Personal Computer World

BET ON A PET
BUSINESS FEATURE

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OCTOBER 1979 50p

JAPANESE MICROS ~ THE FIRST WAVE

Exclusive "Benchtest" of the Sharp MZ-80K

Ask for our free colour brochure

DIAL NOW

031-225 2022
(24 HOURS ANSWERING)

MicroCentre are the UK Cromemco experts

Sample catalogue prices:

*System Two computer	1995
*System Three computer	3293
*Z-2H computer	4998
Extra 64K memory	893
3101 visual display unit	1147
3355 daisywheel printer	2297
HDD 11-mbytes hard disc	4022
ANSI Cobol compiler	55
ANSI Fortran IV compiler	55
16K extended Basic	55
Word processing system	55
Database management	55
Macro relocating assembler	55

Prices exclude VAT and delivery

MicroCentre also supply peripherals, applications sofware, and multi-user timesharing systems; a PROM programmer; analogue-digital interface; and much more. On site maintenance can be arranged throughout the UK.
*Computer systems include fast 4MHz Z80A micro, S-100 bus (21 slots), 64K memory, dual floppy discs, peripheral interfaces, etc. CP/M compatible operating system CDOS free with software.

With our in-depth experience and total commitment to the reliable Cromemco range we are Cromemco's leading UK distributor. Rely on us, as many others do, for expert support with your routine or special micro-computer applications.

Photo features Cromemco System 3 computer, 3101 VDU, and 3355 daisywheel printer.

Micro Centre

Complete Micro Systems Ltd.
132 St. Stephen Street,
Edinburgh EH3 5AA.
Tel: 031-225 2022.

Look out for us at Compec '79, stand no. 756

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Volume 2 No.6 October 1979.

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PCW welcomes all unsolicited material (written, photographic and illustrative) and although no guarantee can be given as to its safe return, reasonable care and attention will be exercised.

Guidelines for contributors
PCW welcomes articles of interest. Don't be put off if your style of writing is 'under developed'. . . true worth lies in the content, and shaping features comes naturally to us! Manuscripts should not exceed 3,000 words and authors are asked to use triple-spaced lines with a wide left-hand margin; diagrams, listings and/or photographs should be included wherever possible. Please enclose a stamped, self-addressed envelope if you would like your article returned.

Because of the foregoing, it is necessary to add that the views expressed in articles we publish are not necessarily those of *Personal Computer World*. Overall, however, the magazine will try to represent a balanced, though independent viewpoint. Finally, before submitting an article, please check it through thoroughly for legibility and accuracy.

Subscription rates: Britain £8.00 for 12 issues, USA $20 for 12 issues (surface mail), Continent and elsewhere £9.80 for 12 issues. All prices include postage and packing. Supplies to specialist shops can be arranged by negotiation direct with the publishers.

Thinking Computers?

Then come to the number one micro-computer centre

If you're wondering if a micro-computer can help you, we are here to advise you.

At Lion House–London's leading centre for micro-computers–you'll find:

* Experts who'll explain the equipment in a way you can easily understand, showing how and where it applies to *your* work.
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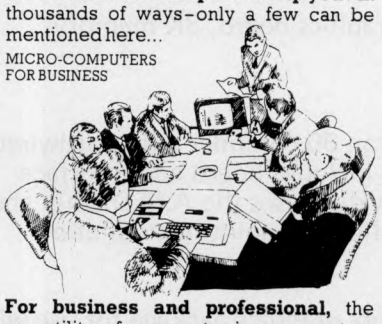
* Total service–including the availability of full maintenance after you've bought an installation.
* Leasing and H.P. facilities immediately available.
* A computer book section with publications that give you new insight into the world of micro-computers.

How will micro-computers help you? In thousands of ways–only a few can be mentioned here...

MICRO-COMPUTERS FOR BUSINESS



For business and professional, the versatility of compact micro-computers means that all the benefits of big computers are made available to all at low cost. The businessman can now computerise his accountancy, his stock control, his records and much more–cutting his overheads and improving his efficiency.

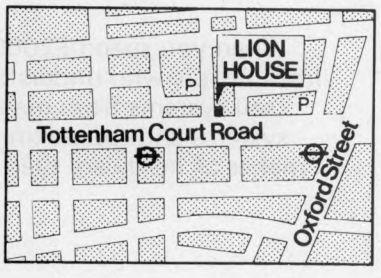
For the home, micro-computers have innumerable uses and considerable value too–sometimes in unexpected ways.

MICRO-COMPUTERS FOR THE HOME

Budgeting . . . investments . . . controlling heating or security . . . storing information on things like recipes . . . designing complex and fascinating games . . . education . . .

Come and see. We invite you to visit us and investigate the possibilities and the potential. If you're too far away, phone or write and we'll send you more information.

You need a micro-computer. We can supply it.



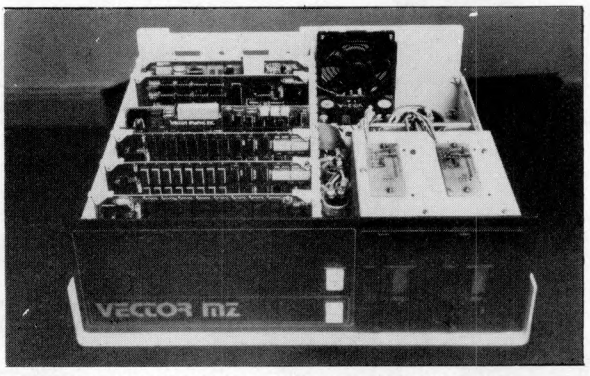
LION MICRO-COMPUTERS

SMALL COMPUTERS–TO MAKE YOUR BUSINESS BIGGER

Lion Computer Shops Ltd, Lion House, 227 Tottenham Court Road, London W1 (First Floor). Telephone: 01-637 1601.
Telex: 28394 Lion G.
Open 9 to 6, Monday to Saturday (Thursday to 7).

ALMARC

NO.1 FOR VECTOR GRAPHIC



OUR NEW EXTENDED RANGE OF PROFESSIONAL GRADE SYSTEMS

SYSTEM MZ
Z80 4MHZ CPU, 48K Ram, 630K bytes disc storage,
Serial port & two parallel ports, prom rad board
with monitor, 18 slot motherboard (S100),
MDOS operating system, Z80 assembler, Basic interpereter **£2300.00**

SYSTEM B
As MZ plus Vector mindless terminal, 24x80
flashwriter board, MZOS North Star compatable DOS.
CP/M configured by Almarc: **£2850.00**

SYSTEM BG
As System B plus 20x256 graphics board, 8K memory,
10" monitor. **£3240.00**

SYSTEM BF
As System B plus Fast Fortran 80 compiler with hardwired
floating point system which includes board and interface
software for Fortran. This system uses the A.M.D. chip and
privides breathtakingly fast floating point manipulation **£3595.00**

SYSTEM BFG
Combines BG & BF plus 'Glib' graphics package for use with
Fast Fortran 80 and 240x256 graphics board **£4190.00**

We also sell a wide range of s100 boards and C/PM compatable software.

WE ARE THE SPECIALISTS

When you spend £2000.00+ on a microcomputer system your entitled to support from people who understand the equipment and your problems. At ALMARC we don't sell systems from many different manufactuers, we specialise in Vector Graphic systems and supporting hardware & software. So if you want to just buy different makes of hardware then don't come to us, but when you decide that Vector Graphic is for you then contact ALMARC.

ALMARC

ALMARC DATA SYSTEMS LTD., 29 CHESTERFIELD DRIVE,
BURTON JOYCE, NOTTINGHAM. Telephone: 0602 248565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We care about what leaves our factory. After all it's got our name on it.
The next time you want reliable microcomputer products – single card computers, floppy disk systems and disk systems – take a look at what we put in our boxes.
A Comart Computer Catalogue will show you.
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Comart Ltd., P.O. Box 2, St. Neots, Huntingdon, Cambs.
Or telephone (0480) 215005.

If your Accounts are a problem- the solution could be on your desk.

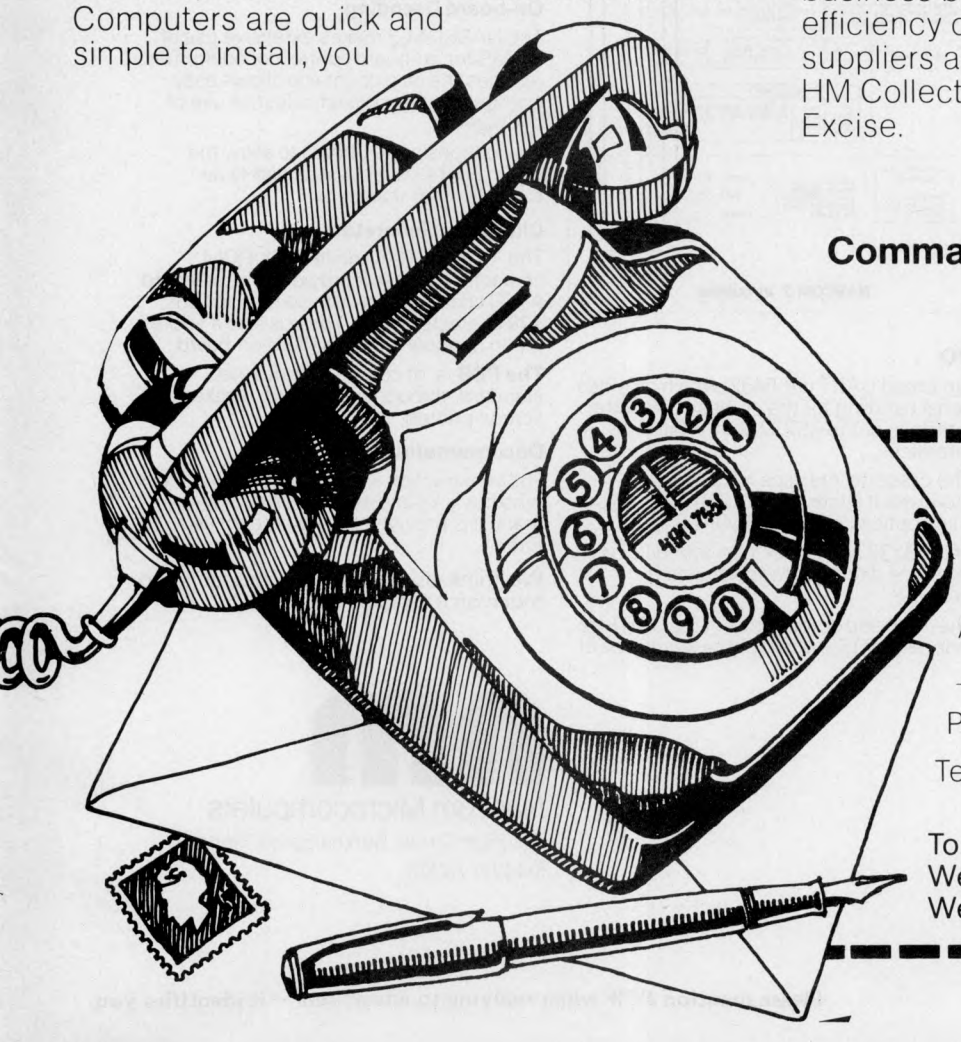
You could use your telephone to call Comma Computers on Brentwood (0277) 811131.

Or you could use a pen and envelope to complete and return the coupon to us.

Later on, you could have a free copy of our 'no jargon' brochure on your desk from which you could see how Comma Computers have used advanced micro-processor technology to make business computers easy to understand, use and afford!

Still later, but not much later because Comma Computers are quick and simple to install, you could have a Comma Aquarius, Aries or Leo business system on your desk – a complete system with computer, printer, keyboard, display, installation, 12 months maintenance and software to perform Payroll, Accounts, Invoicing and Credit Control applications and provide instant management information including Profit and Loss Statements and all from less than £6000.

Butchers, bakers, candlestick makers . . . can all, at last, enjoy the benefits brought to business by the silicon chip and increase the efficiency of dealings with customers and suppliers as well as accountants, auditors, HM Collectors of Taxes and Customs and Excise.



