed. I'll wipe that grin off your smug little screen. Next time I'll set up the robot rows and really work out a strategy. Just don't let me see those frightened faces, that's all . . .

Summary
A totally brilliant version of Nim. Get it, and experience a computer laughing at your incompetence. **KJ**

Volcanic Dungeon

Carnell Software, 4 Staunton Road, Slough, Berkshire.
ZX81, 16K.
Price £4.50 plus 50p p&p.

Volcanic Dungeon is one of the better adventure games currently on the market. Set in a Tolkeinesque world of elves and dragons, you have the task of rescuing Princess Edora from a crystal coffin hidden deep within the Volcanic Dungeon.

Volcanic Dungeon & HANGMAN C2

When the game begins, you will find yourself in the top left-hand cavern. You are armed with a sword and a magic ring given to you by the elfin lord Fendhal. The ring has two important properties. It enables you to absorb strength from opponents that you succeed in killing, and it warns you when the evil witch Magra is powerful or weak.

Various treasures, in the form of enchanted weapons and defences, are scattered about the dungeon. But only experience will tell you which weapons/defences will be effective against which enemies.

The Volcanic Dungeon is ringed with fiery caverns. Death is instantaneous if you enter any of them.

Other hazards include unmarked pits. Falling into a pit is not necessarily fatal, but you will need at least 100 units of strength to climb out of it.

You can replenish your water supply from a number of water holes, provided they are unguarded. If a water hole is guarded, you will have to kill the guard before you can drink the water.

Parts of the Dungeon are only accessible by crossing bridges. If a bridge collapses, you will have to use a flying carpet or flying potion to reach the other side.

Summary
An excellent game at a reasonable price. The instructions are among the best I have ever seen. There is also a Hangman game on the other side of the tape. **BG**

Astro Invaders

John Price, 29 Brook Avenue, Levenshulme, Manchester.
ZX81, 16K, cassette.
Price: £3.65.

It could have been any one of a thousand streets in a hundred cities.

I walked through the clammy fog, keeping to the shadows. A light glinted weakly from the corner as I approached. I could make out a few words: "Astro-Invaders . . . superior m/c programming . . . explosive on-screen kill effect".

My attention was held. "A new dimension in ZX81 value — only £3.75" screamed at me in neon. That clinched it. This I gotta see, I muttered, as I entered the low doorway.

The place was almost deserted. Just a pianist doodling on a baby grand, two or three cool-looking guys and a couple of sparkling starlets. But at the bar . . . WOW! I sidled up to the cassette, letting my cigarette dangle from the corner of my mouth. "This could be really something" I figured.

I loaded the program. Would it give me what it promised? I could see it had "high-scoring saucers" and "destructible defence shields".

For a while I got an "accelerating attack rate" but, in the end, it didn't deliver.

I tried to cover a yawn, but the cassette caught my eye. It hit me with a few other little games — but they were just window-dressing.

The spool ran some more. It's final ploy was *Swat*, which drew a momentary flicker of interest from the punters at the bar. It almost made it worth my while to stick around. After all, the price was cut back so far a bald man might think he needed a trim.

But I had places to go — things to do. I couldn't hang around all night.

It was getting light. As I passed the piano I threw a couple of dimes on to the polished keys. "Play it again" I drawled.

Summary
This spool promised a lot, but didn't deliver. Maybe, kiddo, *you'd* find the price right. I'll meet it again some day, when it's learnt some more tricks. Until then, I'll stick with the classier reels. **TB**

Copyright

Hard lesson in store for 'soft' pirates

***Roger Pearson** explains how the law on software copyright could affect you.*

A nasty shock could be in store for some home computer software producers. They could, in the near future, find themselves in the High Court accused of copyright piracy.

The past year has seen a flurry of activity at the High Court, in London, as various manufacturers of coin-operated video amusement machines have battled to stop their games being copied.

Various big names in the amusement industry such as Sega, Atari and Williams Electronics have taken legal action against alleged pirates, claiming that their games are protected by copyright. This action has provided an effective remedy against the unauthorised copying that has been going on.

Now it seems the big guns of the amusement industry could well be turned towards the home computer market, where they believe unauthorised copies of their games are being marketed to home computer enthusiasts.

A lawyer who has represented several of the major amusement industry companies, Mr Gordon Day, said: "Companies in the amusement industry are now beginning to turn their attention to the home computer versions of some successful amusement arcade games.

"I think the outcome could well be that some of the people who produce software for home computers could face legal action in the not too distant future."

A number of software writers and companies have been producing their own versions of popular arcade games such as Puckman, unaware that they may be in breach of copyright. But the copyright war in the amusement industry has gone a long way in clarifying certain aspects of the argument over copyright protection for computer programs.

However, this has gone largely unnoticed in the computer world. Micro enthusiasts have failed to recognise the similarity of the basic issues involved when it comes to protecting arcade games from unauthorised copying.

For this reason a look at the amusement industry copyright battle is worthwhile. So far, all the hearings in the High Court have been interim claims for injunctions to stop alleged piracy, pending the full trial of copyright actions at a later stage.

Sega's Frogger . . . at the centre of an important legal battle to establish copyright.

Until July 2, judges had been careful not to give any firm judicial indications that computer programs are actually protected by copyright. However, on July 2, in interim injunction proceedings between Sega Enterprises and John Richards (a video game conversion expert) and his company Trolfame, this was changed.

Granting Sega injunctions stopping Mr Richards and his company from dealing in alleged unauthorised copies of Sega's game 'Frogger', Mr Justice Goulding gave the clearest indication from any judge so far that he believes copyright protection is available for computer programs.

In his judgement he said: "On the evidence before me in this case I am clearly of the opinion that copyright under the provisions relating to literary works under the Copyright Act of 1956 subsists in the assembly code program of the game of 'Frogger'.

"The machine code program derived from it, by operation of a programmed part of the system of the computer called the assembler, is to be regarded I think as a reproduction or adaptation of the assembly code program.

"Accordingly I find that for the purpose of deciding this motion that copyright does subsist in the program."

Sega also claimed that there is artistic copyright protection for the images reproduced on the video screen of the game, both during play and during the non playing attract mode sequence. In addition, Sega said that there is further protection for the sequence of visual images under the copyright laws which relate to cinematographic film.

The judge made no ruling on the latter two points, however. He said it was sufficient for the purpose of the injunctions to make a finding on the literary copyright issue.

As a result of this case, some home computer software producers could be caught unawares if they are making unauthorised copies of popular video games.

The first surprise for anyone who is making unauthorised copies of a game is likely to be the worst of all. It will probably come in the form of a knock on the door by solicitors acting for a company alleging their games are being pirated. Those solicitors will be armed with what in legal circles is known as an 'Anton Pillar' order.

This is a court order, granted at the High Court in private and in the absence of the party accused of piracy. It entitles those alleging piracy to go to the premises of those they are accusing, to search them and sieze various items of information relating to the alleged infringement and the infringing articles themselves.

The Anton Pillar order is a legal weapon widely used in the war against all copyright piracy and particularly in the amusement, film, record and garment industries. Now, if the predictions of lawyers in the know are correct, it is a legal weapon which may very soon be aimed at those in the home computer industry.

MORE FUN WITH YOUR ZX81!

16K RAM PACK

PUSH-ON PLUG-COMPATIBLE MEMORY

The addition of our fully-compatible, assembled, tested and guaranteed 16K Ram Pack means **more memory for better games and programs**

ORDER YOURS TODAY FROM:

Phoenix Marketing Services
Dept. POCW, Oaklands House
Solartron Road, Farnborough
Hants GU14 9QL

Please send me my Byg Byte 16K Ram Pack. I enclose cheque/postal order for £25.00 (includes VAT, Postage & Packing)

Name .....

Address .....

.....

.....

Dept POCW

Allow 28 days for delivery

Fully **£25.00** inclusive

Classified

Do you want to sell your computer and buy a bigger and better one?

Have you ever thought of trying to make some money out of selling tapes of your own programs?

Whatever it is you want to buy or sell why not use our classified pages? It has to be better than waiting for up to nine weeks to get into one of the old monthly magazines.

Not only that, but our rates are very reasonable.

For private individuals it only costs 20p per word, with a minimum of 10 words. We can make it so cheap because we charge companies using the classified columns 40p per word.

The classified pages can be used for semi-display advertising. The cost for this is £10 per single column centimetre, with a minimum charge of £30.

All copy for the classified pages must be pre-paid. Cheques/postal orders should be made out to *Popular Computing Weekly*, and your advertisement should arrive at least two weeks before the publication date.

For semi-display advertising please call David Lake on 01-839 2846.

For classified entries please fill in the form below and send it, with your cheque/postal order, to Classified Department, *Popular Computing Weekly*, Hobhouse Court, 19 Whitcomb Street, London WC2.

If you have any queries regarding classified advertising please call Alastair Macintosh on 01-930 3840.

Please write your copy in bold capital letters on the lines below.

Here's my classified ad.

I make this.....words, at .....per word so I owe you £.....

Name.....

Address.....

.....

Telephone.....

Please cut out and send this form to:
Classified Department, *Popular Computing Weekly*, Hobhouse Court, 19 Whitcomb Street, London WC2

Open Forum

Open Forum is for you to publish your programs and ideas.
It is important that your programs are bug free before you send them in. We cannot test all of them.
Contributions should be sent to: Popular Computing Weekly, *Hobhouse Court, 19 Whitcomb Street, London WC2H 7HF.*

How to contribute

Each week the editor goes through all the programs that you send to Open Forum in order to find the Program of the Week.
The author of that program will qualify for DOUBLE the usual fee we pay for published programs.
(The usual fee is £10.)

Presentation hints

Programs which are most likely to be considered for the Program of the Week will be computer printed and accompanied by a cassette.
The program will be well documented, the documentation being typed with a double spacing between each line.
The documentation should start with a general description of the program and then give some detail of how the program has been constructed and of its special features.
Listings taken from a ZX Printer should be cut into convenient lengths and carefully stuck down on to white paper, avoiding any creasing.
Please enclose a stamped, self-addressed envelope.

BBC Scroll

on BBC Micro

If you own of have seen a BBC Micro listing a program, you will know how incredibly fast it is compared with other computers, even in the high-res modes where it has to scroll 20K of memory. The main reason for this is that the computer changes the address of each line of screen memory and not the actual contents.

However, since the BBC Micro is such a versatile machine, you can perform software scrolls as well. This is required when you define text windows, however, if you define the text window as being the whole screen, eg in mode 4 or 1: VDU28,0,31,39,0

When the screen is scrolled no memory addresses are changed. However, the process is much slower than normal. Without changing memory addresses we can use the Rom software to scroll up and down.

