HARDWARE . . . . SOFTWARE . . . . AT HOME . . . . IN BUSINESS

computing today

FOR THE BUSINESS OF MICROCOMPUTING

DECEMBER 1980
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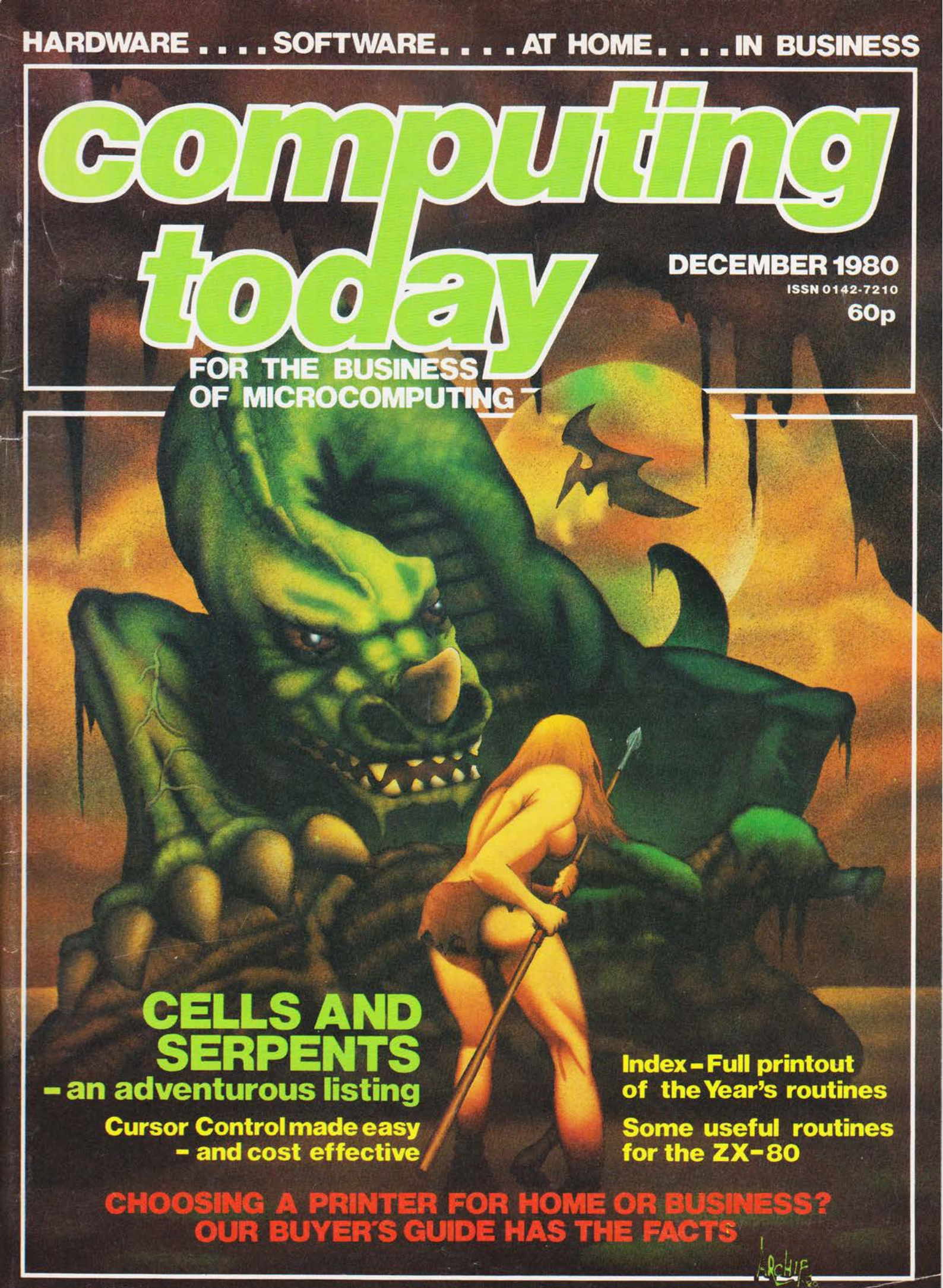

CELLS AND SERPENTS
- an adventurous listing

Cursor Control made easy - and cost effective

Index - Full printout of the Year's routines

Some useful routines for the ZX-80

CHOOSING A PRINTER FOR HOME OR BUSINESS? OUR BUYER'S GUIDE HAS THE FACTS

ARCHIE

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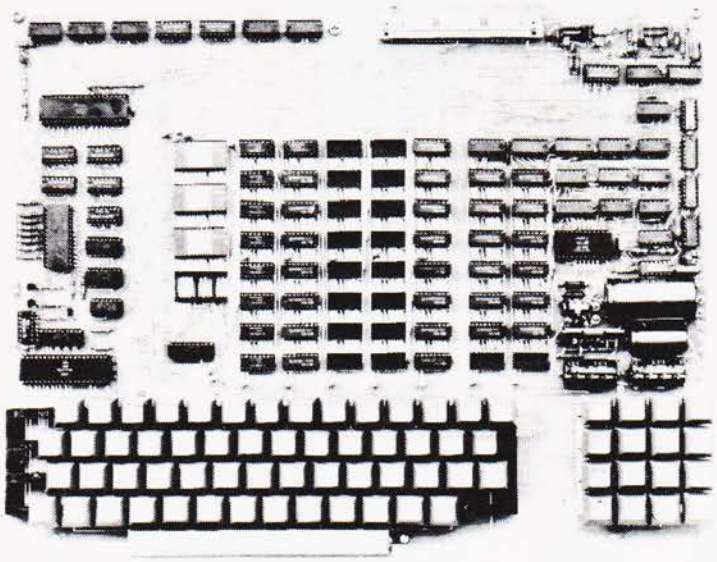

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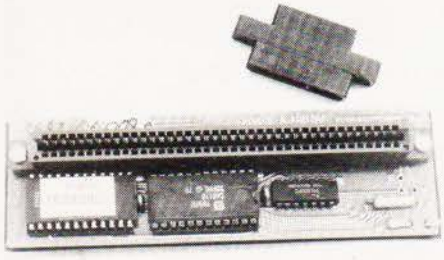

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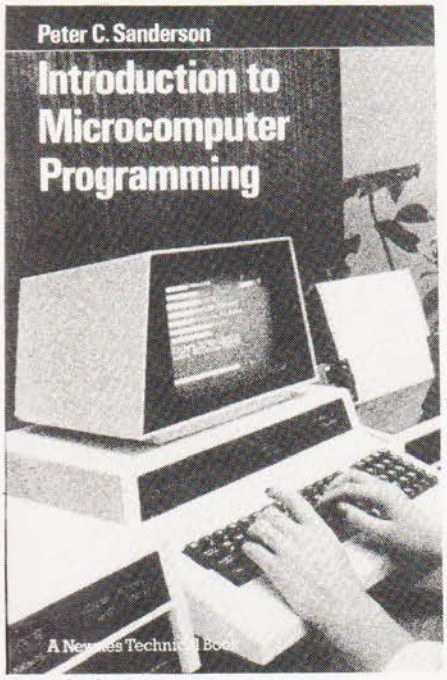

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AGENTS THROUGHOUT THE UK AND OVERSEAS

David Ahl, Founder and Publisher of Creative Computing

creative computing

The beat covered by Creative Computing is one of the most important, explosive and fast-changing. —Alvin Toffler

You might think the term "creative computing" is a contradiction. How can something as precise and logical as electronic computing possibly be creative? We think it can be. Consider the way computers are being used to create special effects in movies—image generation, coloring, and computer-driven cameras and props. Or an electronic "sketchpad" for your home computer that adds animation, coloring and shading at your direction. How about a computer simulation of an invasion of killer bees with you trying to find a way of keeping them under control?

Beyond Our Dreams

Computers are not creative per se. But the way in which they are used can be highly creative and imaginative. Five years ago when **Creative Computing** magazine first billed itself as "The Number 1 magazine of computer applications and software," we had no idea how far that would take us. Today, these applications are becoming so broad, so all-encompassing that the computer field will soon include virtually everything!

In light of this generality, we take "application" to mean whatever *can* be done with computers, *ought* to be done with computers, or *might* be done with computers. That is the meat of **Creative Computing**.

Alvin Toffler, author of *Future Shock* and *The Third Wave* says, "I read **Creative Computing** not only for information about how to make the most of my own equipment but to keep an eye on how the whole field is emerging."

Creative Computing, the company as well as the magazine, is uniquely lighthearted but also seriously interested in all aspects of computing. Ours is the magazine of software, graphics, games and simulations for beginners and relaxing professionals. We try to present the new and important ideas of the field in a way that a 14-year old or a Cobol programmer can understand them. Things like text editing, social simulations control of household devices, animation and graphics, and communications networks.

Understandable Yet Challenging

As the premier magazine for beginners, it is our solemn responsibility to make what we publish comprehensible to the newcomer. That does not mean easy; our readers like to be challenged. It means providing the reader who has no preparation with every possible means to seize the subject matter and make it his own.

However, we don't want the experts in our audience to be bored. So we try to publish articles of interest to beginners and experts at the same time. Ideally, we would like every piece to have instructional or informative content—and some depth—even when communicated humorously or playfully. Thus, our favorite kind of piece is accessible to the beginner, theoretically non-trivial, interesting on more than one level, and perhaps even humorous.

David Gerrold of *Star Trek* fame says, "**Creative Computing** with its unpretentious, down-to-earth lucidity encourages the computer user to have fun. **Creative Computing** makes it possible for me to learn basic programming skills and use the computer better than any other source."

Hard-hitting Evaluations

At **Creative Computing** we obtain new computer systems, peripherals, and software as soon as they are announced. We put them through their paces in our Software Development Center and also in the environment for which they are intended home, business, laboratory, or school.

Our evaluations are unbiased and accurate. We compared word processing printers and found two losers among highly promoted makes. Conversely, we found one computer had far more than its advertised capability. Of 16 educational packages, only seven offered solid learning value.

When we say unbiased reviews we mean it. More than once, our honesty has cost us an advertiser—temporarily. But we feel that our first obligation is to our readers and that editorial excellence and integrity are our highest goals.

Karl Zinn at the University of Michigan feels we are meeting these goals when he writes, "**Creative Computing** consistently provides value in articles, product reviews and systems comparisons...in a magazine that is fun to read."

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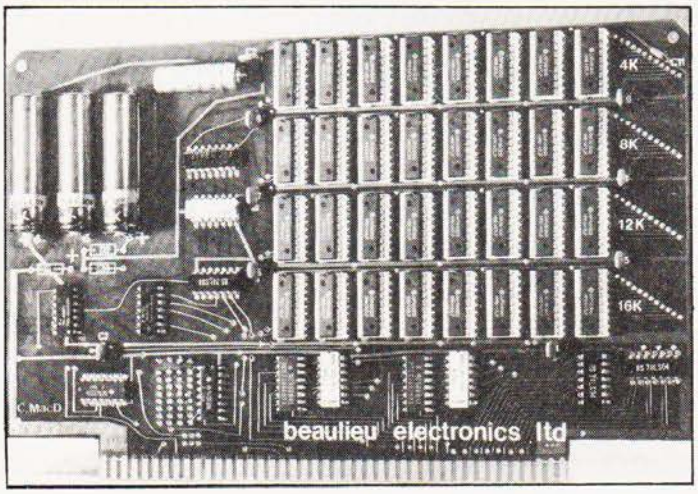


SYSTEM COMPATIBLE

Owners of Motorola Exorciser or Rockwell System 65 products who need to increase their memory capacity can now buy a flexible CMOS RAM card range from Beaulieu Electronics of 16/17 College Place, Southampton, Hants S02 2FE. Designed around 1K by 4 devices the cards can hold up to 16K and are fitted with Ni-Cad battery back-up. It is hoped to produce a 32K version and an S100 compatible version in the near future. Power requirements are a meagre 500 mA at 5V with 200 nS access times. The battery back-up gives up to 20 days data protection so, in theory at least, you could pull the card out for transportation. Address boundary selection is made by links on the board so it can be set to any 4K field within the system memory map.

TUNE-UP KIT

Owners of the original 8K PET with the calculator style of keyboard may be interested to hear of a replacement full-size unit. Produced by High Fidelity Electronics of 33 Canonbie Road, Honor Oak, London SE23 3AW, it is an exact replica of the full size unit except for four additional keys on the numeric pad. All the keys are mounted on a steel panel which fits over the whole front panel area, the cassette unit must be removed and used externally. There is one very special key on the unit which can be user defined, system reset perhaps? Conversion can be done by those confident at handling files etc., or the firm can do the job for you. Prices are available upon application to the company.

TALK TO US

On November 19th at the Polytechnic of North London a group of eminent computer people will be talking about defining new software and hardware standards for micros. The seminar is being organised by the Association of London Computer Clubs and will run between 10am and 5pm. Anyone interested in attending should contact the Poly, in the person of Robin Bradbeer, on 01-607 2789. Computing Today will, of course, be represented. After the successful Computer Faire last summer the Association has decided to advance the date of the 1981 edition to the 13th to 15th of April. Book early as it's bound to be packed.

WORDS ON WORDS

An American based company, Small Systems Group, has started its career with the publication of a report entitled "Word Processing on Personal Computers". Covering the Auto Scribe, Electric Pencil, Magic Wand and Wordstar packages in detail, it compares some 159 individual features. Copies of the report are available mail-order for $12.00 from the Small Systems Group, Box 5429, Santa Monica, California CA 90405. Please mention where you saw this news item when writing.

ROM DELAY

The new 8K BASIC ROM for the ZX80 that we announced in the news a few weeks ago has been delayed until February next year, according to Clive Sinclair. The delay is not due to any problems in producing the software but by the development of the printer driving routines that will be included in the ROM. These routines were to be launched next year but to avoid the unnecessary trouble of having to blow two sets of ROMs Science of Cambridge are delaying production. The price of the new ROM will be unchanged and apparently all people who have ordered have been informed of the situation. The printer will be launched in middle '81 if all the development proceeds as expected and the BASIC will be able to directly access the device using the new code.

BREADBOARD 80

Whatever aspect of electronics you're into, make sure you're in London during November for this year's Breadboard exhibition. From CB to home computing, soldering to synthesisers — demonstrations, special offers — it's all at Breadboard 80.

The exhibition runs for five days — the doors open at 10.00 am on November 26th (watch the electronics Press for full details). Don't miss it!

MOVED AGAIN

No sooner had ink been applied to paper in last month's news section than we received notice that one of the companies featured, Midwich, had moved. They are developing a nasty habit of doing this, it's the second time in about twelve months! They now live at Hewitt House, Northgate Street, Bury St Edmunds, Suffolk IP33 1HQ. Their new telephone number is 0284-701321.

ASSEMBLER COURSE

Owners of 6502 based systems who are into machine code programming have a new course starting in the new year at the University of Liverpool. Based around the AIM 65 it aims (pun unintentional) to teach the necessary skills to write assembly language routines, especially drivers and linkers. Once the basics have been grasped the ideas are easily transferred to machines such as PET and Apple, both of which are available on-site. The course consists of five lectures starting at 2.00pm on Tuesday 27th January and costs £100 per person. For registration or further details contact Dr M D Beer at the Computer Laboratory, University of Liverpool, PO Box 147, Liverpool L69 3BX.

MAN-MACHINE COURSE

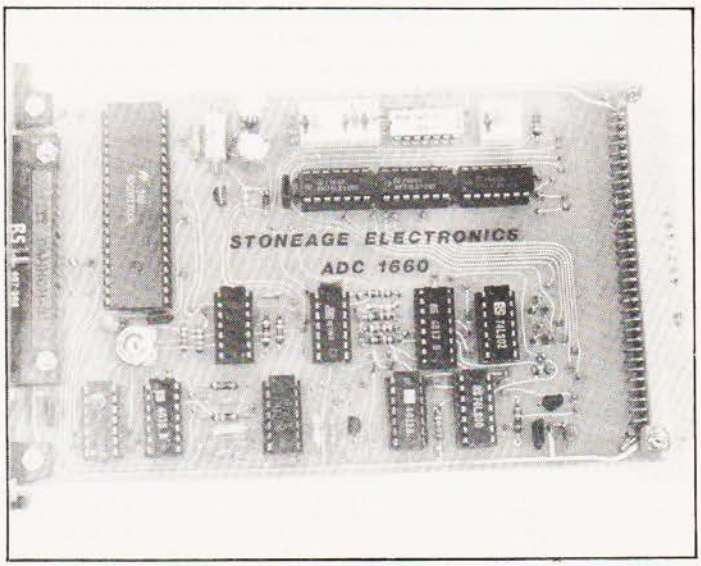
Students of Man-Computer interaction and other allied topics can now be lectured to at Polytechnic of Central London. On 4th December at 12.30pm at the School of Engineering and Science in New Cavendish St, the first of a new series of lectures entitled 'Keyboard Designs' will be held. Anyone interested who requires further details should contact Mohan Kala on 01-486 5811.

SOURCE OF SUPPLY

We understand that some people have been having trouble in locating the Siliconix IC at the heart of last month's A to D converter project. Semiconductor Specialists (UK) Ltd of Carroll House, 159 High Street, Yiewsley, West Drayton, Middlesex are happy to supply one-off orders for the device. Currently available as ex-stock it costs £4.14 to which must be added £1.00 p&p and the obligatory 15% VAT, totalling £5.91 according to our trusty (rusty) calculator.

BC A TO D?

One of the most popular card sizes for micro systems must be the Euro/International set. Machines using this format are often rack mounted and it is good to see a number of add-ons appearing in this format to support them. One of the first is a 16 channel analogue to digital card from Stoneage Electronics. Based around the Acorn Eurocard it can be adapted fairly simply to fit machines such as Microtan 65, Triton and SC/MP. Available as kit or ready built and with an optional "Experimenter" PCB, the unit offers a fast conversion time, 60 uS, with all the control and data being treated as memory locations. Prices are from £82 for the kit to £110 for the assembled unit. The extra PCB costs around £14 with a suitable cable assembly. For further details contact Stoneage at The Cottage, 70 Albion Drive, London E8 4LX.



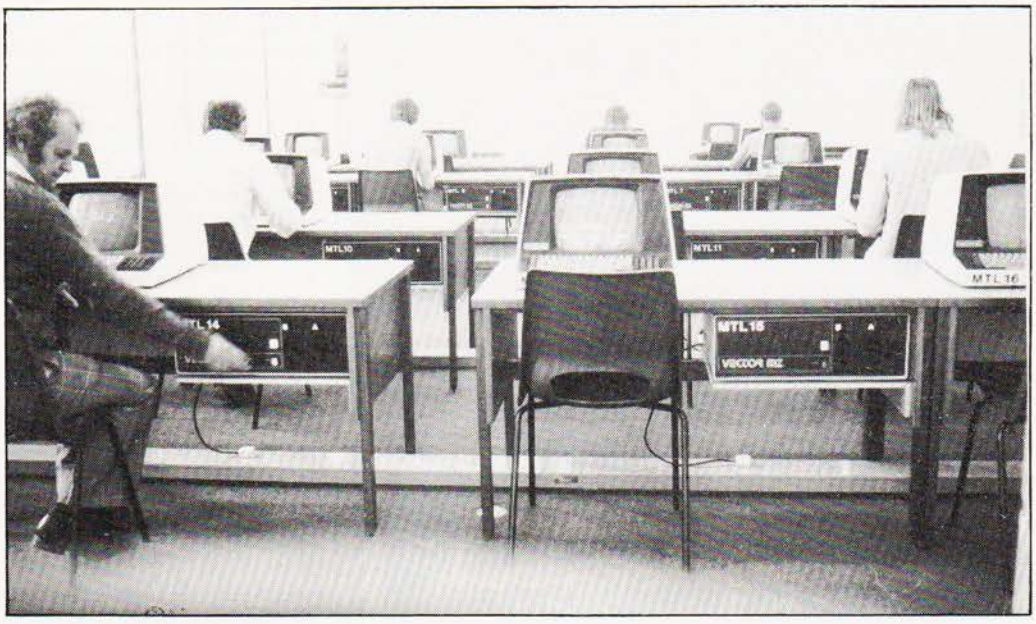
NEWS

COMPANION REVISED

One of the first books to be produced as an addition to the original ZX 80 manual was the ZX 80 Companion from LINSAC. This has now been revised to remove the occasional error caused by its rapid production and is now available as a second edition. As well as ironing out the mistakes, the volume now includes a chapter on the operating system detailing all the entry points from BASIC and a routine to generate moving displays. LINSAC also offer a range of programs on cassette, these come as packages, seven games at £10.00 for example. Owners of the system who are into the machine code side of programming can purchase a full assembly listing of the operating system. Complete with annotations and explanations it will be published at the end of November. For a catalogue and price list contact LINSAC at 28 Barker Road, Linthorpe, Middlesbrough, Cleveland TS5 5ES.

PET PROFESSIONALS

One of the more innovative and active Commodore distributors, Amplicon Micro Systems, have moved into new premises in Crawley. The new office is at Kingston House, Stephenson Way, Three Bridges, Crawley and is intended to offer demonstration and after sales facilities for the new 8000 series as well as the existing range. Among the products from Amplicon are the BCD to PET interfaces that we mentioned a couple of months ago, Kybe floppy discs (Amplicon are the UK distributors), and a PET to S100 interface that allows up to four cards to be run off the back of the machine. Anyone wishing to view the range is welcome in office hours, the contact is Peter Wood. Anagram Software is Amplicon's software arm and any contact on this side should go to Dick Simmonds on Crawley 26494 rather than the usual Amplicon number of Crawley 26943.



PASCAL SCHOOLED

A brand new computer laboratory has been set up at Essex University with Pascal running as the main language. Seventeen Vector Graphic System Bs have been installed by Almarc Data Systems, the main UK distributor, and it is estimated that some 300 students will benefit each year. The new laboratory will also take some of the strain off the University's existing DEC 10/90. The Pascal implemented is a university derived version of the UCSD original. For details of Vector Graphic contact Almarc at 906 Woodborough Road, Nottingham.

BOUNCING BACK

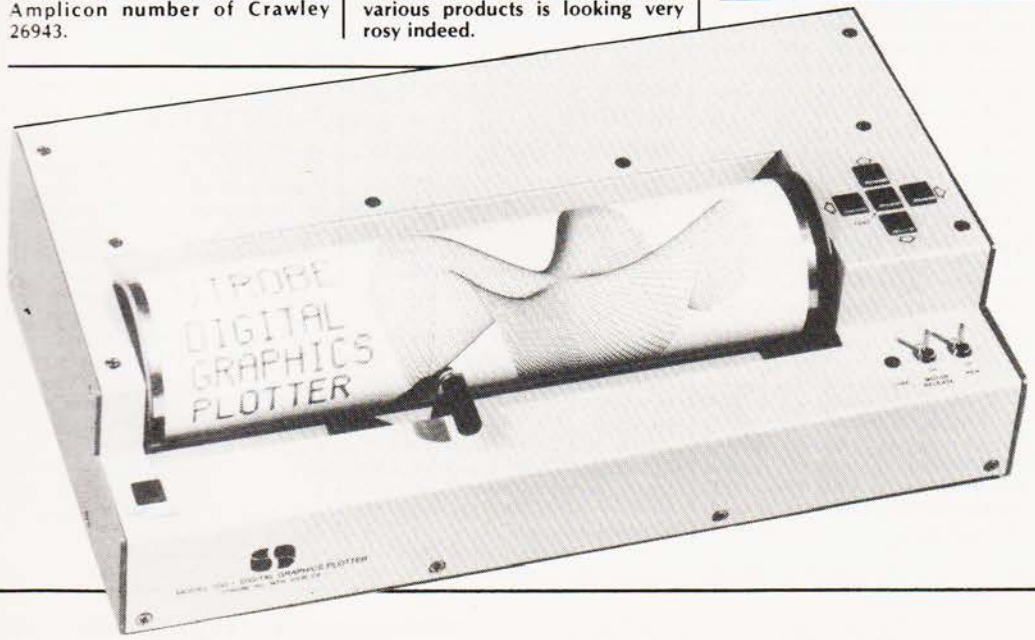
We're glad to announce that the recently troubled firm of Nascom is back. Thursday the 9th of October saw the signing of the final documents that sold the ailing firm to Alltech, a Watford based electronics company. After four months of doubt it now seems certain that the firm will emerge to play as big, or even bigger, role in the personal micro business. The interesting thing to note is that over the last four months the sales of Nascom hardware and the introduction by independant companies of extras has been running at a very high level. With this amount of support from outside, the future for the various products is looking very rosy indeed.

BUG BYTES

This month's correction corner concerns the Space Invasion program. Apparently a rare fault exists which allows part of an invading saucer to disappear and then re-appear. This may be corrected by the patch; 0695 to EA, 0696 to EA. For further interest the bomb rate can be reduced by changing and OAF1 to 3F and OAF4 to EA. A new feature has been implemented in the ROM version which makes the invading saucers start at a fixed point once all the bases have disappeared, this gives you a slightly less onerous task in saving the Universe but fatigue sets in at around 140,000!

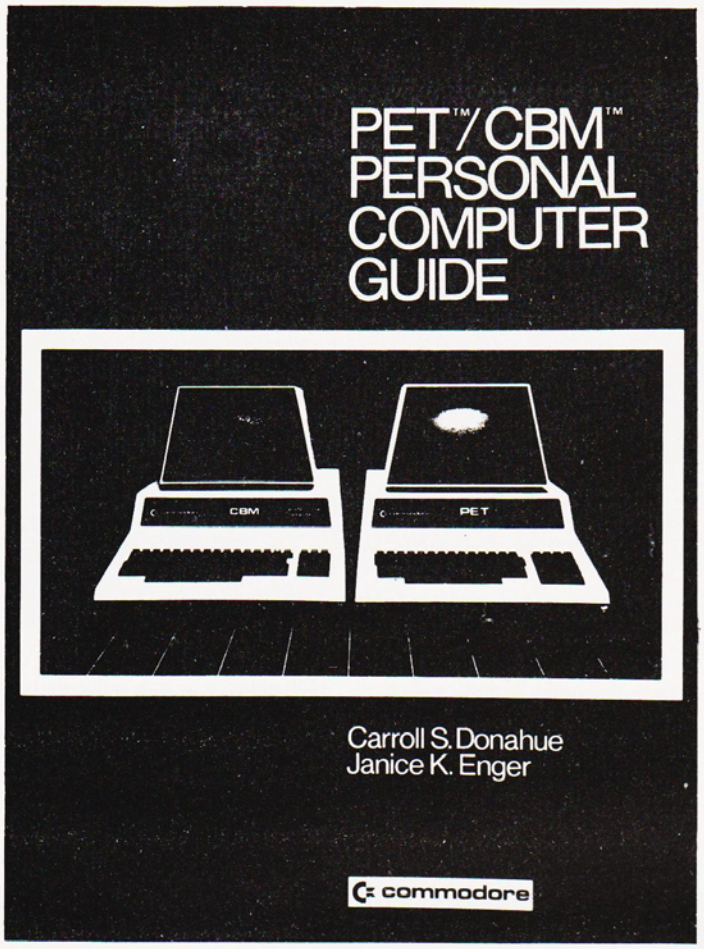
IMPORTANT NOTICE

Readers have recently confused Electronics Today Limited as being associated with the ownership of our magazine, Electronics Today International. Our magazine is owned by Modmags Limited, part of the Argus Press Holdings Limited Group of Companies. Electronics Today Limited advertises in our magazine, as "Metac", but so as to prevent any further confusion we wish to make it clear that Electronics Today Limited is not in any way owned or managed by any member of the Argus Press Holdings Limited Group of Companies.



PLOT IT AGAIN?

Users of micros in educational and laboratory situations with a need for graphical output now have another possible choice in the marketplace. Called the Strobe Model 100 it is designed for easy connection to a wide range of common microcomputers using BASIC or FORTRAN. As well as full XY plotting, the unit can also report the pen position directly to the computer in a digitising mode. Supplied complete with paper and pens the unit may be configured, at the order stage, to a wide variety of systems. Full source code listings for 8080, Z80 and 6502 based machines are also included for motor control and vector plotting. For prices and full specification contact HAL Computers Ltd, 133 Woodham Lane, New Haw, Weybridge, Surrey KT13 3NJ.



PET/CBM PERSONAL COMPUTER GUIDE

Since 1977, when Commodore launched the PET, an almost uncountable number of words have been written about what, why and how you can work with this little beauty. Unfortunately Commodore have been sadly lacking in the expertise of technical writing to back up their brainchild with a really down-to-earth and comprehensive operating manual. Now at last such a manual/guide has arrived. The front cover of the book tells us that it is "Commodore authorised", it is a pity that Commodore do not authorise the inclusion of a copy with each new machine. The first three sections of the book take you through the initial stages of operating your PET, leading you gently from unpacking it through to a clear and concise description on the rudiments of writing programs. Section 4 of the book, under the heading 'PET BASIC' clearly explaining all there is to know about the BASIC commands and keywords that you can use on your system. The fifth section, 'Making the most of PET features', follows up with a host of useful information which enable the operator to achieve a firm basis of understanding just what can be done with his machine. The final section and Appendices add to this understanding, giving you the means to move smoothly through that part of the learning curve that follows the realisation that you have reached the stage of being an 'expert novice'. If you are thinking of buying a PET, or have just bought one and are struggling with the Commodore manual or indeed if you just want to find out more, then this book is definitely recommended reading. The PET/CBM PERSONAL COMPUTER GUIDE is written by Carroll S. Donahue and Janice K. Enger, published by Osborne/Mc Graw-Hill and will cost you £10.00 for its 429 pages. For those in trouble the ISSN No is 0 931 988-30-6. P.F.

PERKY PASCAL

Users of Perkin Elmer minis can now access an optimising version of Pascal. Running on their 3220 and 3240 machines it will allow shared access to 64 users and will cost £3620 with complete documentation, the right to copy fee is £360. The implementation conforms to the draft ANSI specification. For more product information contact Perkin Elmer Data Systems at 227 Bath Road, Slough, Berks or ring on Slough 34511.

GIVE ME INFORMATION

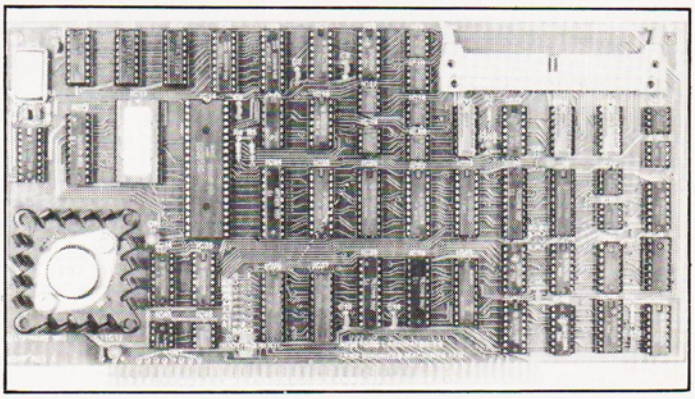
The National Computing Centre, (that august body) has recently added a Computer Guidance Service to its formidable array of courses and publications. Designed to help the small business person who is caught between buying and making a mistake and hiring professional advice which might be too expensive, it consists of four basic parts. These are a free brochure which gives useful hints and outlines the service, guidance talks on how to go about acquiring the hardware, etc., clinics for those who have specific problems and a complete package which includes guidance by an NCC advisor. For more information on these services, available in both London and Manchester, contact the NCC at Oxford Road, Manchester, M1 7ED or ring on 061-228 6333.

SNAP TO IT

If you are in any way involved in collating data obtained from surveys or market research, then a new computerised system might be the answer. Designed for the area between the 'do it by hand' and the massive nationwide survey, one and two thousand samples, it is fully interactive and easy to use. To buy the system costs £4,950 or you can lease it for £25 per week. The package is based around a quad density Superbrain with a printer and can cope with a maximum of 2400 samples each having 64 questions. The software takes care of the questionnaire design and printing, the data entry and all the analysis and output of results. For full information contact the distributors, Mercator Management Consultants Ltd., at 6 Vyvyan Terrace, Clifton, Bristol BS8 3DF or give them a ring on 0272-33636.

NEWTONIAN SOLUTIONS

Do you own an S100 based micro? Do you have a storage problem? A new British product may have the solution to this, it's an S100 controller card for the industry standard 5+5 Mb hard discs. Developed by Newtons Laboratories of Wandsworth, (the home of Youngs brewery no less) it can handle up to four of the drive units at a transfer rate of 2.5 Mbits per second. The operating system is based around CP/M 2.2 and further operating systems will be available later in the year. One interesting feature is the capability to conform the hard disc as a peripheral to any existing floppy discs or vice versa. Full technical information and pricing can be obtained direct from Newtons Laboratories, PO Box 789, 111-113 Wandsworth High Street, London SW18 4JB.



KIENZLE BRANCH OUT

The Slough based firm of Kienzle Computers, well known in the business computer rental market, have opened a new regional office in Tolworth Towers, Surbiton. Fully equipped with both staff and systems it represents a major move in the company's expansion. Not only do they rent small and medium sized business systems but also sell worldwide. The address of the new offices and showroom is Tolworth Tower, 3rd Floor, Low Rise, Ewell Road, Surbiton, Surrey and your contact is Michael Jennings, the regional manager.

FLOPPY EXTRA

In the expanding world of floppy disc based microcomputers it seems that the manufacturers of media are but one small step behind the manufacturers of media. Recent announcements by Shugart, IBM and DEC in the field of drives (Land Rover territory?) has brought forth a new family of diskettes from 3M under the Scotch brand. Available in a multitude of formats and types they are available singly or in boxes to suit all the previously mentioned drives. For detailed information contact John McBride at Data Recording Product Group, 3M UK Ltd, 3M House, Bracknell, Berkshire RG12 1JU or ring on 0344-58449.

NEWS

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Making a late entry into the intelligent small business terminal market is Ragen International Ltd. After much perusal of the market they have chosen the Ai Electronics Corporation of Japan's ABC-20 series of machines. Ragen are associated with one of the biggest ORC and Data Prep bureaux in Europe and their entry into the small business market is a logical extension of the range of services which they offer. The current market leader of the ABC range is the ABC-24 which features 64K of RAM, 12" VDU with detachable keyboard, dual floppies and a number of I/O ports. Various options are available including a choice of operating systems and a Wordstar word processing package with printer. Prices range from £3000 to about £5000 depending on the software chosen. To obtain more detailed information on this new product contact Ragen International at Assets House, 17 Elverton Street, London SW1P 2QG or give them a ring on 01-828 2355.