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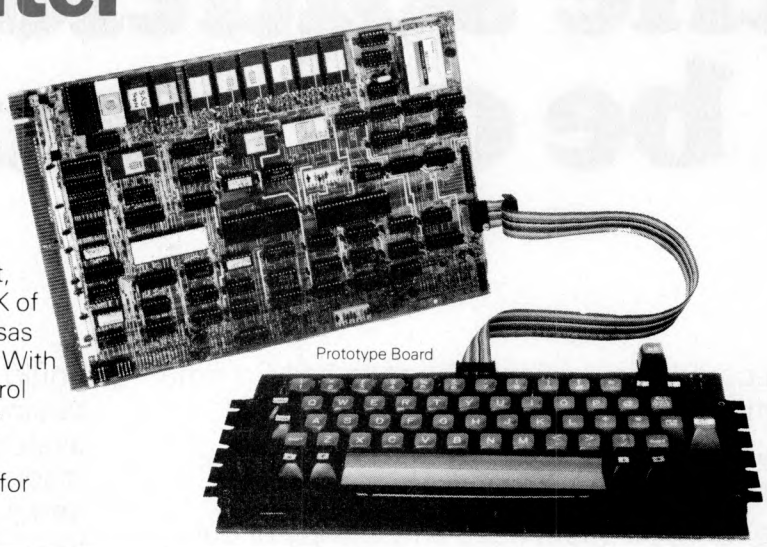
NASCOM-2
Our nomination for the best microcomputer board in the world.



In about the same area as this advertisement, we have designed a microcomputer with 20K of addressable memory ON-BOARD. With Kansas City standard cassette interface ON-BOARD. With TV/monitor interface ON-BOARD. With control decoding ON-BOARD. With all bus lines fully buffered ON-BOARD.

We call this microcomputer **Nascom-2**. And for under £300 this is what it has:

Microprocessor

Z80A. 8 bit CPU. This will run at 4 MHz but is selectable between 1/2/4 MHz.

This CPU has now been generally accepted as the most powerful, 8 bit processor on the market.

The software library for the Z80, with its base around the 8080, has rapidly expanded with the increasing use of its more powerful instruction set.

Hardware

12''×8'' Card

All bus lines are to the Nasbus specification.
All bus lines are fully buffered.

PSU +12v, +5v, −12v, −5v.

Memory

On-board, addressable memory:–

2K Monitor – Nas-Sys I (2K ROM)
1K Video RAM (MK4118)
1K Work space/User RAM (MK4118)
8K Microsoft Basic (MK36000 ROM)
8K Static RAM/2708 EPROM

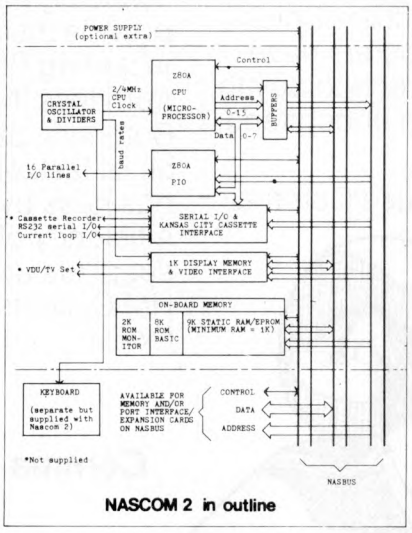
INTERFACE

Keyboard

New expanded 57 key Licon solid state keyboard especially built for Nascom. Uses standard Nascom, monitor controlled, decoding.

T.V.

The 1v peak to peak video signal can drive a monitor directly and is also fed to the on-board modulator to drive the domestic T.V.



NASCOM 2 in outline

I/O

On-board UART (Int.6402) which provides serial handling for the on-board cassette interface or the RS232/20mA teletype interface.

The cassette interface is Kansas City standard at either 300 or 1200 baud. This is a link option on the NASCOM-2.

The RS232 and 20mA loop connector will interface directly into any standard teletype.

The input and output sides of the UART are independently switchable between any of the options – i.e. it is possible to use input on the cassette and output on the printer.

PIO

There is also a totally uncommitted Parallel I/O (MK3881) giving 16, programmable, I/O lines. These are addressable as 2×8 bit ports with complete handshake controls.

On-board Decoding

The NASCOM-2 makes extensive use of ROMS for on-board control decoding. This reduces the chip count and allows easy changes for specialised industrial use of the board.

Link options are on-board to allow the Reset control to be reassigned to an address other than zero.

Character Generators

The 1K video RAM drives a 2K ROM character generator providing the standard ASCII character set with some additions, 128 characters in all. There is also a socket for an optional graphics ROM on-board.

The PCB is, of course, of industrial standard, through hole plated, masked and screen printed.

Documentation

Full construction article is provided for those who buy a kit and an extensive software manual is provided for the monitor and Basic.

We think no other board has quite so much on it for £295 (plus VAT).

Nascom Microcomputers
121 High Street Berkhamsted Herts.
(04427) 74343

P.E.T NEWS

PET BOOM IN BRITAIN!

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Bournemouth
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Data Efficiency
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Hove
Amplicon Micro Systems
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Leeds
Holdene
0532-459459

Liverpool
Dams Office Equipment
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Rockliff Bros
051-521-5830

THE PET 4K COMPUTER at £450 (+VAT) it's got to be Britains best buy!

Why the PET is the number one Personal Computer

The Self Contained PETS
The self contained PET models 2001-4 and 8 come complete with TV screen, keyboard and built-in cassette deck as well as the computer circuitry. They are simply plugged into any 13 amp mains and no special knowledge is needed for running standard programs — over 200 of which are available on cassettes.

The Big Memory PETS
The BIG MEMORY PETS contain the same main features as for the 2001-4 and 8 models except that they incorporate a full typewriter size keyboard and have larger internal memory of 16K and 32K bytes RAM respectively.

Professional Printers

High specification printers can print onto paper all the PET characters — letters, numbers and graphics. A tractor feed model has the advantage of accepting mailing labels, using standard pre-printed forms. The only connections required are an A/C lead and PET connecting leads. The PET is programmable, allowing the printer to format print and it accepts 8½" paper giving up to four copies.

Dual Drive Floppy Disc

The Dual Drive Floppy Disk is the latest in Disk technology with extremely large storage capability and excellent file management.

The Floppy Disk operating system used with the PET computer enables a program to read or write data in the background while simultaneously transferring data to the PET. The Floppy Disk is a reliable low cost unit, and is convenient for high speed data transfer. Due to the latest technological advances incorporated in this disk, a total of 360K bytes are available in the two standard 5¼" disks.

Only two connections are necessary — an A/C lead and PET interface lead.

Software and application areas for PET

There are a large number of programs that can readily be used with the PET. Personalised programming is available from many Authorised Dealers. Over 200 programs are now available from Commodore and other software suppliers for the PET. Popular program titles include Stock Control, Statistics, Payroll, Strathclyde Basic Course, Chess, Lunar Landing and Education Packs.

FOR THE COMMERCIAL USER
The Commodore PET offers for the first time a really cost effective business computer for use in Accountancy, Statistics, Stock Control, Payroll, Invoicing etc.

FOR THE SCIENTIST AND THE LABORATORY
PET has a comprehensive set of scientific functions making it a far superior tool to the best programmable calculators. PET interfaces directly with hundreds of laboratory instruments. PET is an ideal industrial and commercial controller.

FOR THE EDUCATIONAL WORLD
The extensive basic language makes PET an ideal tool for teaching computer programming. Programs can be written to "tutor" the user (pupil) in almost any discipline, including BASIC itself. And, of course, the PET can be used to take care of school records, exam results, attendance figures etc.

IN THE HOME
The PET is an extremely creative and instructive learning medium of the future for young and old alike. There are also large numbers of entertainment programmes available including chess and space games.

☎ Phone about PET now!

CALL YOUR LOCAL AUTHORISED DEALER or in case of difficulty contact:
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Xitan Systems Ltd.
0703-38740

Sunderland Tripont
Associated Systems
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P.P.M.
Brookwood (04867)-80111

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Thistle Computers
Kirkwall (0856)-3140

Northern Ireland
Medical & Scientific
Lisburn (08462)-77533

NEW LOW PRICE FOR LEVEL 1 BASIC 4K RAM

TRS-80 Microcomputer

the world's biggest selling personal microcomputer

This is a fantastic opportunity to own a TRS-80 personal microcomputer. Designed and built by TANDY, the TRS-80 is the world's biggest seller, with over 100,000 in use.
The 'silicon chip' revolution is here, now, at your nearest TANDY store. If necessary you simply add-on extra modules to suit your individual requirements. See a TRS-80 at your Local TANDY today.

- ✻ Level refers to version of BASIC computer language.
- ✻ 4K is size of Random Access Memory Capacity.
- ✻ Both Level & RAM can be extended.
- ✻ All systems include 232 page users manual & games cassette program.
- ✻ No prior knowledge of computing is required to use the TRS-80.
- ✻ Fully wired and tested —NOT a kit.
- ✻ Designed and Manufactured by TANDY Corporation.

From August 1st new, low prices will also extend to the following TRS-80 systems.
26-1003 LEVEL I 16K
26-1004 LEVEL II 4K
26-1006 LEVEL II 16K
Clip the coupon or check at your nearest TANDY store for full details.

26-1001

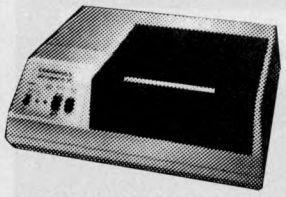
£375 +VAT
(TOTAL £431.25) OLD PRICE £531.34
inc. VAT at 15%

SAVE £100

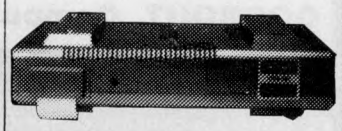
TRS-80 Expansion is easy!—Just add the units to suit your needs.

TRS-80 LINE PRINTER
Prints from 10 to 16.5 characters per inch at speeds from 60 to 110 characters per second. Requires 4K RAM Level II and Expansion Interface. 26-1150 **£1,063.74**
With tractor feed. 26-1152 **£1,202.16**

TRS-80 MINI DISK SYSTEM
Gives more data storage and greater operating speeds. 35 tracks. 89,000 bytes per diskette. Transfer rate 12,500 bytes per second. Requires 16K RAM Level II and expansion interface. 26-1160 **£478.10**



TRS-80 QUICK PRINTER
Produces copy at rate of 150 full lines per minute on 4.75 inch roll and provides user software selection of 20, 40 or 80 characters per line. Requires Level II, Expansion Interface. 26-1153 **£456.80**



TRS-80 EXPANSION INTERFACE
Upgrade your system as your needs increase. Contains sockets for additional 16K or 32K RAM, disk controller for up to 4 mini disks, software selectable dual cassette use. Centronics parallel port, real time clock. Requires Level II Basic. 26-1140 from **£243.84**

Offers subject to availability.
Instant credit available in most cases.
Access, Barclaycard and Trustcard welcome.
Check your telephone directory for your nearest store.

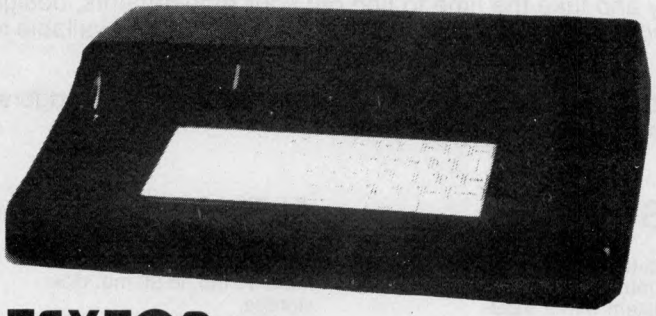
OVER 170 STORES AND DEALERSHIPS NATIONWIDE.
KNOWN AS RADIO SHACK IN THE U.S.A. MAKERS OF THE WORLD'S BIGGEST SELLING MICROCOMPUTER TRS80.

TANDY

BRINGING HIGH TECHNOLOGY DOWN TO EARTH
Please send full details and new low prices of TRS-80 systems.
NAME _____
ADDRESS _____
_____ PHONE _____
TANDY CORPORATION, BILSTON ROAD, WEDNESBURY, W. MIDLANDS, WS10 7JN.