You may wish to scroll the screen

to next page

BBC Scroll
by G. Jones

```
 5 REM**LEFT+RIGHT SCROLL - G.L.J JUNE 82**
10 MODE0
20 FOR O=0TO3STEP3
30 P%=&A00
40[OPT O
50.LSCROLL
60 LDA #0:STA &80:LDA #&30:STA &81:JSR FLINE \CLEAR FIRST COLUMN
70 LDA #0:STA &80:LDA #&30:STA &81:STA &83:LDA #8:STA &82
80.L1 LDY #0
90.L2 LDA (&82),Y:STA (&80),Y:INY:BNE L2
100 CLC:LDA #1:ADC &81:STA &81:STA &83:CMP #&80:BNE L1
105 \CLEAR BOTTOM RIGHT 8 BYTES
110 LDX #8:LDA #0
120.L7 STA &7FF7,X:DEX:BNE L7
130 RTS
135
140.RSCROLL
150 LDA#&78:STA &80:LDA #&32:STA &81:JSR FLINE \CLEAR LAST COLUMN
160 LDA #0:STA &80:LDA #&60:STA &81:STA &83:LDA #8:STA &82
170.L5 LDY #255
180.L6 LDA (&80),Y:STA (&82),Y:DEY:CPY #255:BNE L6
190 SEC:LDA &81:SBC #1:STA &81:STA &83:CMP #&2F:BNE L5
195 \CLEAR TOP LEFT 8 BITS
200 LDX #7:LDA #0:.L8 STA &3000,X:DEX:BPL L8:RTS
203
205 \CLEAR SPECIFIED COLUMN TO ENSURE NO 'WRAP ROUND'
210.FLINE
220.L3 LDY #7
230.L4 LDA #0:STA (&80),Y:DEY:BPL L4
240 CLC:LDA #&80:ADC &80:STA &80 LDA #2:ADC &81:STA &81:CMP #&80:BCC L3
250 RTS
260]
270 NEXT
275 REM**DEMONSTRATION OF SCROLLS**
280 S=GET:MODE0
290 FOR L=1TO100:DRAWRND(1280),RND(1024):NEXT
295 REM**SET TEXT WINDOW TO MAXIMUM**
300 VDU28,0,31,79,0
310 FOR L=1TO10:VDU30:VDU11:NEXT:     REM**SCROLL DOWN**
320 FOR L=1TO20:PRINTTAB(0,31):NEXT: REM**SCROLL UP  **
330 FOR L=1TO10:VDU30:VDU11:NEXT
340 FOR L=1TO10:CALL LSCROLL:NEXT
350 FOR L=1TO20:CALL RSCROLL:NEXT
360 FOR L=1TO10:CALL LSCROLL:NEXT
370 VDU26
```

Open Forum

from previous page

sideways. This may sound pointless, but it can be a very effective visual effect if nothing else. As far as I know there is no built-in software to do this, so I have had to write a program to do it.

The machine code is assembled in memory from &A00 which seems to be used for the RS423 buffer (the provisional guides memory map is not quite correct in places — eg the soft key buffer appears to start at &900).

After assembling the code the program waits for a key to be pressed, then it demonstrates the different scrolls simply by shifting random lines about. Lines 275 to 360 can be left out, in which case 'call lscroll' will scroll the screen to the left, and 'call rscroll' will scroll to the right.

See the listing for scrolling up and down. VDU26 resets the normal scroll. If you want to learn about programming in assembler I suggest one of the things you should do is buy/borrow/steal an Atom manual, unless, that is, you want to wait for the proper BBC manual.

Reflexes

on Vic-20

This program is for the Vic-20, 3.5K, and it is called Reflexes. At the top of the screen is a cross, at the bottom is an x. You must get the cross to the x. The background is full of balls and if the cross hits the balls the screen will burst into colour with an explosion.

If you hit the x the computer will play some music. This means the cross made it without hitting a ball.

Lines 0-9 print the title page and give a red screen.

Lines 11-12 put a coloured setting on the top and bottom of the screen, 81-82 and 561-562, are also the same.

Line 13 tells the computer to gosub 2000, 2000-2380 is the music and it is used more than once in the program.

Lines 14-16 will cause the title page to move down the screen.

Lines 27-28 will clear computer and screen.

Lines 30-40 are the layout and the quantity of the balls.

Line 90 will tell the computer to goto 4000 and it will do this twice. Line 4000 is the first sound effect; it is a running scale.

Lines 100-1030 are the heart of the program. The screen is black with a purple border and the print is white.

Lines 167-200 are the key control. You can use F1 to end while the game is in play or F7 to reset the game.

The balls are drawn by pokes and so is the x and the cross. If the cross hits a ball

to next page

PROGRAM OF THE WEEK

Reflexes
by Ca Saphier

```
0 PRINT"□":POKE36879,42
1 PRINT"□■■■■■■■"
2 PRINT"■■■■■■■■■■■■■■■■■■■"
4 PRINT"■■■■   ■REFLEXES■   *"
5 PRINT"■■■■               *"
6 PRINT"■■■■      BY       *"
7 PRINT"■■■■               *"
8 PRINT"■■■■  CA SAPHIER   *"
9 PRINT"■■■■               *"
10 PRINT"■■■■■■■■■■■■■■■■■"
11 FORA=0TO21:POKE7680+A,160:POKE38400+A,(AAND7):POKE8164+A,160
12 POKE38884+A,(AAND7):NEXT
13 GOSUB2000
14 FORA=37TO200:POKE36865,A:NEXTA:PRINT"□"
15 FORA=37TO200:POKE36865,A:NEXTA:PRINT"□"
16 FORA=0TO37:POKE36865,A:NEXTA
27 CLR
28 PRINT"□"
29 V=0:M=0
30 E=INT(22*RND(1)+7702)
40 H=INT(22*RND(1)+8164):PRINT"■■■■■":POKE36879,42
50 PRINT"**********************"
60 PRINT"* 2-DOWN     4-UP      *"
70 PRINT"* 6-LEFT     8-RIGHT   *"
75 PRINT"* F1-END     F7-RESET  *"
80 PRINT"**********************"
81 FORA=0TO21:POKE7680+A,160:POKE38400+A,(AAND7):POKE8164+A,160
82 POKE38884+A,(AAND7):NEXT
90 GOSUB4000:GOSUB4000
93 PRINT"□"
100 POKE36879,12
110 FORA=1TO250
120 B=INT(4222*RND(1)+7724)
130 POKEB,81
140 NEXTA
150 POKEH,91:GETA$
160 POKEE,86
165 POKE36878,15
167 IFA$="■"THEN3200
168 IFA$="■"THEN27
169 IFA$="2"THENPOKE36876,200:POKE36876,0
170 IFA$="2"THENG=22:GOTO250
179 IFA$="4"THENPOKE36876,210:POKE36876,0
180 IFA$="4"THENG=-22:GOTO250
189 IFA$="6"THENPOKE36876,220:POKE36876,0
190 IFA$="6"THENG=-1:GOTO250
199 IFA$="8"THENPOKE36876,230:POKE36876,0
200 IFA$="8"THENG=1:GOTO250
250 M=M+1
260 POKEE,32:E=E+G
270 IFPEEK(E)=81THENGOSUB3000:GOTO550
280 POKEE,90
290 IFE=HTHENPOKE36879,11:GOSUB2000:GOTO600
300 GOTO150
550 POKE36879,8:PRINT"□■■■■■■■■■■■■■■■■YOU HIT A BALL"
560 PRINT"■■■■ANOTHER GAME (Y/N)"
561 FORA=0TO21:POKE7680+A,160:POKE38400+A,(AAND7):POKE8164+A,160
562 POKE38884+A,(AAND7):NEXT
570 GETG$:IFG$=""THEN570
571 IFG$="Y"THEN590
572 IFG$="N"THEN3200
```

from previous page

sideways. This may sound pointless, but it can be a very effective visual effect if nothing else. As far as I know there is no built-in software to do this, so I have had to write a program to do it.

The machine code is assembled in memory from &A00 which seems to be used for the RS423 buffer (the provisional guides memory map is not quite correct in places — eg the soft key buffer appears to start at &900).

After assembling the code the program waits for a key to be pressed, then it demonstrates the different scrolls simply by shifting random lines about. Lines 275 to 360 can be left out, in which case 'call lscroll' will scroll the screen to the left, and 'call rscroll' will scroll to the right.

See the listing for scrolling up and down. VDU26 resets the normal scroll. If you want to learn about programming in assembler I suggest one of the things you should do is buy/borrow/steal an Atom manual, unless, that is, you want to wait for the proper BBC manual.

Reflexes

on Vic-20

This program is for the Vic-20, 3.5K, and it is called Reflexes. At the top of the screen is a cross, at the bottom is an x. You must get the cross to the x. The background is full of balls and if the cross hits the balls the screen will burst into colour with an explosion.

If you hit the x the computer will play some music. This means the cross made it without hitting a ball.

Lines 0-9 print the title page and give a red screen.

Lines 11-12 put a coloured setting on the top and bottom of the screen, 81-82 and 561-562, are also the same.

Line 13 tells the computer to gosub 2000, 2000-2380 is the music and it is used more than once in the program.

Lines 14-16 will cause the title page to move down the screen.

Lines 27-28 will clear computer and screen.

Lines 30-40 are the layout and the quantity of the balls.

Line 90 will tell the computer to goto 4000 and it will do this twice. Line 4000 is the first sound effect; it is a running scale.

Lines 100-1030 are the heart of the program. The screen is black with a purple border and the print is white.

Lines 167-200 are the key control. You can use F1 to end while the game is in play or F7 to reset the game.