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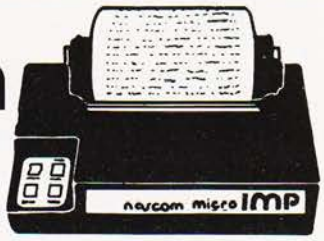

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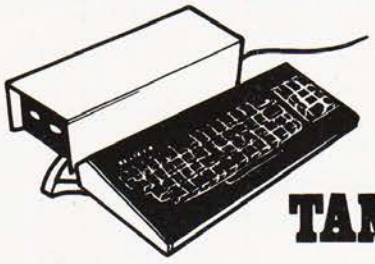

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NEWTON'S COOL

Remember those classroom experiments to find out how hot things cool down? This superb piece of software uses a rather macabre application to illustrate the serious and educational side of computing.

MINNIE WINNIE WHO?

New technology strikes in the computing department. The development of low-cost mass storage devices based around Winchester technology has brought small business computers to the masses. In a follow-up to his earlier article on floppy discs the author takes a close look at what they are and how they do it.

BUYER'S GUIDE

For those with terminal specificitis, eyesight crippled from peering too closely at the spec sheets, we present this month's buyer's guide. Once more our researchers have provided the most up-to-date list of VDUs to be found anywhere this month.

Articles described here are in an advanced state of preparation. However, circumstances may dictate changes to the final contents.

Ian Pine

TIGHTROPE WALK

The game is basically a reaction tester (no, a hammer doesn't jump out and hit you on the knee!). The task is to step a flashing symbol along an imaginary tightrope, strung across the display from left to right. To move the symbol one place to the right, the key corresponding to the display digit number must be pressed.

BE CAREFUL: If you press the key when the digit is not illuminated you fall off the tightrope and are sent back to the beginning (digit 7).

The rather obvious documentation was written to enable beginners (like myself about a year ago) to be able to follow through the listing and, hopefully, understand how the program works.

Program Locations

X'F21: This location contains the segment pattern that is displayed, any pattern can be displayed as long as location X'F12 contains X'00 at the start of the game.

X'F25 & X'F29: The delay is caused by mounting down to zero, a binary value. A single byte gives a maximum count of 256 (starting at X'00) but this was much too fast so a 16-bit count value was required. This is given by two nested loops (one inside the other), the inner loop labelled LOOPL and the outer loop labelled LOOPH. The values stored in the two locations give a count of X'06FF loop cycles.

X'F4A: The X'3F contained in this location causes a return to the monitor when the player has successfully reached the end of the tightrope (this includes stepping PAST the rightmost end of the display). This location up to the end of available RAM could be used for a subroutine to display a message or perhaps ask the player if he wants another game. At the end of each game a subroutine could be executed that reduces the delays and makes the next game faster.

Execution of the program starts at X'F15. The frustration starts when the player has almost reached the end of the tightrope and then loses concentration and is sent back to the beginning.

Program Listing

```
F12                DIGIT:    .=.+1          ;remember on or off
F13                LOOPH:    .=.+1          ;number of times LOOPL is iterated
F14                LOOPL:    .=.+1          ;delay for display and keyboard
F15   C4 OD        START:    LDI   X'0D     ;set up register P1 to contain X'D00
F17   35                     XPAH  (1)      ;X'D00 is the least significant address
F18   C4 00                  LDI   X'00     ;of the MK.14 display and keyboard.
F1A   31                     XPAL  (1)
F1B   C4 07        BACK:     LDI   X'07     ;start player at digit 7
F1D   01           NEXT:     XAE            ;remember in Extension register.
F1E   C0 F3        FLASH:    LD    DIGIT:   ;load AC with contents of X'F12
F20   E4 40                  XRI   X'40     ;change AC X'00 becomes X'40, X'40 becomes X'00
F22   C8 EF                  ST    DIGIT:   ;put AC back into X'F12
F24   C4 06                  LDI   X'06     ;load AC with value for LOOPH
F26   C8 EC                  ST    LOOPH:   ;store AC at X'F13
F28   C4 FF        WAIT:     LDI   X'FF     ;load AC with value for LOOPL
F2A   C8 E9                  ST    LOOPL:   ;store AC at X'F14
F2C   C0 E5        DISP:     LD    DIGIT:
F2E   C9 80                  ST    (1)+E    ;display DIGIT according to value in E register.
F30   C1 80                  LD    (1)+E    ;read keyboard. Look for key.
F32   E4 FF                  XRI   X'FF     ;was there a key?
F34   9C OA                  JNZ   MOVE:    ; yes — jump to X'F40, no — continue.
F36   B8 DD                  DLD   LOOPL:   ;count down LOOPL
F38   9C F2                  JNZ   DISP:    ;continue if loop finished, else jump to X'F2C.
F3A   B8 D8                  DLD   LOOPH:   ;count down LOOPH
F3C   9C EA                  JNZ   WAIT:    ;continue if loop finished, else jump to X'F28.
F3E   90 DE                  JMP   FLASH:   ;jump to X'1E.
F40   CO D1        MOVE:     LD    DIGIT:   ;was key pressed at the wrong moment?
F42   98 D7                  JZ    BACK:    ;yes — jump to X'F1B, no — continue.
F44   40                     LDE            ;load AC with contents of Extension register.
F45   03                     SCL            ;set CY/L for 2's complement.
F46   FC 01                  CAI   X'01     ;subtract 1 from AC
F48   94 D3                  JP    NEXT:    ;if AC positive or zero jump to X'F1D, else cont.
F4A   3F                     XPPC  (3)      ;SUCCESS: return to monitor (display 0000 00)
```

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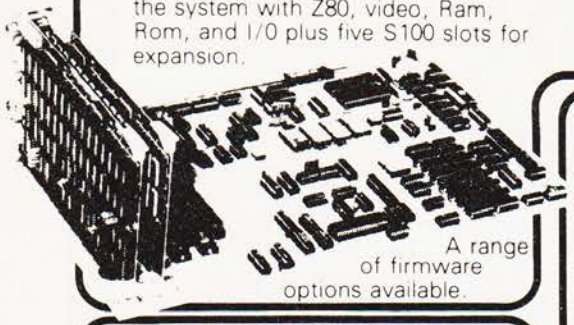

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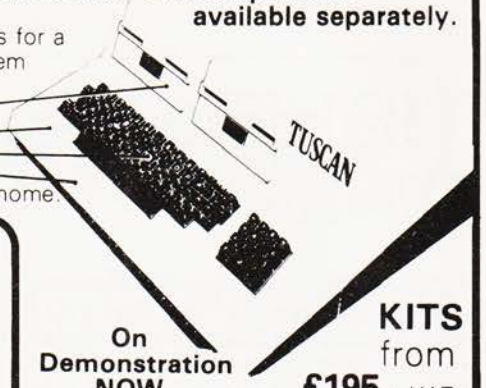

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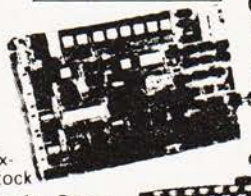

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Some useful tips from owners of this popular low-cost computer.

SCREEN POKES FOR ZX80

M.E.Bryant

Of the design compromises which allowed Sinclair to produce a high-level language microcomputer selling for under £100, perhaps the most noticeable is the lack of a memory-mapped display with separate video control, resulting in the now infamous screen-flicker on data entry and the absence of any display during computations.

The absence of a memory-mapped display can be a nuisance, especially for the writer of games programs, as one of the most interesting things one is able to do is to PEEK at individual screen locations and to POKE characters directly onto the screen. Animated graphics, of course, depend on this facility but they are definitely *out* with the ZX80 because the screen would remain blank while the action was being computed. On the other hand using POKE to put characters onto the screen is feasible and is potentially a useful feature.

Filing A Display

With a memory-mapped display there is no problem because the display file is contained within a fixed amount of RAM. The screen can be considered to consist of a matrix of locations (number of lines by number of characters per line) with the memory address of each one fixed and known. To make a character appear at any desired point on the screen it is simply a matter of POKEing the code for that character at the relevant location address.

On the ZX80 things are rather different. The display-file uses a variable amount of RAM depending on the quantity of data to be displayed. The addresses of the various locations on the screen also vary according to the length of the program. In addition the location addresses change during the running of a program whenever data is input for the first time or variables are assigned.

The computer, of course, knows where the display-file is in the RAM at any time and the address of the start of the display-file is recorded as a two-byte record at address 16396. By PEEKing at that address we can locate the display-file and then calculate the addresses where we need to POKE to get characters onto the screen.

Character By Character

The first character in the display-file is a "newline" character so that if we call the address of the start of the display-file W then the first visible character location (top left) is at W+1. Each line consists of up to 32 visible characters with a newline character at column 33. By adding the appropriate multiple of 33 plus the column number to W we can get the address of any character location on the screen. If we call the row number A and the column number B then the address formula is W+(A−1)*33+B.

Of course the display-file has to exist before we can start PEEKing and POKEing at it. If we wish to POKE onto a blank screen then it is first necessary to create a display-file full of spaces. Unfortunately a succession of PRINT statements will not achieve this and although a FOR. . NEXT loop PRINTing individual spaces will, it is very cumbersome. Luckily PRINT,,,, creates a line full of spaces so a short loop can be used to produce the required number of screen lines. Obviously characters can be used as well as spaces to create a display-file. Up to 23 lines can be printed in this way.

Having ensured that we have a display-file we can now take a PEEK at its starting address. The following subroutine achieves this and it is used in all subsequent listings:-

```
500  LET P=PEEK(16397)
510  IF P>127 THEN LET P = P − 256
520  LET W = PEEK(16396) + P*256
530  RETURN
```

It should now be obvious how we can use this address to POKE a character onto the screen. The following program establishes a blank display-file, inputs a row and column number, POKEs character code 148 (inverse asterisk) at the relevant address and then inputs another "grid reference". When the program is run, inverse asterisks appear at your bidding anywhere on the screen:-

```
 10  LET P = 0
 20  LET W = 0
 30  FOR A = 1 TO 22
 40  PRINT,,,,
 50  NEXT A
 60  INPUT A
 70  INPUT B
 80  IF A>22 OR B>32 THEN GOTO 60
 90  LET Y = (A−1)*33 + B
100  GOSUB 500
110  POKE W + Y, 148
120  GOTO 60
500  LET P = PEEK(16397)
510  IF P>127 THEN LET P = P−256
520  LET W = PEEK(16396) + P*256
530  RETURN
```

The following two alterations to the listing extend this simple program:-

Specify character to be POKEd:-

```
 84  INPUT C
110  POKE W + Y, C        (C is relevant character code)
```

POKE character taken from the keyboard:-

```
 84  INPUT C$
 86  LET X = CODE (C$)
 88  IF X>191 THEN GOTO 84
110  POKE W + Y, X
```

It will be noticed that the programs above assign variables P and W before the first PEEK. This is because, as mentioned before, any variable assignment or initial input will alter the location of the display file. If you write any screen-POKE programs and find that the characters are displaced it will almost certainly be because a variable in either PEEK or POKE has not been previously assigned. A similar case is where an initial input or an assignment is made after a previous PEEK or POKE, when it will be necessary to take another PEEK at W before POKEing again.

Careful POKEs

Another thing worth remembering is that POKEing can be a hazardous occupation if you happen to POKE in the wrong place or even if you POKE an inappropriate character code in the right place. Care should therefore be taken when writing

programs to ensure that characters are not POKEd outside the boundaries of the display-file. Usually such characters seem to disappear without trace but sometimes they can find their way into your program, invariably with unpleasant consequences. Some bad POKEs can cause havoc with the video control. The codes for all statements, tokens and operators should *definitely* be avoided (ie. codes > 191).

A more subtle problem is that any extensive use of screen space is very expensive in terms of memory. A 23 line "blank" screen will occupy 760 bytes of RAM, which does not leave much for the program if you are using the basic model ZX80 with 1K of memory. You therefore need to think hard about the balance of memory requirement when writing screen-POKE programs if you have no memory expansion.

Having grasped the principles involved in defining and locating the display-file it is relatively simple to manipulate it. Existing characters on the screen can be replaced by POKEing an alternative code at the same address. If this is the code for a space (0) then the character already on the screen disappears. By PEEKing at the address you plan to POKE to you can see what character already occupies that location, thus opening up the possibility of a conditional response. All the relevant character codes are identified in the ZX80 handbook.

Graphic Example

Finally, here is a simple games program that demonstrates the features discussed and which just fits onto the 1K ZX80. The computer prints up a display consisting of black and grey squares in a pattern determined by a number input at the beginning of each series of games. The object of the game is to get the "woodworm" (an asterisk), which first appears at line 8 column 1, to eat its way across the screen to column 32 in the least number of moves. The snag is that the black squares represent a particularly tough kind of wood and each time one is eaten a penalty of 5 moves is incurred. Numerals 6, 7 or 8 are input as pseudo-cursor controls to move the insect down, up, or forwards respectively. The computer keeps track of the number of moves taken to reach column 32 and displays the total at the end of each game together with the best performance in the present series. Pressing NEWLINE after a game sets up another game in the same series. Entering a character starts a new series.

```
 2 LET Y = 32000                    No. of moves — best so far!
 4 INPUT R                          Seed for random number
                                    generator
 8 LET P = 0
10 LET W = 0                        Assign variables prior to PEEK
12 LET B = 1                        and POKE
14 LET A = 8
16 LET Z = -1
18 LET M = 0
20 RANDOMISE R                      Set seed for random number
                                    generator
22 FOR N = 1 TO 352
24 LET D = 9
26 LET X = RND(2)
28 IF X = 1 THEN LET D = 128        Print eleven lines with black and
30 PRINT CHR$(D);                   grey squares at random. Pattern
                                    determined by R.
32 NEXT N
34 GOSUB 500                        Locate display-file
36 POKE W + 232, 20                 Insect in initial position
38 LET Z = Z + 1                    Count No. of moves
40 INPUT C                          Which way?
42 GOSUB 500                        Locate display-file
44 LET M = W + (A-1)*33 + B
46 POKE M, 0                        Put a space where insect is
48 IF C = 6 AND A<11 OR C = 7 AND   Set A and
   A>1 THEN LET A=A-2*C+13          way and make sure we don't
                                    POKE off-screen
50 IF C = 8 THEN LET B = B+1
52 LET M = W + (A-1)*33 + B         Set M to next insect location
                                    address
54 IF PEEK(M) = 128 THEN LET Z=Z+5  If there's a black square in the
                                    way, add penalty
56 POKE M, 20                       Put insect in next location
58 IF B = 32 THEN GOTO 62           Watch for end of game
60 GOTO 38                          Next move
62 IF Z<Y THEN LET Y = Z            Set Y to best so far
64 PRINT "END OF GAME IN ";Z;"
   MOVES"
66 PRINT "BEST SO FAR ";Y;" MOVES"
68 INPUT X$
70 CLS
72 IF X$ = " " THEN GOTO 8          NEWLINE for another game
74 RUN                              Any character for another series
500 LET P = PEEK(16397)
510 IF P>127 THEN LET P = P-256     Subroutine for setting W to
520 LET W = PEEK(16396) + P*256     address of start of display-file
530 RETURN
```

ONE ARMED BANDIT

Mark Harrison

A computerised version of the pub game. Three barrels are rolled on which are marked six symbols. According to the symbols displayed, different payments are awarded.

Winning Positions

COIN	COIN	COIN	66
BELL	BELL	BELL	55
CASTLE	CASTLE	CASTLE	44
LEMON	LEMON	LEMON	33
CHERRY	CHERRY	CHERRY	22
ORANGE	ORANGE	ORANGE	11
COIN	COIN	—	18
—	COIN	COIN	18
BELL	BELL	—	15
—	BELL	BELL	15
CASTLE	CASTLE	—	12
—	CASTLE	CASTLE	12
LEMON	LEMON	—	9
—	LEMON	LEMON	9
CHERRY	CHERRY	—	6
—	CHERRY	CHERRY	6
ORANGE	ORANGE	—	3
—	ORANGE	ORANGE	3
CHERRY	—	—	5

At random intervals, "HOLD" will appear. The player may then choose to hold any of the barrels.

To hold barrel 1 Press "Y" (else "N")
To hold barrel 2 Press "Y" (else "N")
To hold barrel 3 Press "Y" (else "N")

i.e. To hold barrel 1 and barrel 3 Press "YNY" N/L

List Of Variables

A(0) . . . . . Result for barrel one.
A(1) . . . . . Result for barrel two.
A(2) . . . . . Result for barrel two.
C . . . . . Credit.

W$ . . . . . String used for display.
V$ . . . . . String used for display.
H$ . . . . . String used for containing what is to be 'held'.
G$ . . . . . String used to check H$ is legal.
Q$ . . . . . String used to stop program.
I . . . . . Dummy variable.
J . . . . . Dummy variable.

```
10 LET W$ = "                    "
15 LET V$ = "■"
20 LET C = 1000
25 RANDOMISE
30 DIM A(2)
35 LET H$ = "NNN"
40 INPUT Q$
45 IF Q$ = "STOP" THEN STOP
47 LET C = C - 5
50 FOR I = 0 TO 2
55 IF CODE(H$) = 62 THEN GOTO 65
60 LET A(I) = RND(RND(6))
65 LET H$ = TL$(H$)
70 NEXT I
75 IF A(0) = A(1) OR A(1) = A(2) THEN LET
   C = C + 3*A(1)
80 IF A(0) = A(1) AND A(1) = A(2) THEN LET
   C = C + 8*A(1)
85 IF A(0) = 2 AND NOT A(1)2 THEN LET C = C + 5
95 CLS
98 PRINT "ONE ARMED BANDIT    M.R.HARRISON"
100 PRINT "      CREDIT  $";C
105 PRINT
110 PRINT W$
115 FOR I = 0 TO 2
120 PRINT V$
125 IF A(I) = 1 THEN PRINT "(inverse) ORANGE";
130 IF A(I) = 2 THEN PRINT "(inverse) CHERRY";
135 IF A(I) = 3 THEN PRINT "(inverse) LEMON";
140 IF A(I) = 4 THEN PRINT "(inverse) CASTLE";
145 IF A(I) = 5 THEN PRINT "(inverse) BELL";
150 IF A(I) = 6 THEN PRINT "(inverse) COIN";
155 NEXT I
160 PRINT V$,,W$
180 IF RND(5) < 5 THEN GOTO 35
185 PRINT" ■■■ HOLD ■■■ "
195 INPUT H$
200 LET G$ = H$
205 FOR J = 0 TO 2
215 IF NOT ( CODE(G$) = 62 OR CODE(G$) = 51) THEN
    GOTO 195
220 LET G$ = TL$(G$)
225 NEXT J
230 GOTO 47
330 STOP
```

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Trevor Lusty

Old methods solve new problems, unless you've been driven insane!

Let's hope you still have hold of your marbles after last month's problem. The solution which follows is neither the shortest nor the quickest, but it will help you to understand the problem, if you have had difficulties. The problem should transfer easily to other dialects of BASIC providing you have a memory mapped VDU.

Pertinent Questions

When I attempt a problem, I try to resist the temptation of immediately coding the first idea that comes into my head. Here are some of the questions I asked myself before I started:

1) How many orientations of the cube are there?
2) Is the position of the cube in the stack important?
3) How many different positions of the cubes need to be tested?
4) How many distinct ways are there of inserting the first cube?
5) Must we test all the orientations of the other cubes?
6) Should the cubes with fewer orientations be stacked before or after the rest?

Not all these questions were answered before I began work, but they did put me on the right track. I decided on a tree search similar to that used for the Knight's Tour Problem (February 1980). The flowchart (Fig. 1) gives the method for those who missed it!

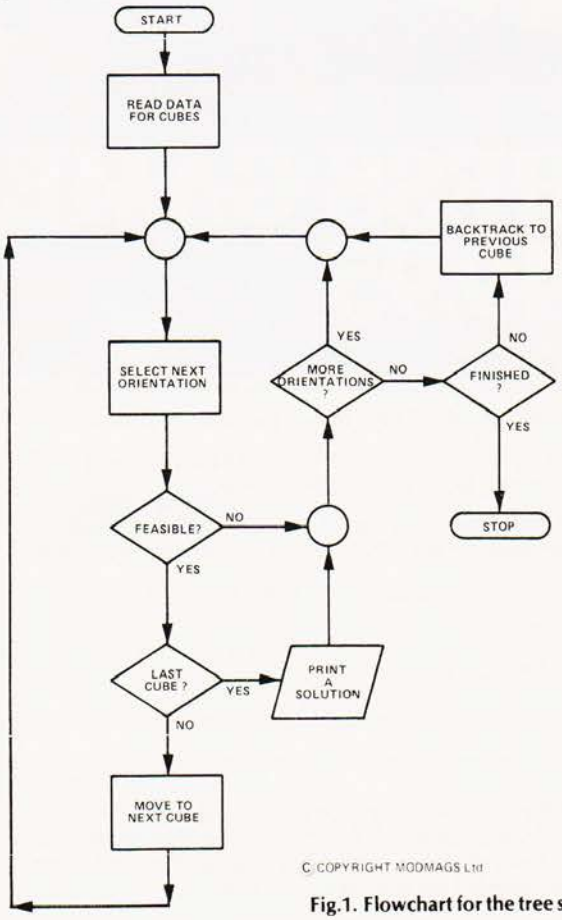

Fig.1. Flowchart for the tree search.

The Program.

As I'm not aiming for speed, I thought "d have something to look at while I was waiting. My first piece of coding merely sets up the screen parameters of SP —the poke number for the top left hand corner of the screen, LL —the number of characters in a screen line, and then draws a cube.

```
100 REM *** INSTANT INSANITY ***
110 REM *** SP=SCREEN POINTER ***
120 REM *** LL=LINE LENGTH ***
130 REM *** SET THEM FOR YOUR ***
140 REM *** OWN SYSTEM. ***
1160 DIM P(24,6),F$(4)
1180 LET SP=32767:LL=40:S=SP
1200 REM *** OUTLINE OF CUBE
1220 PRINT "[CLS][14 CD]"
1240 PRINT"                  /‾‾‾‾‾‾/|  "
1260 PRINT"                 /      / |  "
1280 PRINT"                /      /  |  "
1300 PRINT"               /‾‾‾‾‾‾/   |  "
1320 PRINT"               |‾‾‾‾‾‾|   /  "
1340 PRINT"               | INSTAN |  /   "
1360 PRINT"               | T INS  | /    "
1380 PRINT"               | ANITY. |/     "
1400 PRINT"               |‾‾‾‾‾‾|      "
1420 PRINT"
1440 PRINT"[HOM][8CD]"
```

My next problem was that if I wanted to make the program transportable without losing a static screen I had to find some general way of getting the nets of the cubes onto the screen. The 102 in line 1580 gives a grey square on the PET but you may change it to suit your system.

```
1460 REM *** PRINT BACKGROUND
1480 REM *** FOR THE CUBE NET
1500 FOR K=1 TO 7
1520 LET S=S+LL
1540 READ G$
1560 FOR L=1 TO LEN(G$)
1580 G=32:IF MID$(G$,L,1)="B" THEN G=102
1600 POKE S+L,G
1620 NEXT L:NEXT K
1640 DATA "AABBBAAAAAAAABBBAAAAAAABBBAAAAAAABBBAAAA"
1660 DATA "AABBBAAAAAAAABBBAAAAAAABBBAAAAAAABBBAAAA"
1680 DATA "BBBBBBBBBABBBBBBBBBABBBBBBBBBABBBBBBBBB"
1700 DATA "BBBBBBBBBABBBBBBBBBABBBBBBBBBABBBBBBBBB"
1720 DATA "BBBBBBBBBABBBBBBBBBABBBBBBBBBABBBBBBBBB"
1740 DATA "AABBBAAAAAAAABBBAAAAAAABBBAAAAAAABBBAAAA"
1760 DATA "AABBBAAAAAAAABBBAAAAAAABBBAAAAAAABBBAAAA"
```

Having recently dealt with permutations the next part of the program should pose few problems. Each face of a cube is assigned a number from 1 to 6 and all the different arrangements are stored in array P. Note that there are just four possible positions for each cube once the top face is fixed.

```
1780 REM *** READ CUBE PERMUTATIONS
1800 FOR K=1 TO 24
1820 FOR L=1 TO 6
1840 READ P(K,L)
1860 NEXT L
1880 NEXT K
1900 DATA 1,2,3,4,5,6
1920 DATA 1,2,6,3,4,5
1940 DATA 1,2,5,6,3,4
1960 DATA 1,2,4,5,6,3
1980 DATA 2,1,6,5,4,3
2000 DATA 2,1,3,6,5,4
2020 DATA 2,1,4,3,6,5
2040 DATA 2,1,5,4,3,6
2060 DATA 3,5,1,4,2,6
2080 DATA 3,5,6,1,4,2
2100 DATA 3,5,2,6,1,4
2120 DATA 3,5,4,2,6,1
2140 DATA 4,6,1,3,2,5
2160 DATA 4,6,5,1,3,2
```

```
2180 DATA 4,6,2,5,1,3
2200 DATA 4,6,3,2,5,1
2220 DATA 5,3,6,2,4,1
2240 DATA 5,3,1,6,2,4
2260 DATA 5,3,4,1,6,2
2280 DATA 5,3,2,4,1,6
2300 DATA 6,4,5,2,3,1
2320 DATA 6,4,1,5,2,3
2340 DATA 6,4,3,1,5,2
2360 DATA 6,4,2,3,1,5
```

The final piece of data concerns the colours of the faces, and these are held in the string variable F$. If you wish to experiment with different cubes then you only have to change the data in this part of the program.

```
2380 REM *** COLOURS ON CUBE FACES
2400 FOR L=1 TO 4
2420 READ F$(L)
2440 NEXT L
2460 DATA GGYBBR
2480 DATA YGYGBR
2500 DATA GYYBRR
2520 DATA YBGRRR
```

Once the data is stored we can start building our pile of cubes. Each orientation to be tried is stored in A$ for the first cube, B$ for the second cube, C$ for the third cube and D$ for the final cube. The subroutine calls to 3620, 3960, 4240 and 4460 plot each cube on the screen. Every cube is tested as it is placed on the stack. This ensures that false trails are detected early and saves a considerable amount of computing time.

```
2540 REM *** STEP THROUGH CUBES
2560 FOR C1=1 TO 24 STEP 8
2580 FOR L=1 TO 6: A(L)=P(C1,L): NEXT L
2600 FOR L=1 TO 6
2620 A$(L)=MID$(F$(1),A(L),1)
2640 NEXT L
2660 GOSUB 3620
2680 REM *** CUBE TWO
2700 FOR C2=1 TO 24
2720 FOR L=1 TO 6:B(L)=P(C2, L):NEXT L
2740 FOR L=1 TO 6
2760 B$(L)=MID$(F$(2),B(L),1)
2780 NEXT L
2800 GOSUB 3960
2820 FOR L=3 TO 6
2840 IF A$(L)=B$(L) THEN 3520
2860 NEXT L
2880 REM *** CUBE THREE
2900 FOR C3=1 TO 24
2920 FOR L=1 TO 6: C(L)=P(C3,L): NEXT L
2940 FOR L=1 TO 6
2960 C$(L)=MID$(F$(3),C(L),1)
2980 NEXT L
3000 GOSUB 4240
3020 FOR L=3 TO 6
3040 IF A$(L)=C$(L) THEN 3500
3060 IF B$(L)=C$(L) THEN 3500
3080 NEXT L
3100 REM *** CUBE FOUR
3120 FOR C4=1 TO 24
3140 FOR L=1 TO 6:D(L)=P(C4,L):NEXT L
3160 FOR L=1 TO 6
3180 D$(L)=MID$(F$(4),D(L),1)
3200 NEXT L
3220 GOSUB 4460
3240 REM *** TEST THE LAST CUBE
3260 FOR L=3 TO 6
3280 IF A$(L)=D$(L) THEN 3480
3300 IF B$(L)=D$(L) THEN 3480
3320 IF C$(L)=D$(L) THEN 3480
3340 NEXT L
```

If our stack of cubes passes all the tests, then we can display the results. Line 3460 will stop execution on the PET while the results are checked and the line should be altered if your BASIC does not support the GET statement.

```
3360 REM *** PRINT A SOLUTION
3380 FOR L=3 TO 6:PRINT A$(L);:NEXT L:PRINT
3400 FOR L=3 TO 6:PRINT B$(L);:NEXT L:PRINT
3420 FOR L=3 TO 6:PRINT C$(L);:NEXT L:PRINT
3440 FOR L=3 TO 6:PRINT D$(L);:NEXT L:PRINT
3460 GET Z$:IF Z$<>"C" THEN 3460
3480 NEXT C4
3500 NEXT C3
3520 NEXT C2
3540 NEXT C1
3560 STOP
```

The final part of the program is the subroutine which pokes the nets of the cubes onto the screen. There is a different routine for each cube as the early cubes blank the ones which follow.

```
3580 REM *** POKE THE NETS
3600 REM *** FOR THE CUBES
3620 LET S=SP+2*LL+1
3640 POKE S+3, ASC(A$(1))-64
3660 POKE S+13,32
3680 POKE S+23,32
3700 POKE S+33,32
3720 LET S=S+2*LL
3740 FOR L=3 TO 6:POKE S+2*(L-3)+1,ASC(A$(L))-64: NEXT L
3760 FOR L=3 TO 6:POKE S+2*(L-3)+11,32:NEXT L
3780 FOR L=3 TO 6:POKE S+2*(L-3)+21,32:NEXT L
3800 FOR L=3 TO 6:POKE S+2*(L-3)+31,32:NEXT L
3820 LET S=S+2*LL
3840 POKE S+3, ASC(A$(2))-64
3860 POKE S+13,32
3880 POKE S+23,32
3900 POKE S+33,32
3920 RETURN
3940 REM *** NET 2
3960 LET S=SP+2*LL+1
3980 POKE S+13, ASC(B$(1))-64
4000 POKE S+23,32
4020 POKE S+33,32
4040 LET S=S+2*LL
4060 FOR L=3 TO 6:POKE S+2*(L-3)+11,ASC(B$(L))-64:NEXT L
4080 FOR L=3 TO 6:POKE S+2*(L-3)+21,32:NEXT L
4100 FOR L=3 TO 6:POKE S+2*(L-3)+31,32:NEXT L
4120 LET S=S+2*LL
4140 POKE S+13,ASC(B$(2))-64
4160 POKE S+23,32
4180 POKE S+33,32
4200 RETURN
4220 REM *** NET 3
4240 LET S=SP+2*LL+1
4260 POKE S+23,ASC(C$(1))-64
4280 POKE S+33,32
4300 LET S=S+2*LL
4320 FOR L=3 TO 6:POKE S+2*(L-3)+21,ASC(C$(L))-64:NEXT L
4340 FOR L=3 TO 6:POKE S+2*(L-3)+31,32:NEXT L
4360 LET S=S+2*LL
4380 POKE S+23,ASC(C$(2))-64
4400 POKE S+33,32
4420 RETURN
4440 REM *** NET 4
4460 LET S=SP+2*LL+1
4480 POKE S+33,ASC(D$(1))-64
4500 LET S=S+2*LL
4520 FOR L=3 TO 6:POKE S+2*(L-3)+31,ASC(D$(L))-64:NEXT L
4540 LET S=S+2*LL
4560 POKE S+33,ASC(D$(2))-64
4580 RETURN
```

The Eight Queens Problem

While we are dealing with permutations there is one problem which should not be missed. How should eight queens be placed on a chess board so that no queen is attacking another, ie. no two queens are in a line horizontally, vertically or diagonally?

Assuming you find a solution to the problem, go on to discover all the distinctly different solutions, ie. two solutions are not different if a simple rotation of the board transforms one into the other.