SIRTON PRODUCTS (SP)

13 WARWICK ROAD, COULSDON, SURREY CR3 2EF Tel: 01-660 5617



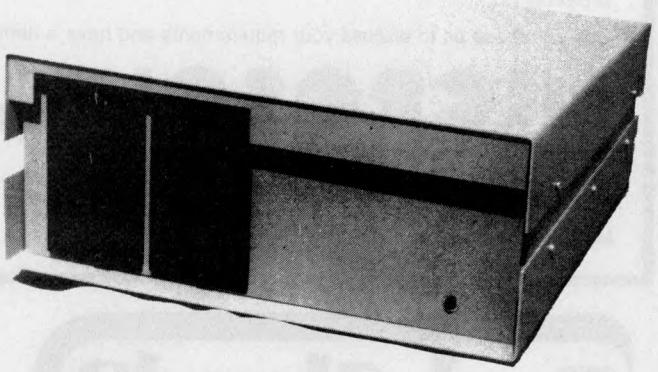
TEXTOR

DON'T BORE YOUR COMPUTER WITH DATA PREPARATION!
Let it run programmes that work for you while the TEXTOR is used to edit programmes and data off line.

TEXTOR has 2K of user memory, text editing facilities, and transmits and receives via serial link to your Computer

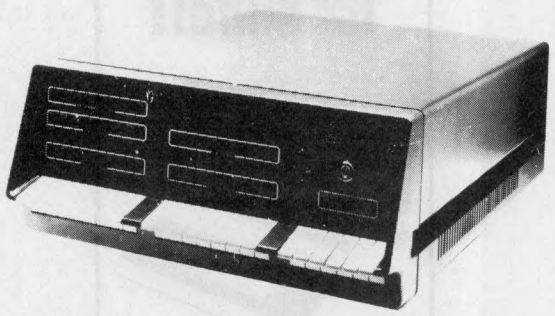
MIDAS

MIDAS S.100 SYSTEMS



Substantial Mainframe to house your S100 system, with optional 5" or 8" disc drives. Special systems built to your requirements from Z80 CPU and other S100 boards held in stock

Mainframes from £228
MIDAS 1 : Z80 System from £625 (built)
MIDAS 2 : Z80 Disc System from £1100 (built)



The ITHACA DPS·I

Professional versatile computer system with comprehensive front panel facilities and 20-slot motherboard. Units have substantial power supply etc. and come with 2 or 4 MHz Z80 CPU. BUS conforms to the IEEE S100 standard.

DPS.1 from £695

STOP PRESS!
Siemens 8" Drives @ £325 EPROM Erasers (240V) @ £38.00

Suppliers for:
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CROMEMCO
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ITHACA AUDIO
ETC & SSM
GODBOUT
& others

Comprehensive Range of S100 Boards Stocked

Bare Boards — Kits — Built & Tested

VIDEO RAM
ROM
DISCS CPU
PARALLEL/SERIAL I/O

WRITE OR PHONE FOR CATALOGUE

SOFTWARE

BASIC
CP/M DOS
Z80 ASSEMBLER
MONITOR
BIOS

The 2nd PERSONAL COMPUTER WORLD SHOW

1-3 November 1979
West Centre Hotel-Lillie Road, London

LAST YEAR

Last year, the overwhelmingly enthusiastic response to the 1st Personal Computer World Show ensured its establishment as probably the U.K.'s most important annual event in the small computer marketplace.

THIS YEAR

This year, the 2nd Personal Computer World Show is going to be even bigger and better. We've organised more space for exhibitors, all of which has already been pre-booked.

The first European Microprocessor Chess Championship, (with a £1,500 first prize), under the direction of David Levy will be held during the show alongside a host of other special features.

This year's show, like last year's, will be a state-of-the-art showcase for a whole range of micro-and-mini systems and software. From the levels of interest already expressed by potential exhibitors and visitors alike, we're expecting to exceed last year's performance and we advise anyone wishing to attend the show in any capacity to pre-book now using the coupon.

THE CONFERENCE

As with last year, a full conference programme is attached to the show and once again it consists of a separate Seminar on each day. The timetable has been structured to allow delegates to follow up points individually with speakers at coffee, lunch and tea breaks in addition to the discussion periods. Two hours are allowed for lunch to enable delegates to visit the exhibition then as well as after the seminars finish.

Each day's seminar programme will start promptly at 09.45 and finish at 16.30.

THE CONFERENCE PROGRAMME

Seminar 1
Thursday 1 November MICRO-COMPUTERS FOR THE SMALL BUSINESS

The Decision to Purchase a Micro-Computer. Potential Applications of the Micro-computer in a Small Business. Case History of a First Time User. The Bottom Line of a Small Business System (Recovery of Investment).

Seminar 2
Friday 2 November MICROPROCESSOR APPLICATIONS IN INDUSTRY

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Seminar 3
Saturday 3 November MICRO-COMPUTERS FOR THE INDIVIDUAL ENTHUSIAST

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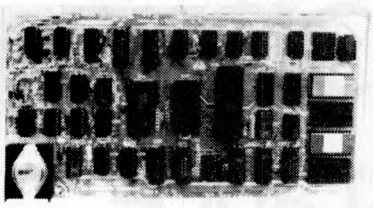

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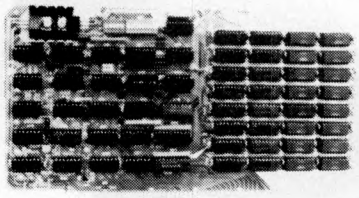

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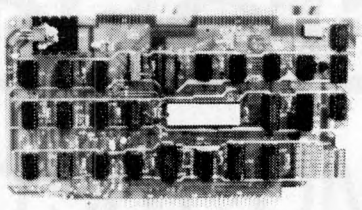

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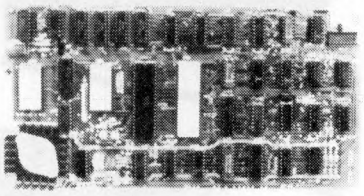

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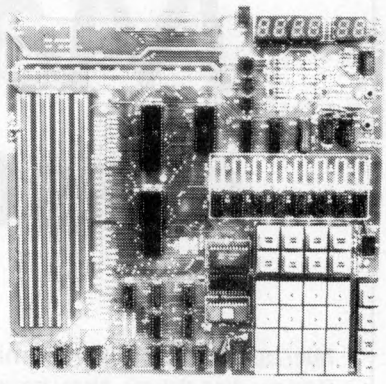

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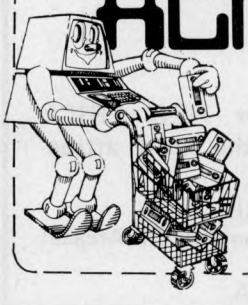

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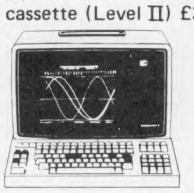

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The Toolkit is a machine language program which is provided in a 2 kilobyte ROM chip. Just plug it in — no tools are necessary — and your PET's BASIC has 10 new and very useful commands including:
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Programs are available on Commodore format cassettes. Some titles are available on disk for ACT PETSOFT and Commodore Disk systems.

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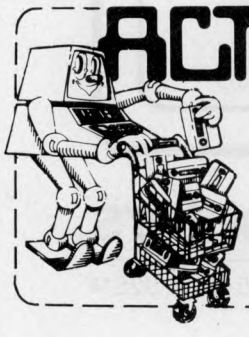

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Bad news travels faster

Electricity Board customers may not agree with the aims of UCSL Microsystems, a company which has produced a micro to speed up reading of gas and electricity meters. Nonetheless, as an example of micro use robbing nobody of work, the portable data capture terminal looks nice. It not only records all the readings, correlates them with the meter and address details and so on, but it also contains the reader's schedule for the day. It saves time mainly by transmitting all its accumulated data — up to 64K-bytes worth — at night by phone (cheaply) to headquarters, rather than waiting for the post.

(Bad News. . .) Meter reading terminals under assembly and test at UCSL in Berkhamstead.

Micro~phone

The possibility of networks of hundreds of personal computers, all talking to each other down phone lines, has come a step closer with news that the personal computer that was designed to be connected to the Post Office Prestel information network has made its big breakthrough; the Post Office has approved it.

The result could be do-it-yourself viewdata, because this computer can access the Post Office viewdata, Prestel itself, or be used by a private viewdata network "spinner".

For £1,955, the machine (called Tecs) provides access to the broadcast teletext services, Ceefax and Oracle, plus a BASIC interpreter in 3K-bytes of permanent memory, and access to Prestel.

The Post Office has moved with astonishing speed on this product, especially considering the unusual conditions under which it can be built — that is, by you at home. There is also the fact that this is the first product for attachment to the standard telephone lines — with its own modem — to come available to the private buyer.

The purpose of the modem is to send and receive data between the Tecs computer and the local Prestel computer. However, it will talk to any compatible machine whose phone number you know; that is, another Tecs computer — and the possibilities are obviously enormous.

Purely as a standard Prestel receiver, the Tecs would seem to offer considerable advantage over an "ordinary" £1,500 colour TV Prestel set . . .because of its processing power. The builder, Technalogics of Liverpool, observes: "You could create a local database of frequently used pages, which can be accessed — for example from your disc — with Prestel disconnected."

Then there is the possibility of receiving programs down the line. . .telesoftware. Technalogics expects that if and when the big software house, Cap, gets its act together on telesoftware, the Tecs machine will accept programs from the network. It remains to be seen if they will be in BASIC or Cap's own invention, MicroCobol. If the latter, the price will need some haggling over between Technalogics and Cap. Currently, Cap expects a user to invest a couple of kilo£ to get MicroCobol working although they have said that, for bulk buyers, special terms will apply one day. Details from Technalogics on 051 724 1695.

Logic box promise more

The start of a new shop chain called Logic Box has given the proprietors a chance to say some rude things about their competitors — and the level of service offered.

The first shop is being opened by Jock Eggeling and George Spilling near Caxton Hall, Westminster, with financial backing for the parent company, Beyts Logic, coming from "city industrialist Nicholas Leonard."

Most smaller companies, say the Logic Box people, "cannot afford the investment for retailing, and some of the new 'chip shops' are also undercapitalised". The result, they think, is the same: "An uninitiated customer gets half the story only — detailed hardware or skilled software knowledge is lacking."

Beyts Logic, a software and micro training company, will start pushing Logic Box into Commodore, Compelec — that is, Altair and Hewlett Packard product markets. Beyts is in Sunbury, tel 09327 86262, and Logic Box, at 31 Palmer Street SW1, is on 01-222 1122.

The Packard Prize

Nick Bright at the 'controls'

Nick Bright has won a microprocessor "trainer" using the Intel 8085 micro, from Hewlett Packard. It was a contest he entered as the result of a motorcycling accident a few years back; plans to become a mechanic were crushed along with his pelvis, and he started studying electronics instead.

From the point of view of the rest of us, the interesting fact must be that HP makes some of the best micros in the world. . .and we still can't buy them. It will sell only a trainer, for £457, using an 8-bit Intel device. It's a strange world.

Comp halo intact

The people at Comp Computer Components tell us they don't like the Press. Considering that the company has featured in many rather exciting news stories recently, this sentiment is not too surprising.

It has been suggested that the Compukit UK101 is a photocopy of the Ohio Scientific Superboard. It's also been said that American Data, the company which markets Ohio Scientific (OSI) equipment, was raving mad about it, and taking steps to suppress the UK101. And the company knows, too, exactly how close it came to featuring in a story about whether or not the 8K Basic on Compukit was authorised by Microsoft Corporation, which wrote it.

And if that were not enough, it has suffered public abuse for its software competition — the "win a printer" contest — from exactly the sort of enthusiast that Comp, with its low retail prices, has chosen to try to please (in the face of vilification from rival retailers who wanted to make fatter profits).

Happily, Comp has emerged triumphant from all these scrapes with a shiny reputation and a clear conscience. Yet even the shop's best friends must admit that the Press did not pick all these stories out of thin air; and it's worth looking back to see just how the confusion arose.

It started with Comp's advertisements, describing the UK101 as a "low cost superboard in kit form" a statement which had Superboard importer, American Data, in some anxiety — especially since they were mentioned on the advert as responsible for European distribution. In the words of one Comp executive, American Data has been "making a fuss, approaching editors and trying to get adverts dropped".

American Data was soothed by Comp assurances that, while the two products were "cosmetically the same", the circuit board had different track layout, the video was different (being designed around UK TV standards) and the character set new; and Comp had a complete licence with Microsoft.

As an example of how Comp proved no friend to itself, however, the Microsoft licence is a splendid case in

point.

When, they were asked (in August) was the UK101 design completed?

In May or June, was the answer.