The balls are drawn by pokes and so is the x and the cross. If the cross hits a ball

to next page

PROGRAM OF THE WEEK

Reflexes
by Ca Saphier

```
0 PRINT"▯":POKE36879,42
1 PRINT"▯▒▒▒▒▒▒▒"
2 PRINT"▮▮▮▮****************"
4 PRINT"▮▮▮▮    ▒REFLEXES▒    *"
5 PRINT"▮▮▮▮                  *"
6 PRINT"▮▮▮▮       BY         *"
7 PRINT"▮▮▮▮                  *"
8 PRINT"▮▮▮▮  CA SAPHIER      *"
9 PRINT"▮▮▮▮                  *"
10 PRINT"▮▮▮▮****************"
11 FORA=0TO21:POKE7680+A,160:POKE38400+A,(AAND7):POKE8164+A,160
12 POKE38884+A,(AAND7):NEXT
13 GOSUB2000
14 FORA=37TO200:POKE36865,A:NEXTA:PRINT"▯"
15 FORA=37TO200:POKE36865,A:NEXTA:PRINT"▯"
16 FORA=0TO37:POKE36865,A:NEXTA
27 CLR
28 PRINT"▯"
29 V=0:M=0
30 E=INT(22*RND(1)+7702)
40 H=INT(22*RND(1)+8164):PRINT"▒▒▒▒▒":POKE36879,42
50 PRINT"**********************"
60 PRINT"* 2-DOWN     4-UP      *"
70 PRINT"* 6-LEFT     8-RIGHT   *"
75 PRINT"* F1-END     F7-RESET  *"
80 PRINT"**********************"
81 FORA=0TO21:POKE7680+A,160:POKE38400+A,(AAND7):POKE8164+A,160
82 POKE38884+A,(AAND7):NEXT
90 GOSUB4000:GOSUB4000
93 PRINT"▯"
100 POKE36879,12
110 FORA=1TO250
120 B=INT(4222*RND(1)+7724)
130 POKEB,81
140 NEXTA
150 POKEH,91:GETA$
160 POKEE,86
165 POKE36878,15
167 IFA$="▒"THEN3200
168 IFA$="▮"THEN27
169 IFA$="2"THENPOKE36876,200:POKE36876,0
170 IFA$="2"THENG=22:GOTO250
179 IFA$="4"THENPOKE36876,210:POKE36876,0
180 IFA$="4"THENG=-22:GOTO250
189 IFA$="6"THENPOKE36876,220:POKE36876,0
190 IFA$="6"THENG=-1:GOTO250
199 IFA$="8"THENPOKE36876,230:POKE36876,0
200 IFA$="8"THENG=1:GOTO250
250 M=M+1
260 POKEE,32:E=E+G
270 IFPEEK(E)=81THENGOSUB3000:GOTO550
280 POKEE,90
290 IFE=HTHENPOKE36879,11:GOSUB2000:GOTO600
300 GOTO150
550 POKE36879,8:PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒YOU HIT A BALL"
560 PRINT"▮▮▮▮ANOTHER GAME (Y/N)"
561 FORA=0TO21:POKE7680+A,160:POKE38400+A,(AAND7):POKE8164+A,160
562 POKE38884+A,(AAND7):NEXT
570 GETG$:IFG$=""THEN570
571 IFG$="Y"THEN590
572 IFG$="N"THEN3200
```

Open Forum

from previous page

function. Good use is also made of three of the sound generators.

It may take a little time to enter but it is worth all the effort. If anybody is interested the high score held by yours truly is 17,810. The F1 key will move you in a lane, and the F3 key will move you out of a lane (or two). This game should provide you with some food for thought.

```
5000 POKE36878,15
5010 FORL=130TO254
5020 POKE36876,L
5030 FORM=1TO40
5040 NEXTM
5050 NEXTL
5060 POKE36876,0
5070 POKE36878,0
5080 RETURN
```

Muncher
by Andrew Berti

```
7 POKE37154,127
8 IFPEEK(37137)<>94ANDPEEK(37137)<>30THEN8
800 IFPEEK(37137)=122ORPEEK(37137)=58THENL=L+G
805 IFPEEK(37137)=110ORPEEK(37137)=46THENL=L-H
810 IFPEEK(37137)=118ORPEEK(37137)=54THENL=L-G
815 IFPEEK(37152)=119THENL=L+H
0 PRINT"□":FORI=7624TO7678:READA:POKEI,A:NEXT
1 DATA0,112,64,46,26,106,10,14:V1=36878:S2=V1-3:S3=V1-2:S4=V1-1
2 DATA64,64,120,104,47,61,5,7,0,28,62,125,125,58,28,0,56,124,214,214,254,254,218
,146
3 DATA0,0,28,62,58,54,28,0,24,60,90,126,36,90,66,231,16,8,110,253,253,122,126
6 POKE36869,255:PRINT"■■■PRESS ANY KEY":S=3
8 IFPEEK(197)=64THEN8
10 PRINT"□":FORI=8120TO8143:POKEI,160:POKEI+44,160:NEXT:N=1
20 G=-1:H=0:LL=1:A=15:B=1:L=INT(RND(1)*4)+1:C=160:P=230:CH=0:M=1
90 XX=-1:YY=0:Y=20:X=10:J=X:K=Y:C=A:D=B:POKE36879,152:POKE36828,6
100 PRINT"■■┌──────────────────────┐"
105 PRINT"■□|          ▒▒          |"
110 PRINT"■□| ┌──────┤▒▒├──────┐ |"
115 PRINT"■□| |      ▒▒      | |"
120 PRINT"■□| | ┌────┤▒▒├────┐ | |"
125 PRINT"■□| | |    ▒▒    | | |"
130 PRINT"■□| | | ┌──┤▒▒├──┐ | | |"
135 PRINT"■□| | | |  ▒▒  | | | |"
140 PRINT"■□| | | | ┌──┐ | | | |"
145 PRINT"■□| ┴ ┴ ┴ |    | ┴ ┴ ┴ |"
150 PRINT"■□|▒▒▒▒▒▒▒▒|    |▒▒▒▒▒▒▒▒|"
155 PRINT"■□|▒▒▒▒▒▒▒▒|    |▒▒▒▒▒▒▒▒|"
160 PRINT"■□| ┬ ┬ ┬ |■    ■| ┬ ┬ ┬ |"
165 PRINT"■□| | | | └────┘ | | | |"
170 PRINT"■□| | | |  ▒▒  | | | |"
175 PRINT"■□| | | └──┤▒▒├──┘ | | |"
180 PRINT"■□| | |    ▒▒    | | |"
185 PRINT"■□| | └────┤▒▒├────┘ | |"
190 PRINT"■□| |      ▒▒      | |"
191 POKE8120,221:POKE8141,221:POKE38840,6:POKE38861,6:POKE8130,230:POKE8131,230
195 PRINT"■□| └──────┤▒▒├──────┘ |"
196 U=8142:POKEU,237:POKEU+30720,6:POKE38850,6:POKE38851,6
197 FORI=U+1TOU+20:POKEI,192:POKEI+30720,6:NEXTI
200 POKEU+21,253:POKEU+30741,6:POKEV1,7:POKE7679,60
210 IFS>1THENPOKE7953,60:IFS>2THENPOKE7954,60:IFS>3THENPOKE7955,60:IFS>4THENPOKE
7956,60
220 IFVV=1THENFORI=1TO6:POKES2,200:FORF=1TO20:NEXT:POKES2,0:FORF=1TO20:NEXTF,I
230 IFVV=1THENVV=0
250 POKES2,0:Q=7680+A+22*B:HL=7680+C+22*D:IFPEEK(Q)=221THEN500
```

Open Forum

```
260 OP=SC:IFCH<>0THENPOKECH,160:CH=0
270 IFPEEK(Q)=221ORPEEK(Q)=192THEN500
295 IFO=61THENSC=SC+10:O=160:POKES3,160
296 IFO=59THENSC=SC+50:O=57:CH=HL:POKES3,230
297 IFO=63THENSC=SC+100:O=58:CH=HL:POKES3,240
300 POKEHL,O:POKEHL+30720,6
301 PRINT"■QQQQQQQQQQQ■■■■■■■■■■■■"SC;:POKE7908,221:SC=SC+1:IFOP<1500ANDSC>1499THE
NVV=1
302 IFOP<10000ANDSC>9999THENSC=SC-10000:PRINT"■■■■■■    ":UU=1
303 IFOP<5000ANDSC>4999THENVV=1
304 POKES3,0:O=PEEK(Q):POKEQ+30720,2:POKEQ,60
310 D=B:C=A:A=A+G:B=B+H:IFZX=1THENZX=2:GOTO800
375 IFZX=2THENZX=0:GOTO800
380 IFPEEK(7680+A+22*B)=230THENZX=1
400 ONNGOTO600,650,700,750
410 IFQ=RTHEN1200
420 R=7680+X+22*Y
425 IFRND(1)>.993ANDP=160THENP=63:POKES4,240
427 IFRND(1)>.98ANDP=160THENP=59:POKES4,200
428 IFRND(1)<.2ANDP=160THENP=61:POKES4,180
429 IFP=230THENCO=6
430 IFP=59THENCO=4
431 IFP=61THENCO=5
432 IFPEEK(R)=192ORPEEK(R)=221THEN1050
433 IFP=63THENCO=2
434 POKE7680+J+22*K,P:POKE38400+J+22*K,CO
438 P=PEEK(R):POKES4,0:POKER+30720,0:POKER,62:J=X:K=Y:X=X+XX:Y=Y+YY
461 IFJ=CANDK=DTHEN1200
465 IFPEEK(7680+X+22*Y)=230THENGOSUB1000
467 POKES2,135
470 ONMGOSUB850,900,930,960
480 IFVV=1ANDUU=0THENS=S+1:GOTO210
490 GOTO250
500 N=N+1:IFN=5THENN=1
510 A=C:B=D
520 IFN=1THENG=-1:H=0
530 IFN=2THENG=0:H=1
540 IFN=3THENG=1:H=0
550 IFN=4THENG=0:H=-1
560 GOTO310
600 B=L*2-1:GOTO410
650 A=L*2-1:GOTO410
700 B=22-L*2:GOTO410
750 A=22-L*2:GOTO410
800 IFPEEK(197)=47THENL=L-1
810 IFPEEK(197)=39THENL=L+1
820 IFL<1THENL=1
830 IFL>4THENL=4
840 GOTO400
850 Y=22-LL*2:RETURN
900 X=LL*2-1:RETURN
930 Y=LL*2-1:RETURN
960 X=22-LL*2:RETURN
1000 IFRND(1)<.1THENRETURN
1005 IFLL>LTHENLL=LL-1
1010 IFLL<LTHENLL=LL+1
1015 IFLL>4THENLL=4
1017 IFLL<1THENLL=1
1020 RETURN
1050 M=M+1:IFM=5THENM=1
1060 X=J:Y=K
1070 IFM=1THENXX=-1:YY=0
1075 IFM=2THENXX=0:YY=-1
1080 IFM=3THENXX=1:YY=0
1085 IFM=4THENXX=0:YY=1
1090 GOTO465
1200 POKES2,0:POKES4,220:POKE7680+C+22*D,170
1240 PRINT"■QQQQQQ■BAD ILUCK":L=16
1245 L=L-1:POKEV1,L:IFL=0THEN1290
1260 FORI=1TO60:NEXTI
1285 GOTO1245
1290 S=S-1:IFS=0THEN1400
1300 FORI=1TO100:NEXTI:GOTO10
1400 PRINT"■Q■■■■■■GAME OVER"
1440 RUN6
```

Open Forum

Telephone Call

on ZX81

The need for this telephone call calculation program arose when British Telecom presented me with a telephone bill in excess of £100. Having no other way to check, as the meters are in the exchange, I wrote this program to keep a check on all of my calls.

Any alterations Telecom makes in the unit time can be adjusted in lines 30 to 110; the values are in decimals of a minute. If the cost per unit alters that can be changed in line 795. The rate of VAT is in line 820. The timing is calculated in line 720 and is accurate to a couple of seconds per hour.

The S key is used to stop the timing at which point the cost of the call will be displayed.