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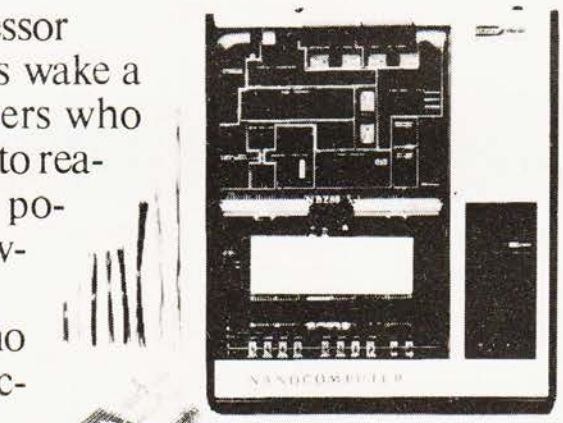

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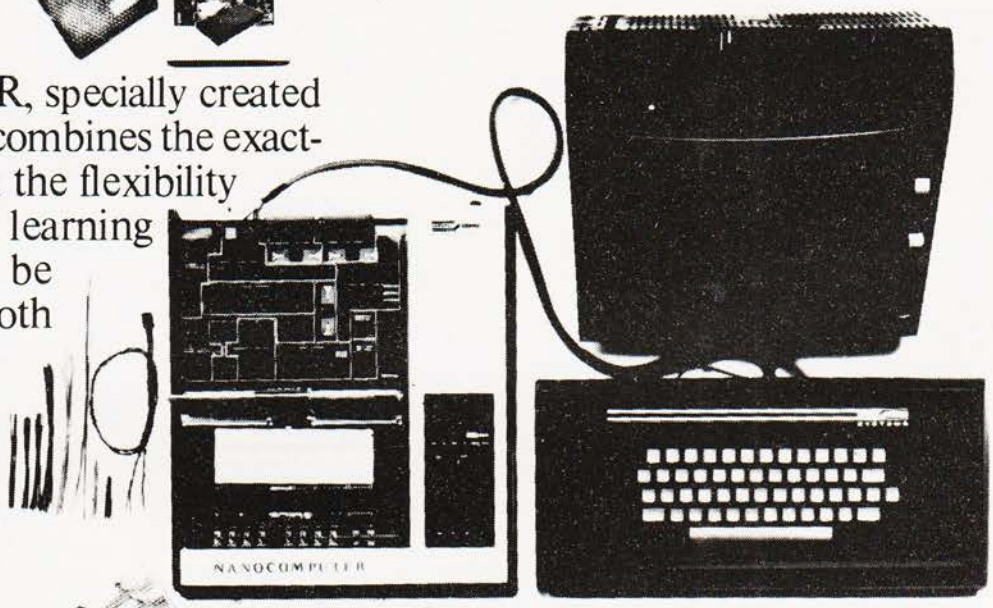

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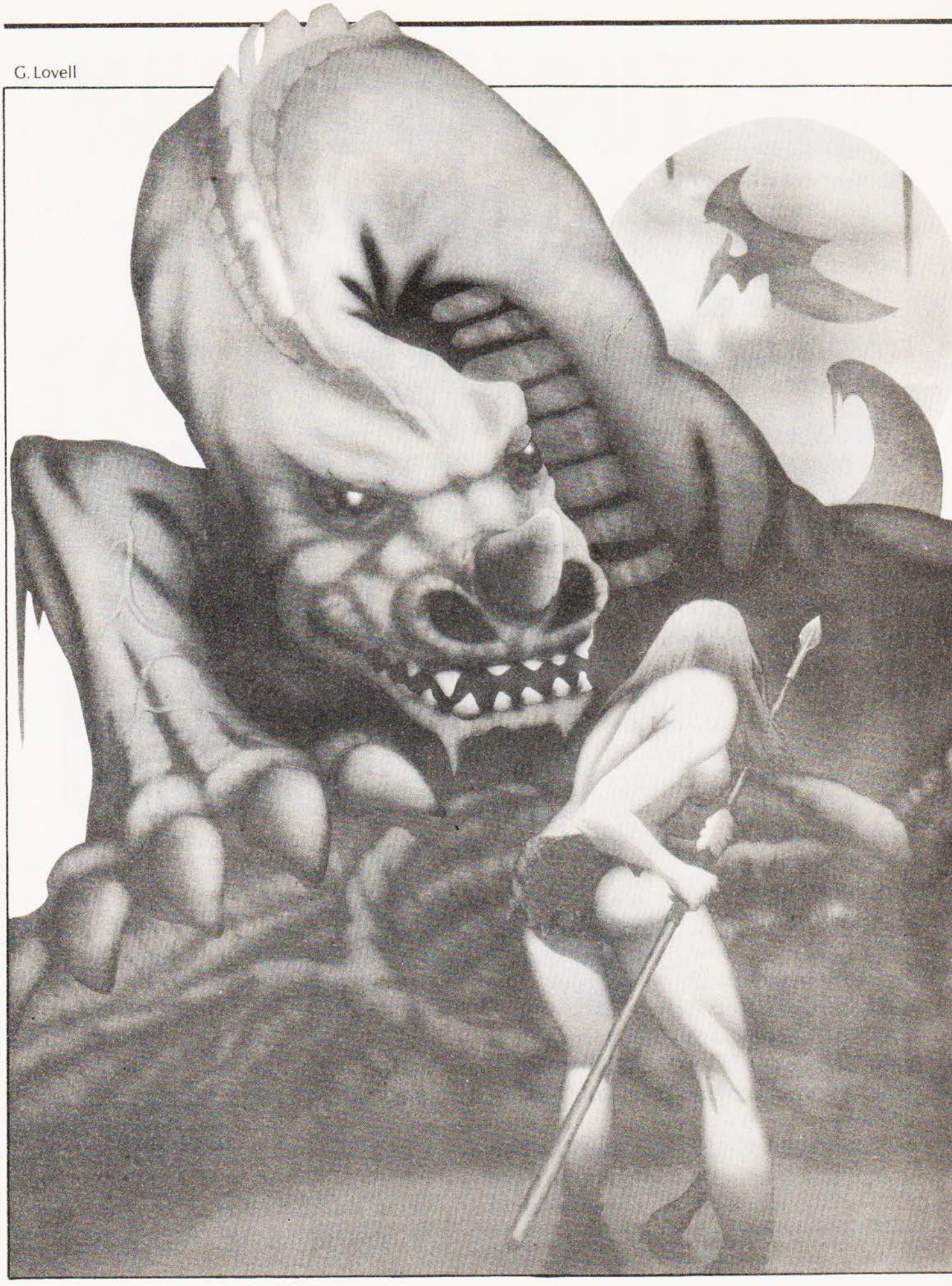
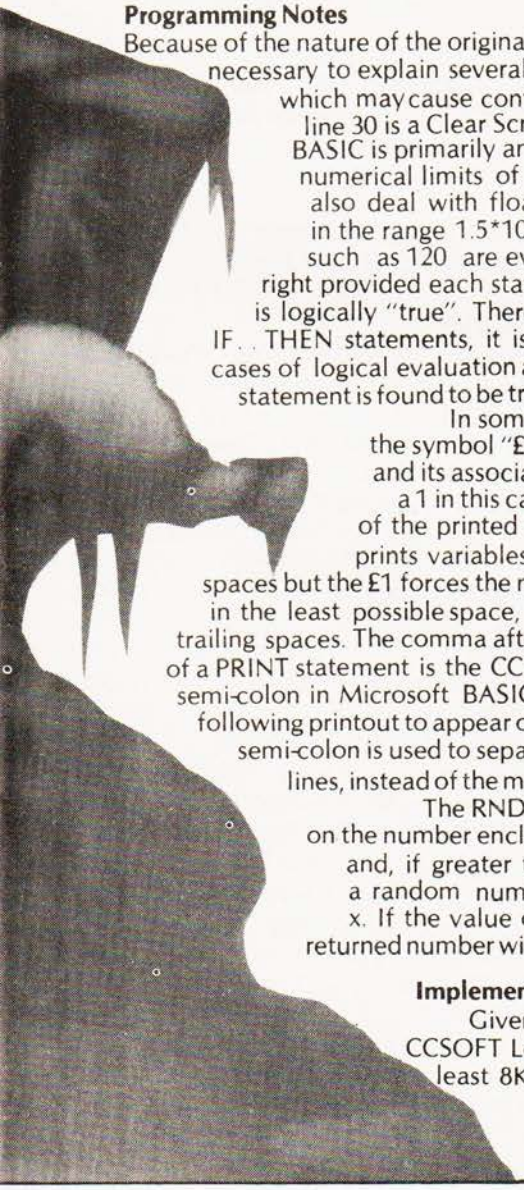


CELLS AND SERPENTS

At last! A role playing Adventure game in 8K! You can enhance it even more if you have the memory.

Up until very recently role playing games of the "Dungeons and Dragons" genre have been outside the scope of microcomputers. This was not caused by any lack of programming ability but simply by the small amounts of memory normally supplied with the systems. However, as the familiarity with the various versions of BASIC grew so it was realised that one could, after all, put a playable game into even 8K of RAM.

This game, which we have called "Cells and Serpents", was originally written to be run using CCSOFT BASIC on a NASCOM system. Because of the nature of the language implementation it has been possible to fit in rather more than expected. On systems with a more powerful BASIC the program will probably take more memory space.



Programming Notes

Because of the nature of the original CCSOFT BASIC it is necessary to explain several points in the listing which may cause confusion. The CLEAR in line 30 is a Clear Screen command. The BASIC is primarily an integer version with numerical limits of ±32767 but it can also deal with floating point numbers in the range $1.5*10^{-39}$ to $1.5*10^{38}$. Lines such as 120 are evaluated from left to right provided each statement encountered is logically "true". There is no THEN in the IF..THEN statements, it is always implied. In cases of logical evaluation a "1" is returned if the statement is found to be true, a "0" if not.

In some PRINT statements the symbol "£" will be found. This, and its associated number (usually a 1 in this case) define the field of the printed number. The BASIC prints variables with a field of eight spaces but the £1 forces the number to be printed in the least possible space, ie with no leading or trailing spaces. The comma after the closing quotes of a PRINT statement is the CCSOFT version of the semi-colon in Microsoft BASIC in that it causes any following printout to appear on the same line. The semi-colon is used to separate multi-statement lines, instead of the more usual colon.

The RND(x) function operates on the number enclosed in the brackets and, if greater than zero, produces a random number between 1 and x. If the value of x is zero then the returned number will be between 0 and 1.

Implementation On NASCOM

Given that you have the CCSOFT Level C BASIC and at least 8K of RAM you must first load 3000H into locations 0CC9H and 0CCAH. The Interpreter can now be executed from F033H. The program, assuming it has been loaded, will now RUN. If you have no more than 8K it is probably advisable to remove the REM statements.

Operating Instructions

After the initial RUN has been typed the program will, after a short delay, display the area around your current position. The prompt "Which direction" is given and you may proceed. The player may obtain a Status Report at any prompt stage other than when "Combat..Spell..Help" is displayed. This Status Report also forms the basis of the final game score when you quit the game, usually by getting killed! The points total is calculated by the formula:- No. of Monsters killed* Level +(Treasure/100)

Getting Back

Because of the space restrictions you can only progress "forwards" through the Cells, you cannot retrace your steps. The actual cell layout is almost infinite, those with more memory at their disposal can adjust the program to give either more monsters or more movement.

If you bomb-out of the program, there are no trap routines because of the space restriction imposed, you can re-enter by typing GOTO 100. Although you will not regain the exact same place in the cell structure, you will retain all your current stock of coins and spells etc.

As a spur to your playing the author's current highest score is 11719.86 points.

Variable Allocation

The only possible sources of confusion within the listing are the array designated by the @ symbol and the variable O. Variable O appears in lines 1790 and 1830 *only* and can be altered to suit your preference if required.

The CCSOFT BASIC only allows for a single array and this may have as much storage space as is left when the program has been entered. Each location within the array takes four bytes, so users of other systems will probably need to DIM whichever array they have chosen, A(x) is as good as any!

Program Listing

```
 10 DATA 36,100,5,9,100,6,10,100,6,6,4,4,100,5
 20 L1=1;G1=0;H1=100;M1=0;J1=0;S1=10;T=0;
    D1=1
 30 CLEAR
100 GOSUB 1010
110 GOSUB 19010
120 IF @(1)=3 IF @(2)=3 IF @(3)=3 GOTO 210
130 GOSUB 1710
140 IF RND(12)=1 GOSUB 19010;PRINT"A(n) ",;
    GOSUB 20010;PRINT" arrives";R1=2;GOSUB
    2300
150 V1=0
160 GOTO 100
200 REM**PIT
210 H=RND(12)
220 PRINT"You fell down a ",£1,H*10,"foot pit"
230 PRINT"you took ",;D1=RND(6)*H;PRINT
    £1,D1,"hp's damage",
240 IF RND(6)=1 GOTO 260
250 H1=H1-D1;L1=L1+1;GOSUB 1310:GOTO 100
260 PRINT"At the bottom there is ",;H1=H1-D1
```

```
270 R=RND(3)
280 IF R=1 PRINT"a pool of acid, you take ",;D1=
    RND(8);PRINT £1,D1,"hp's of damage";GOTO
    250
290 IF R=2 PRINT"some spikes, ",;R=RND(8);PRINT
    £1,R,"of which you hit doing ",;D1=R*RND(4);
    PRINT £1,D1,"hp's of damage";GOTO 250
300 PRINT"a(n) ",;GOSUB 19010;GOSUB 20010;
    PRINT;PRINT;L1=L1+1;GOSUB 2810;GOTO 100
1000 REM**CREATE AREA AROUND CENTRE
1010 FOR D1=1 TO 3
1020 A1=RND(7)
1030 R=RND(100)
1040 IF A1<5 @(D1)=A1
1050 IF A1=5 IF R<10 @(D1)=A1;GOTO 1095
1060 IF A1=6 IF R<25 @(D1)=A1;GOTO 1095
1070 IF A1=7 IF R=1 @(D1)=A1;GOTO 1095
1080 IF A1>4 A1=RND(4);@(D1)=A1
1090 REM**NO GO HERE
1095 NEXT D1
1100 FOR D1=1 TO 3
1110 IF @(D1)=2 GOSUB 1200
1120 IF @(D1)=4 GOSUB 1200
1130 NEXT D1
1140 RETURN
1200 @(D1+3)=RND(4)
1210 IF @(D1+3)=1 RETURN
1220 IF @(D1+3)=4 RETURN
1230 GOSUB 19010
1240 FOR X=1 TO 14
1250 @((30*D1=1))+(45*(D1=2))+(60*(D1=3))
    +X-1)=@(9+X)
1260 NEXT X
1270 RETURN
1300 REM**STATUS
1310 PRINT;PRINT"Your hit points stand at: ",£1,H1
1320 PRINT"You have ",£1,S1,"spells"
1330 PRINT"You are on level : ",£1,L1
1340 PRINT"You have ",£1,G1,"gold pieces"
1350 PRINT"and you have killed ",£1,M1,"monsters!!"
1355 IF J1=0 RETURN
1360 PRINT"You also have a ",£1,J1*25,"% luckstone"
1370 RETURN
1400 REM**DEPICT OPTIONS
1410 PRINT;PRINT" [6 SPC ] LEFT [9 SPC ]
    FORWARDS [9 SPC ] RIGHT"
1420 FOR D1=1 TO 3
1430 PRINT" [2 SPC ]",
1440 IF @(D1)=1 PRINT"    Corridor    ",
1450 IF @(D1)=2 PRINT"     Door       ",
1460 IF @(D1)=3 PRINT"   Blank wall   ",
1470 IF @(D1)=4 PRINT"Room entrance",
1480 IF @(D1)=5 PRINT"    Stairs up   ",
1490 IF @(D1)=6 PRINT"  Stairs down   ",
1500 IF @(D1)=7 PRINT"      Exit      ",
1510 NEXT D1
1520 RETURN;RETURN
1700 REM** OPERATE CELL
1710 PRINT"What direction ",
1720 L=1;F=2;R=3;S=4
1730 INPUT"L,F or R"D1
1735 IF D1=S GOSUB 1310;GOTO 1710
1740 IF D1>0 IF D1<4 GOTO 1760
1750 GOTO 1730
1760 IF @(D1+3)<>2 IF @(D1+3)<>3 GOTO 1765
1761 FOR X=1 TO 14
1762 @(9+X)=@((30*(D1=1))+(45*(D1=2))+(60*
    (D1=3))+X-1)
1763 NEXT X
1765 ON @(D1) GOTO 1770,1780,2070,2150,2370,2460,
    2480
1770 RETURN
1780 PRINT"Door...O-Open, L-Listen"
1790 O=1;L=2;S=3
1800 INPUT"?"A
1805 IF A=S GOSUB 1310;GOTO 1780
1810 IF A>0 IF A<3 GOTO 1830
1820 GOTO 1800
1830 IF A=O GOTO 2150
1840 IF A=L R1=@(D1+3)
1900 PRINT"You hear ",
1910 IF R1<>2 IF R1<>3 PRINT"nothing";GOTO
    1980
1920 R=RND(6)
1930 IF R>2 PRINT"nothing";GOTO 1980
1970 GOSUB 20010;PRINT" 's making noises"
1980 PRINT"Do you want to open it",
2000 Y=1;N=2;S=3
2010 INPUT"?"A
2020 IF A=S GOSUB 1310;GOTO 1980
2030 IF A>0 IF A<3 GOTO 2050
2040 GOTO 2010
2050 IF A=Y GOTO 2160
2060 PRINT" ...Chicken";GOSUB 1410;GOTO 1710
2070 PRINT"You can't move there dummy"
2080 IF RND(6)>1 GOSUB 1410;GOTO 1710
2090 PRINT"but as you have a liking for walls.... ",
2100 FOR X=1 TO 500;NEXT X
2110 PRINT"it falls over, you take ",;D1=RND(20)
2120 PRINT £1,D1,"hp's damage"
2130 H1=H1-D1
2140 GOSUB 1410;GOTO 1710
2150 R1=@(D1+3)
2160 PRINT"The room ",
2170 IF R1=1 PRINT"is empty";RETURN
2180 PRINT"contains ",
2185 IF R1=2 PRINT"a(n) ",;GOSUB 20010
2190 IF R1=3 PRINT"treasure + a(n) ",;GOSUB 20010
2200 IF R1=4 PRINT"treasure";T1=500;T=0
2210 PRINT;PRINT"What now ",
2220 G=1;L=2;H=3;S=4
2230 INPUT"G-Go in,L-Leave,H-Help"A
2240 IF A=S GOSUB 1310;GOTO 2220
2250 IF A>0 IF A<4 GOTO 2270
2260 GOTO 2230
2270 IF A=L GOTO 2060
2280 IF A=H IF R1<4 PRINT"The ",;GOSUB 20010;
    PRINT" has ",£1,D1," hp's";GOTO 2230
2290 IF R1=4 GOTO 18005
2300 PRINT;PRINT"Now what?"
```

```
2310 C=1;S=2;R=3
2320 INPUT"C – Combat,S – Spell cast,R – Retreat"A
2330 IF A=R GOTO 2361
2340 IF A=C GOTO 2800
2350 IF A=S GOTO 2600
2360 GOTO 2320
2361 IF RND(6)=1 PRINT"TOUGH LUCK. He attacks
     you";GOTO 2810
2362 GOTO 2060
2370 L1=L1–1
2380 IF L1<=0 PRINT"Sorry";L1=L1+1;RETURN
2390 RETURN
2460 L1=L1+1;RETURN
2470 REM**EXIT
2480 PRINT"Well done, you got out alive"
2490 GOSUB 1310
2500 PRINT"You scored ",£1,M1*L1+(G/100),
     "points"
2510 STOP
2600 REM**CAST SPELL
2610 IF S1<1 PRINT"Er. . you don't seem to have
     any";GOTO 2310
2620 S1=S1–1
2630 PRINT"The now spell-blasted ",;GOSUB 20010
2690 H=RND(21)
2650 IF V1<>0 D1=V1
2660 D1=D1–H
2670 IF D1<1 PRINT" lies dead on the floor";M1=
     M1+1;GOTO 18010
2680 IF D1>0 PRINT" is angry, he advances",
2690 IF RND(6)<3 PRINT" . .he attacks";GOTO 2810
2700 V1=D1;GOTO 2300
2800 REM**COMBAT
2810 PRINT"You had a terrific battle with the ",;
     GOSUB 20010
2820 IF V1<>0 D1=V1
2830 IF H1>D1 PRINT" and you killed him";M1=
     M1+1;H1=H1–D1;GOTO 18010
2840 PRINT" but he killed you and took all your
     treasure";G1=0;H1=H1–D1;GOTO 2490
18000 REM**TREASURE
18005 IF T1=0 PRINT"It was an illusion";RETURN
18010 IF R1=2 RETURN
18020 PRINT"There is: ",
18030 R=RND(0)*T1
18040 IF J1>0 R=R+(((25*J1)/100)*R)
18045 IF R>32767 R=R+1E10–1E10
18046 IF R<32767 R=INT(R)
18050 PRINT R,"gold pieces"
18060 IF T=0 IF RND(100)<15 GOTO 18090
18070 IF T=0 RETURN
18080 FOR X=1 TO T
18090 R=RND(10)
18100 IF R=1 PRINT" + a sword";H1=H1+RND(120)
18110 IF R=2 PRINT" + a wand";S1=S1+RND(15)
18120 IF R=3 PRINT" + a suit of armour";H1=H1+
      RND(90)
18130 IF R=4 PRINT" + a scroll";S1=S1+RND(12)
18140 IF R=5 PRINT" + some more spells";S1=S1+
      RND(8)
18150 IF R=6 PRINT" + a potion";H1=H1+RND(75)
18160 IF R=7 PRINT" + a special artefact";H1=H1+
      RND(100);S1=S1+RND(12)
18170 IF R=8 PRINT" + a book";GOSUB 18300
18180 IF R=9 PRINT" + a ring";GOSUB 18300
18190 IF R=10 PRINT" + a ",;Z=RND(6)/2;PRINT
      £1,Z*25,"% luckstone"
18200 IF R=10 IF J1<Z J1=Z
18210 IF RND(10)=1 GOTO 18090
18220 IF T<>0 NEXT X
18230 RETURN
18300 IF RND(2)+1 H1=H1+RND(80);RETURN
18310 S1=S1+RND(10);RETURN
19000 REM**CREATE MONSTER
19010 RESTORE
19020 FOR Z=1 TO 14
19030 READ D;@(9+Z)=RND(D)
19040 NEXT Z
19050 RETURN
20000 REM**PRINT MONSTER
20010 R=@(10)
20020 P=@(11);T=0
20030 IF R=1 PRINT"Wraith",;D1=10;T1=8000;
      RETURN
20040 IF R=2 PRINT"Vampire",;D1=20;T1;=10000;
      RETURN
20050 IF R=3 IF P<65 GOSUB 25010 ;PRINT "Serpent"
      ;RETURN
20060 IF R=4 IF P<65 GOSUB 26010;RETURN
20070 IF R=5 IF P<65 GOSUB 27010;RETURN
20080 IF R=6 PRINT"Troll",;D1=16;T1=6000;RETURN
20090 IF R=7 PRINT"Kobold",;D1=1;T1=300;RETURN
20100 IF R=8 PRINT"Ghost",;D1=32;T1=8000;T=1;
      RETURN
20110 IF R=9 GOSUB 28010;PRINT"Giant",;RETURN
20120 IF R=10 PRINT"Hydra",;D1=50;T1=4000;
      RETURN
20130 IF R=11 IF P<65 PRINT"Intellect devourer",;
      D1=20;T1=6000;RETURN
20140 IF R=12 PRINT"Salamander",;D1=20;T1=9000;
      T=2;RETURN
20150 IF R=13 PRINT"Zombie",;D1=8;T1=0;RETURN
20160 IF R=14 PRINT"Aerial servant",;D1=40;T1=0;
      RETURN
20170 IF R=15 PRINT"Basilisk",;D1=10;T1=6000;
      T=1;RETURN
20180 IF R=16 PRINT"Beholder",;D1=42;T1=15000;
      T=3;RETURN
20190 IF R=17 IF P<65 GOSUB 29010;PRINT"
      Elemental",;T1=0;RETURN
20200 IF R=18 PRINT"Ettin",;D1=39;T1=12000;
      RETURN
20210 IF R=19 PRINT"Gargoyle",;D1=10;T1=1000;
      RETURN
20200 IF R=18 PRINT"Ettin",;D1=34;T1=12000;
      RETURN
20230 IF R=21 IF P<65 GOSUB 30010;PRINT"Golem",;
      T1=0;RETURN
20240 IF R=22 PRINT"Hell hound",;D1=12;T1=1000;
      RETURN
```

CELLS AND SERPENTS

```
20250 IF R=23 IF P<65 GOSUB 31010;RETURN
20260 IF R=24 PRINT"Were-",;GOSUB 32010;RETURN
20270 IF R=25 PRINT"Manticore",;D1=48;T1=8000;
      T=1; RETURN
20280 IF R=26 PRINT"Medusa",;D1=15;T1=12000;
      T=1;RETURN
20290 IF R=27 IF P<65 PRINT"Mind flayer",;D1=48;
      T1=4000;T=2;RETURN
20300 IF R=28 PRINT"Minotaur",;D1=10;T1=5000;
      RETURN
20310 IF R=29 PRINT"Mummy",;D1=12;T1=5000;
      RETURN
20320 IF R=30 PRINT"Orc",;D1=2;T1=500;RETURN
20330 IF R=31 PRINT"Purple worm",;D1=56;
      T1=9000;T=2;RETURN
20340 IF R=32 IF P<65 PRINT"Umber hulk",;D1=34;
      T1=40000;T=2;RETURN
20350 IF R=33 PRINT"Wight",;D1=8;T1=8000;
      RETURN
20360 IF R=34 IF P<65 PRINT"Xorn",;D1=34;T1=
      40000;T=2;RETURN
20370 PRINT"Hobgoblin",;D1=6;T1=1000;RETURN
25000 REM**SERPENTS
25010 R=@(12)
25020 IF R=1 PRINT"Black ",;D1=50;T1=60000;T=2;
      RETURN
25030 IF R=2 PRINT"White ",;D1=40;T1=50000;T=1;
      RETURN
25040 IF R=3 PRINT"Blue ",;D1=60;T1=70000;T=2;
      RETURN
25050 IF R=4 PRINT"Green ",;D1=70;T1=80000;T=3;
      RETURN
25060 PRINT"Red ",;D1=80;T1=90000;T=4;RETURN
26000 REM**DEMONS
26010 R=@(13)
26020 P=@(19)
26030 IF R=1 IF P<5 PRINT"Demogorgon",;D1=95;
      T1=100000;T=6;RETURN
26040 IF R=2 IF P<5 PRINT"Jubilex",;D1=80;T1=
      80000;T=2;RETURN
26050 IF R=3 IF P<5 PRINT"Orcus",;D1=105;T1=
      150000;T=7; RETURN
26060 PRINT"Type ",
26070 IF R=4 PRINT"VI",;D1=60;T1=60000;T=3;
      RETURN
26080 IF R=5 PRINT"V",;D1=50;T1=50000;T=2;
      RETURN
26090 IF R=6 PRINT"IV",;D1=40;T1=40000;T=1;
      RETURN
26100 IF R=7 PRINT"III",;D1=30;T1=30000;RETURN
26110 IF R=8 PRINT"II",;D1=20;T1=20000;RETURN
26120 IF R=9 PRINT"I",;D1=10;T1=10000;RETURN
16130 IF R<=3 R=@(15)+3;GOTO 26070
26140 PRINT" DEMON",;RETURN
27000 REM**DEVILS
27010 R=@(16)
27020 P=@(17)
27030 IF R=1 IF P<5 ;PRINT"Asmodeus",;D1=110;
      T1=170000;RETURN
27040 IF R=2 IF P<5 PRINT"Baalzebul",;D1=80; T1=
      80000;T=5;RETURN
27050 IF R=3 IF P<5 PRINT"Dispater",;D1=70; T1=
      60000;T=3;RETURN
27060 IF R=4 IF P<5 PRINT"Geryon",;D1=50; T1=
      40000;T=2;RETURN
27070 IF R=5 PRINT"Barbed Devil",;D1=32;T1=0;
      RETURN
27080 IF R=6 PRINT"Bone Devil",;D1=35;T1=0;
      RETURN
27090 IF R=7 PRINT"Erinyes",;D1=16;T1=40000;
      RETURN
27100 IF R=8 PRINT"Horned Devil",;D1=35;T1=5000;
      RETURN
27110 IF R=9 PRINT"Ice Devil",;D1=60;T1=10000;
      T=3;RETURN
27120 IF R=10 PRINT"Pit fiend",;D1=65;T1=12000;
      T=4;RETURN
27130 R=@(18)+4;GOTO 27070
28000 REM**GIANT
28010 R=@(19)
28020 IF R=1 PRINT"Cloud ",;D1=36;T1=9000;
      RETURN
28030 IF R=2 PRINT"Fine ",;D1=30;T1=8000;
      RETURN
28040 IF R=3 PRINT"Frost ",;D1=24;T1=8000;
      RETURN
28050 IF R=4 PRINT"Hill ",;D1=16;T1=3000;RETURN
28060 IF R=5 PRINT"Stone ",;D1=18;T1=4000;
      RETURN
28070 PRINT"Storm ",;D1=42;T1=10000;T=1;
      RETURN
29000 REM**ELEMENTALS
29010 R=@(20)
29020 IF R=1 PRINT"Air ",;D1=90;RETURN
29030 IF R=2 PRINT"Earth",;D1=65;RETURN
29040 IF R=3 PRINT"Fire ",;D1=48;RETURN
29050 PRINT"Water ",;D1=60;RETURN
30000 REM**GOLEMS
30010 R=@(21)
30020 IF R=1 PRINT"Clay ",;D1=30;RETURN
30030 IF R=2 PRINT"Flesh ",;D1=32;RETURN
30040 IF R=3 PRINT"Iron ",;D1=90;RETURN
30050 PRINT"Stone ",;D1=24;RETURN
31000 REM**LICH
31010 D=@(22)
31020 IF D>6 PRINT"Hobgoblin",;D1=6;T1=1000;
      RETURN
31030 PRINT"Lich",;D1=90;T1=85000;T=5;RETURN
32000 REM**LYCANTHOPES (Were-creatures)
32010 R=@(23)
32020 IF R=1 PRINT"bear",;D1=10;T1=2500;RETURN
32030 IF R=2 PRINT"boar",;D1=12;T1=3000;RETURN
32040 IF R=3 PRINT"rat",;D1=8;T1=2000;RETURN
32050 IF R=4 PRINT"tiger",;D1=20;T1=5000;
      RETURN
32060 PRINT"wolf",;D1=8;T1=2000,RETURN
99999 END
```

Leave out all REMs if you have less than 8K of RAM. Our thanks are due to CCSOFT for unscrambling the program and helpful advice.

interface components

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The Nascom 2 kit is supplied complete with construction article and extensive software manual for the monitor and BASIC.

EXPANSION OPTIONS
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16K RAM B Board £140 + VAT
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Nascom-1 Kit Price
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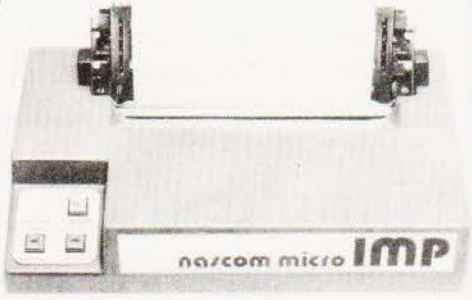

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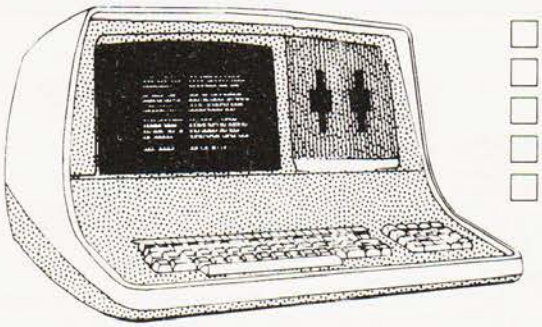

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S Moppett

The best of the bunch in our quest for a high-level language version of May's feature article.

This version of Anthony Fleet's Stockmarket simulation was written in Extended BASIC on a Research Machines 380Z. It should be adaptable to many other machines and requires between 7 and 8K of memory. Those with Tiny and Integer versions of the language will probably need to make more alterations and it is hoped that the following notes will assist. For those who are unfortunate enough to own less than 8K you can save space by removing options E and F along with some of the obvious frills, while still keeping the main object of the game intact. Only one of the original options has been altered but two new ones have been added.

Dealing

When you wish to deal in shares 'D' should be pressed giving access to the following table:-

CO	The Company name
CODE	The Company code (i.e. its first letter)
PRICE	The price per share (followed by '(S)' if suspended)
MAX NO	The maximum number of shares that can be bought is limited by either the amount of money or the maximum share issue. This is replaced by a dash if the company has been suspended.
HELD	This is the number held by you.

After displaying the table the Company Code is asked for. If you have changed your mind about dealing or cannot buy or sell then press 'E'. Once a correct code is input the number of shares is asked for. If you wish to buy then press 'B' or if you wish to sell press 'S'. The input is then thoroughly checked for potential errors.

The Current Situation

To view the current state of share prices and the current balance of what you hold you can key 'E'. The information is presented in the form of two tables.
The first gives the share information in the format below:

CO	The Company name
O PRICE	The original or starting price
P PRICE	The present price
DIFF	The difference between the two
HIGH	The highest price this run
LOW	The lowest price this run

The second table gives the details of your current position as follows:

CO	The company name
HELD	The number of shares held
P PAID	The total price paid for those shares
VALUE	The value of those shares at the current price
PROFIT	The profit made on those shares excluding income dividends. This value can be negative if a loss has been incurred.

The total profit to date on all your shares is also given at the end of these tables.

Share Price Information

Access to more specific information on shares is available through 'F' option. This gives information in the following tabular format.

P PRICE	The present price per share
FLOOR	If the price falls below this limit the company will go bankrupt
DIFF	The difference between the two
CEIL	If the price of the share exceeds this limit the company will pay a bonus of 25% of the current price per share held for a maximum of five issues of 'Market News'. The actual number of payments is randomly determined.
DIFF	The difference between CEIL and the present market price

Game Options

At the command stage of the game turn, the following options are available to the player.

A	Market news
B	A printout of the current bank balance including all shares held
C	Game conceded, all shares added up and total bank balance given
D	Share dealing
E	The current situation printout
F	The share price printout

Arrays And Variables

To assist those who are trying to break the program down into the various logical units in order to implement it on another system the following information may be useful.

N$	Company name
FF	The floor price
OP	The starting price
CC	The ceiling price
M	The maximum share issue
P	The present price
L	The lowest price
F	Flag, 1 if share is suspended
CD	The number of times a dividend has been paid
S	The number of shares held
Q	The price paid
BB	The bank balance
BR	The bank rate

Program Notes

The following is a breakdown of the complete program showing what function each segment is performing.

180	Clears space for string variables, might not be necessary on some machines. RANDOMISE selects a new seed for the random number generator.
200-260	Pre-defines certain functions. Users without this facility will have to write the function out in full

each time it appears in the listing.

200 Note that the 'greater than' sign returns a flag of −1 if true and 0 if not true. Because of the ABS function the number will return as '1' or '0'.

220 Returns a random number between 1 and X.

230 Computes the new share price.

240 Returns the length of a variable.

250 Rounds off a number to two decimal places.

260 Returns the number if positive and 0 if negative.

270-300 The share data.

310-330 Data set into the various arrays, variables defined.

410 The USR function calls a routine written in machine code that has been created by lines 2550 to 2650. This routine inputs a character from the keyboard and returns its ASCII code. On machines using Microsoft BASIC you could replace with the GET function;

```
410 GET A$:IF A$=" " THEN 410
415 F=ASC(A$)-64
```

Alternate BASICs such as the TRS-80 could use INKEY$ or you could simply use INPUT. The ASC function returns the ASCII code of the first character input.

440 If F=1 control jumps to 470, if F=2 it goes to 450 etc., you could replace with separate IF . . THENs.

490 PRINT CHR$(12) clears the screen and should be replaced by the suitable statement for your machine.

1160 Treat as line 400

1630 Treat as line 400

2530 Routine to get a 'Yes' or 'No' reply. Could be changed to a GET or INKEY$ or INPUT routine to suit your system.

2550 Start of the machine code routine. See the notes for line 410 for implementation on other machines. This segment *must* be removed if you are not using an RML 380Z. Owners of the 380Z with BASIC in ROM or outside the locations 4200H to 63FAH (16896-25594) should consult their manual.