And when did Comp arrange its Microsoft Licence? No comment. Why no comment? "Because you would probably deduce the wrong thing. We haven't given them any money yet, and haven't filled in all the forms, but we had no intention of ripping them off, and we always intended to get a Microsoft licence."

Comp's software man, Andy Fisher, makes no bones about the fact that adapting the BASIC to the Compukit from the Superboard version was a hard task, because he did not have the advantage of the powerful configuration tools that Microsoft provides with its code. He had to change the sections of code which deal with the display of data on the TV screen; he did this by producing a program flow diversion at the point where the original code took over — into a new section of code in a spare area of memory, then jumping back into the main flow again: "A sort of patch, really," he observed.

This is neither illegal nor immoral. It would have been a risky shot to approach Microsoft for a £10,000 licence when the product was still in the design stage. And at that point, there was no question of selling the BASIC without licence, because there were no BASICS to sell (a state of affairs which persisted beyond the first deliveries of Compukit, due to the slowness of suppliers of the read only memory chips containing Basic, monitor program and character generator).

All's well that ends well, and the Compukit story is no exception. But given what was being said in the pubs and computer clubs at the time, it's not hard to see why "The Press" said what it did. Let's hope then, that this analysis clears up any lingering anxieties potential customers may have developed; and watch these pages for our review of the system.

Save our Sol

American micro maker, Processor Technology, may have been wrecked. . .but not without trace. A salvage operation has been mounted by UK specialist in S100 products, Comart, with the result that an interface card for a video display monitor — originally made by Processor Technology — has now surfaced as a Comart product. Comart's inspired beachcombing has retrieved the entire work-in-progress of the interface card, and the manufacturing rights.

The device is memory mapped, sits on the S100 bus and generates 64 upper and lower case characters on 16 lines of screen text. It costs £135.

Discount status

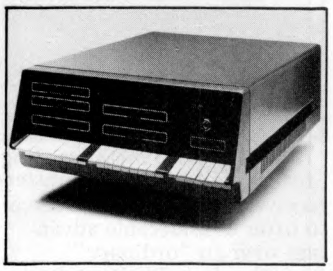
Intel distributor, Rapid Recall, has a special deal for non profit and charity organisations. . .it is selling devlopment systems at 15% off. To qualify you have to be on the list quoted by Rapid Recall: that features, "Universities, Colleges, Schools, and Government funded research establishments who will use the equipment to support their training programme or for basic research work". If the customer also buys one software package, they will get a 15% price reduction on subsequent packages, and on peripherals, service equipment and so on. Contact the company on Bourne End (06285) 24961.

Ithaca moves in

A company dedicated to making the S100 bus look like the safest option has now established a London office, and is looking for European distributors for its products.

It is Ithaca Intersystems, a New York firm of which the knowledgeable speak highly for product quality, and which boasts a chief engineer, Kells Elmquist, who is principal author of the proposed American standard S100 bus. It now boasts an equally well respected UK star in Jim Wood, one of the founders of Comp; he has left the Barnet shop to become Intersystems European Sales Manager.

The company has appointed Newbear Computing Store in Newbury as its main UK distributor. Newbear informs us that it has taken delivery of the first batch of Ithaca's DPS-1 "mainframe" computer. . .a box with a Z80 micro processor board, a front panel with a lot of thought behind it and a very carefully engineered S100 bus with 20 slots — for £695. By the time the customer has configured a complete system, it will cost a lot more; Ithaca claims that it will then stand favourable comparison with Cromemco and North Star equivalents.



What makes the DPS-1 unique is the software; it includes a Pascal compiler (not an interpreter) producing Z80 mnemonics, and an assembler to turn these into direct machine code.

Ithaca claims that a Pascal development system would be one that had 64K-bytes of RAM memory, an eight inch diskette, an operating system called K2, and RS 232 standard input and output. It would cost £2,799.

Boat comes in

The Software Supermarket has opened in the UK. This enticing title belongs to the well respected US based firm, Lifeboat Associates, which has produced much standard software for the micro market, and which markets the output of companies such as Microsoft (whose BASIC rules OK) and Digital Research (whose CP/M operating system is a near essential standard for diskette machines).

Lifeboat was set up two years ago in New York by expatriate Englishman, Tony Gold, who claims a million dollar turnover already.

The software catalogue is available; code is supplied for 8080 and Z80 based systems, and comes on diskette. It includes no games: prices from about £75 to £400 cover products such as editors, assemblers, interpreters, and applications programs (eg. an "apartment management system").

Intriguing oddments include a £6 "flippy disc kit" which allows you to flip single sided minidiskettes over and use the back.

Software ~wise

A new company writing software for the Tandy TRS-80 has launched a newsletter called, "TRS.80 Software".

The first issue, published by Tim Hill and Fred Brown of BC Weatherseal, includes a text editor called Textman, a review of a new disc operating system called Newdos +; a game called Tank Battle, and a few pungent remarks to appeal to readers. The newsletter costs £1, and the new company is 3 Line Computing. Fred Brown is also chairman of Hull District TRS-80 user group, and can be contacted on Hull (0482) 859169.

Upcoming courses

On the Zilog Z80: a three day introductory course costing £200 is available from Software Architects with Zilog approval. First course ran in September. Details from Bob Hin or Julia Symonds at SAL on 01-734 9402.

On the Intel 8066: Intel runs a £34 plus VAT one day seminar, covering the new 16-bit micro family, associated devices and the "new concept of co-processing." Details from the seminar registrar on Oxford (0865) 711829.

On Motorola products: four courses have been launched by Motorola at prices between £150 to £250. A four day initial course on the basic 8-bit 6800 costs £200. A three day course on the other micros in the 6800 family costs £150. High level software is covered in a three day course for £150; and the giant 16-bit micro, the 68000, plus Pascal, star in a five day, £250 course which goes into such refinements as structured programming. Details on all four courses from Diedre Kibble, 01-902 8836.

On micro impact: two short seminars, one on small business and mini computers, the other on word processing and the electronic office, will be run in parallel with exhibitions held by ICFC training and management, in Manchester on 20th/21st November, and Solihull on 12th/13th February; Details from Groundrule Exhibition company, 061 928 2227.

WHAT'S NEW

What's New compiled by Guy Kewney

On the cards

A printed circuit board costs £25 or more.

That simple, perhaps even oversimplified, fact, explains better than anything else why "cheap" computers using the S100 bus aren't all that cheap. The whole idea of the S100 bus is that you can plug a lot of cheap add-on modules into the bus. But a lot of add-on modules will still be pricier than a single, general purpose computer, because each one costs upwards of £25. The result has been that, until now at least, almost no S100 systems have been produced by British manufacturers.

Comp Shop, the inventor of the Compukit UK101, may be about to end this with a computer on a board — which is, in fact, a computer on two boards. The story is an interesting one. People first realised it might happen when software man Andy Fisher, at Comp Shop, let it slip that the licence Comp has negotiated for Microsoft Corporation's Basic interpreter (used in the UK101) includes a version for the Zilog/Mostek Z80 microprocessor. The UK101, however, does not use the Z80; it used the MOS Technology 6502, as does the Ohio Superboard from which it is derived.

Naturally, Fisher was asked what the Z80 licence was for. "Oh, (blast)," was his reply, "I'd rather not say; if I tell you, you'll go and print it." How right he was! The plan is apparently a long term one, and customers need not expect to see a prototype, never mind a product on the shelves, for another year.

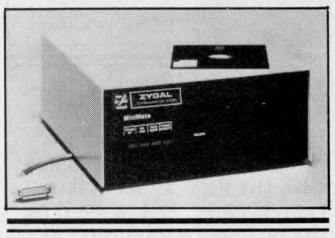
Nonetheless, Comp will happily admit that its UK101 kit is not the most sophisticated system since Apple II. "The sort of thing an ordinary person can buy cheaply and learn something about micros on," is the modest way Comp describes it — and as such, very good value indeed. But when a user wants to start expanding to something using diskette storage, he may well look at machines with the Intel 8080 or Zilog Z80 micros, because of the fact they will run the large CP/M user group library of software. And yet, any single board computer must end up looking very like Nascom, or Compukit, or Transam Triton — nice, but restricted unless you can really raise the finance to built it into a Pet or an Apple, and sell thousands.

"The trouble with the S100 board is that it's very small," Fisher explained, "and you can't get a lot on it. We wanted a basic system with extended BASIC, 32K-bytes of read and write RAM memory, interface to a keyboard and to a video, and to a tape. It wouldn't all fit."

So Comp's basic plan is a "piggy-back" arrangement ... a simple S100 board with another board bolted onto it. It's an idea exploited well by the Acorn; it gives you your self-contained system, and also gives you an expandable, "crateable" system for more grandiose usage. That enables the industrial controller, the scientific monitor, and the specialised data-processing applications people to make and sell their own systems with your board inside, which enlarges the market and which enables the processor builder to bring down prices because of the volume discounts on components.

Minifloppy meets micro

A minifloppy that can be driven by a micro with a standard serial input/output port conforming to RS 232, has been put together by Zygal. Pricey for a minifloppy at just under £1,000, it does offer the user without a diskette operating system some 70,000 characters of working storage; Zygal sees it as a logical replacement for paper tape, cassette, or mag card units. Details on Chesham (02405) 75681.

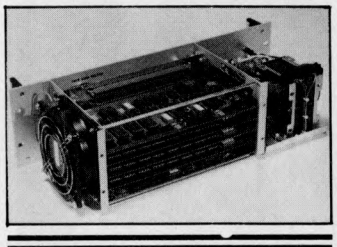


Bigger floppies

Full size floppies for Apple are available from Personal Computers that provide 1¼M-bytes or 2 M-bytes of storage — a lot more than the Apple minifloppy. Details on 01-283 3391.

Vero crate

For the man who has picked up a few S100 cards and does not want to build a box out of bits of iron, nor buy a big name frame which already includes some of the items he has, Vero now provide an S100 crate. It has its own power supply, providing plus and minus 8V, and plus 18V. It takes six S100 cards, and Vero says it will operate up to 4MHz speeds. Details from Chandlers Ford (04215) 69911.



Failsafe

A box in which to put Intel's micro boards alongside its single board computer, SBC series, has been announced by Rapid Recall; the box includes power supply, air cooling, and mains power failure detection circuitry that can generate an interrupt for the processor, giving it time to shut down the system, while storing important data.

Tandy talk

A British software company has decided that Tandy's BASIC language is good enough to improve: it has added an astonishing 70 commands which, it thinks, will give an applications program writer the ability to outperform his competitors.

Infinite Basic, the product is called, and it costs £29.95 plus VAT. The list of new functions is huge: it includes complete matrix functions — such as matrix read, inverse, transpose, identity and simultaneous equations; add, subtract or mulitply scalars vectors, or multidimensional arrays; dynamically reshape, expand, delete arrays; change arrays in mid-program; copy array elements, set arrays to scalar, zero arrays, move arrays; tape array read and write including string arrays.

A similarly mind boggling list of complete string functions is offered, running from juggling feats such as justify, truncate and rotate, through to encrypting or decrypting, and ending up with sorts.

This is not BASIC, of course, but at the price, does it matter? It seems to give the Tandy user a lot extra power.

To go with Infinite Basic, the company, A J Harding (Molimerx) it calls itself, has added Infinite Business. For £16.95 plus VAT it is a little less ambitious, with arithmetic and administrative enhancements designed for file handling, forms and printer operation, and record sorting. Details from Bexhill (0424) 220391. (Let us know how it goes if you buy one.)

Telex too

A printer/terminal that will accept both computer codes and five bit Telex code has been launched by Data Dynamics. One application would be to produce paper tapes for a telex installation from an inhouse word processor; or to store incoming telex messages from the paper tape output of the telex machine, and convert this to standard computer code. Details of the Zip terminal from Henry Dorsett, 01-848 9781.

New bubbles

Now you can buy bubble memory: GR Electronics in Newport, Gwent has produced a set of modules starting at £750 for a storage unit of 10k-bytes, rising to £1,000 for a 40k-byte version. The modules attach to the serial RS232 port, and GR sees them as attractive to users who need bulk storage for harsh industrial environments — they are insensitive to dust, vibration or movement, unlike diskette. Details on 0633 67426.

Mac,Tex and Sid

New CP/M software has been announced by British micro system builder, Rair, for its Black Box computer. Mac is a macro assembler, Tex is a text formatter, and Sid is a symbolic debugger for programs generated under CP/M.