The total bill to date will be displayed if the program has been resaved using the commands Break followed by Goto 1000.

Telephone Call
by Ian Carson

```
  0 PRINT AT 0,8;"  IAN CARSON
"
  1 REM "TELEPHONE"
  2 FOR I=0 TO 50
  3 NEXT I
  4 CLS
 10 LET TOT=0
 20 DIM R(3,3)
 30 LET R(1,1)=8
 40 LET R(1,2)=2.4
 50 LET R(1,3)=0.8
 60 LET R(2,1)=2
 70 LET R(2,2)=0.75
 80 LET R(2,3)=0.26667
 90 LET R(3,1)=1.5
100 LET R(3,2)=0.5
110 LET R(3,3)=0.2
120 PRINT AT 1,0;"      TELEPHONE
CALL CALCULATOR      "
130 PRINT AT 3,0;"    DISTANCE O
F CALL:-"
140 PRINT AT 5,14;"LOCAL - ENTE
R L"
150 PRINT AT 7,5;"UP TO 35 MILE
S - ENTER A"
160 PRINT AT 9,6;"OVER 35 MILES
 - ENTER B"
170 PRINT AT 11,0;" REFER TO C
ODE BOOK IF UNSURE "
180 INPUT R$
190 IF R$="L" THEN LET Q=1
200 IF R$="A" THEN LET Q=2
210 IF R$="B" THEN LET Q=3
220 IF R$<>"L" AND R$<>"A" AND
R$<>"B" THEN GOTO 180
230 IF Q=1 THEN PRINT AT 5,30;"
"
240 IF Q=2 THEN PRINT AT 7,30;"
"
250 IF Q=3 THEN PRINT AT 9,30;"
"
260 PRINT AT 14,4;"DAY       
   "
270 PRINT
280 PRINT "8 AM - 9 AM       S
      "
290 PRINT "9 AM - 1 PM*******P*
******  C    "
300 PRINT "1 PM - 6 PM       S
      "
310 PRINT "6 PM - 8 AM       
      "
320 PRINT
325 LET H=0
330 PRINT " WHICH RATE C, S OR P-"
340 INPUT Z$
350 IF Z$="C" THEN LET H=1
360 IF Z$="S" THEN LET H=2
370 IF Z$="P" THEN LET H=3
380 IF Z$<>"C" AND Z$<>"S" AND
Z$<>"P" THEN GOTO 340
390 IF H=1 THEN PRINT AT 21,23;"CHEAP"
400 IF H=2 THEN PRINT AT 21,23;
"STANDARD"
410 IF H=3 THEN PRINT AT 21,23;
"PEAK"
420 FOR O=0 TO 25
430 NEXT O
440 CLS
450 PRINT AT 1,4;"CALL DATA  "
460 IF Q=1 THEN PRINT AT 3,4;"
DISTANCE  - LOCAL"
470 IF Q=2 THEN PRINT AT 3,4;"
DISTANCE  - LESS THAN 35 M"
480 IF Q=3 THEN PRINT AT 3,4;"
DISTANCE  - OVER 35 M"
490 IF H=1 THEN PRINT AT 5,4;"
 RATE     - CHEAP"
500 IF H=2 THEN PRINT AT 5,4;"
 RATE     - STANDARD"
510 IF H=3 THEN PRINT AT 5,4;"
 RATE     - PEAK"
520 PRINT AT 8,0;"  TIME ALLOWE
D PER UNIT ( 5P )"
530 LET E=R(H,Q)
540 LET P=E-INT E
550 LET U=INT (P*60+0.5)
560 PRINT AT 10,9;INT E;" MINS
";U;" SECS"
570 PRINT AT 12,0;"  PRESS ANY
KEY TO START TIMING"
580 PRINT AT 14,0;"  AND THE ""
S"" KEY TO STOP TIMING"
590 IF INKEY$<>"" THEN GOTO 600
595 GOTO 590
600 FOR T=0 TO 1000000
610 PRINT AT 18,12;" TIMING "
620 PRINT AT 18,12;" TIMING "
630 PRINT AT 18,12;" TIMING "
640 PRINT AT 18,12;"        "
650 PRINT AT 18,12;"        "
660 PRINT AT 18,12;"        "
670 IF INKEY$="S" THEN GOTO 700
680 NEXT T
700 CLS
709 PRINT AT 0,0;"
                "
710 PRINT AT 1,0;"  *      COS
T OF CALL     *  "
711 PRINT AT 2,0;"
                "
720 LET C=T/265.5
730 LET D=C-(INT C)
740 LET D=INT (D*60)
760 PRINT AT 5,0;"    DURATION
 - ";INT C;" MINS ";D;" SECS"
770 PRINT AT 8,0;"TIME PER UNIT
 - ";INT E;" MINS ";U;" SECS"
780 LET W=INT (1+(C/E))
790 PRINT AT 11,0;"UNITS CONSUM
ED- ";"     ";W
795 LET U=4.3
800 LET P=INT ((W*U)+.5)
810 PRINT AT 14,0;" COST   (EX
C. VAT) -  ";P;" P"
820 LET L=INT ((W*(U*1.15))+.5)
830 PRINT AT 17,0;" TOTAL  (IN
C. VAT) -  ";L;" P"
840 LET L=L/100
850 LET TOT=TOT+L
860 PRINT AT 21,0;"TOTAL BILL
TO DATE   £ ";TOT;" P"
900 IF INKEY$<>"" THEN GOTO 910
905 GOTO 900
910 CLS
920 GOTO 20
950 STOP
1000 SAVE "TELEPHON"
1020 GOTO 20
```

```
 TELEPHONE CALL CALCULATOR
   DISTANCE OF CALL:-
            LOCAL - ENTER L
    UP TO 35 MILES - ENTER A
     OVER 35 MILES - ENTER B
 REFER TO CODE BOOK IF UNSURE
    DAY
8 AM - 9 AM       S
9 AM - 1 PM*******P*******  C
1 PM - 6 PM       S
6 PM - 8 AM
 WHICH RATE C, S OR P- PEAK
```

```
 CALL DATA
 DISTANCE  - OVER 35 M
 RATE      - PEAK
TIME ALLOWED PER UNIT ( 5P )
      0 MINS 12 SECS
PRESS ANY KEY TO START TIMING
AND THE "S" KEY TO STOP TIMING
 TIMING
```

```
  *    COST OF CALL    *
   DURATION   - 2 MINS 26 SECS
TIME PER UNIT - 0 MINS 12 SECS
UNITS CONSUMED- 13 UNITS
 COST  (EXC. VAT) -  56 P
 TOTAL (INC. VAT) -  64 P
TOTAL BILL TO DATE  £ 1.28 P
```

Putting more byte into the mini-micro

***Elizabeth Wald** explains space saving techniques on Sharp's PC1211.*

The Sharp PC1211 is a remarkable computer for its size, but it does have one major disadvantage — a mere 1424 bytes of memory. However, with careful programming this can be overcome.

It is important to use variables efficiently to store data for programs as this will reduce the number of variables required, and often the length of the program. Each variable can store up to ten digits plus an exponent and signs. Therefore, if five two-digit numbers need to be stored they can be held in one variable as a decimal fraction. The routine needed to store this information is:

```
A(x)=A(x)+E-m^y*a          (nb E=exponent symbol)
```

Where A(x) is the variable for storage, m is the number of digits (in this case two), y is the position within the variable, and a is the number to be stored (m*y must not exceed 10). For example:

```
10:A=12:Y=2:A(30)=A(30)+E-2^Y*A
```

Conversely, the following routine will extract the data and produce the result in A:

```
A=INT (Em^y*A(x)):A=A-Em*INT E-mA
```

eg:

```
10:A=INT (E2^Y*A(30)):A=A-E2*INT E-2A
```

Storing the data as a decimal fraction often makes handling easier, although there are exceptions. Also, it is sometimes advantageous to store a commonly used number as the integer part of the variable — especially if it is handled differently to the data stored in the fractional part. It will therefore be easier to access by using the *Int* function.

One other way of saving time is to use one of the variables W-Z as the control variable in a *For . . . Next* loop. This will reduce the time taken for the loop to be performed by 0.05 seconds per iteration. The reason for this is that these four variables are stored in the same memory chip as the *For . . . Next* stack and are therefore slightly quicker to access.

On a similar note, Z=M is about 0.02 seconds faster than A=M, and M=A is about 0.02 seconds faster than M=Z. It therefore pays to have the higher variable on the left of an assignment, and the lower variable on the right. This does not apply to variables above Z, which seem to take longer.

Sharp's PC1211 . . . the secret is to use variables efficiently.

As space is so precious on the PC1211, it is essential to ensure that each line of program does not require more steps than are necessary.

The first way in which this can be achieved is by using the key words efficiently. Key words are stored as one step each, irrespective of their length. It therefore may be advantageous to use them as prompts for *Input* statements or in *Print* statements.

We may decide on the prompt

```
10:INPUT "ENTER A LETTER",X$
```

This will occupy 23 steps (two for the line number, one for the *Input* statement, 19 for the other characters, and one for the *Enter* key). If we replace the word *Enter* by the key word *Input* we reduce the number of steps by five. To do this key in:

```
10 INPUT INPUT      'ENTER'
```

Then, insert an inverted comma before the second *Input* and complete the line. As an added bonus, the space is automatically inserted after *Input*. One word of warning — do not try to enter too many words as unexpected results may occur:

```
10 INPUT INPUT A LETTER",X$
```

produces

```
10:INPUT INPUT ALET TER",X$
```

Some key words can be omitted. *Then* is totally superfluous and the Rem command does not work very well as the comment must be enclosed by inverted commas if spaces are required within. *Let* can also be omitted in all circumstances bar one. The only occasion when it is required is after a numerical test in an *If* statement:

```
10:IF A=5LET C=12
```

But note:

```
10:IF A$="YES"B=2
```

is a valid statement, despite the description given in the manual for the *If* statement.

Other ways of saving space may seem a little unnecessary, but they may make all the difference on a long program. Lines should be as long as possible, as line numbers are stored in two steps, plus one for the *Enter* key at the end of the line, whereas the separating colon will occupy only one step.

Logic statements are particularly useful in saving space. These take the value 1 if true, and 0 if false, and can be used to reduce the need for complicated *If* statements which have the disadvantage that the next statement will need to be on the following line. They can also save time when assigning values to variables.

An example would be when directions have to be entered during a game. The numerical keyboard can be used to represent the directions by using 5 as the base position, and the other keys to represent moves in relation to it. Thus 8 will be up or north, 6 right or east, and so on around the keyboard.