2660 PRINT CHR$(19) stops the screen display of an RML 380Z from scrolling. Most machines don't have this facility.

Program Listing

```
100 REM ****************************************
110 REM ***                                    ***
120 REM ***    STOCKMARKET SIMULATION          ***
130 REM ***          S. MOPPETT                ***
140 REM ***    BASED ON A PROGRAM BY           ***
150 REM ***         ANTHONY FLEET              ***
160 REM ***                                    ***
170 REM ****************************************
180 CLEAR 1000:RANDOMIZE
190 GOSUB 2660:GOSUB 2550
200 DEF FNT(X)=ABS(RND(1)>X)
210 DEF FNS(X)=FNT(0.75)
220 DEF FNR(X)=INT(RND(1)*X+1)
230 DEF FNN(X)=INT((FNR(9)+1)-(0.4*X))
240 DEF FNL(X)=LEN(STR$(X))
250 DEF FNB(X)=INT(X*100+0.5)/100
260 DEF FNA(X)=INT((SGN(X)+1)/2)*X
270 DATA GOLD, 125, 1250, 6000, 500
280 DATA TIN, 25, 250, 750, 1000
290 DATA ZINC, 5, 50, 150, 1500
300 DATA LEAD, 1, 10, 25, 2000
310 FOR X=1 TO 4:READ N$(X),FF(X),OP(X),CC(X),
    M(X)
320 P(X)=OP(X):H(X)=P(X):L(X)=P(X):NEXT X
330 BB=1000:BR=20:GOTO 470
340 REM *** OPTION ***
350 GOSUB 2800
360 REM
370 IF TT+BB<2*P(4) THEN 1120
380 PRINT "=========":PRINT
390 PRINT "CHOOSE OPTION":PRINT
400 PRINT "A/B/C/D/E/F ?";
410 F=USR(0)-64
420 IF F<1 OR F>6 THEN 410
430 PRINT CHR$(F+64):TF=1
440 ON F GOTO 470,450,2070,1270,2250,2700
450 PRINT CHR$(12):GOSUB 2420
460 PRINT:PRINT:GOTO 340
470 REM***A****
480 REM***MARKET NEWS****
490 IF TF=1 THEN PRINT CHR$(12)
500 PRINT "MARKET NEWS"
510 PRINT "==========":PRINT
520 FOR X=1 TO 4:F(X)=0:PRINT X;" ";N$(X);
    TAB(10);
530 IF CD(X)=5 THEN 740
540 IF P(X)>CC(X) THEN 690
550 IF P(X)<CC(X) THEN CD(X)=0
560 IF FNS(0)=1 THEN 770
570 IF FNS(0)=1 THEN 660
580 IF P(X)>OP(X) THEN A=-1 ELSE A=1
590 IF FNS(0)=1 THEN A=A*-1
600 A=FNN(P(X))*A
610 IF A=0 THEN 660
620 PRINT ABS(A);TAB(15);
630 IF A<0 THEN PRINT "DOWN" ELSE PRINT
    "UP"
640 P(X)=P(X)+A
650 GOTO 670
660 PRINT:PRINT "HOLD";
670 PRINT TAB(10);P(X):PRINT
680 GOTO 930
690 IF FNR(10)=1 THEN 740 ELSE PRINT P(X)
700 PRINT "DIVIDEND OF 25% PAID ON ";
710 A1=S(X)*P(X):PRINT A1:A=FNB(A1*0.25)
720 PRINT A:BB=BB+A:CD(X)=CD(X)+1
730 GOTO 930
740 A=FNN(P(X))*1
750 CD(X)=0
760 GOTO 620
770 REM **** NEWSFLASH ****
780 PRINT:PRINT "NEWSFLASH"
790 IF FNR(9)>6 THEN 840
800 IF FNR(9)>2 THEN 910
810 PRINT "BANKRUPT"
820 S(X)=0:P(X)=OP(X):Q(X)=0
830 GOTO 920
```

```
840 PRINT "TAKEOVER"
850 IF FNR(9) = 1 THEN 910
860 S = FNR(151) + 99
870 PRINT "SELL AT";S;" % OF ";P(X)
880 BB = BB + (P(X)*(S/100)*S(X))
890 S(X) = 0:P(X) = OP(X):Q(X) = 0
900 GOTO 920
910 PRINT "SUSPENDED"
920 F(X) = 1
930 PRINT:IF P(X) < FF(X) THEN 810
940 IF P(X) > H(X) THEN H(X) = P(X)
950 IF P(X) < L(X) THEN L(X) = P(X)
960 IF S(X) = 0 THEN Q(X) = 0
970 NEXT X
980 PRINT:PRINT"BANK":PRINT TAB(10);
990 IF FNS(0) = 1 THEN 1040 ELSE A = 0
1000 IF FNS(0) = 1 THEN 1020
1010 A = FNR(11) - 6
1020 BR = FNA(BR + A):T = BR:TF = 1
1030 GOSUB 1880:GOTO 1140
1040 PRINT:PRINT"NEWSFLASH"
1050 IF FNR(9) = 1 THEN 1080
1060 PRINT"SUSPENDED":BF = 0
1070 GOTO 1140
1080 PRINT"FAILS"
1090 BB = 0:A = 0:BF = 0
1100 GOSUB 2800
1110 IF TT + BB > 2*P(4) THEN 1140
1120 PRINT"YOU HAVE NO MONEY AT ALL!":PRINT
1130 GOTO 2210
1140 REM *** NEWSFLASH ? ***
1150 RF = 0:IF FNS(0) = 1 THEN GOSUB 1690
1160 IF RF < > 0 THEN ON RF GOTO 2100,470
1170 REM * PRINTOUT *
1180 PRINT:PRINT" = = = = = = =":PRINT
1190 PRINT"YOU HOLD:-"
1200 FOR X = 1 TO 4
1210 PRINT TAB(10);S(X);TAB(18);N$(X)
1220 NEXT X
1230 IF BF = 0 OR BR = 0 THEN 1250
1240 BB = BB*(1 + (BR/100))
1250 PRINT:GOSUB 2480:PRINT:PRINT
1260 GOTO 340
1270 REM***DEAL***
1280 PRINT CHR$(12);"SHARE DEALING":PRINT
     " = = = = = = = = = = = = = = = = = ":PRINT:PRINT
1290 PRINT"CO.  CODE PRICE  MAX.NO.  HELD"
1300 PRINT" -    - - - - -    - - - -    - -":
     PRINT
1310 FOR X = 1 TO 4
1320 PRINT N$(X);TAB(6);LEFT$(N$(X),1);TAB(9);P(X);
1330 IF F(X) = 1 THEN PRINT"(S)";TAB(19);" -";:
     GOTO 1370
1340 NN = INT(BB/P(X))
1350 IF NN > M(X) - S(X) THEN NN = M(X) - S(X)
1360 PRINT TAB(18);NN;
1370 PRINT TAB(26);S(X);
1380 PRINT:NEXT X:PRINT:PRINT:PRINT
1390 PRINT"CO. CODE    ? ";
1400 A$ = CHR$(USR(0)):C = 0
1410 IF A$ = "G" THEN C = 1
1420 IF A$ = "T" THEN C = 2
1430 IF A$ = "Z" THEN C = 3
1440 IF A$ = "L" THEN C = 4
1450 IF A$ = "E" THEN 1670
1460 IF C = 0 THEN 1400 ELSE PRINT A$
1470 INPUT"NO. OF SHARES  ";N
1480 PRINT"BUY(B)/SELL(S)  ? ";
1490 A$ = CHR$(USR(0))
1500 IF A$ < > "B" AND A$ < > "S" THEN 1490 ELSE
     PRINT A$
1510 IF FNR(25) = 1 THEN 1650
1520 IF N < 1 THEN 1640
1530 IF A$ = "S" AND S(C) < N THEN 1640
1540 IF F(C) = 1 THEN PRINT "SUSPENDED":GOTO
     340
1550 V = N*P(C)
1560 IF V > BB AND A$ = "B" THEN PRINT
     "OVERDRAWN": GOTO 340
1570 IF A$ = "B" THEN N > NN THEN 1640
1580 IF A$ = "B" THEN F = -1 ELSE F = 1
1590 BB = BB + (V*F)
1600 S(C) = S(C) + (N* - F)
1610 Q(C) = FNA(Q(C) + (V* - F))
1620 RF = 0:IF FNS(0) = 1 THEN GOSUB 1690
1630 IF RF = 0 THEN 1680 ELSE ON RF GOTO 2100,470
1640 PRINT:PRINT"FRAUD":GOTO 1680
1650 PRINT:PRINT"MARKET SUSPENDED"
1660 PRINT" = = = = = = = = = = = = = = = = = ":
     GOTO 1680
1670 PRINT"E":PRINT"ESCAPE"
1680 PRINT:PRINT:GOTO 340
1690 REM *** NEWSFLASH ***
1700 IF FNR(20) > 8 THEN RETURN
1710 PRINT"<NEWSFLASH>":PRINT
1720 IF FNR(10) > 7 THEN 1930
1730 IF FNR(10) = 1 THEN 2050
1740 IF FNR(10) > 5 THEN 1830
1750 M = FNR(4)
1760 PRINT N$(M);" BONUS"
1770 IF FNR(10) = 1 THEN 1860
1780 B = FNR(81) + 9
1790 B1 = P(M)*(1 + (B/100))*S(X)
1800 BB = BB + B1
1810 PRINT B1;" TOTAL (";B;" %)"
1820 RETURN
1830 PRINT"TAX BONUS":TF = 1
1840 T = FNR(81) + 9
1850 IF T < 85 THEN 1880
1860 PRINT"SUSPENDED"
1870 RETURN
1880 REM ** TAX ADJUST **
1890 A = BB*(T/100)*TF
1900 PRINT"RATE: - ";T;" %"
1910 BB = FNA(BB + A)
1920 RETURN
1930 IF FNR(20) < 4 THEN 2050
1940 IF FNR(20) < 4 THEN 2040
1950 IF FNR(20) > 5 THEN 1980
1960 PRINT"SUPER TAX":TF = -1
```

STOCKMARKET IN BASIC

```
1970 GOTO 1840
1980 M=FNR(4)
1990 PRINT N$(M);" BONUS ISSUE"
2000 N=INT(S(M)/(FNR(2)+1))
2010 PRINT N;" ADDED"
2020 S(M)=S(M)+N
2030 RETURN
2040 RF=1:GOTO 2060
2050 PRINT"MARKET SUSPENDED":RF=2
2060 TF=0:PRINT:PRINT:RETURN
2070 PRINT CHR$(12);"YOU HAVE CONCEDED"
2080 PRINT"= = = = = = = = = = = = = = = = = = = ="
     :PRINT:PRINT
2090 GOTO 2130
2100 REM **** END OF GAME ****
2110 PRINT"MARKET FAILS"
2120 PRINT"BANK TAKEOVER"
2130 FOR X=1 TO 4
2140 PRINT:PRINT N$(X);TAB(10);"(";S(X);")"
2150 PRINT"SELL AT";TAB(10);P(X)
2160 BB=BB+S(X)*P(X)
2170 P(X)=OP(X):Q(X)=0:S(X)=0
2180 NEXT X
2190 PRINT:PRINT:PRINT:PRINT "YOU HOLD"
2200 GOSUB 2480
2210 PRINT:PRINT "GAME ENDED":PRINT
     "= = = = = = = = = = ="
2220 PRINT:PRINT:PRINT "WOULD YOU LIKE
     ANOTHER GAME"
2230 GOSUB 2520
2240 IF A$="N" THEN END ELSE GOSUB 2660:GOTO
     330
2250 REM***E!***
2260 PRINT CHR$(12)
2270 PRINT TAB(5);"THE PRESENT SITUATION"
2280 PRINT TAB(5);"= = = = = = = = = = = = ="
     :PRINT:PRINT
2290 PRINT"CO. 0.PRICE P.PRICE DIFF. LOW"
2300 PRINT" -   ---   ---   --":PRINT
2310 FOR X=1 TO 4:PRINT N$(X);TAB(5);OP(X);TAB
     (11);
2320 PRINT P(X);TAB(19);P(X)-OP(X);TAB(25);H(X);
     TAB(33);
2330 PRINT L(X):NEXT X:PRINT:PRINT
2340 PRINT"CO.  HELD  P.PAID  VALUE  PROFIT"
2350 PRINT" -   --   ---   ---   ---"
     :PRINT:T=0
2360 FOR X=1 TO 4:V=S(X)*P(X):PRINT N$(X);
     TAB(4);
2370 PRINT S(X);TAB(11);Q(X);TAB(20);V;TAB(29);
     V-Q(X)
2380 T=T+(V-Q(X)):NEXT X
2390 PRINT TAB(29);"----"
2400 PRINT TAB(22);"TOTAL";TAB(29);T:PRINT:
     PRINT
2410 GOTO 340
2420 REM***? BALANCE***
2430 PRINT "THE PRESENT BANK BALANCE IS"
2440 PRINT "= = = = = = = = = = = = = = = = =";
     PRINT
2450 PRINT"(INCLUDING SHARES)"
2460 PRINT:BJ=1
2470 GOSUB 2800:JJ=TT
2480 J=FNB(BB+JJ):J1=20-FNL(J)-2
2490 PRINT TAB(J1);"£";J;
2500 IF BJ=0 THEN PRINT TAB(25);"BANK" ELSE
     PRINT
2510 BJ=0:JJ=0:RETURN
2520 PRINT"(Y/N) ? ";
2530 A$=CHR$(USR(0))
2540 IF A$="Y" OR A$="N" THEN PRINT A$:PRINT:
     RETURN ELSE 2530
2550 A$="F70228FC473E00C32A44"
2560 A=16880:GOSUB 2580
2570 A$="C3F041":A=17414
2580 FOR X=1 TO LEN(A$)
2590 GOSUB 2630:N=D*16:X=X+1
2600 GOSUB 2630:N=N+D
2610 POKE A,N:A=A+1
2620 NEXT X:RETURN
2630 D=ASC(MID$(A$,X,1))
2640 IF D>64 THEN D=D-55 ELSE D=D-48
2650 RETURN
2660 PRINT CHR$(12):PRINT CHR$(19)
2670 PRINT TAB(5);"STOCKMARKET SIMULATION"
2680 PRINT TAB(5);"= = = = = = = = = = = = = ="
2690 PRINT:PRINT:PRINT:TF=0:RETURN
2700 REM***PRICE PRINT OUT***
2710 PRINT CHR$(12)
2720 PRINT TAB(5);"PRICE PRINT OUT"
2730 PRINT TAB(5);"= = = = = = = ="
     :PRINT:PRINT
2740 PRINT"CO. P.PRICE FLOOR DIFF. CEIL. DIFF."
2750 PRINT" -   ---   ---   --   --   --"
     :PRINT
2760 FOR X=1 TO 4:PRINT N$(X);TAB(5);P(X);
2770 PRINT TAB(11);FF(X);TAB(18);P(X)-FF(X);
2780 PRINT TAB(24);CC(X);TAB(32);CC(X)-P(X)
2790 NEXT X:PRINT:PRINT:GOTO 340
2800 REM *** SUB TO ADD UP SHARES ***
2810 TT=0
2820 FOR XX=1 TO 4:TT=TT+S(XX)*P(XX):NEXT XX
2830 RETURN
```

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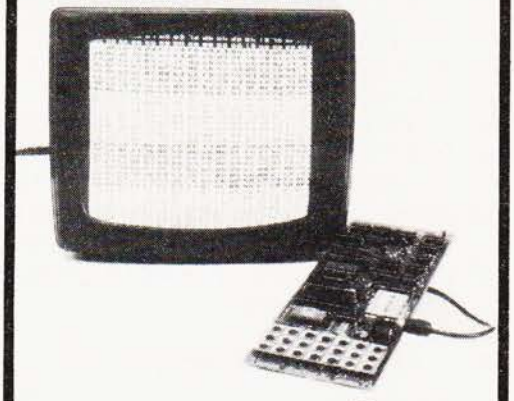

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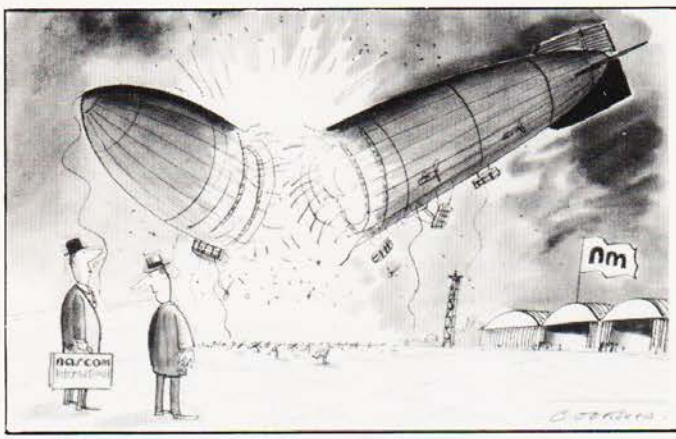
Peter Mathews Chairman



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NASCOM PATTERNS

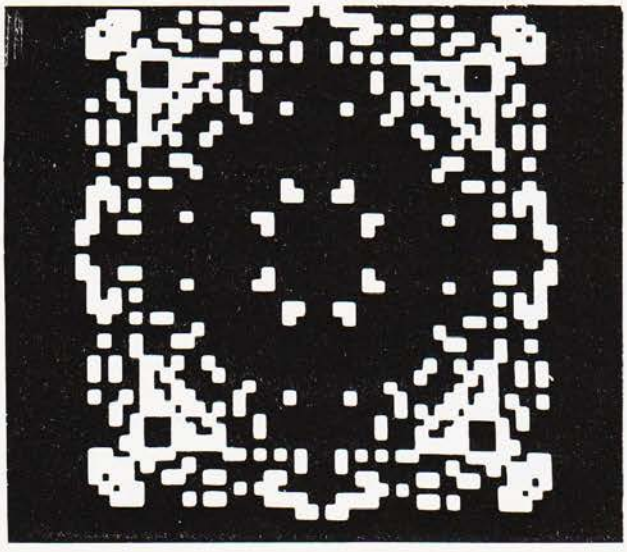
P.A. Forrester

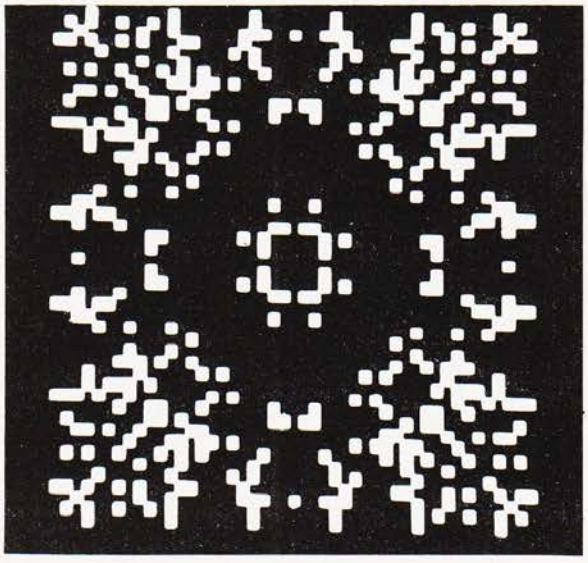
This program generates a random, but highly symmetrical, pattern which gradually builds up, stays a while and is then replaced by a new sequence. Typical examples of the patterns produced are shown in the illustration. They have reflectional symmetry about the diagonals and about the vertical and horizontal axes passing through the centre. The program produces a (nearly) square array of 48 by 48 points using the SET(x,y) function and so can only be used when the Graphics ROM is available. The patterns produced are quite pleasing in black and white, but would be fabulous if adapted for use with a colour board.

Logical Progression

The logic flow is as follows. A random number pair (x,y) is generated in the range (1,1) to (24,24), corresponding to the upper left-hand quadrant of the pattern. The program makes sure that $x > y$, so that the point lies in the upper half of the quadrant. The subroutine at line 2000 centres the pattern and reflects the point about the horizontal and vertical axes passing through the centre of the screen. The original values of x and y are interchanged (line 250) to give reflection about the diagonals, and the subroutine called again. The values of x and y are then incremented by ± 1 or 0; the program checks that the point is not already set and that it still lies within the starting segment. Each point thus grows as a randomly shaped blob until these conditions fail and then a new random point is started. A more disconnected pattern can be produced by removing line 320 and setting K in line 350 to 75. The two photographs were actually taken with line 320 removed.

The patterns are generated with x and y values lying between 1 and 48; the SET function has x values from 0 to 95 and y from 0 to 47. The x values are all incremented by 22 to bring the pattern into the centre of the screen before SETting. The unscrolled line 16 in the NASCOM is printed as the top line above lines 1 to 15, and has to be unscrambled to produce a symmetrical pattern. This is taken care of in the subroutine, which decreases each y value by 4 (you would expect it to be 3 since SET divides each character into 3 vertically as well as 2 horizontally, but x values start at 1 while SET runs from 0) but if $y < 4$ it is increased by 48 to produce the top line.





```
 50 K=0: CLS: DX=0: DY=0
100 X=INT(RND(0.5)*24+1): Y=INT(RND(0.1)*
    24+1)
120 IF X<Y THEN Y=25-Y
140 DX=INT(RND(0.3)*3-1: DY=INT(RND(0.2)*
    3-1
150 X=X+DX: Y=Y+DY
160 IF X<25 AND X>0 AND Y<25 AND Y>0 AND
    Y<=X THEN 180
170 GOTO 100
180 IF POINT(X,Y)=0 THEN 200
190 GOTO 100
200 GOSUB 2000
250 Z=X: X=Y: Y=Z
255 REM Interchange X and Y
257 REM reflects about diagonals
300 GOSUB 200
320 Z=X: X=Y: Y=Z
325 REM Change X and Y back again
350 K=K+1: IF K<175 THEN 120
355 REM K determines number of points set
400 FOR T=1 TO 5000: NEXT: GOTO 50
405 REM T determines wait before new pattern
1995 REM Subroutine reflects about central axes,
1997 REM centres pattern and puts line 16 at bottom
2000 A=X+22: IF Y<4 THEN B=Y+44: GOTO 2200
2100 B=Y-4
2200 SET(A,B): SET(70-X,B)
2300 P=X+22: Q=44-Y
2400 SET(P,Q): SET(70-X,Q)
2500 RETURN
```

FRUIT MACHINE

John Hiscott

This program, written in Triton Level 7 (8K) BASIC, occupies less than 1.5K RAM. The amount in the jackpot, player's winnings, number of games played and number of wins are all displayed at the appropriate times, and the program will run indefinitely if boredom or bankruptcy do not set in!

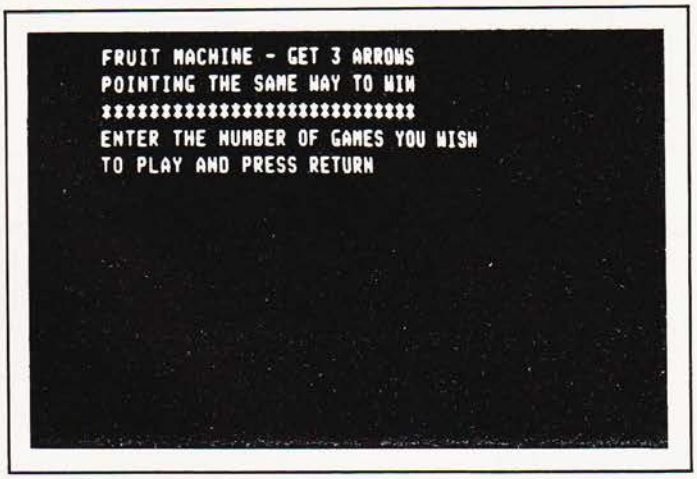
Program Notes

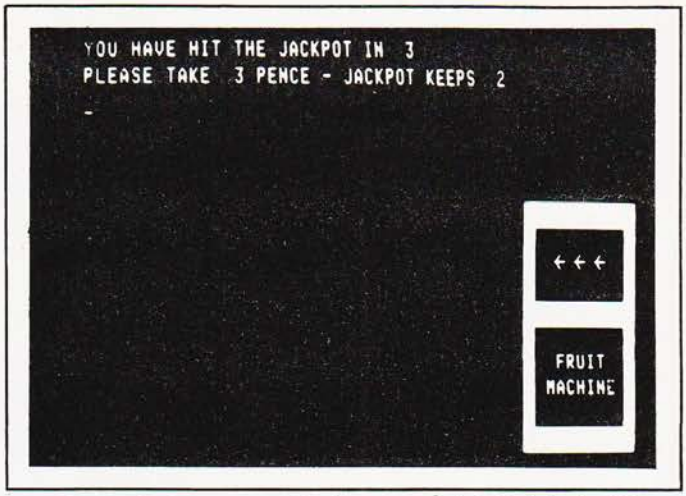
The following notes will assist users of other systems to make necessary adaptations.

The 'VDU' instructions 'memory-map' the screen with the picture of the fruit-machine (lines 60-90), the words 'fruit machine' (lines 100-120) and the symbols (lines 220, 240 and 260) appearing in the machine (arrows as written). Lines 210, 230 and 250 generate random numbers from 1 to 3 and these determine which of the three symbols will be displayed.

The program will run on Triton BASICs 4, 5 and 6 with minor amendments as the memory-mapping is compatible. The photographs illustrate the screen displays during the course of the game.

```
10  Q=0:CLS
15  PRINT "FRUIT MACHINE — GET 3 ARROWS
20  PRINT "POINTING THE SAME WAY TO WIN
22  PRINT "**********************************
23  PRINT "ENTER THE NUMBER OF GAMES YOU
    WISH
24  INPUT "TO PLAY AND PRESS RETURN ";P
25  PRINT "THE STAKE IS ONE PENNY FOR EACH
    GAME —
26  PRINT "PLEASE PUT ";P" PENCE IN THE
    JACKPOT
27  T=T+P
28  PRINT "**********************************
29  FOR L=1 TO 2000:NEXT
30  PRINT "WINNER TAKES THE JACKPOT PLUS
    HIS
31  PRINT "STAKE (ONLY) FOR EACH GAME
    PLAYED
32  PRINT "**********************************
40  J=J+1:PRINT "JACKPOT NOW STANDS AT
    ";J
```





Typical screen display generated by the program, the initial display is bottom right.

```
45  PRINT "NUMBER OF WINS SO FAR ";W
50  FOR L=1 TO 3000:NEXT :CLS
55  P=P-1
60  FOR M=0 TO 9
65  VDU 426+M, 122
70  VDU 426+(M*64), 122
75  VDU 436+(M*64), 122
80  VDU 1002+M, 122
85  VDU 682+M, 122
90  NEXT
100 VDU 813,70:VDU 814,82:VDU 815,85:VDU 816,73:
    VDU 817,84
110 VDU 876,77:VDU 877,65:VDU 878,67:VDU 879,72:
    VDU 880,73
120 VDU 881,78:VDU 882,69
130 FOR L=1 TO 1000:NEXT
200 FOR L=1 TO 25
210 A=INT(3*RND(1)+1)
220 VDU 557,A+122
230 B=INT(3*RND(1)+1)
240 VDU 559,B+122
250 C=INT(3*RND(1)+1)
260 VDU 561,C+122
270 NEXT
280 Q=Q+1
300 IF A=B GOTO 320
310 IF A<>B GOTO 400
320 IF B=C GOTO 340
330 IF B<>C GOTO 400
340 PRINT "YOU HAVE HIT THE JACKPOT IN ";Q
350 W=W+1
360 T=T-J
370 PRINT "PLEASE TAKE ";J" PENCE — JACKPOT
    KEEPS ";T
380 J=T
390 FOR L=1 TO 4000:NEXT :GOTO 10
400 PRINT "END OF GAME ";Q" — YOU LOSE THIS
    TIME"
410 IF P=0 PRINT "END OF PLAY":FOR L=1 TO
    1000:NEXT : GOTO 10
420 GOTO 40
```

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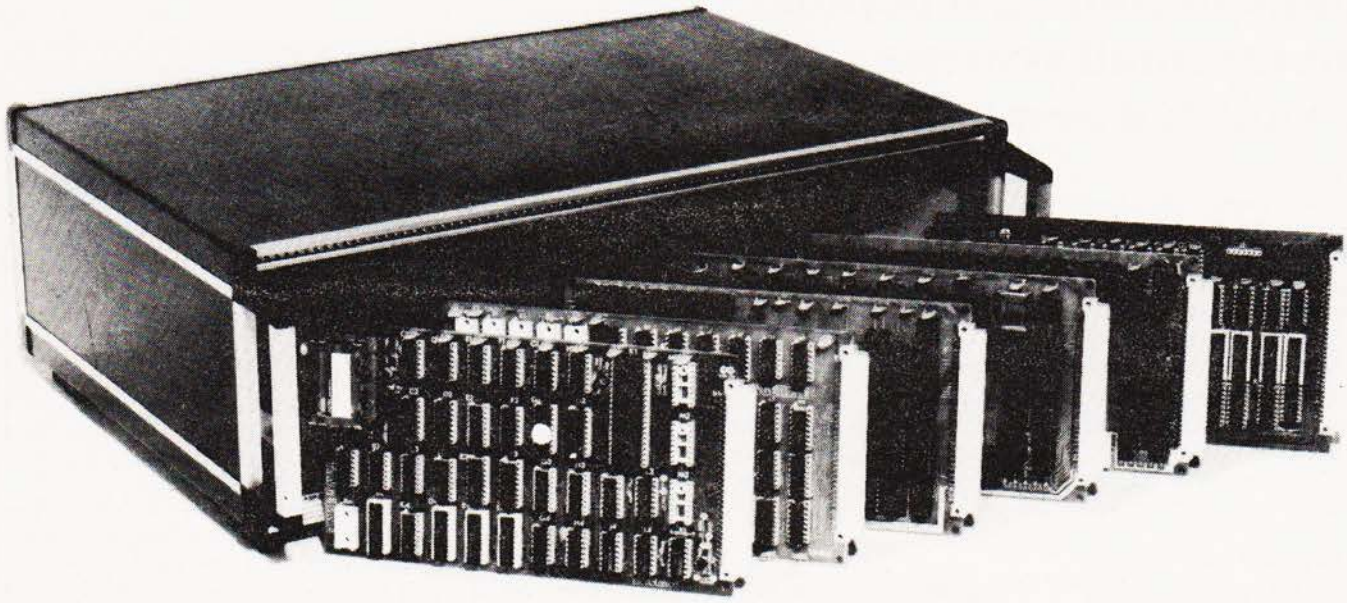

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ADDRESS: _____

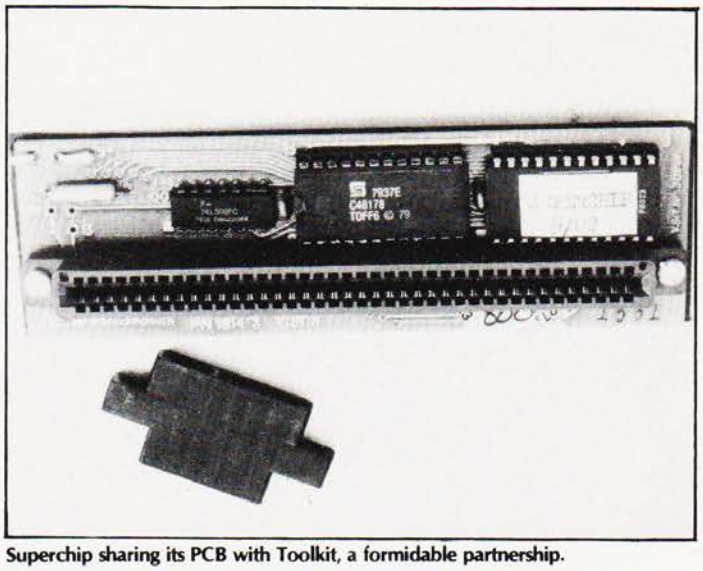
_____

PLEASE ENCLOSE 12p STAMP. THANK YOU.

Pete Freebrey

Pre-packaged routines are rapidly becoming a popular item for small systems, we look at a new arrival.

Bolt-on extras for the PET abound in the market place. The problem is to separate the genuinely beneficial from the ordinary. One of the most successful products for the PET has been the Programmer's Toolkit from Petsoft which we reviewed in October '79. This gives a number of very useful utility type commands, Auto line numbering and Renumbering, to name but two of the ten time-saving and de-bugging functions. Now you can go one stage further with the introduction by Supersoft of the Superchip. Available for both Old and New ROM PETs and completely compatible with the existing Toolkit, Superchip offers yet further power to your digits.



Superchip sharing its PCB with Toolkit, a formidable partnership.

What You Get

Superchip comes complete with a very comprehensive set of operating notes, in the form of a 32 page manual, which leaves little or nothing to the imagination. Once in operation most of the functions may be called directly from the keyboard and/or from BASIC using SYS and POKE commands, See Tables 1 and 2 for the command set.

Installation

The Superchip is literally that, a chip. With New ROM machines it plugs directly into the socket adjacent to the PET ROMs, next to Toolkit if you have it fitted (who doesn't?). If you have an Old ROM PET then an expansion board is available with sockets for both Toolkit and Superchip. This plugs into the memory expansion port on the right hand side of your PET. Power for this is taken from the second cassette port.

Installation in both cases is very quick and simple but must be performed with the machine disconnected from the mains.

Operation

All the keyboard functions are generated by holding down the RUN/STOP key and then pressing another key. The operating instructions refer to the RUN/STOP key as the CONTROL key, a convention which we will follow in this article. With the Superchip in operation you can stop programs with the "(", left bracket, key.

Calling the Superchip to action can be done with one of three SYS commands. These are:

SYS 38039 Turns on all functions.

SYS 37449 Turns on keyboard functions only.

SYS 38015 Turns on RETRACE function only.

If you have a Toolkit you have a further three commands that enable this as well. If you wish to use any of the SYS accessible commands from BASIC the Superchip does not have to be turned on.

Keyboard functions operate through the interrupt and for Old ROM machines *these must be disabled* before using the cassette I/O. To disable one merely presses CONTROL RVS. If you don't do this you will wait a very long time when LOADing or SAVEing as only the tape motor is running. It's all too easy to forget to disable the Superchip until you get used to it, panic sets in quickly when you think that you have lost your latest precious program! Fear not. Stop the tape, press '(', rewind, disable the interrupt and then proceed as though you had never made the mistake in the first place.

If you are using Commodore disc drives with the Superchip you must load DOS SUPPORT before turning the Superchip on. Superchip will not work with CompuThink drives, for which a special disc version is available.

What You Can Do

Having initialised the Superchip, flex your digits and away you go. Space in this article is too limited for a complete breakdown of all the functions in depth but let us look briefly at the options.

All the PET keys except HOME will automatically start repeating at a rate of twelve per second if held down. Both the initial delay before repeating starts and the rate at which they repeat may be altered as desired. If you wish, repeating may be limited to only cursor movement, insert/delete and SPACE keys. The repeat function also applies to special functions generated by the Superchip.

The screen handling functions may be called by first initialising the Superchip by keying CONTROL SHIFT and/or the individual function key or directly via a BASIC SYS command. Two erase functions allow either clearing of a program line up to, but not including, the cursor position or clearing from the cursor position to the end of the line. Using the delete function one can remove a cursor 'tagged' line completely, the listing moves up one line on the screen as well. Conversely, the insert function opens up the listing by a line.

One can choose from three scrolling functions to give either scroll up or down or with up to nine lines static and the rest scrolled. As added extras one can swop lower case and graphics by a single key rather than POKEing and one can escape, allowing cursor movement rather than characters to be inserted in quotes, or vice versa.

In common with many other systems you can now have single key programming of many of the common BASIC functions, they even generate the opening bracket where applicable.

System Debugging

The following functions may only be called from SYS and are not keyboard accessed. Shrink removes all REM

statements and redundant spaces from a program (I wish people wouldn't use it when they send us programs) which makes the program use less memory and speeds the execution. Reverse allows any rectangular portion of the screen to be reversed and Movit allows you to move chunks of memory around, mainly used in machine code but it could be applied to the display memory area, I suppose.

Just as in the original Toolkit there are a number of debugging commands, Retrace and Hold. Having initialised Retrace a record is kept of every program line executed and the last ten are displayed on command. The Hold function halts all PET functions until the RETURN key is pressed. This enables program listings and execution to be paused and resumed.