Wallchart accessories

Top quality supplies for word processing; the bits you forget about at the system design stage, (such as daisy print wheels, typewriter ribbons, and diskettes) are included in the ISA Gold label from International Systems and Applications. A wallchart of daisy wheel type styles, plus details of other products is available from ISA in London on 01-965 1942, or Bradford (0274) 306787.

Shine-on

A bit of green plastic worth £8.50 and called The Green Screen can, apparently, make all the difference to the PET computer. It cuts out ambient light falling on and reflected from the PET video, tints the PET video green, and enhances contrast (according to supplier Petsoft) to the point where the display can be read in direct sunlight.

Soft on Pet/SWTPC

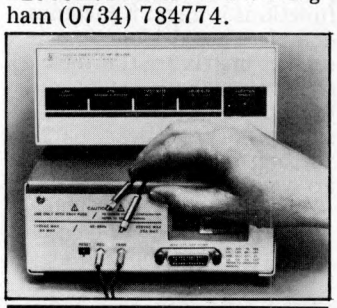
A complete business program package for PET and South West Tech Products computers has been announced by GW Computers. Tony Winter, a director, expects to sell the suite of 20 programs for between £300 and £400, or to give them away with a personal system of 48k-bytes size. Details on 01-636 8210.

Remote sensor amp

To amplify very low level signals from remote sensors such as thermocouples, National Semiconductor has launched a circuit in a single, chip size pack which it claims is a third of the price of similar circuits packaged in board modules. Details of the LH0038 from Bedford (0234) 47147.

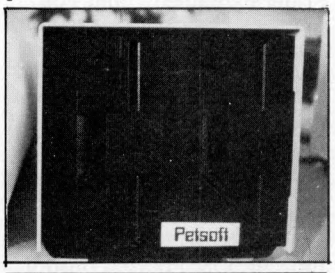
Fibre control

Test and measuring instruments using the HP interface bus can be operated at distances up to 100 metres from associated computer controllers — such as the PET, which uses the bus — by utilising fibre optics. The advantage of fibre optics is that it does not pick up interference from the "large electromagnetic disturbances" typically found in industrial environments, and will carry data at speeds up to 20k-bytes per second — according to Hewlett Packard. To provide the light receive/transmission, HP has produced a Fibre Optic link called the HP 12050A. Details from Wokingham (0734) 784774.



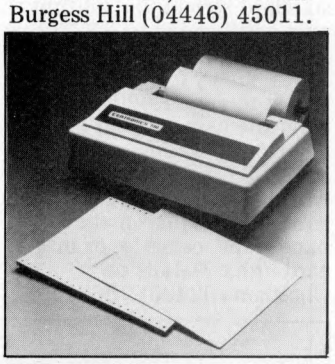
Pet storage plus

"Faster, cheaper and with greater storage capacity than any other diskette for the PET," are the confident claims made by Petsoft for its new product from Silicon Valley firm, Compu/think. Petsoft is selling the 400k-byte drive system for £795, and already can boast seven regional distributors including Stack Computers in Liverpool, Intex Datalog in the North East, and HB Computers in the East Midlands.



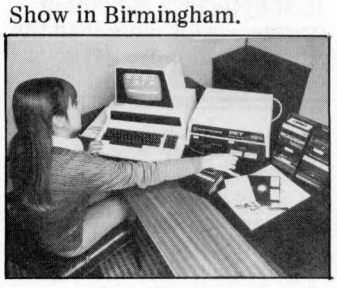
New from Centronics

A printer, costing £650 and using plain paper, has been launched in Europe by Centronics, some four months after it appeared in America. The price is obviously designed to be attractive to micro users, and in America, says the company, some 20,000 units had been ordered before the printer crossed the Atlantic. The European version gives six different character sets . . . a point of more interest to system builders than individual users, but useful for incorporating in end products that have to sell in other European countries. The printer is the model 730; details from Burgess Hill (04446) 45011.



Pet programs

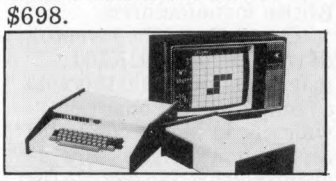
A powerful set of business programs has been packaged with the PET by its maker, Commodore, and offered to the business community at under £2,500 for computer, dual diskettes, printer, and software. The printer, the model 3022, was launched at the International Business Show in Birmingham.



Ohio news

For the trifling sum of £13,000, Byte Shop (Computerland, as it is known outside London) will sell an Ohio Scientific machine with a giant 74M-byte capacity hard disc storage unit. The C3-B has three processors; 6502, 6800, and Z80 "giving the programmer the best of all worlds in performance and versatility".

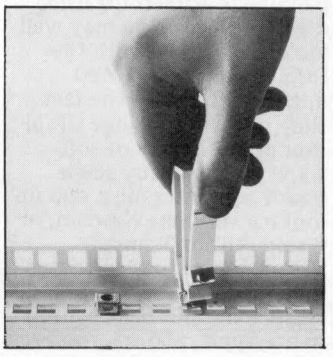
Meanwhile, back in America, Ohio has announced the C4P MF as a "top of the line personal computer", costing $1,695. An 8K Basic (in read only memory) version sells in the US for $698.



Now, without wanting to mislead you, we rather think that the letter 'C' stands for Challenger, and the MF for mini floppy. The cheap version is no MF; but it does feature "a real time clock, a unique home control operating system with Foreground Background operation, an AC remote control interface, and a home security and fire alarm interface." It would appear, therefore, to be an ideal machine to include in the electrical rewiring of your home — for full details, contact American data.

Nuts

Finally, a product from Vero which may confirm your worst suspicions about the sort of people who engage in computing as a hobby. It is a Caged Nut Insertion Tool costing a mere £2.67; and if that sounds redolent of medieval treatment of lunatics, the fact that it is to be used in the racking of electronic equipment will not reassure you. If you've broken fingernails on these nuts before, however, it will be just what you wanted.



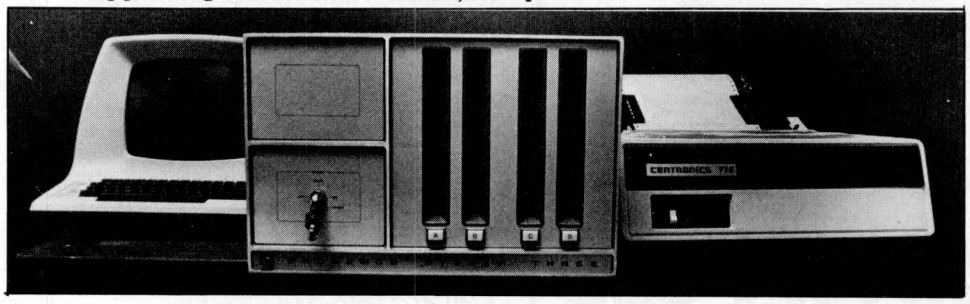
ADVERTISERS INDEX

BENCH TEST

THE CROMEMCO SYSTEM THREE

BY SUE EISENBACH

For some time now anyone with a bulky wallet and a strong friend could walk into one of several shops and emerge with the top of the market personal computer, Cromemco's System Three. As a 'black-box' machine running purchased software the System Three is less appropriate than some of its more compact, less expensive alternatives. But, for someone looking for a personal computer for computing, the System Three is a thoroughly professional machine. There is nothing gimmicky about the hardware or the software. The hardware is solid and based on the S100 bus; the operating system is more extensive than CP/M but will run most CP/M system software. The supporting software is reliable, comprehensive and well documented.



Hardware

The System Three is contained in one large, heavy box (all-up weight around 80 lbs). To open it up one simply presses a button and the front swings open. Immediately visible are the card cage, the two drives and the power supply; with the cage slid forward, every card is completely accessible. The hardware layout has been carefully designed to that everything can be reached with complete ease. The machine that I was lent ran cool even over extended periods of time. I'm sure that this was aided by the emptiness of the box and the size of the power supply.

The CPU is Cromemco's 4MHz, S100 compatible, Z-80A CPU — called ZPU (Z rhymes with C in American). It has power-on jump circuitry so that it can force an automatic jump to 1 of 16 memory locations. The clock can be set to 2 or 4 MHz (set at 4 on the System Three). There is a Wait State generator allowing use with slow memory.

The memory consists of four Cromemco 16KZ dynamic RAM cards. They can operate at 2 or 4MHz. A Bank Select feature allows memory to be organised into up to 8 banks of 64K, each selected by software. Cromemco also produce a memory card called the 64KZ, which can be used with their Extended Bank Select feature to expand the memory to 16 megabytes.

The disc controller card is Cromemco's Model 4FDC which interfaces with both mini and full size floppy discs. The card contains a serial I/O RS232 port with software-selectable baud rates (from 110 to 76,800). After powering-up one hits the return key a few times so that the System Three can set the baud rate. Also on the card is a 1K, 2708 PROM with system software and several switches for both enabling and disabling initialisation of discs and for booting specific software.

The disc drives are Persci's model 277. The discs are in IBM 3740 Diskette Format. Data capacity is 1.9 megabits per disc, located on 77 tracks (26.6 kilobits per track). Reading and writing transfer rate is 250 kilobits per second.

For the Benchtest, a Centronics 779 printer came connected to a Cromemco PRI parallel printer interface board. This board provides two parallel interfaces for simultaneous operation of a dot matrix printer and daisywheel printer. I was not impressed by the Centronics 779. It was a noisy, comparatively slow (60-100 cps), unidirectional and upper case only dot matrix printer. The cable plugs into the back of the Centronics, interfering with the positioning of the input paper.

The printer aside, I found the hardware well designed and substantial. For the two weeks that I had the system at no time did it show any sign of distress.

System Software

There are two operating systems supplied with the System Three. On powering-up, first of all the Resident Disk Operating System (RDOS) is booted in. Located in 1K of ROM on the disc controller card, RDOS contains a rather primitive monitor with fourteen

commands (for reading, writing and displaying data on discs and in memory). More importantly, RDOS contains a bootstrap loader for the Cromemco Disk Operating System (CDOS), If you don't want to use RDOS, there is a switch on the disc controller board that can be flipped so that CDOS will automatically boot in on powering-up. Additionally, if a System Three is going to be used by an untrained operator, there is also, when powering-up, a facility to enter directly into an application program.

CDOS will appear familiar to CP/M users because although it's written in Z80 machine code (instead of CP/M's 8080 code) by Cromemco, they use the CP/M data structures and user interface under licence from Digital Research. Cromemco claim that most CP/M programs will run under CDOS but that programs developed under CDOS probably won't run under CP/M. I assume they are referring to system programs such as compilers and interpreters and not BASIC programs, since Microsoft Extended BASIC and Cromemco Extended BASIC have incompatibilities.

Under CDOS, both main memory and disc memory are divided into two parts. . .one for the operating system, the other for the user. CDOS takes up the lowest 256 words, the highest 8K of RAM and the first two tracks of a system disc. When booting in CDOS the system locks on drive A. This is in fact the default drive and the system prompts with 'A'. A user can move to another drive by specifying it (B, C, or D) and CDOS then prompts with the appropriate letter. Any command typed in response to the prompt is interpreted by a system program called CONsole PROCessor. If it is an internal function (part of CDOS), a utility or user COMmand file name, then the command is executed. Otherwise the message, "program not found" is displayed, followed by the CDOS prompt.

In any computer system there are tasks that users need to execute regularly in order to keep the system running smoothly. As is common practice, Cromemco provides a set of utility programs for some of these tasks.

Unlike the intrinsic commands, running a utility program takes up user space, as do user written COMmand files. The language translators (BASIC, COBOL, FORTRAN and Macro Assembler) are also supplied as COMmand disc files and therefore accessed by typing the appropriate name.

The feature that CROMEMCO appear most proud of (and which they believe makes CDOS superior to CP/M) is the power of their system calls. These are instructions which are passed directly from program to CDOS without any modification from the language translator. They are designed to handle I/O to and from specific peripherals, load subroutines from a library (such as multiplication and division), etc. CDOS has 151 of these making it possible to transfer programs to a wide variety of CDOS configurations; unfortunately this makes it more difficult to run the same programs under other operating systems.

The major design fault (which it shares with CP/M) concerns the allocation and deallocation of file space. When a file is ERAsed, no file rearrangement occurs and therefore space on a disc becomes increasingly fragmented. If records are not completely filled, the "holes" in the records will not be empty but rather contain whatever was previously on the disc. Also disc space is allocated in 1K "clusters" so that a 13 byte datafile takes up 1K.