If the variable D is used to enter the direction, the following can be used to assign the changes in the co-ordinates to variables X and Y:

```
X=(D=6)-(D=4):Y=(D=8)-(D=1)
```

Logic statements can also be used to perform the same functions as *On . . . Goto* and *On . . . Gosub* in standard Basic.

```
Standard ON X GOTO 100,150,230
PC1211 GOTO 150-50*(X=1)+80*(X=3)
```

Space can also be saved by utilising the fact that pressing *Enter* alone in an *Input* statement, will automatically send the computer to the next line. This saves the need for an *If* statement, for example by entering Y for yes and *Enter* for no. Defined keys can also be used in a similar way to transfer control to other parts of the program.

Spectrum

Learn to eat as much as you can

***Sam Goodwin** presents some machine code tips and a new game called snake.*

Although lower case lettering often improves programs, it can also lead to trouble. Some programs will act on the upper case letter A being pressed, but they will not recognise lower case a as being the same. To avoid this problem on the ZX Spectrum you can either test both conditions:

```
100 LET I$=INKEY$
110 IF I$="A" OR "a" THEN . . .
```

or switch on the CAPS LOCK in the program.

```
100 POKE 23658,8 : REM CAPS LOCK ON
110 IF INKEY$="A" THEN . . .
POKE 23658,0 will switch CAPS LOCK OFF.
```

The one graphics command I miss is a *Plot* 23,45 *To* 67,89. To do this on the Spectrum you always need to know where the end point is in relation to the starting point. This is because the command used for drawing lines (*Draw*) will act from the last recorded point (The above instruction would be entered as PLOT 23,45 : DRAW 44,44.)

The following program sketches a fine system of spirals by subtracting the previous plot position from the new one so lines can be joined as absolute coordinates.

```
10 LET X=23677; LET Y=23678
20 PLOT 128,88
30 FOR T=0 TO 377
40 LET R= SIN (T* 3/4)
50 DRAW SIN T*R*80+128-PEEK X,
COS T*R*80+ 88-PEEK Y
60 NEXT T
```

Machine Code

All the registers can be used except for the HL pair. If you are going to change their contents during the program it is wise to restore their original contents before returning to basic.

For machine code that requires critical timing, such as printer output and sound effects, it may be necessary to disable the clock and keyboard scans. This is done with the DI instruction (Disable interrupt, code 243). The keyboard scan must be Enabled, code 251, before returning, otherwise the system will hang when a keyboard input is required.

This feature could be used to protect programs from being copied, as disabling the break key would make it impossible to stop the program without switching the computer off.

Instructions can be stored in the user definable graphics memory area. This would allow the program to be retained, even after the *New* command.

The following machine code program does a smooth horizontal scroll from right to left along the middle of the screen:

```
  1d BC,window size
  1d HL,lowest point
→rl (HL)
  dec HL
  djnz →
  dec C
  jr NZ →
  ret
```

The machine code could be entered in the following way:

```
10 FOR A=USR "S" TO USR "U"
20 INPUT B
30 POKE A,B
40 NEXT A
```

RUN

```
1 8 0 33 255 79
203 22 43 16 251
13 32 248 201 0 0
```

(The information has been stored in an area that will remain unaffected by the instruction NEW.)

NEW

```
10 FOR A=0 TO 26 STEP .1
20 PLOT 255,SIN A*30+80+USR USR"S"
30 NEXT A
40 CLS : LIST : LIST
50 LET A=USR USR "S"
60 GOTO 50
```

The above program should produce a gently moving sine wave that glides across the screen, and then display the program rolling the middle section smoothly from right to left.

The one bug I have found in the Spectrum is hardly worth worrying about. In fact, it could prove to be beneficial.

It appears that when a *Control* H (back space) is printed at the beginning of a line, the previous line loses one of its bytes. The idea of being able to edit a program while it is being Run offers tremendous potential, but somehow I do not think it was an intended feature.

Finally, I have devised a game called Snake. You are a slowly growing snake, kept in a confined space. The object of the game is to eat as much of the food as possible, while avoiding the obstacles.

When entering this program, it is important to type in line 50 with exactly 33 spaces in the *Print* statement. The character printed in lines 186 and 230 is a user definable A.

```
   5 BRIGHT 0: OVER 0
  10 FOR A=USR "A" TO USR "A"+6
  20 POKE A,62: NEXT A
  40 LET I=0: LET P=7: INK I: PA
PER P: CLS : GO SUB 500
  50 LET B=6: BORDER B: PAPER B:
 PRINT "
";
  60 FOR N=1 TO 20: PRINT AT N,3
1;" ";: NEXT N: PRINT AT 21,31;" ": PAPER P
  70 LET FOODC=2: LET ROCK=1
  80 LET SNAKE=4: LET FOOD=P*8+F
OODC: POKE 23658,8: REM CAPSLOCK
 100 LET LAND=P*8+I: LET MX=1: L
ET MY=0
 110 LET S=1: LET X=2: LET Y=8
 120 DIM X(200): DIM Y(200)
 130 FOR N=1 TO S
 140 LET I$=INKEY$
 150 IF I$="N" THEN LET MX=-1: L
ET MY=0
 160 IF I$="M" THEN LET MX=+1: L
ET MY=0
 170 IF I$="Q" THEN LET MY=-1: L
ET MX=0
 180 IF I$="A" THEN LET MY=1: LE
T MX=0
 185 LET X=X+MX: LET Y=Y+MY: LET
 A=ATTR (Y,X)
 186 IF Y<22 THEN PRINT AT Y,X;"■"
 187 IF A=FOOD THEN LET S=S+5: GO TO 200
 188 BEEP .01,S/4
 190 IF A<>LAND THEN INPUT "  Yo
u have ""CRASHED";A$: RUN
 200 PRINT AT 0,0; PAPER B;" SCO
RE = ";INT S*10
 210 PRINT AT Y(N),X(N); INK I;
PAPER P;" "
 220 LET X(N)=X: LET Y(N)=Y
 230 PRINT AT Y,X; INK SNAKE;"■"
 240 NEXT N
 245 PRINT AT RND*10+5,RND*20+5;
 INK FOODC;"■"
 246 PRINT AT RND*21+.5,RND*25+.
5; INK ROCK;"▄▄"
 250 LET S=S+RND*8
 260 GO TO 130
 500 PRINT AT 1,9;"SNAKE _____"'',"By
Sam Goodwin"
 510 PRINT ''" You are a snake a
nd must try toeat the food but a
viod hitting anything else."
 520 PRINT '"  ▄▄ - Rocks  , ■ -
 Food"
 530 PRINT ''"  To move Press  Q
 to go Up"''"  N-Left,M-Right &
A to go down"
 600 INPUT a$: CLS : RETURN
```

Sound & vision

It's all a question of values, ain't it?

This is a simple yet effective program for the BBC micro model B, to show the graphs of various equations. The equation is typed in the form Y=F(X). The computer then asks for what values of X you wish to equate Y with.

If you press *Return* without entering any values, the program will default to plotting over the whole range of −640 to +640. Note that the origin is in the centre of the screen.

The computer will draw the axis in white, marking them in steps of 100. It will then draw the original equation in blue, then scale it up or down as appropriate and draw it again in yellow.

However, funny things can happen if very large Y values are encountered, so try and keep the values sensible.

Program notes

Line 70 shifts the graphics origin from 0,0 to 640,512,IE in the middle of the screen, so that negative values of Y are plotted directly.

Variable D is the scaling factor; after the first plot, M contains the largest value of Y, and D=512/M sets D to the required scaling value. Just in case you are not sure what the 'EVAL' in line 170 does, imagine that A$="2*X" and X=2 — the instruction Y=EVAL(A$) assigns the number 4 to Y.

Gwynfor Jones

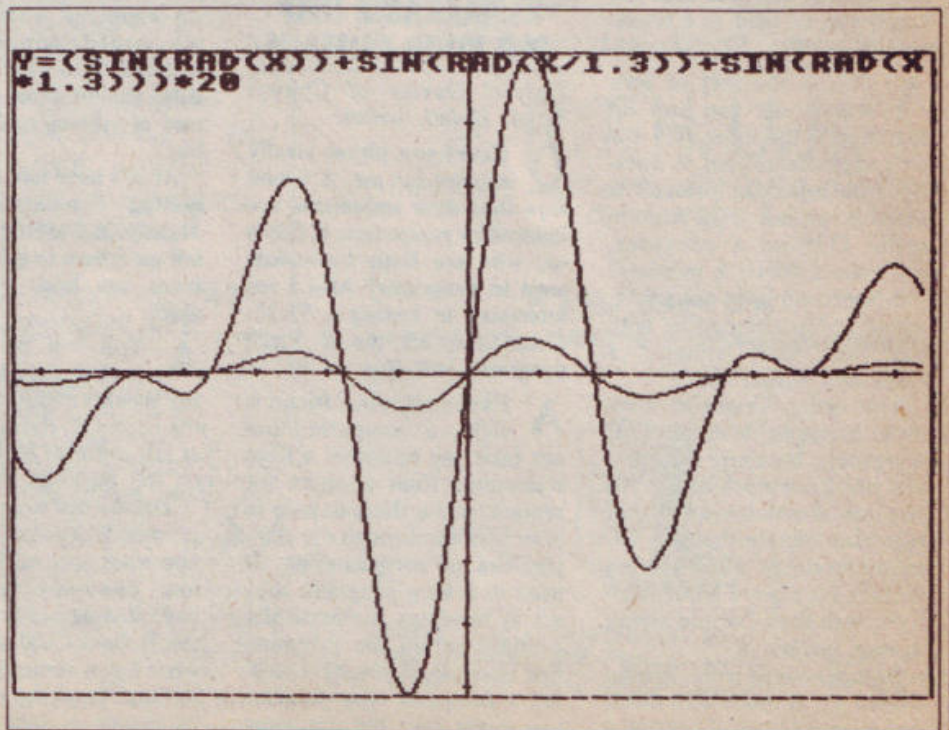
Contribute!

You can share your own favourite Sound or Vision programs with other readers by sending lists with explanations to us at *Popular Computing Weekly*.

WRITE TO: Sound & Vision, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Graph plot
by Gwynfor Jones

```
 5 REM**GRAPH PLOT - G.L.J JUNE82**
10 MODE7
20 D=1:M=0:C=1
30 INPUT"Y="A$'"FOR VALUES OF X FROM "S'"TO "F
40 IF S=0 AND F=0 S=-640:F=640
50 MODE1:PRINT"Y=";A$
60 VDU19,1,4,0,0,0
70 VDU29,128,2,0,2
80 REM**DRAW AXIS**
90 MOVE-640,0:DRAW640,0:MOVE0,-512:DRAW0,512
100 FOR L=-700TO700STEP100:MOVEL,-4:DRAWL,4:NEXT
110 FOR L=-600TO600STEP100:MOVE-4,L:DRAW4,L:NEXT
120 REM**MAIN LOOP**
130 GCOL0,C
140 X=S:MOVES,EVAL(A$)*D
150 FOR X=S TO F STEP4
160 IF X=0 GOTO210
170 Y=EVAL(A$)*D
180 IF Y>65500 OR Y<-65500 GOTO210
190 IF Y>M M=Y
200 DRAWX,Y
210 NEXT
220 IF C=2 G=GET:RUN
230 D=512/M:C=2:GOTO 130
```



Peek & poke

Peek your problems to our address. Ian Beardsmore will poke back an answer.