Finally, yes really!, there are two features under the heading of 'Advanced Techniques'. The first of these allows for ten user defined keys (0 to 9) which can be used to pass control to a machine language routine. The second feature is that pressing CONTROL HOME causes a user defined message to be displayed. Up to 170 characters may be stored.

Conclusions

On receiving Superchip the depth of control and user convenience offered were found most impressive, but was it worth paying out hard cash for it? All that one can say after much hard use is 'Yes'. Like the Toolkit it offers a further dimension to using the PET and you quickly wonder just how you did cope without it. It's rather like frozen food, you can manage without it but the convenience of having it around grows on you and becomes a way of life.

Function	Keyboard [] = shifted	Notes
ERASE BEGIN	CTL— [B]	Erases line up to cursor
ERASE END	CTL— [E]	Erase from and including cursor
DELETE LINE	CTL—DEL	
INSERT LINE	CTL—INST	
SCROLL UP	CTL—DOWN	Cursor does not move
SCROLL DOWN	CTL—UP	Cursor does not move
SCROLL WINDOW	CTL—0 to 9	
GRAPHICS TOGGLE	CTL— [G]	
ESCAPE	CTL—QUOTE	
RETRACE	CTL— [T]	
HOLD	CTL—RETURN	RETURN to resume
STOP	(	
DISPLAY MESSAGE	CTL—HOME	Message stored at 655—825
USER-DEFINED FUNCTIONS	CTL—0 to 9	If used

SINGLE KEY BASIC

ASC(. . . . . A	INPUT I	PEEK(. . . . . K	RND(. . . . . Z
CHR$(. C	INPUT# . . . . . U	POKE . . . . . E	STEP . . . . . W
CLOSE X	INT(. . . . . J	PRINT. . . . . ?	STR$(. . . . . S
DATA . . . . . D	LEFT$(. L	PRINT# . . . . . P	TAB(. . . . . T
FOR . . . . . F	MID$(. . . . . M	READ . . . . . Y	THEN . . . . . H
GOSUB . . . . . B	NEXT . . . . . N	RETURN . . . . . R	VAL(. V
GOTO . . . . . G	OPEN . . . . . O	RIGHT$(. . . . . Q	

Table 1. Functions called direct from keyboard.

Table 2. Functions called from BASIC SYS commands.

Function	BASIC	Notes
ERASE BEGIN	SYS 37561	Erases line up to cursor
ERASE END	SYS 37284	Erase from and including cursor
DELETE LINE	SYS 37839	
INSERT LINE	SYS 37773	
SCROLL UP	SYS 37910	Cursor does not move
SCROLL DOWN	SYS 37717	Cursor does not move
SCROLL WINDOW	SYS 38130	PEEK(982)= lines protected
DISPLAY MESSAGE	SYS 38074	Message stored at 655—825
SHRINK	SYS 38500	Direct mode only
REVERSE	SYS 38695	Parameters at 192—195 (lost)
	SYS 38734	Parameters at 968—971 (retained)
	SYS 38746	Parameters at 972—975 (retained)
MOVIT	SYS 37571	Parameters at 177—182 (lost)
	SYS 38758	Parameters at 962—967 (retained)

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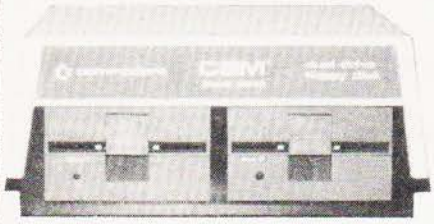

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SUBMISSIONS

Are you interested in writing for our magazine? Or, to put it another way, are you interested in writing for your own magazine? Computing Today is always on the look-out for interesting articles, innovative programs and useful projects and we are sure there are many readers who have the capability to pass on their hard won knowledge to others. Not only will this make the magazine a better one, it will also put some money in *your* pocket to further finance your computing.

Featuring You

The main bulk of the magazine is usually taken up with feature articles reviews, projects and general topics. Each of these articles attempts to convey the necessary information as clearly and concisely as possible but at the same time remain easily readable. Articles of this nature can be thought of as similar to a school "essay" in that they must have a beginning, a middle and an end. Diagrams and photographs are an enormous help to any article, the old adage of a picture being worth a thousand words holds very true in this case.

If you are a regular reader of the magazine you will know the 'style' in which we write. Generally each section of the article that deals with a new topic is given its own heading and, whilst not essential, they do help to increase the readability of the final text. We prefer all copy to be typewritten on one side only of a page, using double line spacing and with large margins on each side of the text. However, this does *not* rule out the submission of handwritten material provided it is clearly legible and set out in a similar way.

All associated diagrams and photographs should be clearly labelled both as to their intended use and as to where they relate in the text. Circuit diagrams should follow the standard style of component designation and layout that is used throughout Computing Today. All components used in a given circuit must also be listed in a single table or Parts List to avoid any possibility of confusion.

Programming For All

In general the format for computer programs follows that of articles. We *cannot* accept any program that is not accompanied by a full listing, and TAPES ARE TOTALLY UNACCEPTABLE. Whilst it is desirable to have a printed listing, it is not at all reasonable to expect everyone to have access to a printer so typewritten or even good handwritten copy will be considered.

Remember to include sufficient detail to enable people who don't own an identical piece of hardware to be able to follow your program. The inclusion as is a description of any sections that may be unique to your machine. All graphics characters must be detailed with their associated codes and cursor controls should be presented in the CT standard format. The use of printers which give graphical output is acceptable provided all the graphics are fully explained. It is often worth including a photograph or drawing of the display produced or an actual sample run if possible.

Remember that the frustration you feel when you can't run a program, due to lack of documentation, will be felt by everyone else if YOU send in a program in that same state!

Soft Spots?

The Softspot features are really programming ideas that are submitted by readers. Because of this they do tend to be for specific systems. They must be submitted in the same format as other programs, ie. printed or typewritten but will probably contain less general detail and more specific machine instruction. The more detailed a program submitted for a Softspot the more chance of it being considered as a feature in its own right!

Paying For It

It takes up to four working weeks for any submitted material to get through the system. At the end of this period a decision is made as to whether it is acceptable or not and, if it is, a letter will be sent informing you of its acceptance and the rate offered. If it is found unsuitable we will return the program or article at this stage.

It for any reason you feel the sum we are offering you is not in line with the amount you anticipated then you should discuss this with the Editor. (This is very unlikely as we pay some of the highest rates in the field.) All payments are made upon publication, that is you will receive your cheque in the same month as the magazine appears on the streets.

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PRINTOUT

Dear Sir,

I have read in the national press (Guardian) that a £1 surcharge is to be imposed by the government upon blank cassette tapes, for the benefit of the British phonographic industry in order to recompense them for record piracy.

Will those of your readers who feel as I do, that such a charge is an unwarrantable imposition upon users such as computer hobbyists, please write to their local MPs to that effect at the Palace of Westminster, SW1.

Yours sincerely,
J.R. Handford

31 Greenway Road,
Gosport,
Hampshire
PO12 4RG

Dear Sir,

I was pleased to see my "Snap" program in the October edition of "Computing Today", there are however several printing errors in the listing, they are:-
Line 110 P = P - 1: N = N + 1 (Second P has been printed as B)
Line 210 SET (X,Y): SET (X + 61,Y) (Colon missing)
Line 270 PRINT @ 266, "YOU";:PRINT @ 296, "ME"; (First address is printed 226).

Square brackets have been placed around the CLS statements, and these are not available on the TRS-80. An inexperienced person might type in the parentheses which will result in the dreaded Syntax Error.

I hope that this information will be useful.
Yours faithfully,
J.H. Bamber

97 Cooper St.,
Doncaster,
South Yorkshire
DN4 5DE.

Dear Editor,

I have just come across an essay by Frederick Pohl, the well known science fiction writer, which contains a quick and simple method of decimal to binary conversion. Apparently it is related to the manipulation which Russian peasants who do not know the multiplication table use to do multiplication, which itself is rather wonderous, but I digress.

The method consists of repeatedly halving the decimal number, ignoring any fractions arising, and scoring one point for an odd result and zero for an even one, until nothing remains, thusly:-

274	0
137	1
68	0
34	0
17	1
8	0
4	0
2	0
1	1

Reading the score column from the bottom gives the binary for the number you first thought of (274). I now await a simple method of hexadecimal calculation not requiring sixteen fingers.

Yours,
Iolo Davidson

Littlefield,
Hawling,
Gloucestershire,
GL54 5SZ.

Dear Sir,

There has been something of a proliferation of machine code articles in the press recently, but I consider the approach to be wrong.

Most people want to use machine code as a speedy alternative for BASIC, so would it not be possible to provide guide lines for a 'human compiler' for, say, the Z80 and 6502? I visualise a series of routines which emulate the simpler BASIC statements. A simple example would be:-

For α = ß to 0(Hex)
:
Next α
In Z80 Assembler
Reg B = loop counter

Address
N,N+1 LD B,ß
:
:
N+x, N+1+x DJNZ x (in two's complement)

I don't think I have the expertise to tackle many of the statements, so I pass the buck to you.

Yours faithfully,
Jeremy Ruston

4 Horton Place,
London W8 4LX

Dear Sir,

A letter for ACORN ATOM users. Having written several programs which needed more specific address information than was supplied in the manual, I have found myself dipping into the BASIC interpreter and rooting out some of the addresses ACORN don't tell you. As other readers may have use for these addresses, I have listed them below:

CE86 — "RUN" Address. If used as the execution address with SAVE, auto-run BASIC programs may be created.
C2F2 — Address used by CE86 will run a program whose start address is in 05 and 06 (High byte in 06-Low in 05).
05,06 — Address of character currently being processed (as far as I've been able to ascertain).
0D,0E — "TOP" Address (High in 0E-Low in 0D).
DE,DF — Cursor address (High in DF-Low in DE).

Here credit is due to Dino Dini who discovered this address.

I hope these are of use to ATOM users.
Yours sincerely,
T. Mabbs.

47 Hartford Rd.,
Bexley,
Kent.

Dear Sir,*

I noted with interest your article on computer-aided art works. This is a field in which I am personally very involved, as I have just finished a three year Fine Arts course at Trent Poly, two years of which was completely devoted to computer-aided graphic work. The system I used was a PDP 11/40 with a Calcomp 70cm plotter, and the language was GINO-F, a FORTRAN based graphic language. The programs are of my own design, and aimed to create shaded areas and illusory effects of depth using 'moiré' techniques. The whole thing is interactive and, though I have not used the usual 'micro' type machines, I see no reason why my work could not translate, with a graphics digitiser and a plotter/screen arrangement. There are very few 'artists' as such interested in this area of expression, probably because it is felt among the tutors and critics that it is all done by just pushing a button!! Not exactly true!

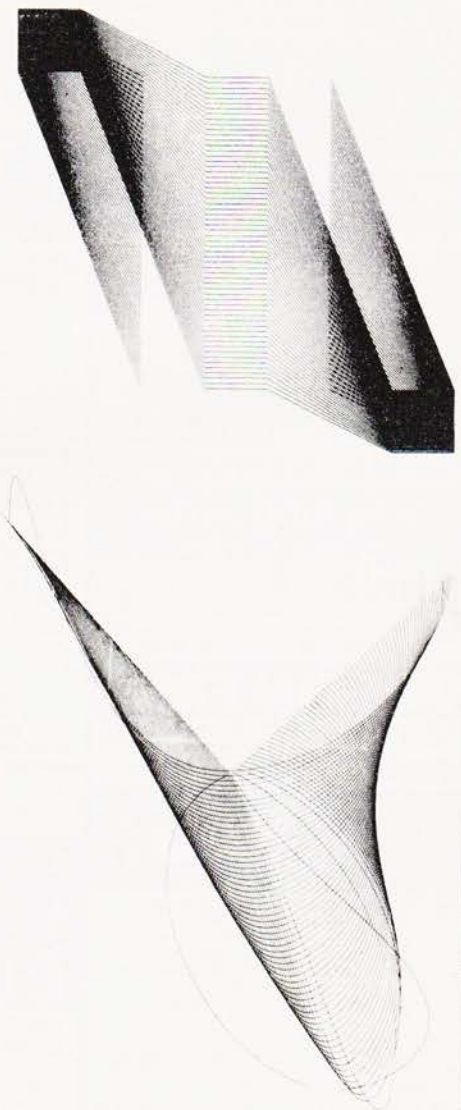
I feel that computers and art is still very much in its infancy, the field in which applications have been most used is, of course, special effects for TV and sci-fi films, including animation techniques, an area in which I would like to be interested, but it seems to be a sort of closed shop, where only computer-sci-fi addicts can get in!! The 'Star Wars' type effects seems to rule supreme, and unfortunately very little real imagination ever gets a chance.

The curved-line drawing shows some interactively-forced curve fitting anomalies, in that I can force the program into producing those rogue lines, but sometimes I cannot predict the results, so these are not only unique, but sometimes I cannot remember how the irregularities were produced in the first place! It is this conceptual area of my own work which I find intriguing. The straight line drawing is one from a set of depth and illusion drawings, from my earlier experiments.

Yours,
Gordon S. Clyre

Flat D,
42 Forest Road,
Nottingham
NG7 4EQ.

(*Edited due to lack of space)



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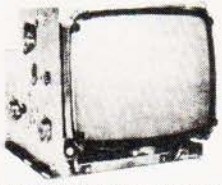

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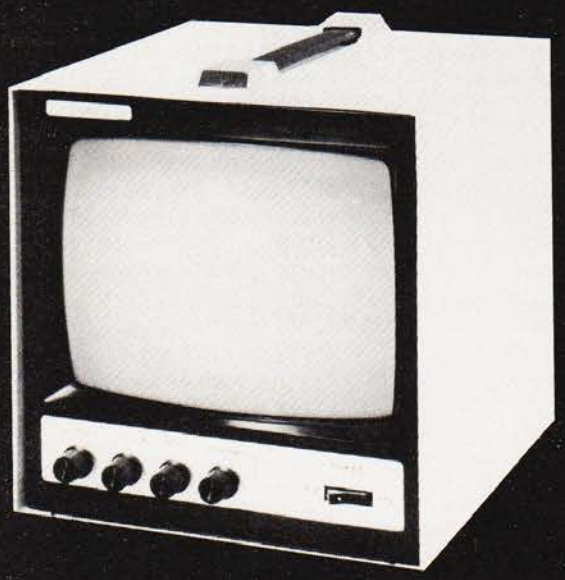

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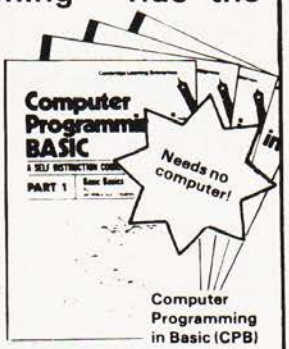

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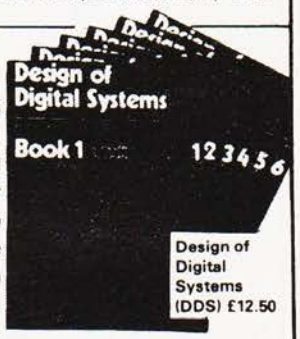

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Part two of our series on how to make your micro move with the times.

Having POKEd about inside the video RAM last month, and moved things around the screen, it might seem that all has been covered. This is not so, for, if your computer has cursor control, you have an alternative method for creating the illusion of movement. Indeed, some VDUs *only* have this method available. If you have a choice, however, you might well be asking why you need to bother with a second method. The answer to that question is in two parts:-

i) Cursor control can be quicker than POKEing, and this is important when a large number of characters have to be moved

ii) It's easier to assemble a cursor controlled PRINT statement because you may be able to use the keyboard graphics symbols directly. There's no need to calculate all the correct ASCII or screen character numbers.

A Cursor String

Cursor control characters need not always be contained in quotes in PRINT statements. It's easy to build up a string variable which contains the necessary 'ups', 'downs' or 'sideways'. Perhaps the simplest examples is as follows:-

```
10 A$="*[CL][SPC]"
20 FOR I=1 TO 6
30 A$=A$+A$
40 NEXT I
50 PRINT A$
60 END
```

Note that line 30 doubles the length of the string every time it is executed and the final string is 192 characters long. When A$ is PRINTed the sequence is as follows:-

i) Print an asterisk.

ii) Move the cursor one space to the left so that the next character will be printed over the asterisk.

iii) Print a space, thus removing the asterisk.

iv) Repeat the above steps until the end of the string.

Animation

So far we have always restricted ourselves to moving the odd one or two characters on the screen. This often leads to an impression of movement, but animation requires that we move large blocks of characters simultaneously. After all, solid objects move as a whole, not one piece at a time.

A problem which arises at this point has little to do with the present topic, but a lot to do with your understanding of it. How, I ask myself, is the magazine going to list my masterpieces? With great difficulty, I expect!

The problem is that cursor control characters are not in the normal character set, and weird graphics symbols pose even more of a problem. I have tried to overcome these difficulties by writing a 'lister' which interprets my programs. Consider the following:-

```
100 REM *** MOVING ENGINE ***
110
120 REM "                    "
130 REM "                    "
140 REM "                    "
150 REM "======= ○== ○======"
160
```

```
170 A$=A$+"
180 A$=A$+"
190 A$=A$+"
200 A$=A$+"= ○== ○====="
210 A$=A$+"
220 A$=A$+"
230 A$=A$+"
240 A$=A$+"= ○   ○
250 FOR I=1 TO 30:PRINT A$;:FOR J=1 TO
    50:NEXT J:NEXTI:END
```

```
100 REM *** MOVING ENGINE ***
110
120 REM " [7XSP] [2X"] [SP] [,] [8XSP] "
130 REM " [8XSP] [2W] [2XOFF] [2←] [7XSP]
    "
140 REM " [7XSP] [2U] [2I] [2XRE] [2U] [2I]
    [6XSP] "
150 REM "======= [J] [K] == [J] [K]
    ======"
160
170 A$=A$+" [SP] [2X"] [SP] [,] [CRD]
    [4XCRL] "
180 A$=A$+" [SP] [RVS] [W] [2XR] [←] [OFF]
    [CRD] [6XCRL] "
190 A$=A$+" [SP] [RVS] [U] [I] [2XE] [U]
    [I] [OFF] [CRD] [7XCRL] "
200 A$=A$+"= [J] [K] == [J] [K] ====="
210 A$=A$+" [3XCRU] [11XCRL] [SP] [2X"]
    [SP] [,] [CRD] [4XCRL] "
220 A$=A$+" [SP] [RVS] [W] [2XR] [←] [CRD]
    [6XCRL] [OFF] "
230 A$=A$+" [SP] [RVS] [U] [I] [2XE] [U]
    [I] [OFF] [CRD] [7XCRL] "
240 A$=A$+"= [J] [K] [2XSP] [J] [K] [3XCRU]
    [6XCRL] "
250 FOR I=1 TO 30:
    PRINT A$;:
    FOR J=1 TO 50:
    NEXT J:
    NEXTI:
    END
```

Fig.1. Two ways of looking at the same thing.

Both these listings represent the same thing — a program to send an engine puffing across the screen. The first is the raw printout, with the outline of the engine visible but virtually everything else unintelligible. The second may appear as bad as the first, but it is easier to decipher with a little practice. All the shifted characters within quote statements have been replaced by the unshifted characters in square brackets. (eg. [2XR] in line 180 means 'two shift R' characters.) The cursor control characters are also abbreviated within square brackets, [SP] represents a space.

The listings are not perfect, but if you compare the two, you should soon get used to the system. The graphics used are for a standard PET, they may be changed for other systems.

Kid's Stuff

If some of my examples make you wonder whether I'm in my second childhood, perhaps I should explain that I have a

three year old son who considers Daddy's 'blooter' the best toy he's ever seen. He'll only leave me to work (play?) in peace if he gets his fair share of button pushing. I found I could either curse or cursor.

Figure 2 shows two screen prints from one of his programs. He pushes a number, the robot opens its mouth, burps the required number of times (the program uses a PETSOFT soundbox) and for every burp displays the correct digit. The reason for its inclusion in this article is that both the robot animation and the digits are produced under cursor control. The only POKEing required is for the starry background on which the robots appear. Apart from being enjoyable to watch, it has also been very effective in teaching the digits 0 to 9.

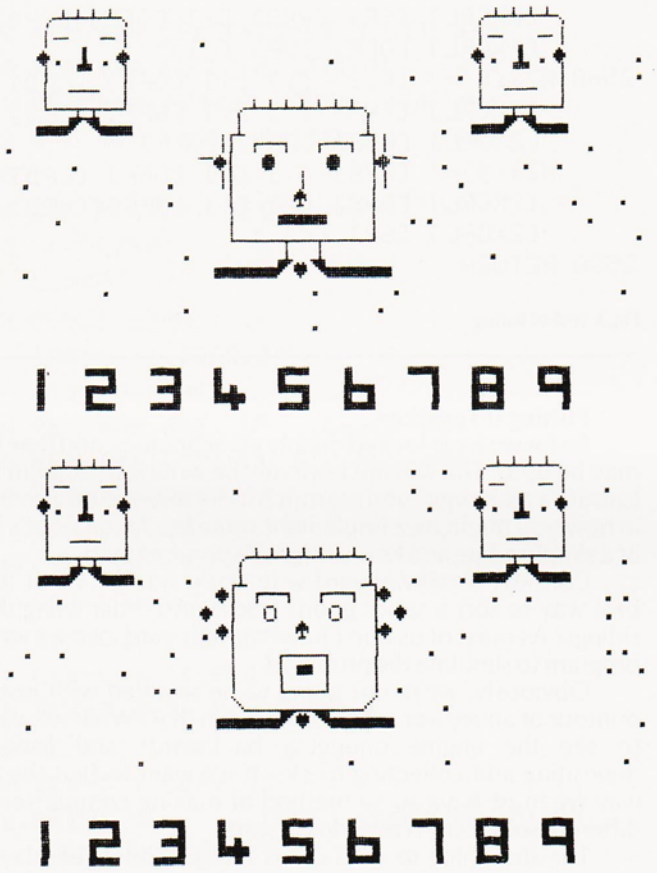


Fig.2. An open and shut case.

Figure 3 is a listing of the program. A$ holds a string of characters which print the robot with its mouth shut, and B$ holds the string for the mouth open picture. By printing these alternately in quick succession it gives the appearance of talking robot. The place at which the robot is printed is also governed by cursor control characters, the string variable P$, when printed, positions the cursor at the correct point. Similarly, line 1600 uses a chunk of LZ$ to find the correct line on which to print the numbers. This number printing routine may be extracted and used as a subroutine in other programs.

```
1000 REM *** ROBOT COUNTER ***
1020
1040 REM *** COUNTING UNDER ***
1060 REM *** CURSOR CONTROL ***
1080
1100 REM *** CLEAR SCREEN, SET UP ***
1120 REM *** CURSOR  STRINGS  AND ***
1140 REM *** PRINT THE BACKGROUND ***
1160 PRINT " [CLR] ":
     LZ=20
1180 FOR I=1 TO 50:
     POKE 32768+INT(700*RND(1)), 46:
     NEXT I
1200 P$=" [HOME] [5XCRD] [13XCRR] "
1220 C$=" [CRD] [11XCRL] ":
     D$=" [CRD] [6XCRL] ":
     GOSUB 1640
1240 PRINT " [HOME] [2XCRR] "+E$:
     PRINT " [HOME] [29XCRR] "+E$
1260 REM *** GET A CHARACTER ***
1280 PRINT P$+A$
1300 GET Q$:
     IF Q$="" THEN 1280
1320 REM *** CHECK FOR A DIGIT ***
1340 IF ASC(Q$)<48 OR ASC(Q$)>57 THEN 1280
1360 REM *** WORK THROUGH DIGITS ***
1380 FOR XZ=0 TO VAL(Q$)
1400 POKE 0,120:
     POKE 1,255-11*VAL(Q$)
1420 IF XZ<1 AND VAL(Q$)=0 THEN GOSUB 1580:
     GOTO 1500
1440 IF XZ<1 AND VAL(Q$)>0 THEN 1500
1460 REM *** OPEN MOUTH & MAKE NOISE ***
1480 PRINT P$+B$:
     GOSUB 1580:
     SYS 826:
     PRINT P$+A$
1500 NEXT XZ:
     PRINT P$+A$:
     FOR I=1 TO 500:
     NEXT I
1520 REM *** CLEAR THE NUMBERS ***
1540 PRINT " [3XCRD] ":
     FOR I=1 TO 20:
     PRINT " [6XSP] ";:
     NEXT I:
     POKE 158,0:
     GOTO 1300
1560 REM *** PLOTTING ROUTINE ***
1580 PZ=18:
     IF VAL(Q$)>1 THEN PZ=4*XZ+15-2*VAL(Q$)
1600 PRINT LEFT$(LZ$,LZ+1);TAB(PZ);NZ$(XZ):
     RETURN
1620 REM *** A$ = MOUTH SHUT FACE ***
1640 A$=A$+" [SP] [U] [7X1] [I] [SP] "+C$
1660 A$=A$+" [SP] [] [7XSP] [] [SP] "+C$
1680 A$=A$+" [] [O] [@] [@] [.] [SP] [@]
      [@] [.] [P] [] "+C$+" [CRL] "
1700 A$=A$+" [C] [Z] [%] [SP] [Q] [3XSP]
      [Q][SP] [^] [Z] [C] "+C$+" [CRL] "
1720 A$=A$+" [] [%] [3XSP] [] [3XSP] [^]
      [] "+C$
```

```
1740 A$=A$+" [SP] [%] [3XSP] [A] [3XSP] [']
      [SP] "+C$
1760 A$=A$+" [SP] [%] [2XSP] [3X"] [2XSP]
      ['] [SP] "+C$
1780 A$=A$+" [SP] [L] [7X$] [:] [SP] "+C$
1800 A$=A$+" [4XSP] [J] [SP] [J] [4XSP] "+
     C$
1820 A$=A$+" [4X"] [)] [S] [←] [4X"] "+C$
1840 REM *** B$ = MOUTH OPEN FACE ***
1860 B$=B$+" [SP] [U] [7X1] [I] [SP] "+C$
1880 B$=B$+" [SP] [J] [7XSP] [J] [SP] "+C$
1900 B$=B$+" [Z] [O] [0] [@] [.] [SP] [0]
      [@] [.] [P] [Z] "+C$+" [CRL] "
1920 B$=B$+" [Z] [SP] [%] [SP] [W] [3XSP]
      [W] [SP] ['] [SP] [Z] "+C$+" [CRL] "
1940 B$=B$+" [Z] [%] [3XSP] [A] [3XSP] ['] 
      [Z] "+C$
1960 B$=B$+" [SP] [%] [2XSP] [3X$] [2XSP]
      ['] [SP] "+C$
1980 B$=B$+" [SP] [%] [2XSP] [%] ["] ['] 
      [2XSP] ['] [SP] "+C$
2000 B$=B$+" [SP] [%] [2XSP] [L] [$] [:]
      [2XSP] ['] [SP] "+C$
2020 B$=B$+" [SP] [M] [7X$] [N] [SP] "+C$
2040 B$=B$+" [4X"] [)] [S] [←] [4X"] "+C$
2060 REM *** E$ = BACKGROUND FACE ***
2080 E$=E$+" [U] [4X1] [I] "+D$
2100 E$=E$+" [J] [@] [2XSP] [@] [J] "+D$
2120 E$=E$+" [Z] . ['] [%] . [Z] "+D$
2140 E$=E$+" [J] [SP] [<] [>] [SP] [J] "+D$
2160 E$=E$+" [J] [SP] [2X@] [SP] [J] "+D$
2180 E$=E$+" [-] [@] [2X2] [@] [=] "+D$
2200 E$=E$+" [2X"] [)] [←] [2X"] "+D$

2220 REM *** MACHINE CODE ROUTINE ***
2240 REM *** FOR THE SOUNDBOX.    ***
2260 POKE 59459, 255
2280 FOR HB=826 TO 870
2300 READ B:
     POKE HB,B:
     NEXT HB
2320 DATA 165,1,162,215,142,64,232,170
2340 DATA 202,208,253,240,0,240,0,240,0
2360 DATA 240,0,240,0,162,223,142,64,232
2380 DATA 170,202,208,253,198,00,208,5
2400 DATA 234,234,234,234,96,240,00
2420 DATA 240,00,208,213

2440 REM *** SET NUMBERS ***
2460 LZ$=" [HOME] [23XCRD] "
2480 NZ$(0)=" [RVS] [,] [;] [OFF] [CRD]
      [2XCRL] [!] [RVS] [!] [OFF] [CRD]
      [2XCRL] [RVS] [2X"] [OFF] ":
     NZ$(1)=" [SP] [!] [CRD] [2XCRL] [SP]
      [!] [CRD] [2XCRL] [SP] [>] "
2500 NZ$(2)=" [RVS] ["] [;] [OFF] [CRD]
      [2XCRL] [RVS] [,] ["] [OFF] [CRD]
      [2XCRL] [RVS] [2X"] [OFF] ":
     NZ$(3)=" [RVS] ["] [;] [OFF] [CRD]
      [2XCRL] [<] [RVS] [;] [OFF] [CRD]
      [2XCRL] [RVS] [2X"] [OFF] "
2520 NZ$(4)=" [!] [SP] [CRD] [2XCRL] [RVS]
      [2X<] [OFF] [CRD] [2XCRL] [SP] [>] ":
     NZ$(5)=" [RVS] [,] ["] [OFF] [CRD]
      [2XCRL] [RVS] ["] [;] [OFF] [CRD]
      [2XCRL] [RVS] [2X"] [OFF] "
2540 NZ$(6)=" [!] [SP] [CRD] [2XCRL] [RVS]
      [,] [;] [OFF] [CRD] [2XCRL] [RVS]
      [2X"] [OFF] ":
     NZ$(7)=" [RVS] ["] [;] [OFF] [CRD]
      [2XCRL] [SP] [RVS] [!] [OFF] [CRD]
      [2XCRL] [OFF] [SP] [<] "
2560 NZ$(8)=" [RVS] [,] [;] [OFF] [CRD]
      [2XCRL] [RVS] [,] [;] [OFF] [CRD]
      [2XCRL] [RVS] [2X"] [OFF] ":
     NZ$(9)=" [RVS] [,] [;] [OFF] [CRD]
      [2XCRL] [RVS] ["] [;] [OFF] [CRD]
      [2XCRL] [SP] [<] "
2580 RETURN
```

Fig.3. Robot listing.

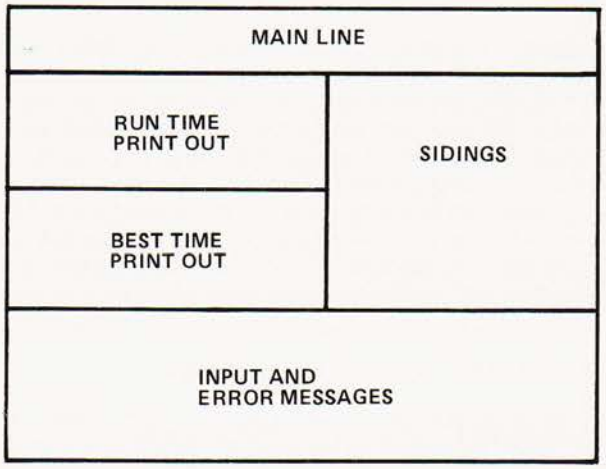
Putting It Together

So far we have looked mainly at techniques, and how they may be used. You will not normally be writing a program to illustrate a technique, you are much more likely to be interested in how you might best implement some bright idea. Let's look at a simple game and how it might be programmed.

Consider a railway yard with three sidings. What is the best way to sort a set of goods trucks into order using those sidings? As most of us don't have a goods yard, can we write a program to simulate the problem?

Obviously, we're not going to be satisfied with just the printout of an answer, where's the fun in that? What we want is to see the engine chugging backwards and forwards depositing and collecting trucks. If we want to find the best way we must have some method of making comparisons of different solutions. Where do we start?

The first thing to consider is the general screen layout. Here's a possible solution:



Now how are we going to simulate train movement? Cursor control is difficult because the pattern to be printed will vary with every shunting action. This leaves POKEing, but how do we know where and what to POKE?

I'll work through the program a bit at a time to show how the two methods may be mixed to produce a final working program.

```
1000 REM ***  SHUNTING  ***
1020
1040 REM *** A  RAILWAY ***
1060 REM *** SIMULATION ***
1080
1100 REM *** SP=SCREEN POINTER ***
1120 REM *** LL=LINE LENGTH    ***
1140 REM *** ADJUST  THEM  FOR ***
1160 REM *** YOUR  SYSTEM.     ***
1180
1200 DIM P1(55), P2(55), P3(55)
1220 SP=32768:
     LL=40
1240 GOSUB 3340:
     IN$="   .[3CRL]":
     BT$="999999"
1260 REM *** SET  UP  CURSOR ***
1280 REM *** CONTROL STRINGS ***
1300 CD$="[HOME]":
     FOR J=1 TO 40
1320 CD$=CD$+"[CRD]":
     CR$=CR$+"[CRR]"
1340 CU$=CU$+"[CRU]":
     CL$=CL$+"[CRL]"
1360 BL$=BL$+"  "
1380 NEXT J
1400 BL$=BL$+CL$+CL$
1420 PRINT "       [RVS] PRESS A KEY TO
     CONTINUE [OFF]"
1440 GET A$:
     IF A$="" THEN 1440
1460 PRINT "[CLR]";:
     POKE 59468,12
```

The main function of this portion of the program is to set up the cursor control strings. The four C?$ strings are filled with sets of cursor control characters for each of the four directions. We can then position the cursor using these strings and the string functions. To move the cursor to the 20th position along the 10th line down, for example, would require that we PRINT LEFT$(CD$, 10);LEFT$(CR$, 19). IN$ is a string used to position a dot under the cursor when using INPUT and BL$ is a string containing 80 blanks and 80 cursor lefts which is used to clear garbage from two lines of the screen without altering the cursor position.