Overall, I found CDOS easy to use, if a little intolerant (ERASE AFILE produces the message "program not found" since one must enter ERA AFILE). However, for people familiar with CP/M or DEC software, it should cause few difficulties. In fact, I inserted a CP/M disc in Drive B, read its directory, transferred a COMmand file onto (CDOS) disc A and then executed this program, without experiencing any problems. Even so, I'm not convinced that Cromemco made the right decision when they decided to bypass the industry standard CP/M. It means that users are far more dependant on Cromemco for software, although, from what I've seen, their standard is high. On the other hand, by writing their own operating system, Cromemco have fully utilized the Z80 processor, while retaining CP/M compatibility.

Text editor

I found the text editor comprehensive, although awkward to handle. It can be used to create, edit and save text on program files. The list of single letter commands that are available is impressive — in fact, only the letter M is not a command. There are line, character and word orientated commands, as well as several commands for moving text between buffer and disc. There is a macro facility for sequences of commands that are needed repeatedly as well as conditional commands that allow the user to execute part or all of a macro.

Although quite powerful, I have certainly come across more convenient editors. When used as a character or word orientated editor the position of the cursor is crucial . . .and yet there is no method for seeing it.

Cromemco have a screen orientated editor that bears a remarkable resemblance to the American UCSD screen editor, used in one of their expensive VDU's. I hope that work going on at Comart to modify it for inexpensive VDU's is successful.

Basic

The most significant fact about Cromemco's 16K Extended BASIC is that it was not written by Microsoft. As system programmers can only get so many facilities into a given size memory, this means that some of Cromemco's unique features preclude their BASIC from having all of Microsoft's capabilities. The two most outstanding features missing are variable names longer than two characters and IF.. THEN.. ELSE.. These omissions alone should ensure that Microsoft BASIC programs will need line by line revision before they can be executed on a System Three.

Having pointed out that this isn't the best BASIC for running "off the shelf" software, it's still worth looking at the language itself. The lack of IF.. THEN.. ELSE.. and decent size variable names make it quite difficult to produce readable programs. On a more positive note, one of the first things I noticed was the speed with which BASIC programs executed and also the accuracy of data.

The speed is partially due to the nature of the interpreter itself. Rather than using a pure interpreter as do most personal computers, after entry, each line is translated into machine code. If a line cannot be translated, an error message with a $ under the offending characters appears. The advantages of separating translation from execution are several. Firstly, it is faster to execute a program in

machine code than in BASIC. Secondly, a program is more likely to run because at least there are no syntax errors. And thirdly, it takes up less space and hence can be transferred to and from the disc more rapidly. Since a machine code program cannot be edited with the text editor and users may want to edit long BASIC programs, Cromemco offers two ways of filing BASIC programs on disc — SAVE-LOAD for machine code and LIST-ENTER for ASCII BASIC listings. When listing a program the system produces a reconstruction from machine code which is unlikely to be spaced as originally entered (FOR-NEXT loops are indented one space; everything else is left-justified).

The other unusual feature, which accounts for the accuracy as well as influencing speed, is the method of representing numbers. The user can specify if numbers are to be held as 14 digit (8 byte) or 6 digit (4 byte) reals or as integers (2 bytes). When running Benchmark 7 — using integers — it took 73% of the time needed for short reals, showing the kind of savings that are achievable if reals are not essential in processing. Reals are represented in BCD format, fully utilizing the Z80's BCD instructions. This allows the System Three to execute BASIC programs faster than less accurate machines. Unfortunately mathematical functions are slow in BCD, although they are usually accurate. (BM.8, which tests them, shows it also doesn't help to turn numbers into short form.)

The list of reserved words in the BASIC Box indicates most of the strengths and weaknesses of Cromemco's Extended BASIC. In aprticular I noted the following features:

1. TRACE and NTRACE are for de-bugging
2. RENUMBER leaves gaps in the numbering if lines have been deleted.
3. The initialization instructions are used to get numbers and angles into their most suitable form.
4. CON continues execution after STOP
5. For files (both sequential and random) PRINT and INPUT are ASCII, PUT and GET are machine code form.
6. BINs perform logical operations on 16 bit operands.
7. FRA gives the fractional part of a number.
8. NO ECHO can be used to prevent user's input from appearing on the screen (passwords).
9. ESC is used to break into an executing program and return to the BASIC system. NO ESC allows the programmer to disable ESC.
10. ON ERROR allows a programmer to trap non fatal errors.

I think from the list of reserved words it can be seen that Cromemco 16K Extended BASIC (which actually takes up 19K) is quite powerful. I preferred the Multi User BASIC which was 16K Extended BASIC without machine level instructions, plus 31 character variable names, IF.. THEN DO.. ELSE.. END.0 and COMMON. I phoned Comart to ask then about implementing it on a single user system and was told the hardware would have to be reconfigured and that the software costs £480. Rather than doing this, it was suggested that I wait for Cromemco's Structured BASIC which will be a single user version of the Multi User BASIC (with multi key files). I hope that it's available soon because if it's as good as it sounds, it should be most impressive.

Benchmark

I timed the Kilobaud Benchmark programs in the modes that would be appropriate for execution. . .and then applied some new tests to evaluate the disc file accessing facilities. All the files in these tests are 100 record files with 256 character records. These sizes have been chosen, not only because they are realistic, but also because they are large enough to allow for the significant improvements in access times which the new technology promises.

DISC TESTS

Test 1 Create "Datafile", open it, close it.

Test 2 Using a FOR-NEXT loop, put 256 'A's into A$, create "datafile", open it, using a FOR-NEXT loop write A$ to records Ø to 99, close the file.

Test 3 As test 2 but writing the records to the file starting with the last record, that is the FOR-NEXT loop's step is -1.

Test 4 Open "Datafile" using a FOR-NEXT loop, read each record out of the file, close the file.

Test 5 As test 4 but reading from the file starting with the last record.

Test 3 and Test 5 are designed to evaluate the "directness" of the file's random access facilities.

Disc Test 1 2.9	Disc Test 4 25
Disc Test 2 115.4	Disc Test 5 40.4
Disc Test 3 115.4	

Other languages

Besides the Extended BASIC Interpreter, Comart supplied me with a FORTRAN compiler, a COBOL compiler and a Z80 Macro Assembler. All three come with comprehensive de-bugging packages. A program written in any of these languages can be saved in machine code form as a COMmand file and executed just by typing its name.

The compilers and assembler give the System Three great flexibility (although there is no PASCAL, and no immediate plans for it). I would be surprised, though, if they get used anything like as often as the powerful, fast, easy-to-handle BASIC.

Business potential

How one judges a business system depends on the use that's intended for it. If what is wanted is a black box that will run ready made packages, there are certainly cheaper, more compact personal computers on the market. . .eg. the Compelec Series One or the Apple II. Also, although Cromemco say that software produced under the CP/M operating system will run on the System Three, their BASIC is sufficiently different from the industry standard Microsoft Extended BASIC that packages produced to run in this BASIC under CP/M will need customizing.

If on the other hand, the intention is to use a personal computer for a variety of tasks (that include a substantial amount of development work) it is difficult to fault the System Three. The documentation is comprehensive and clearly written; most of the available software is accessible to both the novice who is prepared to devote some time as well as to the more experienced user. There is a wide selection of software enabling development of good business programs. These include a COBOL compiler, a FORTRAN compiler with file handling facilities, a powerful, fast Extended BASIC interpreter, a macro assembler and a comprehensive text editor.

I was also given documentation

for three Cromemco packages designed to be used in a business environment. These are the Data Base Management System, the Text Formatter and Multi User BASIC. Having read the documentation, I was interested to see them in operation. Since I live in London, I walked into the Tottenham Court Road "Byte Shop" and asked for a demonstration. I was shown the Data Base Management System. As I gathered from the documentation (unfortunately not the best Cromemco has produced), the DBMS is an indexed sequential filing system that can be utilized without any programming knowledge. By following the manual, users can create a file, examine and alter the layout of its fields, enter new data, sort on multiple keys, display, insert, delete and query records and print out mailing labels. In addition, the files created by the DBMS can be accessed in BASIC.

The Byte Shop did not have the Text Formatter although Kevin Byrne of Comart says it is available. From the documentation, it would appear to be a comprehensive Word Processing System. Unfortunately it is not memory mapped so it is not as easy to use as those systems now on the market with screen editing (for example the late SOL, which is still being supported). Although available, I was unable to evaluate the Multi-User BASIC; the system I had was not configured for it. From the documentation, it seems that if several users need to access the discs simultaneously, due to the protection system (that is designed to prevent users from corrupting each others files) they would find it painfully slow. If Multi User BASIC is going to be used for development work, rather than file accessing, it probably has a reasonable response time and it definitely has a very powerful instruction set.

Moving on to the hardware, the large box with places for four disc drives and twenty one S100 boards (the industry hardware standard) means that the System Three can be easily expanded without the added expense of boxes, cables and power supplies. Unfortunately, the discs are only one-sided single density and therefore all four drives are needed to put 1 Megabyte on line. If this is not sufficient, Cromemco has just announced the HDD — an add-on system which offers one or two 10 Megabyte Winchester Discs. If the thought of a System Three sitting on top of a desk is unappealing, a custom desk (expensive) can be bought that will support it; more reasonably, a standard 19" rack mounting will do the job.

In conclusion, for a business that wants a personal computer in order to develop and run programs, the Cromemco System Three has much to recommend it. Firstly, it is available, by which I mean you can actually go into a shop and walk out with the hardware and software described; secondly it is an extremely expandable system and the add-ons are also easily available; thirdly Cromemco is a financially secure company and therefore there is no reason why they shouldn't continue to produce quality hardware and software.

Educational

How one judges a personal computer as an educational machine depends on the functions it has to perform. The design of the System Three with its substantial box to cope with expansion, could be either desirable or undesirable. If you want something to move easily from room to room, then go for a smaller system. If, on the other hand you'll want to be plugging in all sorts of unusual boards, then the System Three is ideal; it has fourteen free S100 slots.

The software also has its pros and cons. On the one hand there are the four language translators available, so one isn't locked into BASIC. And, for teaching programming, their new Structured BASIC is an improvement over Extended BASIC. On the other hand, the System Three is not software compatible with Research Machine's 380 Z (CP/M again). . .which seems to be a popular educational machine. Also, there is no PASCAL or ALGOL compiler so language teaching will have to be restricted to the non algorithmic languages.

I'm not convinced that any 8 bit micro with floppy discs can adequately stand simultaneous use. But a System Three with Winchester Discs should make a multi user system that can be compared with mini multi-user BASIC systems.

The System Three seems to be extremely robust in both hardware and software. Although too large to be carted around it's a reasonable choice for an institution that wants a mini but can't afford it. Several Cromemcos would probably be cheaper, more flexible and reliable than a single, larger machine.

Home and games

This section of the Benchtest becomes more or less redundant. Even though Cromemco offer joysticks, they have not made any serious attempt to produce a hobby machine.

Documentation

Along with the System Three, printer and VDU, Comart supplied me with seventeen manuals. That included five language manuals (Extended BASIC, COBOL, FORTRAN, Trace Simulator for the Macro Assembler and Multi User BASIC), two text orientated manuals, for editing and word processing, two operating system manuals (RDOS and CDOS), six hardware specification manuals (for the CPU board, the memory boards, printer interfaces, the disc controller and two on the disc drives) a graphics manual and a Data Base Management Systems manual. No one could accuse Cromemco of skimping on documentation!

Unless perhaps the sheer volume of paper proves rather too daunting, a novice could learn a fair amount about computers and programming from reading them. In particular, the manuals aimed at the new user (16K Extended BASIC, DBMS and Text Formatter) explain at some length the underlying theory of the software in question. The DBMS manual explains how files are organised, while the BASIC manual has an introductory chapter on languages, the types of problems that can be solved by programs and how the System Three responds to a BASIC program. This manual also includes a glossary of general computer terms.

For the more experienced user, these details can be easily skipped over because the manuals have comprehensive tables of contents, indices, appendices and user guides. The introductions also indicate for whom each chapter is aimed. In the programming and text manuals, each instruction and data type is clearly defined and provided with examples. There are also ample programs and text that describes a variety of features in a realistic context.