BUDDING MICRO STAR NEEDS SCREEN TEST

Tony Johar of Cambridge Road, Hounslow, Middlesex, writes:

Q I cannot decide which television or monitor to buy for my ZX Spectrum. I have been informed that it is possible to connect a colour monitor to the Spectrum using the existing port. Is this correct and does the Spectrum give out a PAL signal?

There are three types of Visual Display Unit that I am thinking of buying. The first is a Sony Trinitron television which is meant to be good for computers. The second is a Portatel Luxor 14in monitor, which is a cross between a television and a monitor, and has PAL and RGB inputs. I am told that it works better than an ordinary television because it does not rely on the internal modulator.

Or, should I go the full swing and buy a proper monitor? But, I am not sure if I really need it since the Spectrum does not give out the extremely high resolution graphics of the BBC computer. Will a proper monitor give me a significantly higher quality to justify its purchase, bearing in mind that the Luxor can be used as a television as well?

A This is the sort of area where one can end up spending a lot of money for little appreciable gain. A question you must ask yourself is whether or not it is wise to spend £175 on a computer, and then £300 on a monitor? The Spectrum gives out a PAL signal and is compatible with any PAL UHF colour, or black and white, set.

The Sony Trinitron does make a reasonable monitor for computers, but there are other sets which are much better. No one can doubt the quality of television picture that the Trinitron produces, but if you are looking for a good VDU facility as well then I would advise against buying it.

Portatel were very helpful when I got in touch with them, and though they had not had a Spectrum on a Luxor, they had had very good results on their Hitachi monitors.

The Luxor has the advantage of being compatible not only with European PAL standards but also the US NTSC specifications which make it very versatile. It can be used on most of the popular home computers and I am sure that it would enhance the Spectrum. However, £300 is a lot of money to pay for a monitor.

One alternative, if you are not sure about how much computing you are going to do in the future, is to buy a cheap secondhand colour set and find an electrician to take the various circuits that accept and amplify the broadcast signal. Replace the signal amplifier circuit, the tuner circuit, et al, with a fixed frequency oscillator circuit. This would give you in effect a monitor, at a much lower price.

However, one word of warning. This is an option that you can take only if you know a good electrician. It would be very easy for someone to bodge a job like this and leave you in a worse state than before. Allow at least £50-£75 for the secondhand television and £20-£40 for the work.

REMARKABLE HELP FOR POOR HUMANS

Dafydd Davies of Cynwyl Elfed, Dyfed, writes:

Q Could you please clarify a point for me. A friend says that Rem statements are ignored by computers. If this is so, why are Rem statements used in programs? Also I am interested in buying a Vic30. Could you tell me if Vic20 programs will *Run* on it?

A Essentially your friend is right, a computer does not take any notice of a Rem statement. Rem is short for remark, and is there to help us poor humans through the complexities of programming. If used in a long program, they act as headings for particular routines within the program. For example, if you have written a Breakout type program you might have the statement Rem "SET UP WALL" at the start of the section that does just that. If, when you come to *Run* the program the wall does not work properly, then the Rem will help you find the section which is at fault.

As to the question of the Vic20, and the Vic30 programs being compatible, until we actually get a machine we cannot be absolutely sure. It seems unlikely that the two will be directly compatible, because it is very improbable that the memory locations will be the same.

Also, the Vic10 has a reduced version of Basic, with no *Dim* statements. As the Vic30 is a closer relation to the Vic10 than the Vic20, it is possible that it will have this reduced Basic as well. So, any program on the Vic20 which uses a statement that is not available on the Vic30 will not *Run* without some sort of modification.

AVOID MAKING A BOOB WITH THE BEEB

Mark Middleton of Cannon Hill Road, Coventry, writes:

Q I have ordered a BBC micro model B. After a delay of five months, I expect it to be here soon. My friend has just bought a synthesizer, and we wondered whether or not we could connect them together. If so what port on the BBC should I use, and what sort of ribbon cable should I buy?

Also, I have had difficulty in getting *Popular Computing Weekly* in Coventry. Can you tell me where to get it, and are there any back issues available?

A You will by now have read in *Popular Computing Weekly* about the delays in the model B, though the Beeb at last seem to be catching up on the backlog.

You do not say what sort of synthesizer your friend has, nor what sort of I/O ports it has. The only synthesizer I have had any experience of is the Roland C100 series. From what I can remember, all the internal patching on that was by means of Jack plugs and, apart from the speakers, external access was the same. This would mean that there was no directly compatible port on the BBC micro.

To my knowledge it would not be possible to directly link the two. The most likely port to use would be the RS 423, but I cannot see it being used without some sort of buffer hardware.

I must ask why you want to connect your BBC micro to a synthesizer? The synthesizer should have all the features you need. By comparison a computer is a very poor music maker and I cannot see how it can add to the synthesized sounds. Cassettes can be ued to store the music in a normal audio fasion, while patch notes should be available to store the various configurations used to create the sounds.

There is a trap which, quite understandably, many people fall into. A computer is not a universal panacea that will do absolutely anything. Nor is there any real point in trying to do things with your computer just because you happen to have the bits there.

As for your problems in getting a copy of *Popular Computing Weekly*, I have passed your letter on to our distributors. In the last few weeks, now that we have become established, circulation has been increasing which has led to some local problems. Problems we are overcoming by stepping up production.

Back issues are available, except for issue two. If you write to us with a cheque or postal order for 50p per issue, we will be happy to send them to you. Mind you, the way to guarantee a regular copy is to place a regular order, or take out a subscription. It is well worth it.

STOP agonising over that nagging problem. Write to Ian Beardsmore at Peek & poke for the answer. Letters should be as brief as possible and include full name and address. Write to Peek & poke, *Popular Computing Weekly*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Competitions

Is your number high or low?

by Gordon Lee

The use of logarithmic functions to find powers and roots has been seen to bring its own problems when used with *If/Then* statements (*PCW* July 15 Puzzle).

For a cube, the ** can be replaced by two separate *s (ie replace 3**3 by 3*3*3). Unfortunately, it is not always possible to avoid using logarithmic functions — for instance, in the case of cube roots. If there is no easy way around the problem, then the conditions of the *If/Then* statement must be changed.

In theory, having found the cube root of our number, we can just test to see if it is a whole number (integer). In practice, we know that this value may be a bit out, and we have no easy way of knowing if it is slightly too high or too low. If it is too high then:

```
IF ABS(N-INT N)<0.000001 THEN . . .
```

will work. However, if N is slightly too low:

```
PRINT INT (27 ** (1/3))
```

gives a reading of 2.

All is not lost. Since we know that the value to be tested might be slightly under the integer, we add a small amount — eg 1E−8.

If the value being tested was within this value of the integer, it will now equal or slightly exceed that integer. This we can test as above. So the complete test necessary is:

```
IF ABS(N-INT(N+1E-8))<0.000001 THEN . . .
```

The amount added (1E−8) should be more than the possible error induced by the system and less than the limit of accuracy expected for the test.

Puzzle No. 16

Professor Otto Hex, the well known mathematician, recently moved house.

In order to help him remember his new telephone number (he was rather absent-minded) he used the ages, in years, of his four offspring.

To get the number he could either add the cube of Susan's age to the cube of Billy's age or add the cube of Lucy's age to the cube of Ronnie's age.

What was Otto's new number? (He lives in a small village so the smallest possible solution is the correct one.)

Rules

The winner of the puzzle will be the reader who, in the opinion of *Popular Computing Weekly*, has submitted the best program.

Entries should be marked clearly "PUZZLE".

The closing date for the competition is Tuesday, August 17.

Solution to Puzzle No. 12

The fourth and fifth lines of the poem tell us that this is a cryptarithm, in which numbers are substituted for letters.

As there are more than ten different letters in the names given, each name should be treated separately. Each name consists of three identical letters and three different letters — though with the identical letters placed in a different position in each case. This means that we need to find eight six-digit numbers which are perfect squares which, in each case, have three identical digits in the positions indicated by the letters found in each of the names. Also the remaining three digits must be different.

The guilty party will be the one whose name 'code' number is the largest.

In the example below, Lines 30 to 50 are set to test the name Beedle. For the other names, the string locations (N$(1−6)) in Lines 30 to 50 should be altered.

```
 10 FOR N = 999 to 317 STEP - 1
 20 LET N$ = STR$ (N * N)
 30 IF N$ (2) < > N$ (3) OR N$ (2) < > N$ (6) THEN
    GOTO 100
 40 IFN$ (2) = N$ (1) OR N$ (2) = N$ (4) OR N$ (2)
    = N$ (5) THEN GOTO 100
 50 IF N$ (1) = N$ (4) OR N$ (1) = N$ (5) OR N$ (4)
    = N$ (5) THEN GOTO 100
 60 PRINT N, N * N
 70 STOP
100 NEXT N.
```

The largest possible squares in each case are:

Beedle = 944784 = 972²; DeVere = 190969 = 437²; Farrer = 824464 = 908²; Heeley = 900601 = 949²; Lowell = 438244 = 662²; Nanson = 151321 = 389²; O'Toole = 565504 = 752²; and Strutt = 902500 = 950².

The largest of these is 944784 so Beedle did it.

Winner of Puzzle 12

The winner is: Ian Turtle, St John's Road, Ashby, Scunthorpe, South Humberside, who receives £10.

Solution to Crossword 12

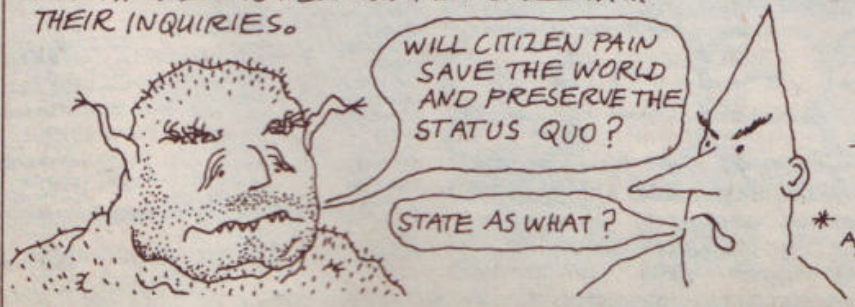
Across: 4 Robin, 7 Spartan, 8 Screen, 10 Adana, 12 Ruin, 13 Athlete, 14 Xmen, 15 Clark, 16 Unborn, 20 Captain, 21 Angel.

Down: 1 Spiderman, 2 Ironman, 3 Dan, 5 Orc, 6 Ire, 8 Super, 9 Epidermis, 11 Chain, 12 Replete, 17 Bun, 18 Roe, 19 Man.