The rest of the coding is fairly standard. GOSUB 3340 calls the instructions and lines 1420 and 1440 halve the program while we read. BT$ is used in the clock routine to hold the 'Best Time' and is set initially to a false value.

```
1480 REM *** SET UP THE MAIN LINE ***
1500 FOR J=0 TO 39
1520 P1(J)=SP+J:
     P2(J)=SP+J:
     P3(J)=SP+J
1540 POKE P1(J),61
1560 NEXT J
1580 REM *** SET UP AND POKE THE SIDINGS
     ***
1600 FOR J=1 TO 16
1620 P1(J+19)=SP+19+LL*J
1640 POKE P1(J+19), 34
1660 P2(J+29)=SP+29+LL*J
1680 POKE P2(J+29), 34
1700 P3(J+39)=SP+39+LL*J
1720 POKE P3(J+39), 34
1740 NEXT J

1760 REM *** POKE THE SIDING NUMBERS ***
1780 POKE P1(35)+2*LL, 177
1800 POKE P2(45)+2*LL, 178
1820 POKE P3(55)+2*LL, 179
```

The screen POKE numbers of the main line and sidings are held in arrays, one for each siding. This section of the program sets up those arrays and POKEs the lines onto the screen. Note that if your line length is less than 40 characters you will have to change line 1500, and the numbers in lines 1780 to 1820 are peculiar to the PET.

```
1840 REM *** SET UP INITIAL CONDITIONS ***
1860 T1=35:
     S1=0:
     T2=45:
     S2=0:
     T3=55:
     S3=0:
     LT=15
1880 TI$="000000":
     PRINT LEFT$(CD$,8);"[RVS]RUN TIME"
1900 PRINT "[HOME]=[RVS][)][;][OFF][:]
     -[RVS] FEHACDBKJGI"

1920 REM *** INPUT ROUTINE ***
1940 PRINT LEFT$(CD$,21);BL$+"SIDING"+IN$;:
     INPUT S
1960 IF S<1 OR S>3 THEN PRINT "[CRU][RVS]";
     GOTO 1940
1980 PRINT LEFT$(CD$,22);BL$+"NUMBER"+IN$;:
     INPUT SX
```

```
2000 IF LT-SX<4 THEN PRINT "[CRU][RVS]";:
     GOTO 1980
2020 ON S GOSUB 2340, 2680, 3020
2040 REM *** RUN-TIME ROUTINE ***
2060 ST$=TI$
2080 PRINT LEFT$(CD$,10);MID$(ST$,3,2);"
     MINS ";MID$(ST$,5,2);" SECS"
2100 FOR I=1 TO 11:
     IF PEEK(32772+I)<>128+I THEN I=12:
     NEXT I:
     GOTO 1940
2120 NEXT I
```

Here we have the guts of the program. Moves are input and checked, the appropriate subroutine is selected, and the running time is updated at the end of each move. The run time could be continuously updated but this slows down the train movement too much.

```
2140 REM *** BEST-TIME ROUTINE ***
2160 IF ST$<BT$ THEN BT$=ST$
2180 PRINT LEFT$(CD$,14);"[RVS]BEST
     TIME[CRD]"
2200 PRINT MID$(BT$,3,2);" MINS ";MID$(BT$,
     5,2);" SECS"
2220 PRINT LEFT$(CD$,21);BL$
2240 PRINT "[CRU][RVS]ANOTHER GO ?[OFF]":
     FOR I=1 TO 100:
     NEXT I
2260 GET A$:
     IF A$="" THEN PRINT "[CRU]ANOTHER GO
     ?":FOR I=1 TO 100:
     NEXT I:
     GOTO 2240
2280 IF A$="Y" THEN TI$="000000":
     GOTO 1900
2300 STOP
```

Once the train has been properly sorted, this routine checks whether or not the previous best time has been beaten. The 'Another Go' routine shows how cursor control may be used to flash the question on and off using reverse video. The FOR — NEXT loops in this part of the program are for timing purposes.

```
2320 REM *** PUT 1 ***
2340 IF S1+SX<0 THEN PRINT "[CRU][RVS]";:
     GOTO 1980
2360 FOR J=1 TO T1-LT-S1
2380 FOR K=J+LT TO J STEP -1
2400 POKE P1(K), PEEK(P1(K-1))
2420 NEXT K
2440 NEXT J
2460 S1=S1+SX:
     LT=LT-SX
2480 REM *** TAKE 1 ***
2500 FOR J=T1-LT-S1 TO 1 STEP -1
2520 FOR K=J TO J+LT-1
2540 POKE P1(K), PEEK(P1(K+1))
2560 NEXT K
2580 IF P1(K)>32808 THEN POKE P1(K),34:
     GOTO 2620
2600 POKE P1(K),61
2620 NEXT J
2640 RETURN
```

This subroutine moves the train to and from siding one. Line 2340 is testing for a legitimate move as trying to remove non-existent trucks could result in one of the sidings disappearing completely. The movement is produced by the caterpillar method described in the last article.

```
2660 REM *** PUT 2 ***
2680 IF S2+SX<0 THEN PRINT "[CRU][RVS]";:
     GOTO 1980
2700 FOR J=1 TO T2-LT-S2
2720 FOR K=J+LT TO J STEP -1
2740 POKE P2(K), PEEK(P2(K-1))
2760 NEXT K
2780 NEXT J
2800 S2=S2+SX:
     LT=LT-SX

2820 REM *** TAKE 2 ***
2840 FOR J=T2-LT-S2 TO 1 STEP -1
2860 FOR K=J TO J+LT-1
2880 POKE P2(K), PEEK(P2(K+1))
2900 NEXT K
2920 IF P2(K)>32808 THEN POKE P2(K),34:
     GOTO 2960
2940 POKE P2(K),61
2960 NEXT J
2980 RETURN

3000 REM *** PUT 3 ***
3020 IF S3+SX<0 THEN PRINT "[CRU][RVS]";:
     GOTO 1980
3040 FOR J=1 TO T3-LT-S3
3060 FOR K=J+LT TO J STEP -1
3080 POKE P3(K), PEEK(P3(K-1))
3100 NEXT K
3120 NEXT J
3140 S3=S3+SX:
     LT=LT-SX
```

```
3160 REM *** TAKE 3 ***
3180 FOR J=T3-LT-S3 TO 1 STEP -1
3200 FOR K=J TO J+LT-1
3220 POKE P3(K), PEEK(P3(K+1))
3240 NEXT K
3260 IF P3(K)>32808 THEN POKE P3(K),34:
     GOTO 2960
3280 POKE P3(K),61
3300 NEXT J
3320 RETURN
```

This section is similar to the one above but is for the other two sidings.

```
3340 REM *** INSTRUCTIONS ***
3360 POKE 59468,14:
     PRINT "[CLR]";TAB(15);"[RVS] SHUNTING
     [OFF] [CRD][CRD][CRD]"
     3380 PRINT "  SHUNTING is a railway
     simulation game"
3400 PRINT "where you have to shunt a
     set of goods"
3420 PRINT "wagons into order.[CRD][CRD]
     [CRD]"
3440 PRINT "  You must specify a siding
     (1-3) and"
3460 PRINT "the number of wagons to be
     moved. If you";
3480 PRINT "type a positive number wagons
     will be"
3500 PRINT "added to the siding, a
     negative number"
3520 PRINT "removes them.[CRD][CRD][CRD]"
3540 PRINT "  The aim is to sort the train
     in the"
3560 PRINT "shortest possible time.[CRD]
     [CRD][CRD]":
     RETURN
```

Here are the instructions. Although they appear every time the program is run, they do serve the purpose of having something on the screen while the setting up is taking place.

Well that's the end of this month's moving episode. Next month we conclude with a look at RM 380Z and TRS 80 graphics, and double density graphics on the PET.

Paul Williams

DOUBLE DENSITY

Double the plotting capacity of PET with this routine

The following simple program listing allows plotting of characters on an 80 by 50 grid on the PET screen, thus enabling more precise graphs and pictures to be drawn. The first two lines of the program (lines 1 and 2) should be included at the beginning of the program that is to use the double-density feature, they initialise the two arrays required. The plotting section (the latter two lines) can be called by a GOSUB 1000 during the program run, after an x and y value has been specified. The x value should be between −39 and 39, and the y value between −24 and 24.

Where To Go

Assigning 0 to both x and y will produce a dot in the centre of the screen, −39 for x and 24 for y will produce a dot in the top left-hand position of the screen, and 39 for x and −24 for y will be in the bottom right-hand corner of the screen. Thus the positions radiate as for a normal graph from the centre of the screen.

The program works by arranging the codes for the sixteen different double-density graphics in such a way that if the position of the code already on the screen is ORed in binary with the position in the array of the code that you want to put on the screen, the resulting position will give the code containing both the characters that you want to plot. Array S contains the list of all sixteen codes, and array T is used for decoding the PEEK code from the screen into a position for use with array S. This method is best explained by looking at the array S. Table 1 shows the contents in graphical form.

For example, if the character ▖ was on the screen, and the character ▘ wanted to be added, the position of the first character, -0 0 0 1, is ORed with the position of the second character, 0 1 1 0, the result obtained is 0 1 1 1, which, in the table, is the character ▙ , which is the one required to POKE on to the screen. Line 1010 of the subroutine does this, as well as calculating which character needs to be added to the screen.

```
 1 DIM S(15),T(255):FOR T=0 TO 15:READ S(T):
   T(S(T))=T:NEXT T: T=0
 2 DATA 32,123,126,97,108,98,127,252,124,255,226,
   236,225,254,251,160
1000 S=33267+(X/2)-INT(Y/2)*40
1010 POKE S,S(T(PEEK(S)) OR (2▲((X/2-INT(X/2))*4+
   ((Y/2-INT(Y/2))*2)▲2))):RETURN
```

POSITION IN ARRAY	BINARY POSITION	DECODED CHARACTER		POSITION IN ARRAY	BINARY POSITION	DECODED CHARACTER	
0	0000		SPACE	8	1000		SHIFTED <
1	0001		SHIFTED ;	9	1001		RVS SHIFTED ?
2	0010		SHIFTED >	10	1010		RVS SHIFTED "
3	0011		SHIFTED !	11	1011		RVS SHIFTED ,
4	0100		SHIFTED ,	12	1100		RVS SHIFTED !
5	0101		SHIFTED "	13	1101		RVS SHIFTED >
6	0110		SHIFTED ?	14	1110		RVS SHIFTED ;
7	0111		RVS SHIFTED <	15	1111		RVS SPACE .

The block graphics characters and their binary and character key designations for producing the double density effect.

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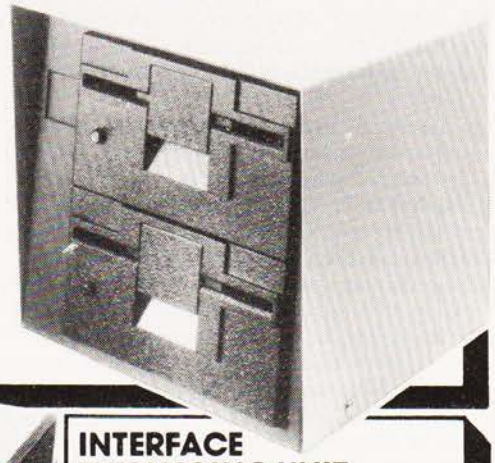

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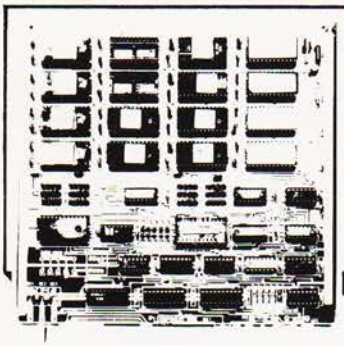

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What better way to take a look at a new book on microcomputer programming than to bring you a sample chapter.

Our Thanks to Newnes Technical Books for their kind permission in allowing us to reproduce this extract from their book. The chapter is shown exactly as it appears in the volume as a guide to the high standard of production.

This chapter is an introduction to the useful features of assembly-language and machine-code programming, rather than a detailed guide to the programming of a specific microprocessor. It describes some aspects that will be of assistance, but does not deal at great length with some of the more intricate facilities of specific chips.

If you are using a packaged microcomputer system for business, ordinary domestic, or scientific calculation work then it is unlikely that you will prefer this type of language to Basic. If, however, you wish to link your system to an external control device or to some non-standard peripheral, such as an analogue-to-digital converter or an amplifier, you will have to write the appropriate software interface in assembly language or machine code. The provision of PEEK and POKE statements in most versions of Basic on packaged systems appears to indicate some awareness of the need to use machine code on occasions.

Undoubtedly machine-code programs are a great deal faster than high-level language ones, but this execution speed must be balanced against the time occupied by their writing and development, and by the fact that a Basic program with machine-code insertions is not transferable to systems based on a different microprocessor. However, there is nothing inherently difficult about programming in a low-level language. Until the early 1960s, when Fortran was fully developed, most technical programs were written in assembly language. This language was also very widely used for the programming of business applications until the late 1960s, and thousands of programmers were trained in it. So do not be put off – assembly-language and machine-code programming is by no means as difficult as it may first appear.

You may find it useful to read pages 21–24 of Chapter 2 again, to refresh your memory of some of the terminology. This will also remind you of the binary and hexadecimal systems. Examples in this chapter will be written in assembly language, from which you can derive the machine code by referring to the operation code on the code card of the system you are using and, where appropriate, attaching an address of your choice.

For instance, using the Intel 8080 code, if you were working on a payroll program and wished to store the computed pay in address 260, your translation would appear as:

```
STA PAY    00110010   (STA)
           00000100 }
           00000001 } location 260 (order reversed)
```

(The reasons for inverting the order of the address are discussed in the appropriate section of this chapter.) If, of course, you are fortunate enough to have an assembler supplied for your system, you can let that do the translation for you.

As mentioned in Chapter 2, if you have to work in machine code, it is a great help to accurate programming to write and check the program in assembly language first, before converting the instructions into binary and hexadecimal for entry through the keyboard or switches.

Examples in this chapter will be confined to the four most common microprocessor chips you are likely to encounter, either in building your own equipment or in using a packaged system. The chips (followed by some of the packaged systems they support) are: Intel 8080 (Altair and Imsai); Motorola 6800 (SWTP and MSI); MCS6502 (Apple and Pet); and Zilog Z-80 (Tandy TRS80 and Research Machines). These have many likenesses; all have 40 pins and work on eight bit operands, and there is much common ground in their instruction sets.

Some fundamentals

1. Notation

The binary and hexadecimal notations are described on page 22. Sometimes addresses or program listings are given in *octal*. This uses base 8. The decimal numbers 1–10 in octal are:

1 2 3 4 5 6 7 10 11 12

2. Byte

All the microcomputers discussed use an eight-bit unit known as a *byte* as a unit of storage and as the basic instruction length.

3. Address

An *address* is the identifying number of a memory byte (a 'memory location') that holds data or an instruction. The example in the previous section referred to data held in address 260.

Although an address refers to a single byte, addresses in microcomputer systems are themselves usually two bytes (16 bits) long, so that locations with addresses larger than 255 can be referenced. Theoretically the largest address that can be held in two bytes is 65 535, but your system probably has much less than this amount of memory.

A system's memory is often referred to as having a certain number of 'K', where K stands for 1024 bytes; so a 32K system will have 32 768 locations, with addresses ranging from 0 to 32 767. Note that the first 256 locations of memory are often described as *page 0* of the memory.

If you are using assembly language, there is a facility ORG by which you can set the starting address of the program, e.g.

```
ORG 2000
```

would start assembling at address 2000.

You have to ensure that the addresses you choose for the storage of your programs and data do not interfere with those used by any monitor or input-output subroutine you are holding in memory at the same time as your program.

4. Registers

These are used for holding data and for some special purposes. Since they are an integral part of the microprocessor chip, access to them is much faster than to memory locations. They should therefore be used, when they are not being utilised for a special purpose, for the storage of intermediate results.

All four microprocessor systems have the following registers:

- program counter (shows address of next instruction);
- stack pointer (purpose explained on page 104);
- accumulator or A register (8 bits).

Other registers are:

8080	6800	6502	Z-80
General purpose			
B, C	B, C	None	B, C
D, E, H, L			D, E, H, L, A′, B′, C′, D′, E′, H′, L′
8080	6800	6502	Z-80
Special-purpose			
None	Index register X	Index registers X, Y	IX, IY
			Interrupt vector
			Memory refresher

The use of the special-purpose registers will be explained in the course of this chapter.

5. Flags

A flag is a bit that defines a specific condition (e.g. arithmetic overflow in the accumulator) as true or false. It is given the value 1 if the condition is present and 0 if not. Flags are mostly concerned with arithmetic and interrupts, and are discussed in the relevant sections of this and the next chapter.

Transferring data

Some of the most important instructions deal with moving data from registers to memory locations and vice versa. Arithmetic is done in the accumulator, so a transfer to that register is needed. Temporary results are often moved from register to memory, while input-output usually needs a memory-to-register transfer.

Transfers between memory and accumulator

To perform arithmetic, one of the operands needs to be loaded into the accumulator using an LDA instruction (or equivalent), and the result needs to be stored using an instruction of the STA type. Appropriate instructions for the four microprocessors are given below. With these, as with the instructions given in other sections of this chapter, you should look up the length of the instruction, the flags (if any) affected, and the machine-code format on your code card.

8080

LDA	Loads the accumulator with the *contents* of the address given in the two bytes following the operation code. The low-order part of the address comes before the high-order; this does not affect your naming the address with a name of your choice in assembly language, but if you are working in machine code it is important to get this order right (see STA example on page 85).
LDAX B	Loads the accumulator with the *contents* of the address given in registers B and C. This enables you to use the same instruction to refer to a different address, simply by changing the register contents.
LDAX D	As above, but using registers D and E.
STA	Stores the contents of the accumulator in the address given in the two bytes following the operation code. Corresponds to LDA.

STAX B and STAX D correspond to LDAX B and LDAX D.

6800

CLR	Sets a memory location to zero.
CLRA	Sets the accumulator to zero.
LDAA	Loads the accumulator with the *contents* of the address given in the two bytes following the operation code. The high-order part of the address comes before the low-order (not as in the 8080); if the address is in the range 0–255 only one byte is needed to store it (this facility applies to *all* instructions containing a memory address). Can also load a *value* into the accumulator: the value is usually preceded by the # sign, e.g. LDAA # 5, and is held in the second byte of the instruction. This form of addressing is known as *immediate addressing*.
STAA	The 'store' command corresponding to LDAA.

6502

LDA and STA are like the 6800 LDAA and STAA, except that representation of an address in two bytes is 'back to front', as in the 8080.

Z-80

LD A, (location address or name)	Functions like the 8080 LDA.
LD (location address or name), A	Functions like the 8080 STA.
LD A, (BC)	Functions like the 8080 LDAX B.
LD A, (DE)	Functions like the 8080 LDAX D.
LD (BC), A	'Store' command, reverse of LD A, (BC).
LD (DE), A	'Store' command, reverse of LD A, (DE).

Be careful about the comma and brackets in all these instructions.
A program using some of the above instructions to interchange the contents of two memory locations, named COX and BOX, is given below. The 'load' instructions do not affect the contents of the memory location that they transfer to the accumulator, and the 'store' instructions do not affect the contents of the location transferred.

8080	*6800*	*6502*	*Z-80*
LDA COX	LDAA COX	LDA COX	LD A, (COX)
STA DUMP	STAA DUMP	STA DUMP	LD (DUMP), A
LDA BOX	LDAA BOX	LDA BOX	LD A, (BOX)
STA COX	STAA COX	STA COX	LD (COX), A
LDA DUMP	LDAA DUMP	LDA DUMP	LD A, (DUMP)
STA BOX	STAA BOX	STA BOX	LD (BOX), A

Transfer of data involving other registers

8080

LHLD	Loads registers L and H *respectively* with the contents of two memory locations: the address given in the two bytes following the operation code, and that address plus one. This is useful for transferring an address to L and H.
SHLD	Stores the contents of registers L and H in a pair of consecutive memory locations.
XCHG	Exchanges the contents of the register pairs D, E and H, L.
MOV R1, R2	Moves the contents of register R2 to register R1. For example, MOV A, E would transfer the contents of register E to the accumulator (counted as register A).
MOV M, R	Moves the contents of a register to the memory location *defined by the address stored in registers L and H*. For example, MOV M, A would transfer the contents of the accumulator to the address given in registers L and H.
MOV R, M	Reverses the above process, i.e. moves the contents of a memory location to a register. For example, MOV A, M would transfer to the accumulator the contents of the address given in registers L and H.
LXI RP	Loads a register pair (BC, DE, HL) with the value of the two bytes following the operation code. For example, LXI B, COX would load registers B and C with the address of COX.
MVI M	Moves the value of the byte following the operation code into the memory location specified by the registers L and H. For example, MVI M, 7 would put 7 into the appropriate address.
MVI R	As above, but moves the value to a register instead of a memory location. For example, MVI A, 6 would put 6 in the accumulator.

6800

LDAB	Loads register B with the contents of the address given in the two bytes following the operation code.
STAB	The corresponding store instruction.
TAB	Transfers the contents of the accumulator to register B.
TBA	The reverse of the above process.
LDX	Loads the index register with the contents of two memory locations: the address given in the two bytes following the operation code, and that address plus one.
STX	The corresponding store instruction.
TPA	Puts all flags into the accumulator.

6502

LDX	Loads index register X from memory locations (as 6800 LDX).
STX	The corresponding store instruction.
TAX	Puts the contents of the accumulator into register X.

TXA — Puts the contents of X into the accumulator.

LDY, STY, TAY, TYA are the corresponding instructions for index register Y.

Z-80

The following are the most common transfer instructions.

LD R1, R2 — Loads the contents of register R2 into R1. R1 and R2 can be any of the registers A–E, H and L.

LD R, *n* — *n* is the *value* in the byte following the operation code. For example, LD A, 0 would clear the accumulator.

LD R, (HL) — Loads the contents of the address defined in registers H and L into a specified register. For example, LD C, (HL) would put the contents of the address defined in registers H and L into register C.

LD (HL), R — The reverse of the previous instruction.

LD (HL), *n* — Loads the contents of the byte following the operation code into the address defined in registers H and L.

LD A, (BC)
LD (BC), A
LD A, (DE)
LD (DE), A — Similar to LD R, (HL) and LD (HL), R. They load or store the accumulator from the address specified by the registers DE or BC.

LD HL, *nn* — Loads the two bytes after the operation code into the H and L registers. Similar instructions are LD BC, *nn* and LD DE, *nn*.

Addition and subtraction

Only addition and subtraction have instructions provided. Multiplication and division have to be performed by subroutines, which you can usually obtain easily.

The simplest type of arithmetic is in binary, involving two single-byte whole-number items. This forms the basis for arithmetic on larger numbers.

Binary notation has already been described in Chapter 2. The representation of negative numbers, however, was not discussed there. In most applications you are bound to meet negative amounts (such as a debit or a low temperature), and if you have a system that displays the contents of registers and memory in lights above switches you may encounter a negative number displayed. In binary, negative numbers are represented by 'twos complement' notation. This uses the most significant digit (the extreme left) of a binary number as the 'sign digit' to indicate whether the number is positive or negative. The sign digit is 0 for a positive number and 1 for a negative one. This limits the largest positive number you can hold in a single byte to 127 (01111111), and the largest negative number to –128 (10000000).

To find the negative representation of a positive number there are two methods:

1. Change 0s to 1s and 1s to 0s, then add 1. For example:

   +7 = 00000111
–7 = 11111001

2. Subtract from 2 raised to the power of the number of bits in the representation you are using. If you are using one byte this will be 2^8 or 256; if two bytes, 2^{16} or 65 536. For example:

   256 – 7 = 249
so –7 = 11111001

You can check your conversion by adding the positive number and its negative conversion; they should equal zero in the number of bits you are using for number representation, e.g.

```
        +7   00000111
plus    –7   11111001
           (1)00000000
```

The above two methods will also give you the positive equivalent of any negative number you may see in your lights in binary, e.g.

```
                    11110011
Reverse, and add one:  00001101 = 13
```

Therefore the number was –13. Some other negative representations in a single byte are:

```
–1   11111111
–3   11111101
–4   11111100
–64  11000000
```

Results from addition and subtraction are usually in the accumulator. All four systems can add the value of the byte following the operation code, so if an instruction is (on the 8080):

ADI 20

it would add 20 to the accumulator; 20 is known as the *immediate operand*.

All four systems have a *carry flag* (flags were briefly discussed on page 87). The carry flag is set to 1 if a carry (or borrow) occurs and cleared if this does not happen. All systems discussed except the 6502 have separate instructions for addition and subtraction with and without the contents of the carry flag being added to (or subtracted from) the result. It is useful in multi-precision arithmetic, which is discussed later in this section. The add and subtract instructions are as follows.

8080

ADI, ACI — Adds the contents of the byte following the operation code to the accumulator – with and without carry respectively.

SUI, SBI — The subtract form of the above – with or without borrow.

ADD R, ADC R — Adds the contents of a register to the accumulator – with or without carry.

SUB R, SBB R — The subtract form of the above – with or without borrow.

ADD M, ADC M — Adds the contents of a memory location referenced by the L and H registers – with or without carry.

SUB M, SBB M — The subtract form of the above – with or without borrow.

6800

ADDA, ADCA — Adds an immediate operand or the contents of a memory location to the accumulator – with or without carry.

SUBA, SBCA — The corresponding subtract instructions.

ADDB, ADCB
SUBB, SBCB — Perform the same functions using register B instead of the accumulator.

ABA, SBA — Adds/subtracts the contents of register B to/from the accumulator, with the result remaining in the accumulator.

6502

ADC, SBC — Adds/subtracts an immediate operand or the contents of a memory location to/from the accumulator, with carry. CLC will clear the carry flag, if you wish to ensure that no carry influences the result.

Z-80

ADD *n*, ADC *n*, SUB *n*, SBC *n* (where *n* is an immediate operand) are like 8080 ADI, ACI, SUI, SBI.

ADD *r*, ADC *r*, SUB *r*, SBC *r* correspond to the ADD R type of 8080 instruction.

ADD (HL), ADC (HL), SUB (HL), SBC (HL) correspond to the ADD M type of 8080 instruction.

The following example finds the difference between two variables CAT and DOG, and then adds 10 and 20. It is assumed that all numbers and the resulting sum can be held in a single byte. The carry facility is not used. To avoid this on the 6502 it is necessary to *set* the carry on a subtraction and *clear* it before an addition. On the other systems a variety of different instructions are utilised to show their use – hence this small program is not necessarily the most efficient way of performing the calculation. The 8080 and Z-80 programs both have to move a sum into a register and the address of a memory location to registers H and L before doing the calculation.

8080	*6800*	*6502*	*Z-80*
MVI B, 10	LDAB # 10	LDA CAT	LD B, 10
LXI H, DOG	LDAA CAT	SEC	LD HL, DOG
LDA CAT	SUBA DOG	SBC DOG	LD A, (CAT)
SUB M	ABA	CLC	SUB (HL)
ADD B	ADDA # 20	ADC # 10	ADD B
ADI 20		ADC # 20	ADD 20

If you are working in assembly language, as opposed to writing a program in this language and then converting it yourself to machine code, you may find the following facilities useful for calculation programs. EQU enables you to give a value to a variable before it is used in a program instruction. This facility is convenient for defining frequently used constants, e.g.

DOZEN EQU 12

DB has a similar function (and is sometimes written as DEFB), e.g.

DOZEN DB 12

DS reserves storage of a specified number of bytes for a data name, e.g.

QUANT DS 4

would reserve four bytes.

Multi-precision arithmetic

You will not want to be limited to quantities not greater than 127. The 8080 and Z-80 have instructions for two-byte arithmetic in registers. If you wish to work with quantities larger than that, you have to make use of the 'carry' facility in such instructions as ADC.

The 8080 two-byte add instruction is DAD followed by B, D or H, which adds to the registers H and L the contents of the register pairs BC, DE and HL. The first-named register in each case would contain the sign bit (0 if positive, 1 if negative) and the most significant part of the number. The equivalent Z-80 instruction is:

ADD HL, BC (or the corresponding register pair)

The following instructions add two 16-bit (two-byte) numbers in QUANT1 and QUANT2 and leave the result in registers H and L. The carry flag is set if there is a carry from the most significant bit.

8080	*Z-80*
LHLD QUANT1	LD BC, (QUANT1)
XCHG	LD HL, (QUANT2)
LHLD QUANT2	ADD HL, BC
DAD D	

If you have not the above systems, or want to use operands larger than two bytes, you will have to utilise the 'carry' version of the add and subtract instructions. The following example shows how addition and subtraction with carry operate on two 16-bit quantities.

Addition

(more significant byte)	(less significant byte)	
00011100	01110111	7 287
+01011111	11111100	+24 572
+ 1 carry flag	01110011	31 859
01111100		

Subtraction

00000100	00000000	1024
−00000000	10000000	−(+128)
− 1 carry flag	10000000	+896
00000011		

The first add or subtract must be done without carry (except on the 6502 when the carry flag must be cleared or set).

The following sequence of instructions performs COX + BOX = FOX on two-byte amounts. It is assumed that all results can be held in two bytes. In order to access the low-order byte of the operands, the address of the type 'COX + 1' is used. The high-order byte would be in COX and the low-order byte would be in the next address, which can be referred to as COX + 1; for example, if the number was 256:

COX	COX + 1
00000001	00000000

In machine code these are two contiguous addresses such as 300 and 301.

8080	*6800*	*6502*	*Z-80*
LDA COX + 1	LDAB COX + 1	CLC	LD A, (COX + 1)
MOV B, A	LDAA COX	LDA COX + 1	LD B, A
LDA BOX + 1	ADDB BOX + 1	ADC BOX + 1	LD A, (BOX + 1)
ADD B	ADCA BOX	STA FOX + 1	ADD A, B
STA FOX + 1	STAA FOX	LDA COX	LD (FOX + 1), A
LDA COX	STAB FOX + 1	ADC BOX	LD A, (COX)
MOV B, A		STA FOX	LD B, A
LDA BOX			LD A, (BOX)
ADC B			ADC A, B
STA FOX			LD (FOX), A

All systems except the 8080 have an *overflow flag*, which is set when a nine-bit signed number appears as a result of adding *two one-byte numbers with the same sign*. This condition occurs with negative numbers in the range −129 to −256 and positive ones in the range 128 to 254. It is usually an error condition.

So far it has been assumed that you are adding and subtracting whole numbers. You can assume the binary point at any place in a single or multi-precision number. For example, 00011110 could represent 7.5; here the point is assumed before the last two bits of the byte. Binary fractions descend in powers of two: .1 = .5; .01 = .25; .001 = .125 etc. You have to work out how many places of binary fractions your result needs, allowing for any multiplication and division, which respectively increase and decrease the number of significant figures in the result. It is best to divide all your input by the appropriate power of 2, so that it is all in fractional form. This power is known as a *scaling factor*. You will have to make adjustments each time you use a multiplication or division subroutine, if you wish to keep the original scaling, and then make the appropriate adjustment to the original numbers on output. This 'hunting the binary point' is a tiresome chore and is best avoided. *Floating point* routines that automatically handle these problems have been written for most systems, and should be used if you are working with fractional numbers. Alternatively, you can use the *binary-coded decimal* (BCD) form of number representation, where you have no need to worry about the lack of correspondence between the decimal point and the binary point.

Reprinted from "Introduction to Microcomputer Programming" by Peter C. Sanderson, published by Newnes Technical Books, Borough Green, Sevenoaks, Kent TN15 8PH. ISBN 0 408 00415 0, price £3.75.

Owen Bishop

Light up your micro's day with this simple but effective light sensitive pen, ideal for quick data entry or menu selection in VDU based systems.

The light-pen we describe this month is extremely simple and cheap to construct. It detects the light being emitted either by a seven segment LED display or from an area of a VDU screen. The sensor is a phototransistor (Fig.1). There is no connection to its base terminal but when light falls on the transistor it has the same effect as an increase in base current and causes an increased flow of current from collector to emitter. The transistor has a lens, so it is fairly directional in its sensitivity, essential if one is to pick out a particular display digit or an area of a screen.

Displays are multiplexed at a high rate so that, although they appear to be shining continuously, the digits are really being turned on and off at high frequency. When the transistor is pointed towards a digit, and that digit flashes, a momentary current flows through the transistor. This causes a brief fall in potential at the junction between R1 and Q1. This 'low' pulse is transmitted through C1 and triggers the flip-flop.

The flip-flop can exist in either of two states, its output being high or low. Its inputs (pins 1 and 6) must normally be held high (+5 V). If the flip-flop is in its 'output high' state, a low input to pin 1 (from C1) causes its output to change to 'low'. To make the output 'high' again, pin 1 must first return to a 'high' input and a 'low' pulse must be applied to pin 6. So, the output from the light pen is normally 'high', but goes 'low' when the pen receives a flash of light. It then *stays* 'low', until it is reset by a 'low' pulse at its reset input.

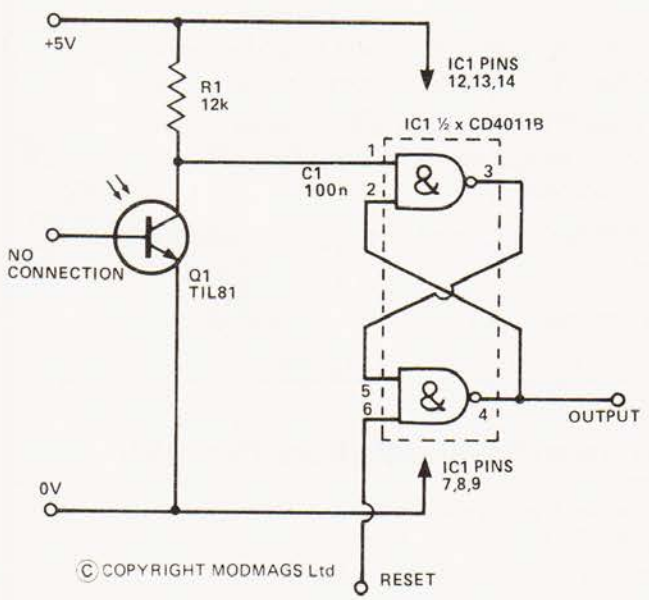

Fig.1. The light pen circuit diagram

Construction

Figure 2 shows that the circuit needs only a tiny scrap of stripboard. It is best to assemble the flip-flop first. For testing, it can be powered from 6 V or 9 V batteries: Connect the meter to pin 4 (output) and temporarily join pins 1 and 6 (reset) to the positive supply. Disconnecting pin 1 from positive should make output go 'low' (nearly 0 V). Then reconnect pin 1 to positive and output should stay 'low'. Disconnecting pin 6 from positive should make output go 'high' again. Strictly speaking, the pins should be connected to 0 V when disconnected from the positive, but the act of disconnection usually triggers the flip-flop.

Figure 3 shows where to solder the wires to the transistor. Use long light-duty wire to give maximum flexibility and slide a piece of sleeving over each joint before twisting the leads together. If you have no sleeving, use a short length of insulation from stouter wire, or tape. The assembly is then mounted in the barrel of an empty ball-point pen. It should wedge firmly in place, but a little glue can be used if required. Cut a section from the plug at the other end of the barrel — just enough so that the wires are firmly gripped when the plug is re-inserted.