You can gather that I was most impressed with the overall standard of documentation. It's clearly written, well organised and informative.

BENCH TEST

Expandability

The System Three is designed with expansion in mind. The computer I was lent had 14 empty S100 slots in its back-plane. The disc-controller can be used with up to 4 drives (5¼ or 8 inch) and there is both the location and power available for the additional two drives. Regretfully, the discs must be single-sided, single-density. In addition, two 10M-Byte Winchester discs, with their controller, can be hung on a System Three. There are 10 places for peripheral sockets (VDU's, printers etc.).

Technical data

CPU:	Z80A, 4MHz
Memory:	16K — 16M dynamic ram
Keyboard: Screen:	Lear Seigler Adm3
Cassette:	N/A
Disc Drive:	Up to 4 drives, 1 head per drive, 8" discs, single density
Printer:	Centronics 779
Bus:	S100
Ports:	1 serial, 1 parallel, expandable to 10
System Software:	CDOS
Languages:	Extended BASIC, FORTRAN, COBOL, Z80 Macro Assembler, Multi User BASIC.

Basic

Program Development Instructions

AUTOL	LIST	SAVE
BYE	LOAD	SCR
DELETE	REM	TRACE
DIR	RENUMBER	
ENTER	RUN	NTRACE

Initialization and Assignment Instructions

DEG	LET	RAD
DIM	LFMODE	SFMODE
IMODE	LONG	SHORT
INTEGER		

Control Structures

CON
END
FOR . . . NEXT
GOSUB . . . RETURN
GOTO
IF . . . THEN
ON . . . GOTO
ON . . . GOSUB
STOP

Input/Output Instructions

INPUT	SPC	PRINT
PRINT	TAB	INPUT
READ	CREATE	PUT
RESTORE	OPEN	GET
DATA	CLOSE	
PRINT USING		

Functions

ABS	MAX	TAN
BINAND	MIN	FEF FN
BINOR	RANDOMIZE	ASC
FINXOR	RND	CHR$
EXP	SGN	LEN
FRA	SQR	POS
INT	ATN	STR$
IRN	COS	VAL
LOG		

System Instructions

DSK	NO ESC	ON ESC
ECHO	FRE	RENAME
NO ECHO	IOSTAT	SET
ERASE	ON ERROR	SYS
ESC		

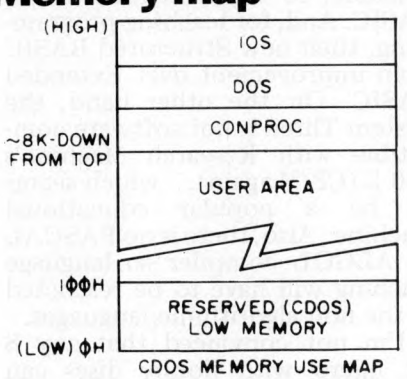
Machine Level Instructions

INP	PEEK	USR
OUT	POKE	

Prices

1 CS-3 — 32K Memory two disc drives £3,005
2 CS3/64 — as above with 64K memory £3,270
3 CS3-002 — dual drive expansion £880
4 HDD-11 — Hard disc subsystem £5,025
5 HDD-22 — Dual hard disc subsystem £6,895
6 JS-1 — Joystick Console £50
7 FOB-L — Extended Basic £55
8 FDA-L — Z80 Macro Assembler £55
9 FDF-L — FORTRAN IV £55
10 FDC-L — COBOL £55
11 FDM-L — Multi User BASIC £480
12 DEM-L — Data Base Management System £55
13 WPS-L — Text Formatting System £55
14 MDBM-L — Multi User Data Base Management £115

Memory map



CDOS MEMORY USE MAP

Conclusion

The impression that the System Three gives is that it is an extremely professional machine. The hardware, software and documentation have all been systematically produced and Cromemco appear to be continuing their development work.

The machine is too expensive for the odd small business application. . .certainly for someone who does not know how to program and who is not planning on hiring a programmer. It does not even come with a set of games programs. But for the buyer who, two years ago, would have bought a small mini (perhaps a Wang or a PDP11 under RT) this machine offers a financially attractive micro alternative.

At a glance

FIRST IMPRESSIONS	
Looks	**
Setting up	****
Ease of Use	****
HIGH LEVEL LANGUAGES	
BASIC	****
COBOL	**
FORTRAN	****
PASCAL	N/A
Z-80 Macro Assembler	Other
System Software	****
PACKAGES	
Business	***
Education	**
Home	N/A
PERFORMANCE	
Processor	****
Cassette	N/A
Disc	****
Peripherals	***
EXPANDABILITY	
Memory	****
Cassettes	N/A
Discs	****
Bus	****
COMPATIBILITY	
Hardware	****
Software	***
DOCUMENTATION	*****
VALUE FOR MONEY	***

***** excellent
**** very good
*** good
** fair
* poor

Benchmark comparisons

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8
Cromemco System Three Short Reals	1.7	4.6	14.9	17.8	19.4	30.2	41.9	22.9
Long Reals	1.9	5.7	16.4	19.7	21.3	32.4	44.1	22.9
Sharp MZ-80K	1.4	9.4	16.3	22.5	25.4	36.8	51.1	10.2
Compucolor II	2.0	10.9	22.4	23.9	25.7	38.7	55.2	10.8
Sorcerer	1.8	10.0	20.7	22.2	24.3	37.6	53.7	9.6
Apple II	1.3	8.5	16.0	17.8	19.1	28.6	44.8	10.7
Tandy TRS 80	2.5	18.0	34.5	39.0	45.0	67.0	109.0	—
PET	1.7	9.9	18.4	20.4	21.0	32.5	50.9	12.3

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		ex. VAT	inc. VAT
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4K Level 2	(c/w K/bd, VDU, T/Rec)	434.78	500.
16K Level 2	(c/w K/bd, VDU, T/Rec)	500.00	575.
0K Interface	(to add printer & disk drives)	195.66	225.
16K Upgrade kits	(for k/bd or interface)	65.22	75.
Disk Drives, single	(up to 200K)	260.88	300.
Disk Drives, dual	(up to 400K)	608.70	700.
Disk Drives, dual	(up to 1000K)	1173.91	1350.
Disk Drives, dual	(up to 2000K)	1521.74	1750.
Disk Drives, cable 2 & 4 way from		21.74	25.
Anadex Printer, Tractor feed		434.78	500.
Printer cable for Anadex/Centronics		21.74	25.
APPLE II ITT 2020			
16K	(c/w Keybd & Palsoft ROM)	608.70	700.
16K Upgrade kits		65.22	75.
Disk Drive, single with cable		326.09	375.
Printer Interface		108.70	125.
Anadex Printer, tractor feed		434.78	500.
Colour TV ITT 340		239.13	275.
COMMODORE PET			
2001-32N	(New keyboard & 32K)	673.91	775.
2040 Dual Disk Drive 343K		673.91	775.
3022 Printer with graphics		521.74	600.
Printer interface and cables, each		21.74	25.
MEDIA LIST			
5¼" Verbatim	from (Qty 10)	17.39	20.
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Position : .....

PO/Chq No : .....
(Payment by Barclaycard / Trustcard / Access etc., can be arranged)

Requirements	Description	inc. VAT
Microcomputer	:	
Upgrade Kit	:	
Interface	:	
Disk Drive	:	
Printer	:	
Cable/Interface	:	
Cluster System	:	
Colour TV	:	
Media	:	
Stationery	:	
Software	:	
Post/Pkg/Ins	:(please tel. for cost)	
PC/PCW/L	TOTAL:	

Lawrence Mynott

COMPUTER ANSWERS

Every month in PCW, Sheridan Williams will be happy to assist readers with their hardware, software and systems difficulties. Some correspondence he will deal with himself. . .other enquiries will be redirected for appropriate attention. In furtherance of this task, Sheridan is anxious to establish a wide-ranging pool of consultants; anyone willing to lend weight in this way is invited to write to him, care of Personal Computer World, 14 Rathbone Place, London W1P 1DE. Finally, Sheridan Williams regrets that, FOR THE TIME BEING ONLY, he is unable to enter into any correspondence with readers — except via 'Computer Answers'.

SHOP ASSISTANCE

I run a sweet shop and am interested in buying a microcomputer for stock control. I'd like to be able to key in each purchase as it's made, but only need to update the files once a day. If possible I'd like it connected to my cash register. How much would I have to pay and is there a package available at the moment, or would I have to write the program myself.

I would imagine that the majority of microcomputers that are in use in small businesses are actively involved in controlling stock. Stock control because of its routine nature, makes an ideal application for a computer; and because of the importance of stock control it is essential that all processes are performed quickly and accurately.

You should have no difficulty in finding a suitable micro to enable you to key in individual purchases as they are made. I do, however, see a difficulty in finding a micro (and a supplier) that will be capable of being connected to a point-of-sale cash register. It *is* possible to connect a cash register to a micro, because it is then just another input device. You will have to purchase a special cash register — which could be costly compared to a microcomputer — and you will also have to establish a coding system for each of your goods to enable the register to transfer relevant details to the computer. Similar coding systems, available now, are bar-encoded goods, (Kimball tags used extensively in clothing retailers), and magnetic characters. I suggest that all of these are impractical in your application. You will have to put in some more thought and discussion before deciding whether it will be viable to use a computer-linked cash register.

If you require a daily update instead of an immediate one, then it is possible to go for a cassette based system. This will keep the cost to a minimum, although there are disadvantages over a disc based system. With a cassette you could find that the cost of a suitable microcomputer and printer are kept within the range, £1200 to £2000. Increasing your budget to £3000 will give you an expandable system that can be built upon. These prices ignore a cash register linked computer; I'm afraid I would have to seek further advice on that front.

Several places profess to be able to supply programs for applications such as yours, and the "Byte" shops are a good starting place. There are advantages to writing your own programs, but it can take many weeks/months to master the art. A tailor made package could cost anywhere from £200 upwards depending on the sophistication that you require.

Sheridan Williams

ORIENTAL RUGS

I've got an oriental rug business and would be interested in a system where I could access all my information rapidly. I want a stock file, a customer file, and a chronological sales file. I need to be able to get information from all three files at the same time. As I don't know how to program, I want to buy a "box" that I can plug in and use. Where do I start, and how much will I have to pay?

A "box" that you can plug in and use, is more frequently called a "Turnkey" system. There are very few suppliers/dealers that can supply such a system in the micro field, but they do exist. You will have to wait while they investigate your exact requirements and write a package for you. The time scale will be around two months and the cost will be around £4000-£5000 for the following: 32K computer, dual disc drives, good high-speed printer, VDU, and all software.

Accessing information from files is the basis of all data processing applications, and accessing three files simultaneously will require a disc system or at the least, multiple tape drives. You state that you want to access the information *rapidly*. This almost certainly means that disc drives are essential. Even "Mini-floppy" discs have the following parameters: Ability to handle upwards of 20 files; reading/writing speeds of 15000 characters/second; any record in any file is accessible within one second, provided that each has a coded key.

Start by contacting a consultant or a dealer directly. They will be able to make a more precise appraisal of your requirements and quote you.

Sheridan Williams

SCHOOL PROGRAM COMPETITION

Together with a colleague I run the computing department at a school in Surrey. We have a PDP8 with two floppy disc drives, the OS/8 operating system and BASIC, FORTRAN 2, editors and assemblers. Although several boys write good programs, the results are not usually constructive enough. In order to encourage a serious approach to program design I propose to set a competition. The target will be to write a program which will help to debug BASIC programs. The prize will be a year's subscription to PCW and for a little prestige it would help if a member of the PCW staff would act as a judge. The incentive provided by such outside arbitration would be invaluable. If you are able to help in any way I would be most grateful.

Schools who are fortunate enough to have a computer, but for a variety of reasons do not run CSE, O, or A-level courses, often have a problem in motivating students to do constructive work. Your idea is superb but obviously needs a more formal specification if it is to be the basis of a competition. If you send me a formal specification I will be pleased to judge the contest on behalf of PCW. I feel sure that we can publish an article around your competition and its results, together with the experiences learned.

I am probably being very controversial, but I do feel that a vocational course such as O level or CSE in computer science will achieve far more than any competition. Even if there is only a two hour per week teacher-resource, I would suggest that this is the way to proceed. The students themselves must be encouraged to complete all the programming in their own time. Computing is addictive, so if their interests have been stimulated while they are young, there should be no difficulty in motivating them.