Winner of Crossword 12

The winner is: R. Filleul, Nunthorpe Road, York, who receives £10.

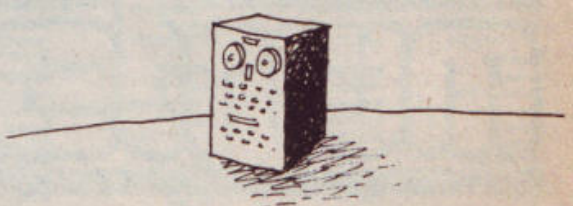
DEAR READER,
IT IS WITH GREAT REGRET THAT WE MAKE THE FOLLOWING ANNOUNCEMENT: SIDNEY PAIN, KNOWN TO MILLIONS AS 'CITIZEN' PAIN, IS MISSING.
HE WAS LAST SEEN BY HIS MOTHER CLIMBING THROUGH A HOLE IN HIS BEDROOM WALL. IT IS BELIEVED THAT HE IS SOMEWHERE WITHIN THE INTERFACE OF A MAINFRAME COMPUTER.
EARLIER TODAY, A POLICE SPOKESPERSON SAID:
"WE ARE VERY CONCERNED ABOUT MR. PAIN'S SITUATION. THOSE GOBS AND GREMLINS ARE TRICKY CUSTOMERS"
A COMPUTER IS HELPING THE POLICE WITH THEIR INQUIRIES.



BUT NOW
STARTING NEXT WEEK...

A.R.T.H.U.R.*
THE LIFE AND OPINIONS OF A DIGITAL COMPUTER

A NEW SAGA BY
LAURENCE LERNER + JAMES MACDONALD



* A.R.T.H.U.R. IS PUBLISHED BY THE HARVESTER PRESS, 16, SHIP STREET, BRIGHTON. TEL: 0273 723031 PRICE: £2.95

spectrum

Spectrum is a new, rapidly expanding group of independent retailers who specialise in selling a range of popular home computers.

Our group policy is simple: we won't be beaten on price and 'know-how'. We can make this claim because our bulk buying power ensures that we select and buy at the best prices and then can pass on the benefits to you.

We guarantee if you find an item advertised and in stock at any other retailer at a better price than us, we will match that price.

You will see we quote our prices both including and excluding VAT - no hidden 15% to suddenly uplift your bill but also making our prices easier to compare with our competitors.

To ease payment we accept Barclaycard and Access as well as our own Spectrum Charge Card. Longer term credit terms are also available.

We believe our product 'know-how' is crucial to you as a customer. In every one of our centres there are personnel who have been trained by the manufacturers or distributors themselves. So we know what we are talking about on the products we sell and can help every customer, including the complete beginner, find and understand the equipment to suit his or her needs. For us it's not just a matter of simply handing over a box and leaving you on your own to figure it out. Our service includes 'hands on' experience that we can pass on to you.

After sales care is also well catered for. Our own Spectrum Service Centres will insure that should your machine 'go down' we will get it up and running as quickly as possible. We can also offer extended warranties at reasonable prices.

When it comes to mail order delivery we use Securicor for despatch to anywhere in the British Isles. The cost is low and the service is good. Further details are available from your local shop at the time of ordering.

Finally, we should point out that although not every Spectrum centre carries every advertised item, they can always be obtained quickly from our central warehouse. If you have any difficulty, please telephone Spectrum Customer Service on (0727) 66646.

Spectrum Computer Group is a division of Spectrum (UK) Ltd - Britain's largest photographic retailing group.

ATARI®

ATARI 400

£217.30

£249.90 INC.VAT

Developed by the Company famous for its TV and arcade games the Atari Computers have superb colour graphics and facilities for the manipulation of visuals on the screen.

In-built "player-missile-graphics" enable the user to compose games to very professional standards. Any key on the keyboard can be made to produce any character the user wishes on the screen. Atari Computers have an extra microprocessor onboard especially to enable these unique features. There are over 200 programmable colours and tones and a wide range of programmable sounds.

Plug a "BASIC" cartridge in and you have a comprehensive computer.

The model 400 has 16K of RAM and a touch sensitive keyboard. The 800 model has a professional style typewriter keyboard and a memory which is user expandable to 48K. Add disk drives (up to 4) and a printer and you have a system of adequate power for business uses.

	EXC VAT	INC VAT
ATARI 800 16K COMPUTER (EXPANDABLE)	£434.70	**£499.90**
ATARI 410 PROGRAM RECORDER	£43.48	**£50.00**
ATARI 810 DISK DRIVE	£260.83	**£299.95**
ATARI 822 THERMAL PRINTER	£230.43	**£264.99**
ATARI 850 INTERFACE FOR DOT MATRIX PRINTER	£117.39	**£134.99**
ATARI 16K RAM EXPANSION FOR 800	£56.52	**£64.99**
ATARI GAMES PADDLES (PAIR)	£12.13	**£13.95**
ATARI GAMES JOYSTICKS (PAIR)	£12.13	**£13.95**
ATARI THERMAL PRINT PAPER (2 ROLLS)	£3.48	**£4.00**
ATARI BLANK DISKETTES (5)	£13.91	**£15.99**
SOFTWARE		
INVITATION TO PROGRAMMING (1)	£13.87	£15.95
INVITATION TO PROGRAMMING (3)	£19.96	£22.95
CONVERSATIONAL FRENCH	£34.74	£39.95
CONVERSATIONAL GERMAN	£34.74	£39.95
CONVERSATIONAL ITALIAN	£34.74	£39.95
CONVERSATIONAL SPANISH	£34.74	£39.95
MUSIC COMPOSER	£31.26	£35.95
TOUCH TYPING	£13.87	£15.95
ASTEROIDS	£26.04	£29.95
MISSILE COMMAND	£26.04	£29.95
PACKMAN	£26.04	£29.95
SPACE INVADERS	£26.04	£29.95
STAR RAIDERS	£26.04	£29.95
SUPER BREAK-OUT	£21.30	£24.50
VIDEO EASEL	£21.30	£24.50
COMPUTER CHESS	£21.30	£24.50
GRAPHIT	£12.13	£13.95
WORD PROCESSOR (DISK)	£86.91	£99.95
ASSEMBLY EDITOR	£34.74	£39.95
DE-RE ATARI	£17.00	No VAT

commodore

The VIC 20 really is extraordinary value for money. It does so much for so little.

It's fully expandable to 27½K user RAM, has a full size typewriter keyboard and plugs straight into your home TV.

COMMODORE VIC 20

£173.90

£199.99 INC.VAT

Micro soft 'BASIC' is standard but additional machine language is available via plug in cartridges. There is also a choice of other programs for chess, music and languages as well as games. Printer disk drive and other peripherals, software and books are all available to further expand your use and enjoyment.

	EXC VAT	INC VAT
VIC C2N cassette unit	£39.09	£44.95
VIC Printer (plain paper, tractor)	£200.00	£230.00
VIC Single floppy disc drive (5¼")	£344.35	£396.00
3K RAM expansion cartridge	£26.04	£29.95
8K RAM expansion cartridge	£39.09	£44.95
16K RAM expansion cartridge	£65.17	£74.95
Super expander Hi Res cartridge	£30.39	£34.95
Joystick	£6.52	£7.50
Games paddles (pair)	£11.74	£13.50
GAMES		
Programmers Aid cartridge	£30.39	£34.95
Machine Code Monitor cartridge	£30.39	£34.95
Introduction to Basic (1)	£13.00	£14.95
"Avenger" (ROM)	£17.35	£19.95
"Star Battle" (ROM)	£17.35	£19.95
"Jelly Monsters" (ROM)	£17.35	£19.95
"Super Lander" (ROM)	£17.35	£19.95
"Road Race" (ROM)	£17.35	£19.95
"Rat Race" (ROM)	£17.35	£19.95
"Blitz" cassette	£4.34	£4.99
BOOKS		
Learn Computer Programming with the Commodore VIC	£1.95	No VAT
VIC Revealed	£10.00	No VAT
VIC 20 Programmers Reference Guide	£14.95	No VAT
VIC Computing Magazine	£0.95	No VAT

ACCESSORIES

Prince PC31 - 12" Green Monitor. **SPECIAL PRICE**	£86.91	**£99.95**
SANYO		
Slim 3G Cassette Recorder (for use with Nascom)	£26.04	£29.95
CTT 3106 14" Colour TV Set	£199.96	£229.95
ACCUTRAK		
C12 Cassettes	£0.43	£0.50
Single sided, double density disks (for Commodore, Atari, Apple, Tandy etc.)	£1.70	£1.95
Double sided, double density disks (for Sharp and Superbrain)	£2.87	£3.30
Single sided, double density, double track disks (for Nascom and Commodore 8050)	£2.30	£2.65
Disk Bank Interlocking cases for diskettes	£3.91	£4.50
Disk head cleaner	£13.00	£14.95
Single part 11" x 9½" printer paper, box of 2200 sheets	£10.39	£11.95

ALFRETON
Gordon Harwood
69/71 High Street
Alfreton Derbyshire
Tel: 0773 832078

BASILDON
Godfrey's
28-32 East Walk
Town Centre
Basildon
Essex
Tel: 0268 289379

BASINGSTOKE
Fishers
2/3 Market Place
Basingstoke
Hants
Tel: 0256 22079

BIRMINGHAM
Sherwoods
Great Western Arcade
Birmingham 2
Tel: 021 236 7211

BRADFORD
Photosave
18 Cheapside
Bradford BD1 4JA
West Yorkshire
Tel: 0274 308598

BRIGHTON
Capricorn
1 Queens Road
Brighton
Sussex
Tel: 0273 29634

CAMBRIDGE
KP Ltd
12a Kings Parade
Cambridge
Tel: 0223 68087

CARDIFF
Randall Cox
18-22 High St Arcade
Cardiff
Tel: 0222 31960

DERBY
C T Electronics
The Spot
Derby
Tel: 0332 44760

GUILDFORD
The Model Shop
23 Swan Lane
Guildford
Surrey GU1 4EQ
Tel: 0483 39115

HARROW
Camera Arts
(Micro Computer Division)
24 St Ann's Road
Harrow Middlesex
Tel: 01 427 5469

LEEDS
Bass & Bligh
4 Lower Briggate
Leeds W Yorkshire
Tel: 0532 45445

LONDON SE9
Square Deal
375 Footscray Road
New Eltham
London SE9
Tel: 01 859 1516

LONDON W11
Electrolesure
120 Notting Hill Gate
London W11
Tel: 01 221 7029

MACCLESFIELD
Camera & Computer Centre
118 Mill Street
Macclesfield
Cheshire
Tel: 0625 27468

MIDDLESBROUGH
McKenna & Brown
190 Linthorpe Road
Middlesbrough
Tel: 0642 248345

NEWCASTLE
Turners
29-31 High Friars
Eldon Square
Newcastle
Tel: 0632 612901

NEWCASTLE-ON-TYNE
Newcastle Camera & Computer Mart
16 Northumberland Court
Newcastle-on-Tyne
Tel: 0632 327461

NOTTINGHAM
Cameo Computers
8/9/10 Trinity Walk
Nottingham
Tel: 0602 42912

READING
David Saunders Computer Centre
8 Yield Hall Place
Reading
Berks
Tel: 0734 580719

TEDDINGTON
"Andrews"
49 Broad Street
Teddington
Middlesex
Tel: 01 977 4716

WALLINGTON
Surrey Micro Systems Ltd
53 Woodcote Road
Wallington
Surrey
Tel: 01 647 5636

WATFORD
SRS Microsystems Ltd
94 The Parade
High Street
Watford
Herts
Tel: 0923 26602

WEST BROMWICH
Bell & Jones
39 Queens Square
West Bromwich
Tel: 021 553 0820

WIGAN
Wilding Ltd
11 Mesnes St
Wigan
Lancs
Tel: 0942 44382

WOKING
Harpers
71-73 Commercial Way
Woking
Surrey
Tel: 04862 61061

WORCESTER
David Waring Ltd
1 Marmion House
High Street
Worcester
Tel: 0905 27551

we won't be beaten on prices. Just compare them!

nascom

SPECIAL EDITION! UNIQUE TO SPECTRUM

The Nascom is a British designed and built microcomputer and one of the first home micros to appear in this country, some five years ago.