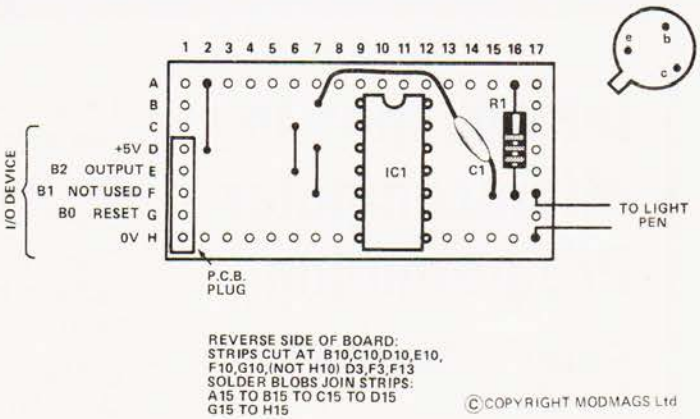

Fig.2. The corresponding Veroboard overlay

PARTS LIST

Resistors ⅓ W 5%

R1	12k

Capacitors

C1	100n polyester

Semiconductors

IC1	4011
Q1	TIL 81 phototransistor

The end is then sawn off the cap of the pen which protects the transistor and further increases its directional sensitivity. The board may be stood on 'legs' made of terminal pins soldered in at A1, A17 and H3, with the pin at H17 acting as a fourth leg. Alternatively, the board is so small that it can be attached to an odd corner of the microprocessor board, using a 'sticky-fixer'.

Before connecting the circuit to the micro, run a test as described above, but pointing the pen at a source of light to make output change from high to low. Remember to point the pen away from light before trying to reset the circuit.

Connections

With the 5-pin PCB plug shown in Fig.2, the connections are compatible with those used for previous interfaces, such as the LED interface (CT, February 1980), or the audio board (CT, August 1980). You can also use a jump-lead between the LED interface plug and the light pen plug. This connects the pen to the I/O device of the system at Port B0 (reset) and Port B2 (pen output). If you are using an Mk-14 without an I/O device, you can connect directly to the MPU — 'reset' to Flag 0, pen output to SENSE A.

At the top edge-connector of the Mk-14 board, Flag 0 is third from the right and SENSE A is seventh. The device operates from the regulated 5 V supply of the micro and draws only 25 uA in the dark or 400 uA in the light, so there is no chance of it overloading the regulator!

Programming

Figure 5 shows a program loop which can be a segment of a longer program. The important points are that the reset must first be made high and held high before one or more of the

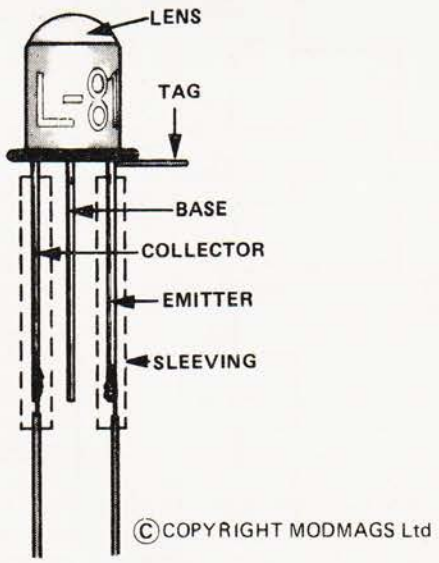

Fig.3. Phototransistor connections

and characters in turn and store them in display. This is repeated in a loop sequence. The flowchart of Fig.6 shows how it is possible for the pen to detect when one particular digit is being pointed at.

By cutting out the part to the right of the dashed line the program exits from the loop as soon as *any* digit is pointed at, the counter then containing the number of that digit. It can now go to any one of a number of different sub-routines.

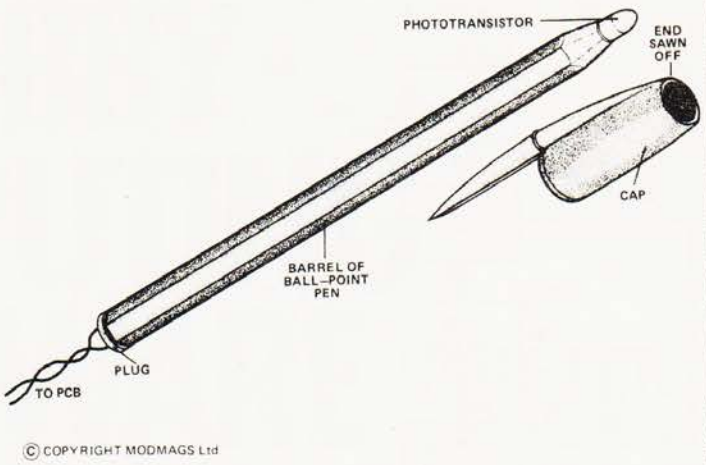

Fig.4. Putting it all together

digits is flashed. This is normally part of the process of displaying a message. The usual way of displaying a message on Mk-14 is to read from memory the code for each of the 8 digits

The sample program given here is useful for testing the pen. The flowchart of Fig.7 explains its action.

Fun and Games

This pen has several applications in educational programs, but even more use as a novelty in games. Instead of shooting down the ducks using the keyboard, why not knock

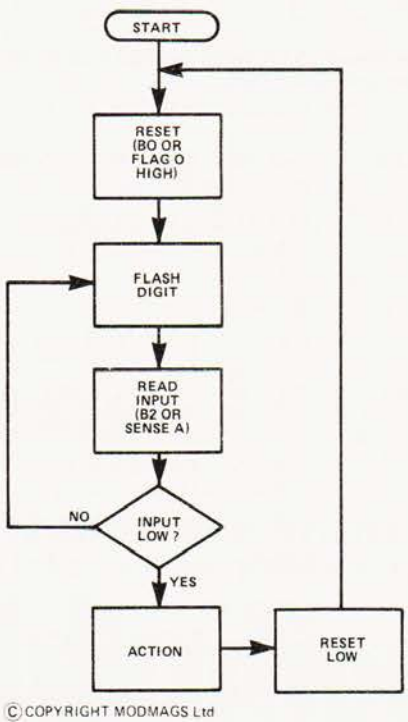

Fig.5. Light pen loop for use within a program

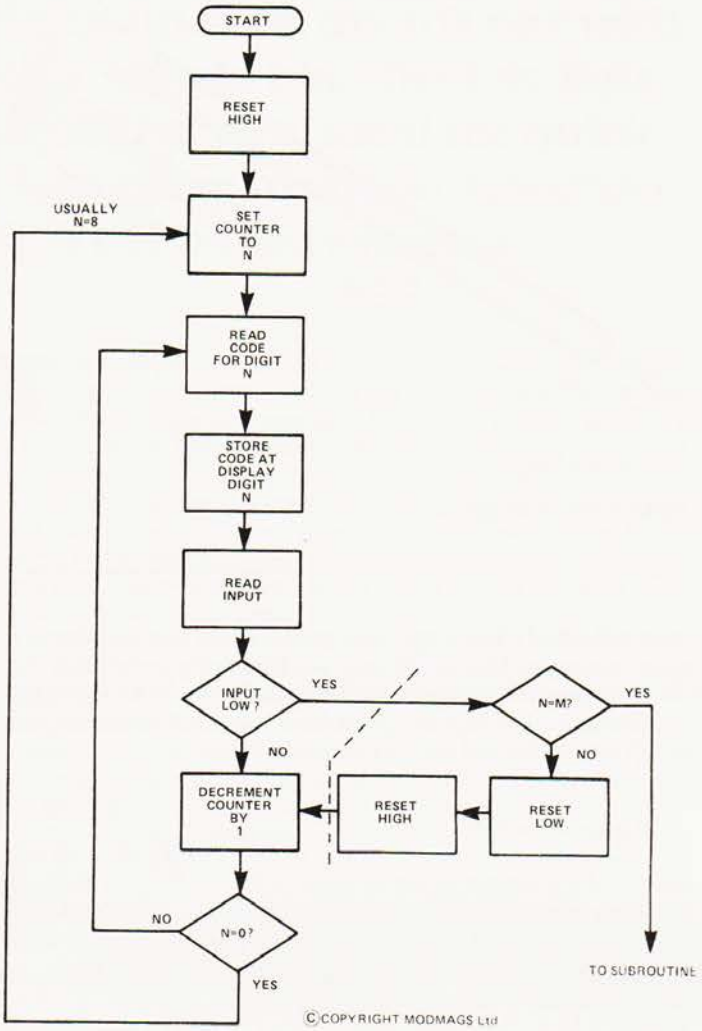

Fig.6. Program flowchart to display an eight digit message until the pen is pointed at a pre-determined digit.

```
0F20  C4 0D      LDI '0D' ]
0F22  34         XPAH P1  ] Pointer 1 to display
0F23  C4 01      LDI '01' ]
0F25  07         CAS      ] Flag 0 high to enable pen
0F26  C4 FF  A:  LDI 'FF'
0F28  C9 01      ST P1+1
0F2A  06         CSA      ]
0F2B  D4 10      ANI '10' ] Read SENSE A
0F2D  9C F7      JNZ A:     If SENSE A still high
                            continue display at digit 1
0F2F  C4 00      LDI '00' ]
0F31  07         CAS      ] Flag 0 low to reset pen
0F32  C4 01      LDI '01' ]
0F34  07         CAS      ] Flag 0 high to enable pen
0F35  C4 FF  B:  LD1 'FF'
0F37  C9 05      ST P1+5
0F39  06         CSA      ]
0F34  D4 10      ANI '10' ] Read SENSE A
0F3C  9C F7      JNZ B:     If SENSE A still high
                            continue display at digit 5
0F3E  C4 00      LD1 '00' ]
0F40  07         CAS      ] Flag 0 resets pen
0F41  C4 01      LDI '01' ]
0F43  07         CAS      ] Pen enabled
0F44  90E0       JMP A:     Go back and display
                            digit 1 again
```

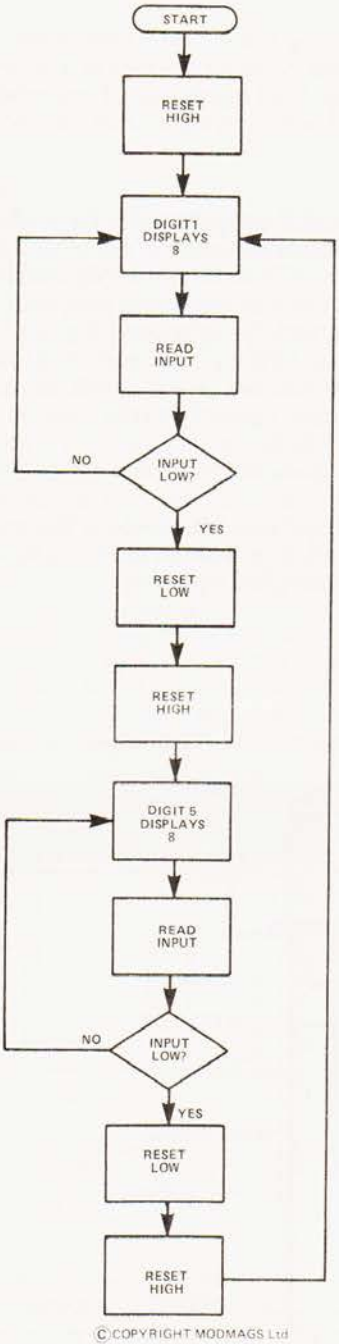

Fig.7. The 'Chase-the-Light' program flowchart. The displayed '8' jumps between positions one and five when it is pointed at by the pen.

them down with the pen? Perhaps the game could be renamed 'Fly-swat'. There are several ways in which one or two pens can be used by players in place of the keyboard, and the pen is certainly cheaper to build than an additional keyboard. Owners of systems with a VDU have almost unlimited scope for using this pen but, as always, it depends on the ingenuity of the programmer.

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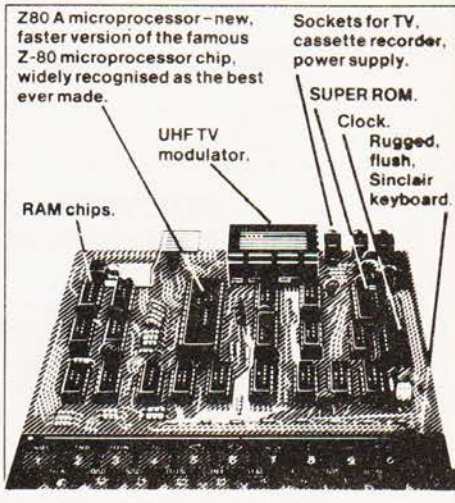

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CT/11/80

AUTO WRITER

Malcolm Friend

The writer program is written for an 8K PET and Commodore CBM2023 printer. As the Treasurer of the local branch of a national charity I often have to write letters or reports. A particularly time consuming fact, when using an ordinary typewriter, is that the content of many of the letters typed is exactly the same. I wrote this program to assist me and it provides all of the following:

1 - a choice of letter or manuscript (i.e. reports).
2 - an automatic count of the number of keystrokes on a line.
3 - an option for an automatically centred and underlined heading.
4 - a facility to address envelopes.
5 - a facility to type the same letter to a different person without the need to input the body of the letter again.
6 - ability to right justify.
7 - ability to edit the name, address, heading etc.
8 - ability to edit the body of the letter or manuscript.

After offering a choice of either a letter or manuscript, the program then instructs the user to enter the text. This is entered into the body of the program by an auto line numbering routine as follows.

Expounding The Text

Line 150 prints the first of the reserved line numbers followed by 'PRINT #1,' and quote marks. Using the GET command in line 160 the keystrokes input are entered on to the line until the RETURN line 270 increments the line number, prints some variables to the screen and a GOTO command. The BASIC program is then interrupted with an END, the keyboard counter is loaded and the buffer is also loaded with the ASC code which represents the RETURN key (13). This has the effect of RETURNing down the screen, entering screen contents into memory and executing the GOTO command. (The variables have to be printed on to the screen as adding lines to the program resets all variables to zero.)

Y and Z are set to the ASCII code for zero in line 140. They are then incremented or decremented as keystrokes are entered or deleted in a PRINT line. However, they are not adjusted for any printer control characters entered. Line 240 POKEs their value to the bottom screen line and this provides the automatic count of keystrokes so that the line does not 'overflow'. When all the text is input the user enters the pi symbol to get out of the auto-mode (why pi? well, why not!). If the letter option has been selected the program then allows the date, recipients name, address etc to be entered. These are entered as variables at first but by using the same interrupt technique as before they are subsequently entered as lines in the program by the routine at line 1130. The next part of the program for both letter and manuscript option allows a heading to be entered if appropriate and the letter or manuscript is then typed with any heading centred and underlined automatically.

Options

The user is then offered various options, but most of these are self explanatory. Use is made of the interrupt technique to provide an auto line delete for option 3. Options 4 and 5 use the same technique to LIST the relevant part of the program automatically allowing use of the normal screen editing facility. The LIST command terminates the program and it is necessary to enter a RUN command to restart. However this would set all of the variables to zero but by entering 'RUN2000' a sub-routine is called which re-inputs the values of all the variables necessary for the execution of the program.

```
 10 REM ** ENTER YOUR OWN ADDRESS ETC IN LINES
    470-500
 20 REM ** NOTE THAT ALL CURSOR COMMANDS ARE TO
    THE CT STANDARD
 30 REM ** THE PET PRINTER ALSO USES CURSOR UP
    AND DOWN TO SELECT
 40 REM ** UPPER OR LOWER CASE IN PRINT
    STATEMENTS
 99 REM ** START OF PROGRAM PROPER
100 PRINT "[CLS]"
110 PRINT "SELECT OPTION:-[CD]":PRINT "1=LETTER.
    [CD]":PRINT "2=MANUSCRIPT."
120 GET S1:IF S1=0 THEN 120
130 REM ** INPUT TEXT
140 PRINT:PRINT:PRINT "ENTER TEXT.":FOR I=1 TO
    1000:NEXT I:LN=555:Y=48:Z=48
150 PRINT "[CLS][5 CD]";LN;"PRINT#1,"CHR$(34);
160 GET L$:IF L$="" THEN 160
170 PRINT L$;:IF ASC(L$)=17 OR ASC(L$)=145
    THEN 230
180 IF ACS(L$)=20 THEN Z=Z-1
190 IF ASC(L$)=20 AND Z=47 THEN Y=Y-1
200 IF ASC(L$)=20 AND Z=47 THEN Z=Z+10
210 IF ASC(L$)=20 THEN 230
220 Z=Z+1
230 IF Z=58 THEN Y=Y+1:IF Z=58 THEN Z=Z-10
240 POKE 33708,Y:POKE 33709,Z
250 IF ASC(L$)=222 THEN 300
260 IF ASC(L$)<>13 THEN 160
270 LN=LN+5:PRINT "LN=";LN;":S1=";S1;":Y=48:
    Z=48:GOTO 150"
280 POKE 525,4:FOR N=0 TO 3:POKE 527+N,13:NEXT:
    PRINT "[HOM]":END
290 REM ** INPUT ADDRESS ETC.
300 PRINT "[CLS]":IF S1=2 THEN 430
310 PRINT "[CLS]ENTER DETAILS OF ADDRESSEE":PRINT
320 PRINT "PRECEDE EACH INPUT WITH QUOTATION MARKS."
330 PRINT "FIRST LINE OF ADDRESS":INPUT "A$=";A$
340 PRINT "SECOND LINE OF ADDRESS":INPUT "B$=";B$
350 PRINT "THIRD LINE OF ADDRESS":INPUT "C$=";C$
360 PRINT "FOURTH LINE OF ADDRESS":INPUT "D$=";D$
370 PRINT "FIFTH LINE OF ADDRESS":INPUT "E$=";E$
380 PRINT "DEAR ??":INPUT "G$=";G$:GOTO 1130
390 IF S2=2 THEN 460:REM ** OPTION 2
400 PRINT "[CLS]DATE":INPUT "F$=";F$:PRINT
    "VALEDICTION":INPUT "H$=";H$
410 PRINT "FIRST LINE RE SIGNATURE":INPUT "I$=";I$
420 PRINT "SECOND LINE RE SIGNATURE":INPUT "J$=";J$
430 PRINT "[CLS]ENTER HEADING OR TYPE QUOTATION
    MARK AND PRESS RETURN."
440 INPUT "K$=";K$:GOTO 1180
450 REM ** PRINT LETTER/MANUSCRIPT
460 GOSUB 1220:OPEN1,4:IF S1=2 THEN 520
470 PRINT "[CLS]":PRINT#1,TAB(40)"XXXXXXXXXXXXXXXXXX,"
480 PRINT#1,TAB(40)"XXXXXXXXXXXX,":
    PRINT#1,TAB(40)"XXXXXXX,"
490 PRINT#1,TAB(40)"XXXXXX,":PRINT#1,TAB(40)"XXXXXXX."
500 PRINT#1,"T[CD]ELEPHONE:-XXXXX"TAB(25)F$:
    PRINT#1:PRINT#1
510 PRINT#1,"D[CD]EAR[CU] "G$:PRINT#1
520 IF K$="" THEN 550
530 T=INT((60-LEN(K$))/2):PRINT#1,TAB(T)K$
540 FOR I=0 TO (LEN(K$)-1):PRINT#1,TAB(T+I)"[^#]"
    CHR$(141);:NEXT I:PRINT#1
550 REM ** LINES 555-825 RESERVED FOR TEXT
830 IF S1=2 THEN 880
840 PRINT#1:PRINT#1,TAB(40)H$:FOR I=1 TO 5:
    PRINT#1:NEXT I
850 PRINT#1,TAB(40)I$:PRINT#1,TAB(40)J$:PRINT#1
860 PRINT#1,A$:PRINT#1,B$:PRINT#1,C$:PRINT#1,D$:
    PRINT#1,E$
870 REM ** SELECT OPTION
880 CLOSE1,4:PRINT "[CLS]SELECT OPTION:-":PRINT
    "1=TYPE LETTER/MANUSCRIPT/COPY."
```

```
 890 PRINT "2=TYPE SAME LETTER TO ANOTHER PERSON."
 900 PRINT "3=TYPE DIFFERENT LETTER OR
     MANUSCRIPT.":PRINT "4=TYPE ENVELOPE."
 910 PRINT "5=EDIT ADDRESS ETC.":PRINT "6=EDIT
     TEXT.":PRINT "7=FINISH."
 920 GET S2:IF S2=0 THEN 920
 930 ON S2 GOTO 940,290,1000,940,1060,1060,1050
 940 REM ** OPTION 1 OR 4
 950 PRINT "[CLS]PRESS ANY KEY WHEN PRINTER READY."
 960 GET S$:IF S$="" THEN 960
 970 IF S2=1 THEN 460
 980 OPEN1,4:PRINT#1,TAB(18)A$:PRINT#1,TAB(18)B$:
     PRINT#1,TAB(18)C$
 990 PRINT#1,TAB(18)D$:PRINT#1,TAB(18)E$:GOTO 880
1000 REM ** OPTION 3
1010 PRINT "[CLS]WAIT WHILE THE OLD TEXT IS
     DELETED.":FOR I=1 TO 1000:NEXT I:J=555
1020 L=1020:PRINT "[CLS][2 CD]":FOR I=J TO J+8:
     IF I>LN THEN L=110
1030 PRINT I:NEXT I:PRINT "J="J+9":LN="LN":GOTO"L
1040 POKE 525,10:FOR N=0 TO 9:POKE 527+N,13:NEXT N:
     PRINT "[HOM]":END
1050 PRINT "[CLS]TERMINAL CLOSED":END:REM ** OPTION 7
1060 REM ** OPTION 5 OR 6
1070 PRINT "[CLS]TEXT WILL NOW LIST AND MAY BE
     EDITED IN THE NORMAL WAY."
1080 PRINT:PRINT "TO RESTART ENTER 'RUN 2000'-
     PRESS 'RETURN'."
1090 FOR I=1 TO 2000:NEXT I
1100 IF S2=5 THEN PRINT "[CLS][3 CD]LIST 1221-1231"
1110 IF S2=6 THEN PRINT "[CLS][3 CD]LIST 555-"LN
1120 PRINT "[HOM]":POKE 525,1:POKE 527,13:END
1130 REM ** GOTO RE VARIABLES
1140 Z$=CHR$(34):PRINT "[CLS][3 CD]1221A$="Z$A$:
     PRINT "1222B$="Z$B$
1150 PRINT "1223C$="Z$C$:PRINT "1224D$="Z$D$:
     PRINT "1225E$="Z$E$
1160 PRINT "1226G$="Z$G$:PRINT "S2="S2":LN="LN":
     S1="S1:GOTO 390"
1170 POKE 525,07:FOR N=0 TO 6:POKE 527+N,13:NEXT:
     PRINT "[HOM]":END
1180 Z$=CHR$(34):PRINT "[CLS][3 CD]1227F$="Z$F$:
     PRINT "1228H$="Z$H$
1190 PRINT "1229I$="Z$I$:PRINT "1230J$="Z$J$:
     PRINT "1231K$="Z$K$
1200 PRINT "1232LN="LN":S1="S1:PRINT "S2="S2":
     GOTO 460"
1210 POKE 525,07:FOR N=0 TO 6:POKE 527+N,13:NEXT:
     PRINT "[HOM]":END
1220 REM ** LINES 1221-1232 RESERVED FOR VARIABLES
1240 RETURN
2000 GOSUB 1220:GOTO 880:REM ** WAY BACK AFTER EDIT
```

PET MENU

Trevor Lusty

This program is designed for the lazy! If you have a PET and cassette recorder rather than discs, you will know how easy it is to lose track of your programs. If you record this short routine at the start of each tape you will be able to:-

1. see what programs are on the tape.
2. select the required program and have it loaded automatically, no matter where it is on the tape.
3. repeat commands such as SAVE without having to retype anything.

How It Works

The program works by poking characters into the PET's keyboard input buffer. The buffer is provided to hold input which is typed while the PET is otherwise engaged. When the PET has completed its current assignment, it reads anything in the input buffer. If this happens to contain the 4 characters 'RUN(return)' then RUN is typed to the screen and the carriage return completes the sequence.

Having asked you to select the required program the menu program clears the screen, and prints the command LOAD and the program name on the screen. It then POKEs a carriage return, the command RUN and a second carriage return to the input buffer. Having homed the cursor the program ends. The normal 'READY' message appears on the second line of the screen, and the cursor is positioned on the next. The input buffer is now polled and the first carriage return executes the LOAD instruction. When the required program is found and loaded the rest of the characters stored in the buffer start it running.

The names of the programs on the tape are stored in the DATA statements. When the program is first entered these statements should contain forty blanks between the quotes. This means that the program is always the same length after updating as it was when first recorded. This precaution ensures that an index update does not overwrite other programs on the tape.

The second feature of the menu program is the short machine code subroutine POKEd to the second cassette buffer. When called, this routine loads 4 'home cursor carriage return' characters to the keyboard input buffer. The routine is useful when more than one copy of a program is to be saved as a precaution against the dreaded load error.

Once loaded this routine will always be in the buffer unless the second cassette file is opened, or the machine is switched off. The method of use is to clear the screen, home the cursor, and then enter the required statement. The 'return' is not pressed at this point, but the cursor is moved down the screen and 'SYS 826(return)' is entered.

You can now have a cup of coffee while the PET gets on with it.

```
 170  P = 825
 180  READ N : IF N < > 0 255 THEN P = P + 1 : POKE
      P, N : GOTO 180
 190  DATA 162, 0, 189, 76, 3, 157, 111, 2
 200  DATA 232, 224, 8, 208, 245, 169, 8, 133
 210  DATA 158, 96, 19, 13, 19, 13, 19, 13
 220  DATA 19, 13, 255
 230  FOR I = 1 TO 10
 240  READ A$(I)
 250  NEXT I
 260  PRINT "[CLS]"
 270  PRINT "FILES ON THIS TAPE ARE :-"
 280  PRINT
 290  FOR I = 1 TO 10
 300  PRINT I; A$(I)
 310  NEXT I
 320  PRINT:INPUT "WHICH DO YOU WANT "; I
 330  PRINT "[CLS] [HOM] [2 CD]"; CHR$(34);
      A$(I); CHR$(34)
 340  POKE 158,5
 350  POKE 623, 13
 360  POKE 624, 82
 370  POKE 625, 85
 380  POKE 626, 78
 390  POKE 627, 13
 400  PRINT "[HOM]";
 410  END
 420  DATA "INDEX [35 SPC]"
 430  DATA "PROGRAM NAME ONE [24 SPC]"
 440  DATA "PROGRAM NAME TWO [24 SPC]"
 450  DATA "PROGRAM NAME THREE [22 SPC]"
 460  DATA "PROGRAM NAME FOUR [23 SPC]"
 470  DATA "PROGRAM NAME FIVE [23 SPC]"
 480  DATA "PROGRAM NAME SIX [24 SPC]"
 490  DATA "PROGRAM NAME SEVEN [22 SPC]"
 500  DATA "PROGRAM NAME EIGHT [22 SPC]"
 510  DATA "PROGRAM NAME NINE [23 SPC]"
 520  END
```

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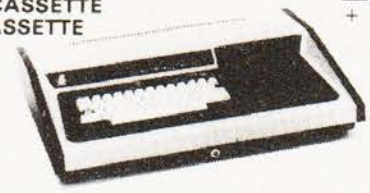

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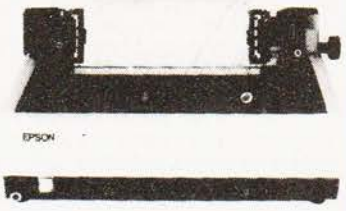

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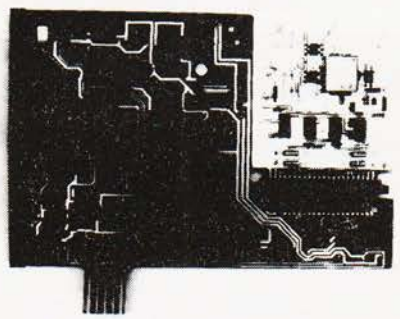

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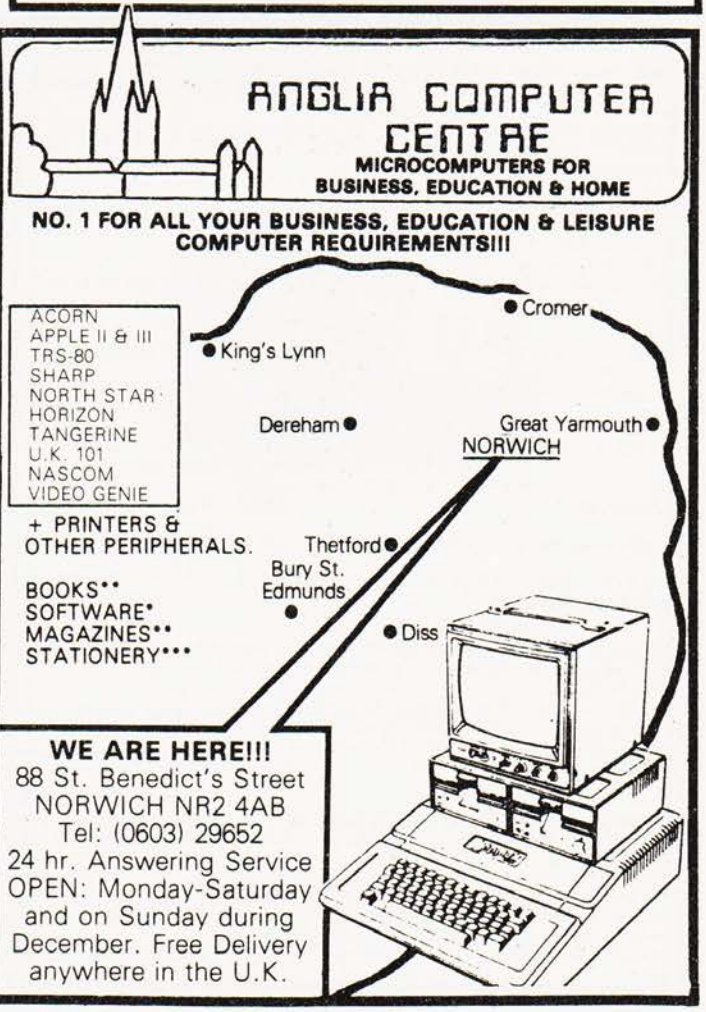

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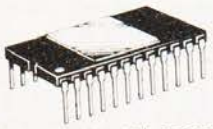

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4041	80
4042	80
4043	95
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4054	130
4055	135
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4069	28
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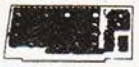

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34	2.40	34	2.80
40	2.80	40	3.30
503.30		50	4.00
60	4.00	60	5.50

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1.0MHz	3.60	6.0MHz	2.70	18.00MHz	2.90
1.008MHz	3.50	6.144MHz	2.70	18.432	2.90
1.8432MHz	3.00	7.0MHz	2.70	36MHz	2.90
2.00MHz	1.50	7.168MHz	2.50	48.0MHz	2.70
2.45760MHz	3.05	8.00MHz	2.70	100MHz	2.90
3.276MHz	2.70				

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Microtan 65 kit	£79.35	10K Microsoft BASIC in Eprom	£56.35
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Tanex (min.confg.) assembled	60.95	Tanram expanded assembled	218.50
Expanded Tanex kit	122.47	Mini-Mother Board	11.50
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Micron £395.00

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Video Genie System £230 + VAT

BOOKS

Ref:		Ref:	
24	TTL Cookbook 7.15	36	Instant BASIC £7.20
38	Introduction to BASIC 7.15	40	BASIC BASIC 6.50
46	How to Program Microcmpt 6.95	60	Programming to 6502 7.95
62	The Best of Byte 8.75	65	The best of BASIC Prog. 5.50
70	Game playing in BASIC 5.50	150	Compt. Progs. that Work 3.95
151	32 BASIC progs. for PET computers 9.75	161	More BASIC Computer Games 5.50
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171	BASIC and the Personal computer 9.75	182	6502 Assem. Lang 8.25
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190	Personal Information Man. Systems 7.50	195	The BASIC Handbook 11.00
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247	Modern Guide to Digital Logic 5.75	246	Modern Digital Communs. 5.95
250	6502 Games 8.95	249	57 Pract. Progr. & Games in BASIC 5.75
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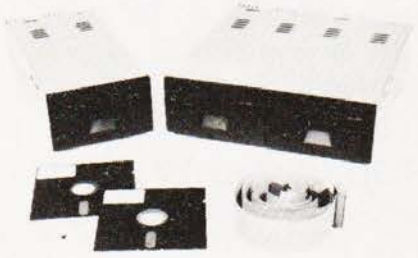

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Z-80 CPU * 16K RAM * 12K Basic ROM * TRS80 Level II compatible * Inbuilt cassette deck * RF & Video output for TV/VDU * £325.00 * Centronics printer interface £35.00

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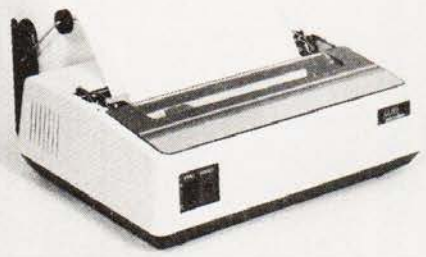

ANACOM 150 PRINTER

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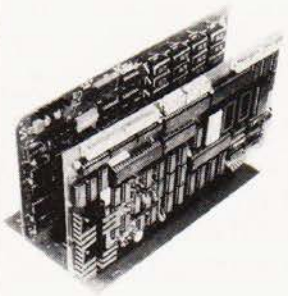

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All prices exclude VAT.

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micron

'MICRON' may sound small - but we all know that it's much larger than an atom!

The un-beatable features of Microtan 65 and Tanex have been brought together to give you **Micron**, a ready built and tested computer of outstanding value. Fully supported by comprehensive documentation, **Micron** represents an ideal starting point in personal computing. We've taken a full O.E.M. licence for Microsoft Basic, which means that you'll have the support of the most popular Basic available, (as used on PET, APPLE, TANDY etc.). If you want to expand **Micron** there's no problem, just move into the system rack and choose from the range of Microtan modules. Read the information, study what the magazines have to say about us and compare what we have to offer with other systems, then we feel sure that you'll be convinced that we've produced an excellent product.