Since then, it has been developed into one of the most powerful and expandable systems around.

It can have up to 206K onboard memory, combined with superb colour graphics, disk drives, printers and various input/output facilities can be added.

Such is the versatility of this micro that it has been adopted for numerous commercial applications including hotel booking systems, blood grouping, weaponry and satellite tracking.

Previously looked upon as a machine for the knowledgeable hobbyist only Spectrum now bring you the opportunity to embark upon this remarkable sphere of computing in the easiest possible way. A ready to plug in and use 'SPECIAL EDITION' Nascom programmable in machine code or BASIC is now available from us.

If you are serious about computing the 'SPECIAL EDITION' is your starter pack. The initial machine provides 8K of memory but a simple plug in board upgrades your computer to 56K.

THE NASCOM 'SPECIAL EDITION'

£429.95

£494.44 INC.VAT

	EXC VAT	INC VAT
THE NASCOM 'SPECIAL EDITION'	£429.95	£494.44
'SPECIAL EDITION' 48K RAM BOARD	£130.00	£149.50

SHARP

£75 OF FREE SOFTWARE WITH THE MZ80A

The MZ80A is the newcomer to the Sharp range with the serious user very much in mind in the design.

A complete stand-alone 48K system incorporating a profiled typewriter keyboard with numeric pad and a 9" green display screen. The "BASIC" contains a number of very useful additions over the previous models.

A full line up of peripherals further add to the versatility of this machine.

INCLUDES £75 OF FREE SOFTWARE.

SHARP MZ80A

£477.38

£548.99 INC.VAT

SHARP PERIPHERALS FOR MZ80A	EXC VAT	INC VAT
* Twin floppy disk unit (5¼")	£590.00	£678.50
* Single floppy disk unit	£400.00	£460.00
* Floppy disk interface card	£100.00	£115.00
* Floppy disk cable	£24.00	£27.50
* Master diskette and manual	£31.00	£35.66
* 80 col printer inc. cable, I/O card and ROM	£415.00	£477.25
* 80 col friction printer, I/O card and ROM	£475.00	£546.25
* 132 col printer inc. cable, I/O card and ROM	£845.00	£971.75
* Expansion unit (required for disk drive and/or printer)	£100.00	£115.00
* Universal interface card	£45.00	£51.75
* Assembler tapes and manual	£42.00	£48.30
* FDOS	£85.00	£97.75
* MZ80K to MZ80A converter tape	£10.00	£11.50

Hand held computers from Sharp give you a pocket genius at your command. We sell the well established PC1211 and the new 1500.

The PC1211 packs high performance functions with Basic language into a slim, compact body. You can extend your PC1211 with a cassette interface or printer/cassette interface.

The new PC 1500 takes technology close to personal computer ability. Its compact body has 16K bytes of ROM and 3.5K bytes of RAM. With an extended alpha-basic numeric. You can then go further with the 4K or 8K RAM upgrades. There's also, for the first time in hand held computers, a four colour graphic printer or a combined printer and cassette interface.

	EXC VAT	INC VAT
PC1211 Computer	£65.00	£74.75
PC1211 Cassette interface	£11.26	£12.95
PC1211 Cassette and printer interface	£60.83	£69.95
PC 1500 Computer	£147.78	£169.95
PC 1500 Printer/cassette interface	£130.39	£149.95
PC 1500 4K RAM upgrade	£43.43	£49.95

SHARP PERIPHERALS FOR MZ80K	EXC VAT	INC VAT
* Twin floppy disk unit (5¼") including I/O card, diskette, manual and cable	£702.49	£807.86
* Dot matrix printer	£378.91	£435.75
* Expansion interface (required for either/both above)	£96.00	£110.40
* Machine code language tape and manual	£17.57	£20.20
* Assembler tapes and manual	£36.00	£41.40
* Basic compiler	£40.00	£46.00
* Pascal	£40.00	£46.00
* Double precision basic	£38.00	£43.70

STOP PRESS! At the time of going to press we still have a few of the very popular Sharp MZ80K computer. It has 48K RAM (approx 34.5 user when operating BASIC), a BASIC tape manual as well as an application tape and demo. tape. It's an incredible package at the price.

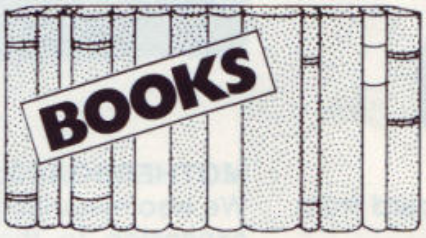
Phone now for availability.

SHARP MZ 80K

£369.57

£425.00 INC.VAT

BOOKS



We stock an extensive range of books to help you. Check below and we're sure you'll find something to whet your appetite.

CP/M Handbook	£11.50	BASIC Computer Programs for the Home	£9.50
DOS T	£9.65	BASIC. A self teaching guide (2nd edition)	£6.75
Programming the Z80	£11.95	Microsoft Basic	£8.95
Programming the 6502	£10.75	More Basic Games	£6.95
Your First Computer	£7.75	Software Secrets (Sharp)	£5.95
BASIC Handbook (2nd edition)	£14.95	Getting Acquainted with your Acorn Atom	£7.95
A-Z of Computer Games	£5.60	Instant Basic	£8.95
Atari Basic	£5.95	Why do you need a Personal Computer	£5.75
Basic BASIC	£9.95	24 Tested Games and Programs	£5.60
BASIC Computer Games	£6.95	33 Games for Apple - TRS 80 - PET	£5.95
BASIC Computer Programs for Business (VOL I)	£8.55	Byteing Deeper into your ZX81	£4.95
		Gateway Guide ZX81	£6.45
		Getting Acquainted ZX81	£5.95
		Hints and Tips ZX81	£4.25
		Mastering Machine Code ZX81	£7.50
		Not Only 3D Programs ZX81	£6.95
		ZX81 Companion	£7.95
		ZX81 Pocket Book	£3.95
		What can I do with 1K ZX81	£4.95
		PEEK POKE BYTE RAM ZX81	£4.95
		Executive Computing	£5.75
		Computers for Everyone	£6.15
		Some Common Basic Programs Atari	£11.10
		49 Explosive Games ZX81	£5.95
		Practical Programs BBC & Atom	£5.95
		34 Amazing Games	£4.95
		30 hr Basic BBC	£5.50

NO VAT ON BOOKS

NO VAT ON BOOKS

DEALERS: Spectrum Computer Centres operate on an exclusive area basis and if you would like to know more about our group, contact Mike Stern or Alan Warren now on (0727) 66646.

Spectrum (UK) Limited, Unit 6, Wentworth Trading Estate, Lakeside Road, St Albans, Herts.

VISA

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

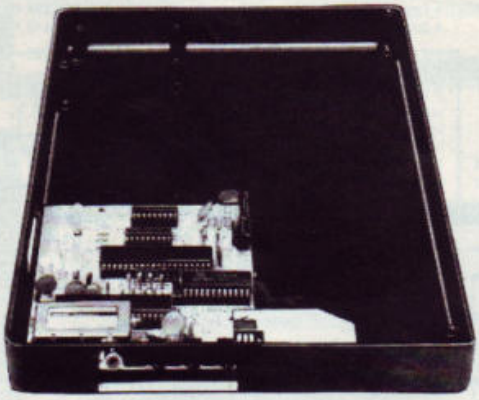
spectrum COMPUTER GROUP

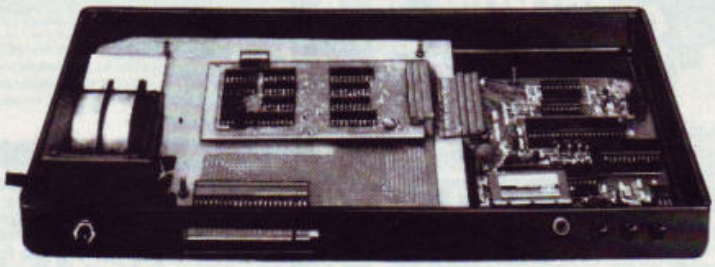
FULLER FD SYSTEM £39.95

Professional Keyboard & Case for Sinclair ZX81

The ZX81 fits inside.
The tough ABS injection moulded plastic case measures 8" x 14" x 2½" and hooks up to your ZX printed circuit board in minutes. No technical know how or soldering is required.

KEYBOARD LAYOUT:
All the Sinclair ZX81 keys are duplicated on our layout, with extra shift and new line keys. The professional momentary action key switches have a guaranteed life of 10^6 operations. The unit is fully built tested and comes complete with a money back guarantee.





INSTALLATION
Simply unscrew the ZX printed circuit board from its case and screw it into the FD Case.

MOTHERBOARD:
We also manufacture a mother board which allows expansion to the ZX memory and I/0 facilities WITHIN the case, as well as our power supply unit and reset switch.

AD Code		Price	Qty	Amount
Fuller	FD System 42 Keyboard & case	39.95		
	FD System Motherboard	15.95		
	FD 16K. Memory Module	29.95		
	FD 64K. Memory Module	78.95		
	FD PSU 9 Volts at 2 amp.	12.95		
	FD *Shipping and Handling*	2.50		

Mail to **FULLER MICRO SYSTEMS,**
The ZX Centre, Sweeting Street, Liverpool 2. England, U.K.

Name .....

Address .....

City/State/Zip .....