- FULLY BUILT, TESTED AND CASED.
- 6502 BASED MICROCOMPUTER.
- VDU ALPHA NUMERIC DISPLAY.
- 8K RAM.
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- 10K EXTENDED MICROSOFT BASIC.
- ALL THE USUAL BASIC COMMANDS.
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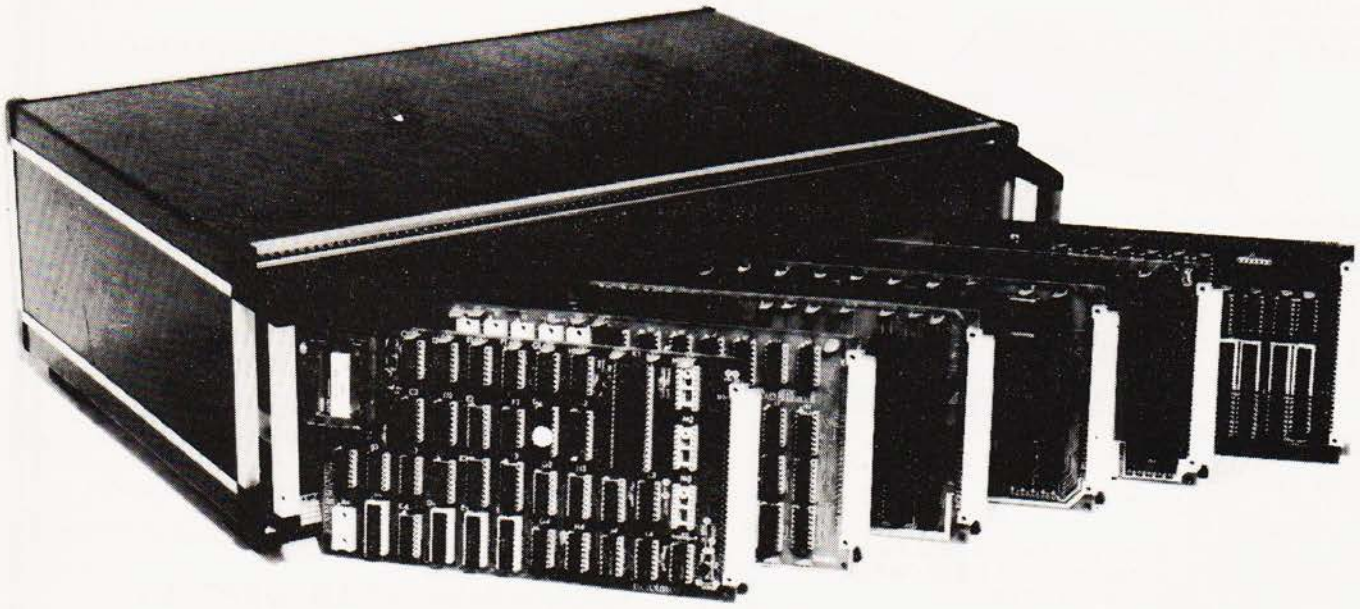
- USER MACHINE CODE INTERRUPT HANDLER INTERFACES WITH BASIC.
- XBUG.
- DATA CASSETTE FILE HANDLING IN BASIC

TANGERINE
COMPUTER SYSTEMS LIMITED
Forehill Works
Forehill Ely Cambs England **Tel: (0353)3633**

microtan 65



The **Microtan** system is rapidly becoming accepted as the ultimate approach to personal computing. Start with **Microtan 65**, a 6502 based single board computer, and expand to a powerful system in simple and in-expensive stages. The **Microtan** system is a concept and not an afterthought, this means expansion is easy and very efficient! Unlike many other systems, you'll find it difficult to outgrow **Microtan**, and you won't be wasting your money on a product that will only last you a few months! When you are ready to expand, **Tanex** is waiting. The features offered by **Tanex** are tremendous, and you can start into them for just £49.45! Cassette interface, 16 I/O lines, two 16 bit counter timers, data bus buffering, memory mapping and a further 1K of RAM are standard. From thereon expansion is simple, just plug in extra integrated circuits to get yourself 8K of RAM, a further 16 I/O lines and two more counter timers a serial I/O line with RS232/20mA loop and full modem control, **XBUG** - a firmware package containing cassette file handling routines, plus a line-by-line assembler (translator) and dis-assembler, **PLUS 10K EXTENDED MICROSOFT BASIC**, a suped-up version of the Basic as used by major manufacturers such as Apple, Tandy and Nascom, **NO OTHER LOW COST MICROCOMPUTER OFFERS YOU THIS SUPERB PACKAGE.** O.K. so you want more memory, try **Tanram** for size! Upto 40K bytes on one board starting for as little as £50.60. RAM freaks will be pleased to hear that our system mother board offers page memory logic which will support 277K Bytes, satisfied? To house these beautiful modules you can choose between our mini-rack (as used on **Micron**), which accepts **Microtan** and **Tanex**, or our system rack pictured above. The system rack will support 12 modules. What are these extra modules? Well for starters there's a couple of I/O modules, parallel and serial offering upto 128 I/O lines organised as 16 8 bit ports and 8 serial I/O ports respectively. Shortly we'll be introducing high definition (256x256) colour graphics, A to D and D to A modules, IEEE 488 Bus interface, a PROM programmer, disc controller and **TANDOS** - a 6502 CPM system. So there's plenty to keep you busy. Send for more details, and find out how you can get started for just £79.35!

ALL PRICES QUOTED INCLUDE V.A.T.

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We have produced a T.V. interface module which simply connects to the expansion socket of your computer and produces a display of 16 rows by 40 characters! Of even more interest will be our Buffer module, which allows you to expand into our system rack, giving you access to the full range of Microtan modules.

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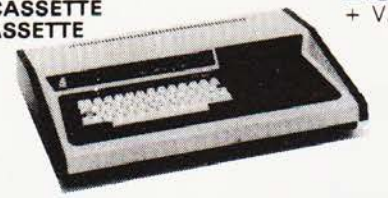

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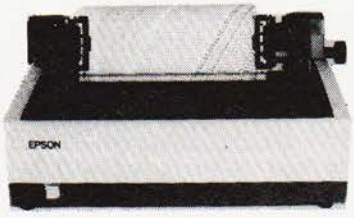

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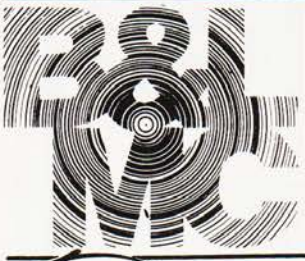

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09905-6333

+ regional outlets

Face:- Dot
Interface:- RS232/20mA Centronics
Feed:- Friction
Head Size:- 5x7
Baud Rates:- 110-2400
Print Speed:- 50cps
Col:- 40
Type Sizes:- 2
Graphics Option:- No
Price:- £400

Options:- Choice of the 3 indicated interfaces
Notes:- 40 column version of DP-8000 with slightly reduced facilities.

DP-8000
Dist:- As DP-1000

Face:- Dot
Interface:- RS232/20mA Centronics
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 110-9600
Print Speed:- 112cps
Col:- —80
Type Sizes:- 2
Graphics Option:- —
Price:- £500

Options:- Large character buffer, other interfaces
Notes:- General purpose dot matrix machine.

DP-9500
Dist:- As DP-1000

Face:- Dot
Interface:- RS232/20mA Centronics
Feed:- Tractor
Head Size:- 9x9 or 9x7
Baud Rates:- 110-9600
Print Speed:- 200cps
Col:- 132/220
Type Sizes:- 2
Graphics Option:- Yes
Price:- £895

Options:- Extended character buffer.
Notes:- 132 column system with expansion to 176 column with coms control. High density graphics.

DP-9501
Dist:- As DP-1000

Face:- Dot
Interface:- RS232/20mA Centronics
Feed:- Tractor
Head Size:- 9x11
Baud Rates:- 110-9600
Print Speed:- 200cps
Col:- —
Type Sizes:- 2
Graphics Option:- Yes
Price:- £995

Options:-
Notes:- Extended carriage version of 9500 with higher density plotting.

ANDERSON JACOBSON

AJ 860
Manuf:- Anderson Jacobson
752 Deal Avenue,
Slough, Berkshire SL1 4SJ
Slough 25172

Also Manchester office

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 9x5
Baud Rates:- 110-1200
Print Speed:- 120cps
Col:- 132
Type Sizes:- 2
Graphics Option:- Yes
Price:- £

Options:-
Notes:- The descender matrix printer that gives both graphics and full APL character set.

AJ 832
Manuf:- As AJ 860

Face:- Daisy
Interface:- RS232
Feed:- Friction
Head Size:- N/A
Baud Rates:- 110-300
Print Speed:- 30cps
Col:- 132/156
Type Sizes:- Various
Graphics Option:- Yes
Price:- £2,560

Options:- Tractor option, 45cps printing option.
Notes:- Daisy wheel printer capable of both graphics plotting and APL printing. IBM 2741 compatible option.

AJ 880
Manuf:- As AJ 860

Face:- Dot
Interface:- RS232
Feed:- Friction
Head Size:- 7x9
Baud Rates:- 110-9600
Print Speed:- 30cps
Col:- 132/216
Type Sizes:- —
Graphics Option:- —
Price:- £899

Options:- Tractor feed.
Notes:- Low cost APL terminal.

BASE 2

Z-800
Dist:- Zero One Electronics
36 Oaklands Avenue,
Thornton Heath, Surrey CR4 7PH
01-689 7924

Also Intelligent Artefacts

Face:- Dot
Interface:- RS232/20mA Centronics/IEEE
Feed:- Tractor/Friction
Head Size:- 5x7
Baud Rates:- 75-9600
Print Speed:- 100cps
Col:- 64/132
Type Sizes:- 2
Graphics Option:- Yes
Price:- £375

Options:- User definable font.
Notes:- Supplier also runs a service and repair centre and supplies ribbons and paper.

CENTRONICS

MICROPRINTER P1
Dist:- Centronics Data Computer (UK) Ltd.,
Victoria Way, Burgess Hill
Sussex RH15 9NU
04446-45011

All prices are one off OEM

Face:- Dot Electrostatic
Interface:- RS232/ Centronics
Feed:- Friction
Head Size:- 5x8
Baud Rates:- 1200
Print Speed:- 150 lpm
Col:- 132
Type Sizes:- 3
Graphics Option:- —
Price:- £335 - £403

Options:- Serial interface, Teletex/Prestel interface
Notes:- CTs offer printer, software selectable line and type sizes.

MODEL 700
Dist:- As Model P1

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 60cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £925

Options:-
Notes:- Conventional low speed matrix printer.

MODEL 701
Dist:- As Model P1

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 60cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £1,025

Options:-
Notes:- Bi-directional version of Model 700.

MODEL 702
Dist:- As Model P1

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 7x7
Baud Rates:- —
Print Speed:- 120 cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £1,245

Options:-
Notes:- Faster version of 701 with extra form controls.

MODEL 703
Dist:- As Model P1

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 7x7
Baud Rates:- —
Print Speed:- 180cps
Col:- 132
Type Sizes:- 2
Graphics Option:- Yes
Price:- £1,545

Options:- Graphics plotting option.
Notes:-

MODEL 704
Dist:- As Model P1

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- choice
Baud Rates:- 110-9600
Print Speed:- 180cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £1,570

Options:- Stand, Buffer, "hush" kit.
Notes:- Large carriage high quality matrix printer.

730 MINIPRINTER
Dist:- As Model P1

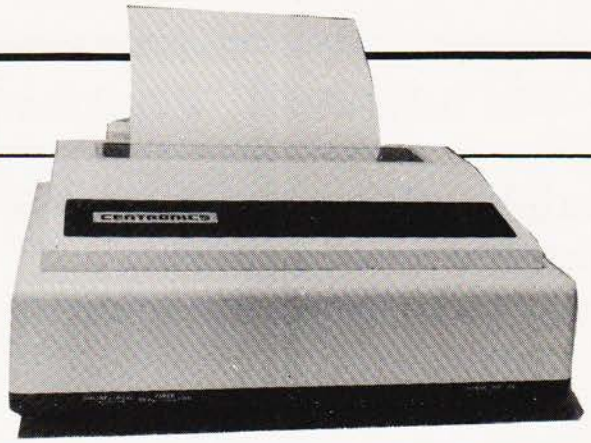
Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- 7x7
Baud Rates:- —
Print Speed:- 100cps
Col:- 80
Type Sizes:- 2
Graphics Option:- —
Price:- £405 - £435

Options:- Serial interface (730-4).
Notes:-

737 MINIPRINTER
Dist:- As Model P1

Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- Nx9 or 7x8
Baud Rates:- —
Print Speed:- 50 or 80cps
Col:- 80
Type Sizes:- 2
Graphics Option:- —
Price:- £510

Options:-
Notes:- Unit capable of proportional spacing and justification under micro control.



A matrix printer with more than a few special features, the Centronics Model 737.

MODEL 753
Dist:- As Model P1

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- Nx9
Baud Rates:- —
Print Speed:- 100-150cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £1,570

Options:- Stand, Various electronic options.
Notes:- Correspondence printer with proportional spacing.

MODEL 779
Dist:- As Model P1

Face:- Dot
Interface:- Centronics
Feed:- Friction
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 60cps
Col:- 80/132
Type Sizes:- 2
Graphics Option:- —
Price:- £725

Options:- Tractor feed.
Notes:- The original micro printer as supplied by Tandy.

MODEL 791
Dist:- As Model P1

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 60cps
Col:- 80
Type Sizes:- 2
Graphics Option:- —
Price:- £1,410

Options:-
Notes:- Heavy duty form printer handling up to 12 part stationery.

COMPRINT

COMPRINT 912
Dist:- Transam,
12 Chapel Street,
London NW1 5DH
01-402 8137

Face:- Dot Electrostatic
Interface:- RS232/Parallel
Feed:- Friction
Head Size:- 9x12
Baud Rates:- —
Print Speed:- 225cps
Col:- 80
Type Sizes:- —
Graphics Option:- —
Price:- £370 - £385

Options:-
Notes:- Electrostatic printer with full page width printing.

DATAROYAL

DATAROYAL IPS 5000
Dist:- Facit Data Products Ltd.
Maidstone Road,
Rochester, Kent.

Face:- Dot
Interface:- RS232/
Centronics
Feed:- Tractor

0634-401721

Head Size:- 9x9
Baud Rates:- 110-9600
Print Speed:- 125cps
Col:- 80/136
Type Sizes:- 2
Graphics Option:- —
Price:- £774 - 910

Options:- Large 136 column platten, 2K buffer, 20mA interface.
Notes:- Slightly less enhanced versions of FACIT 4525/6.

EPSON

EPSON TX 80
Dist:- Westrex
Bilton Fairway Estate
Long Drive,
Greenford, Middx
01-578 0957

Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- 5x7 or 6x7
Baud Rates:- —
Print Speed:- 125cps
Col:- —
Type Sizes:- 2
Graphics Option:- Yes
Price:- £395

Options:- Grafcom graphics, various interfaces, feed option.
Notes:- PET graphics compatible matrix printer.

FACIT

FACIT 4520/1
Dist:- Facit Data Products
Maidstone Road,
Rochester, Kent
0634-401721

Face:- Dot
Interface:- RS232/Centronics
Feed:- Friction
Head Size:- 9x7
Baud Rates:- —
Print Speed:- 80cps
Col:- 80/132
Type Sizes:- —
Graphics Option:- —
Price:- £583

Options:- Tractor feed (4521).
Notes:- Intelligent, bi-directional matrix printer.

FACIT 4525/6
Manuf:- As 4520

Face:- Dot
Interface:- RS232 Centronics
Feed:- Tractor
Head Size:- 9x9
Baud Rates:- —
Print Speed:- 150cps
Col:- 80/132
Type Sizes:- —
Graphics Option:- —
Price:- £890-1046

Options:- 132 column version (4526)
Notes:- Bi-directional printer, can be equipped with most European fonts.

The low-cost 4520 matrix printer from Facit.

FACIT 4530
Manuf:- As 4520

Face:- Dot
Interface:- RS232/Centronics/20mA
Feed:- Tractor
Head Size:- 5x7 or 9x7
Baud Rates:- —
Print Speed:- 200cps
Col:- 132/198
Type Sizes:- Various
Graphics Option:- —
Price:- £1,628

Options:-
Notes:- Microcontrolled printer, capable of bar code printing.

FACIT 4540
Manuf:- As 4520

Face:- Dot
Interface:-RS232/Parallel/Centronics/IEEE/20mA
Feed:- Tractor
Head Size:- 7x9 or 9x9
Baud Rates:- —
Print Speed:- 250cps
Col:- 155
Type Sizes:- —
Graphics Option:- —
Price:- £2,764-3,040

Options:- Keyboard unit (4610), Graphics (4542).
Notes:-

GENERAL ELECTRIC (USA)

TERMINET 200
Dist:- International General Electric of New York,
111 Park Road,
London NW8 7JL
01-402 4100
Distributors include Zygal & Middlectron.

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 7x9
Baud Rates:- 110-1200
Print Speed:- 200cps
Col:- 136/224
Type Sizes:- —
Graphics Option:- Yes
Price:-

Options:-
Notes:- Available as ASR, KSR or forms access printer with wide range of print formats.

TERMINET 2000
Dist:- As TERMINET 200

Face:- Dot
Interface:- RS232
Feed:- Friction
Head Size:- 7x9
Baud Rates:- —
Print Speed:- —
Col:-
Type Sizes:- —
Graphics Option:- —
Price:-

Options:- Tractor feed, character buffer, modem.
Notes:- KSR terminal unit offering three-part form handling and various print formats.

HEATH ELECTRONICS

H14
Dist:- Heath Electronics
Bristol Road, Gloucester GL2 6EE
0452-29451

+ London shop - 01-636 7349

Face:- Dot
Interface:- RS232/20mA
Feed:- Tractor
Head Size:- 5x7
Baud Rates:- 110-4800
Print Speed:- 135cps
Col:- 80/132
Type Sizes:- 3
Graphics Option:- —
Price:- £413(kit)-£592(built)

Options:-
Notes:- High quality reliable printer with no frills.

HEWLETT PACKARD

HP 2631B
Dist:- Hewlett Packard Ltd.
308-314 Kings Road,
Reading, Berkshire RG1 4ES
0734-61022

Face:- Dot
Interface:- RS232/20mA Centronics/IEEE
Feed:- Tractor
Head Size:- 7x9
Baud Rates:- 110-2400
Print Speed:- 180cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £2,110

Options:- Graphics copy option.
Notes:- Software selectable print densities and form sizes.

HP 2635B
Dist:- As HP 2631B

Face:- Dot
Interface:- RS232/20mA Centronics/IEEE
Feed:- Tractor
Head Size:- 7x9
Baud Rates:- 110-2400
Print Speed:- 180cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £2,315

Options:-
Notes:- KSR version of 2631 with same facilities.

LEAR SIEGLER

Ballistic 300
Dist:- Penny & Giles Recorders Ltd.
Mudeford, Christchurch,
Dorset BH23 4AT
04252-71511

Face:- Dot
Interface:-RS232/20mA
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 75-9600
Print Speed:- 180cps
Col:- 136
Type Sizes:- —
Graphics Option:- —
Price:- —

Options:- Foreign character sets, 9x9 or 9x12 heads.
Notes:- Micro controlled 'smart' printer with powerful forms control.

LOGABAX

LOGABAX 100
Dist:- Brospa Data
87 Castle Street,
Reading, Berkshire RG1 7ST
0734-589393

Face:- Dot
Interface:- RS232/Parallel /Centronics/IEEE/20mA
Feed:- Tractor
Head Size:- Various
Baud Rates:- 110-9600
Print Speed:- 100cps
Col:-
Type Sizes:- —
Graphics Option:- —
Price:- £1,081

Options:- Stand and paper handling trays.
Notes:-

LOGABAX 200
Dist:- As LOGABAX 100

Face:- Dot
Interface:- RS232/Parallel /Centronics/IEEE/20mA
Feed:- Tractor/Friction
Head Size:- 7x9 or 9x9
Baud Rates:- 110-9600
Print Speed:- 180cps
Col:-
Type Sizes:- —
Graphics Option:- Yes
Price:- £1,590

Options:- Stand and paper handling trays.
Notes:- Bi-directional matrix printer with expanded and compressed type facility.

Simple yet versatile, the Microtek MT-80S.

MICROTEK

MICROTEK MT 80P
Dist:- HAL Computers
133 Woodham Lane,
New Haw, Weybridge
Surrey KT15 3NJ
Weybridge 48346

Face:- Dot
Interface:- RS232/IEEE Centronics
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- to 9600
Print Speed:- 125cps
Col:- 80/120
Type Sizes:- 2
Graphics Option:- No
Price:- £495 - £550

Options:- Various interfaces, character buffer.
Notes:- 80 or 120 column matrix printer.

NASCOM

IMP
Dist:- Currently available from many local outlets.

Face:- Dot
Interface:- RS232
Feed:- Friction
Head Size:- 7x7
Baud Rates:- 110-9600
Print Speed:- 60 lpm
Col:- 80
Type Sizes:- —
Graphics Option:- Yes
Price:- £325

Options:- Tractor feed, programmable character set.
Notes:- First of a new generation of matrix printers, like the BASE 2 and EPSON.

NEWBURY LABS

8300 RM
Dist:- Newbear Computing Store
40 Bartholomew Street
Newbury, Berkshire
0635-30505

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 7x9
Baud Rates:- 110-9600
Print Speed:- 125cps
Col:-
Type Sizes:- 2
Graphics Option:- No
Price:- £525

Options:- Choice of character per line and buffer sizes.
Notes:- General purpose dot matrix printer.

OKI

MICROLINE 80
Dist:- Distronic
50-51, Burnt Hill, Elizabeth Way,
Harlow, Essex.
Harlow 32947

Face:- Dot
Interface:- RS232/ Centronics
Feed:- Friction
Head Size:- 9x7
Baud Rates:- —
Print Speed:- 80cps
Col:- 80
Type Sizes:- —
Graphics Option:- —
Price:- £499

Options:- Tractor feed.
Notes:- One of the new generation of micro printers for small business and personal use.

Olivetti's new daisy wheel printer, the DY311.

OLIVETTI

DY 311
Dist:- Brospa Data
87, Castle Street, Reading,
Berkshire RG1 7ST
0734-589393

Face:- Daisy
Interface:- RS232/IEEE
Feed:- Tractor/Friction
Head Size:- N/A
Baud Rates:- 110-9600
Print Speed:- 32cps
Col:-
Type Sizes:- Various
Graphics Option:- —
Price:- £1,300

Options:- Sheet feeder, 20mA interface
Notes:- High quality daisy system with full proportional spacing and tabbing.

TH 240
Dist:- As DY 311

Face:- Dot/Thermal
Interface:- RS232
Feed:- Tractor/Friction
Head Size:- 7 pin
Baud Rates:- 110-9600
Print Speed:- 320cps
Col:-
Type Sizes:- —
Graphics Option:- Yes
Price:- £860

Options:- High speed plot, paper handling accessories.
Notes:- Thermal printer capable of producing eight ISO alphabets.

PAPER TIGER

PAPER TIGER
Dist:- Microsense
Finway Road
Hemel Hempstead, Herts HP2 7PS
0442-48151
+ regional outlets

Face:- Dot
Interface:- RS232 Centronics
Feed:- Tractor/Friction
Head Size:- 7x7
Baud Rates:- 110-1200
Print Speed:- 95cps
Col:- 132
Type Sizes:- 4
Graphics Option:- Yes
Price:- £598

Options:-
Notes:- Very versatile printer with various built-in options for line length, etc.

QUME

SPRINT 5
Dist:- Facit Data Products Ltd.,
Maidstone Road,
Rochester, Kent.
0634-401721
Local distribution by: Access Data, Fortronics, Cytec, Wilkes etc.

Face:- Daisy
Interface:- RS232/20mA Parallel
Feed:- Tractor/Friction
Head Size:- N/A
Baud Rates:- 110-1200
Print Speed:- 45-55cps
Col:- 132/158
Type Sizes:- Various
Graphics Option:- —
Price:- £1,700-2,025

Options:- RO or KSR terminals.
Notes:- High quality correspondence printer.

RICOH

RICOH RP1600
Dist:- Nexos (UK) Ltd.,
Metropolitan House, 1, Hagley Rd.,
Edgbaston, Birmingham B16 8TG
021-454 2235
Local dealers, Micropute, Small Systems, London Computer Store.

Face:- Daisy
Interface:- Centronics
Feed:- Friction
Head Size:- N/A
Baud Rates:- —
Print Speed:- 60cps
Col:- N/A
Type Sizes:- various
Graphics Option:- —
Price:- £1,290

Options:- Various interfaces.
Notes:- Fast commercial daisy wheel for WP and other office applications.

ROBETRON

ROBETRON 1152
Dist:- Kingston Computers Ltd.
Scarborough House,
Scarborough Road
Bridlington, Yorkshire.
0262-73036

Face:- Daisy
Interface:- Centronics
Feed:- Friction
Head Size:- N/A
Baud Rates:- —
Print Speed:- 45cps
Col:-
Type Sizes:- various
Graphics Option:- No
Price:- under £1,000

Options:- Interfaces, tractor feed.
Notes:- East German RO daisy printer for high quality type.

SEIKO

SEIKOSHA GP-80
Dist:- Mitecrest Ltd.,
61, New Market Square
Basingstoke, Hants RG21 1HW
0256-56468

Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- 'unihammer'
Baud Rates:- —
Print Speed:- 30cps
Col:- 80
Type Sizes:- —
Graphics Option:- Yes
Price:- £199

Options:- Various interfaces.
Notes:- Amazingly low cost single needle printer capable of reasonable print and graphics quality.

The Qume Sprint 5 is widely used, and equally widely available.

One of the most popular printing terminals, the Teletype 43.

SIGMA

MODEL 801
Dist:- Sigma UK
Unit 2, 106-120 Garrat Lane,
Wandsworth, London SW18
01-870 4524

Face:- Dot
Interface:- RS232/20mA Centronics
Feed:- Tractor/Friction
Head Size:- 7x7
Baud Rates:- 110-1200
Print Speed:- 132cps
Col:-
Type Sizes:- —
Graphics Option:- —
Price:- £695

Options:-
Notes:-

TELETYPE

TELETYPE 43
Dist:- Peripheral Hardware Ltd.
Armfield Close,
West Molesey, Surrey
01-941 4806
+ various regional outlets

Face:- Dot
Interface:- RS232/20mA
Feed:- Tractor/Friction
Head Size:- 7x9
Baud Rates:- —
Print Speed:- 10 or 30cps
Col:- 132
Type Sizes:- —
Graphics Option:- No
Price:-

Options:- IEEE interface, Buffer store, Stand, ASR.
Notes:- High quality matrix terminal available as KSR, ASR or RO.

TEXAS INSTRUMENTS

TI 810
Dist:- Texas Instruments
Manton Lane,
Bedford
0234-67466

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 110-9600
Print Speed:- 150cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £1,450

Options:- Character sets, various interfaces, form handling.
Notes:-

TI 820
Dist:- As TI 810

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 110-9600
Print Speed:- 150cps
Col:-
Type Sizes:- 2
Graphics Option:- —
Price:- £1,450 - £1,650

Options:-
Notes:- KSR bi-directional with RO option at reduced cost.

TI 825
Dist:- As TI 810

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 110-600
Print Speed:- 75cps
Col:-
Type Sizes:- 2
Graphics Option:- —
Price:- £1,095 - £1,250

Options:-
Notes:- Slower RO or KSR matrix printer.

TI 743
Dist:- As TI 810

Face:- Dot Thermal
Interface:- RS232/20mA
Feed:- Friction
Head Size:- 5x7
Baud Rates:- 110-300
Print Speed:- 30cps
Col:-
Type Sizes:- —
Graphics Option:- —
Price:- £995 - £1,105

Options:-
Notes:- Thermal printer KSR terminal.

TI 745
Dist:- As TI 810

Face:- Dot Thermal
Interface:- RS232
Feed:- Friction
Head Size:- 5x7
Baud Rates:- 110-300
Print Speed:- 30cps
Col:-
Type Sizes:- —
Graphics Option:- —
Price:- £1,250

Options:-
Notes:- Integral modem in portable terminal.

TI 763
Dist:- As TI 810

Face:- Dot Thermal
Interface:- RS232/20mA
Feed:- Friction
Head Size:- 5x7
Baud Rates:- 110-9600
Print Speed:- 30cps
Col:-
Type Sizes:- —
Graphics Option:- —
Price:- £2,195

Options:- Expanded character store.
Notes:- Bubble memory based terminal with 20K internal storage.

Hot graphics with this Apple variant of the Trendcom TCM200.

The newly announced KSR variant of the Weyfringe Century.

TRENDCOM

TCM 100
Dist:- Personal Computers Ltd.
194-200 Bishopsgate,
London EC2M 4NR
01-626 8121

Face:- Dot Thermal
Interface:- Parallel
Feed:- Friction
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 40cps
Col:- 40
Type Sizes:- —
Graphics Option:- Yes
Price:- £240

Options:- Interfaces for various machines.
Notes:- 40 column thermal printer capable of graphics plotting.

TCM 200
Dist:- As TCM 100

Face:- Dot Thermal
Interface:- Parallel
Feed:- Friction
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 40cps
Col:- 80
Type Sizes:- —
Graphics Option:- Yes
Price:- £340

Options:- Interfaces for various machines.
Notes:- 80 column version of TCM 100.

SILENTYPE
Dist:- Microsense
Finway Road
Hemel Hempstead, Herts HP2 7PS
0442-48151
+ regional outlets

Face:- Dot Thermal
Interface:- Apple
Feed:- Friction
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 40cps
Col:- 80
Type Sizes:- —
Graphics Option:- Yes
Price:- £349

Options:-
Notes:- Custom interfaced TRENDCOM printer for Apple capable of high density graphics.

WALTERS MICROSYSTEMS

DOLPHIN BD-80P
Dist:- Walters Microsystems
1 Blenheim Road,
High Wycombe, Bucks
0494-445172

+ many regional outlets

Face:- Dot
Interface:- RS232/20mA
Centronics/IEEE
Feed:- Tractor/Friction
Head Size:- 7x9
Baud Rates:- 50-19,200
Print Speed:- 125cps
Col:- 80/132
Type Sizes:- 2
Graphics Option:- Yes
Price:- £525

Options:- Stand, Buffer, Coms interface.
Notes:- A standard matrix printer with excellent reliability reputation.

WEYFRINGE

MODEL 480
Dist:- Weyfringe
Longbeck Road
Marske, Redcar
Cleveland TS11 6HQ
0642-470121

Face:- Dot
Interface:- RS232/20mA
Centronics
Feed:- Friction
Head Size:- 5x7
Baud Rates:- 110-9600
Print Speed:- 110cps
Col:- 40
Type Sizes:- 2
Graphics Option:- —
Price:- £475

Options:- Choice of indicated interfaces.
Notes:- Tally roll printer for logging applications.

CENTURY
Dist:- As MODEL 480

Face:- Dot
Interface:- RS232/20mA
Centronics
Feed:- Tractor/Friction
Head Size:- 7x9
Baud Rates:- 110-9600
Print Speed:- 110cps
Col:- 96/132
Type Sizes:- 4
Graphics Option:- —
Price:- £945

Options:- Optional PET interface, alternate character set.
Notes:- General purpose machine with form handling facilities, Now available with keyboard.

WHYMARK

WHYMARK 201
Dist:- Whymark Instruments
6 Holmesdale Road,
Reigate, Surrey RH2 0BQ
07372-21753

Face:- Dot
Interface:- RS232/20mA
Centronics/IEEE/Parallel
Feed:- Friction
Head Size:- 7x7
Baud Rates:- 110-4800
Print Speed:- 1 lps
Col:- 40
Type Sizes:- 4
Graphics Option:- —
Price:- £410 - £490

Options:- Label printer, rack mounted, interfaces to order.
Notes:- Tally roll printer with 40 character line.

WHYMARK 801
Dist:- As WHYMARK 201

Face:- Dot
Interface:- RS232
Centronics/IEEE
Feed:- Tractor
Head Size:- nx7
Baud Rates:- 75-9600
Print Speed:- 140cps
Col:- 120
Type Sizes:- 2
Graphics Option:- Yes
Price:- £750

Options:- User definable character set, stand.
Notes:- Intelligent printer with proportional control and absolute alignment.

Whymark's 801 showing off its expandable text facility.

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	16KLII	£475
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	16KLII	£375
TRS-80 expansion interface	32K	£275
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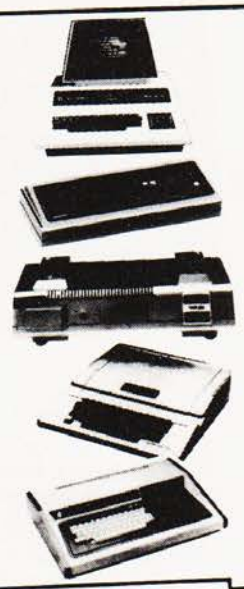
	32K	£625
	48K	£649
Colour monitor system		£399
Video Genie includes on-board cassette recorder, output to VDU or UHF TV (TRS-80 BASIC)	16K	£299
Video Genie expansion bus box	S100	£245



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Computerama

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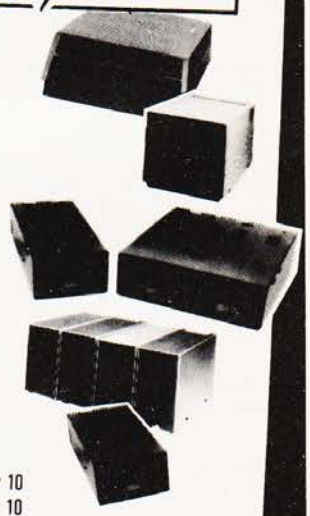

Pet compatible

Commodore Dual		£635
Computhink 400K		£595
Dual	800K	£795
	1.6Mb	£1195

TRS-80 compatible, all with case & P.S.U.

Teac 40 track single	£225
Dual	£399
Quad	£775
77 track single	£325
Dual	£595
Quad	£1155
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Diskettes 5¼" double sided double density £32 for 10
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Quick Printer II (33 col) (TRS-80, serial & parallel inputs)	£129

Thermal Type

Phantom 400 (40 col) (with dot graphics)	£229
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Commodore Tractor 80 col (for Pet) all Pet graphics	£375
Epson Tractor 80 col Pet graphics	£325
Epson Tractor 80 col High Res. graphics	£399
Anadex DP8000	£425
Anadex DP9500	£825
Paper Tiger with 8 char. sizes & High Res. graphics	£595

Interfaces

Pet/TRS-80 to UHF TV	£25
Pet/TRS-80 to RS232 output	£65
Pet to RS232 in/out	£90
Pet to RS232 decoded output	£150
Pet to RS232 decoded in/out	£175
Pet multiplexer for networking up to 20 Pets	£350
Pet/TRS-80 to S100, 4 slot	£112
Pet/TRS-80 to Centronics	£45
Pet to Centronics decoded	£69

Monitors

12"	£69
12" (green screen)	£79

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Pet/IEEE	£20
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RS232 Plug to socket	£25
RS232 Plug to plug	£25

For others please ring

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Electrosensitive for QPII	£3.50 per 2 roll pack
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London Road, Bath, BA1 5DJ

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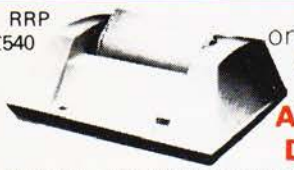

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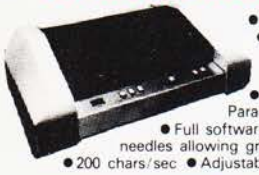

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