Sheridan Williams

WHAT IS A CONSULTANT?

I have seen advertisements for computer consultants. Please can you tell me what services they give, and how they can be approached? Could they offer a service to a small business like mine, anxious to get ahead of competitors?

This is a marvellous question as it allows me to outline the ways in which this particular section of PCW can be of service to readers. I am keen to provide PCW with a pool of consultants with various specialisations.

As a small business you are interested in two things 1) would a micro computer enable me to streamline my business, would it save me money, would my business be more efficient? 2) Who could I get to install and program the proposed computer system?

The only person from whom you could get *unbiased* replies to all your questions would be a professional computer consultant. Consultants can offer a variety of services from answering a simple question to a complete systems analysis and systems design. There are already many established "Computer bureaux" but there are very few that are interested in micro computers because of the small profit margin.

Approach a consultant in the same way as you would any other person offering a service. State your questions clearly, write down your requirements, and don't stop asking questions until you are satisfied.

Sheridan Williams

"PORT" PROBLEM

I bought a "complete" VDU kit and now find it produces parallel output. My computer is supposed to have its VDU connected to its serial port. Can I connect it instead to its parallel port? If not, what

COMPUTER ANSWERS

do I need to interface my VDU to my computer?

Let this be a warning to check that interfaces are compatible before buying new peripherals.

You must either modify your computer software so that it uses the parallel port for VDU I/O, or convert the VDU hardware to serial.

Changing the software is the cheapest solution, but there are many snags and pitfalls. The monitor program may be in ROM or EPROM, which makes changing it difficult; and changing it may introduce bugs or incompatability with other programs.

Converting the VDU is fairly simple and will leave both the computer and VDU perfectly standard. . .all this for the price of a couple of ICs. You will need a UART (Universal Asynchronous Receiver Transmitter), a 555 timer and some transistors. The UART is a pair of shift registers; the receive channel accepts data a bit at a time until it is full, then delivers a parallel character; the transmit channel takes a parallel character and shifts it out a bit at a time. The 555 provides a clock signal at 16 times the bit rate (1760Hz for 10 cps, 4800Hz for 30cps). You will have to find the speed of your computer serial interface, and discover whether it uses "current loop" or RS232 signalling, and design appropriately. You may be able to learn from the circuitry used in your computer; if it uses a UART, you should be able to copy almost all of it. Good luck.

L.S. Warner

WORD PROCESSING

Sheridan Williams' reply to Phil Symons in the August issue was excellent, but does not mention word-processing. My wife and I have 3 types of need — scientific, accounts and file handling and word-processing with first class presentation for reports.

Can you give advice on a system which would fill the above functions? I wish to buy a complete system from a single supplier so that it can be made to work before shipment to France.

I agree that I failed to mention word processors, but I have found very few microcomputers with a good word-processing capability. To answer your query as briefly as possible I would suggest the VECTOR MZ system B, which, at £2850 for a 48K processor plus dual mini-floppy discs, is fairly reasonable. You also get CP/M which is a good operating system, supported by a sizeable software library. Also included is a VDU. For an extra £350 comes a ROM-based word processor. It's designed to work using a single disc and it connects to either the Diablo or Qume printers, both of which have a selection of type faces available for report writing. As far as I know there are two suppliers in England — Almarc data systems 0602 248565 and Sintrom Microshop 0734 85464.

Sheridan Williams

16 or 8?

I keep reading articles about 16-bit micros. I've a home-brew 6800 system but want something more exciting. I don't want to build a machine that no one else has, because then I won't be able to exchange ideas, software etc. Do you think that 16-bit micros will catch on, or do you think I ought to go for a 6809?

It sounds as if the 6809 would be your best bet over the next twelve months, if you want to stick to the 6800 family; sixteen-bit micros are currently a rich man's game. Let us proceed assuming that you can afford one!

Most of the early 16-bit microprocessors came from the minicomputer manufacturers, more in self-defence than anything else. . .eg. the LSI-11 microNOVA and TMS-9900. Only the TMS9900 has attracted any sort of hobbyist following and it may be worth considering if you want to design a system using an established 16-bit micro.

You seem rightly concerned about the availability of software, so an Intel 8086 might suit you. It's probably the best 16-bit microprocessor available off the shelf now, and it is source code compatible with the 8080, which has an enormous amount of very cheap or even free software. The support chips exist, and there are several products already for sale incorporating the 8086.

If you are really adventurous, you could try the Z8000 from Zilog or AMD. The chips are pricey, around £100 each, and, support circuitry being limited, you can look forward to many juicy, problem-solving evenings.

Most people agree that the 68000 microprocessor from Motorola will be the best 16-bit micro when it enters production, but, like the Z8000, it's not really for the hobbyist market. These new 16-bit designs are intended to reduce the frightening cost of professional software, a problem that does not really affect the hobbyist since his efforts are "free".

To summarise, 16-bit micros *will* catch on but only for software-intensive applications, where the hardware cost is relatively insignificant. The average money-conscious hobbyist is more likely to stick with an 8-bit micro or one of the new breed of 'sawn-off-16-bit-multiplexed-to-8-bit-microprocessors.'. The choice is yours.

Richard Ross-Langley,
Mine of Information Ltd.

TRANSACTION FILE

The "Transaction File" is available for the free use of PCW readers (please, no companies). Buying, selling, exchanging, searching. . .whatever, just post your advertisement to: PCW Transaction File, 14 Rathbone Place, London W1P 1DE. We'd appreciate a maximum of around 50 words per insert.

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MK14. . .cased, extra RAM, RAM I/O, revised monitor, single-stepping, cassette interface, fully socketed, power supply, external keyboard, manual and guide to SCMP programming — £60. Contact J. Blackmore at 31 Herne Rise, Ilminster, Somerset, TA19 0HH. Phone Ilminster 3301.

NASCOM-1. . .power supply, 8K memory, tiny-BASIC, T4 monitor, music box, in Vero case, with programs and all documentation — £265. Phone 01-606 0151, or, Longfield (Kent) 4068.

NASCOM-1. . .8K memory, tiny-BASIC, Vero case, many cassette programs — £230. Phone 01-606 4164, or, 01-554 4335 (eve).

Elliot 250/203. . .medium speed optical paper tape reader (250 chars/sec). Takes any standard width tape up to 1" and punched with sprocket holes; up to 8 data channels — £40 ono. Andrew Lister, 37 Park Road, Prestwick, Manchester M25 8ES. Phone (061) 740 6531 — please ring first.

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PET 2001-8K . .as new, plus tapes, programs and literature — £495 and NO VAT to pay. Phone Peter on 01-834 5929 (office).

TEXAS 9900. . .16 bit micro, 256 x 16 RAM, 1K x 16 TIBUG monitor in ROM, 20ma/RS232 I/O. All on a double Eurocard, burnt-in and brand new with manuals (see March '79 PCW) — £150, or highest bidder. Write to Mark Wirt, 12 Alleyn Crescent, London SE21.

ELF 11. . .8K microcomputer, fully built, ready to go. Complete with ASCII keyboard, professional cabinets, tape software — tiny-BASIC, ELFBUG, video display board 32/64 chars x 16 lines, upper/lower case. Full documentation — £350. Phone J. Noble (031) 332 7136 (Edinburgh) after 7pm.

CMC Serial Printer Interface. . .for Commodore PET, brand new (upper and lower case) — £70.

PETSOFT CMC Word Processor Program. . .tape, with instruction manual — £15, I'll pay postage! Phone J. Nuttall on Shoreham-by-Sea (Sussex) 2654.

MK14 micro. . .built and working with revised monitor, extra RAM, RAM I/O, PSU, cassette interface and assembler which cuts program development time — £60. Phone Stevenage (0438) 2924.

NASCOM-1. . .built, mounted and working with B-BUG, buffer board, tape recorder, documentation and games. Offers? Phone Crawley 510358.

Hewlett Packard HP67. . .6 weeks old, in box, all accessories and transferable warranty. Have bought PET instead — £200. Phone 01-699 8681 (eve) or 01-675 0220 (day).

NASCOM-1. . .professionally built, 8K RAM, buffer board, key pads, PSU, Kansas City interface, 2K BASIC in EPROM and B-BUG. 4 months old — offers around £300 (delivery a possibility). Phone Barry on Bourne End 22269.

TRS-80. . .level 2, 16K, VDU and cassette, etc. completely boxed as new — £475 for genuine sale. Phone Sheffield 368975.

MK14. . .built and working with power supply, tape interface, tape recorder and tape with programs. Keyboard modified to click keys — £55. Phone Ripley 873244 (7 Hallfield Road, Newton, Derbys.).

MOTOROLA MEK6800D2. . .micro kit, built and tested, complete with full equipment of RAM, documentation and mains power supply — £120 ono. Write to S.E. Hunt, 21 Green Street, Milton Malso, Northampton.

MK14. . .with RAM I/O, extra RAM, tape interface, PROM programmer, power supply, 21 key touch type keyboard. Full documentation, professionally cased into a desk-top unit, size 11" x 8½" x 3¾" sloped front, with room for 2K expansion and VDU interface — £98. Phone 08444 4537.

SWTPC 6800. . .8K static RAM board (S50 Bus), built and tested — £95. Contact V. Gerhardi, 24 Putnams Drive, Aston Clinton, Aylesbury, Bucks. Phone 0296 630617.

PET 2001-8. . .with second cassette deck and music box. 24 tapes with 1 or 2 programs on each, inc games, utilities and an assembler — £450. Phone 01-802 9002.

8080 CPU System. . .with PROM, RAM, I/O — £99.
Matching Hex Data/Address Display Unit — £49.
EPROM Eraser. . .little used — £39.
Matching Power Pack. . .+5v, ±12v, +24v — £49.
TMS 405INL. . .4K-bit dynamic RAM chips — £1.99
B3222. . .suitable refresh control chip — £1.99
Phone St. Albans 64077 after 7pm.

PR40-Printer. . .with PET plug — £240, cash only (buyer collects). Phone 01-285 8124.

MK14 Micro. . .all cased, built and working, FULL SIZE Univac keyboard with full alphanumeric key set. With new, improved monitor and full documentation, plus power unit. Price — £53. Phone 0282 (Nelson) 67677.

Chess Challenger 10. . .chess computer, ten levels, complete with magnetised chess pieces, adaptor and plug — £135. Phone Adrian on 0494 28177.

Continued on page 91

INTERRUPT

Interrupt is the place in PCW where readers can unburden their grievances and air controversial views. New subjects are always welcome; the 'right of reply' shall be wielded at the discretion of the Editor. Please hold all contributions to within 800 words.

On the trail

Illustrations by IAN POLLOCK.

Watch out INDIANS, the Cowboys are in town! (and the Cavalry haven't arrived yet).

Working within the 'trade' as it were, I've recently become aware of the fact that you, the poor maligned computer buyer, are getting ripped off left, right and centre. You're subjected to ceaseless advertising from many different sources extolling the virtues of machine x, brighter than bright, machine y, whiter than white, etc. etc. Then when you do decide to buy, because of your lack of experience, you are quite likely to be sold a machine totally unsuitable for your requirements by someone totally incapable of providing the support you'll inevitably need.

The lack of experience amongst you the buyers is quite often exceeded by the lack of experience of some (no, not *all*) of those trying to sell you a machine. I've seen with my own eyes a PET described seriously as being suitable for the Stock Control of 150,000 items. And it was an 8K PET! The vendor, I might add, is not a Commodore dealer, but obtains his PETS from another dealer some 35 miles away. The incident, by the way, took place in a very good office equipment shop. I applaud Commodore's recent attempts to stamp out this sort of con-trick.

As we are PET dealers, I thought I'd try out the opposition. An excursion into a local office equipment showroom was a lesson in how not to sell high technology.

Firstly, the young lady who offered her assistance didn't know what or where the PET was. I appeared to her to have made some erotic suggestion! The second assistant was a little better.

"It can add, subtract, multiply, divide and display information."

At this stage Commodore were offering little more than a calculator, which at £550 is rather pricy! To be fair, this young man did know you could program it in BASIC, and he tried to describe the process to me. However, at no time did he offer a demonstration. When I asked if it could do Stock Control, oh my, what a reaction.

"You'll have to speak to the manager about that." I had obviously become a serious customer!

A short while later, the Manager (rather like GOD, you know) appeared to assist my education. Oh certainly sir, stock control, no problem.

"How many items" asked I.

"Let me see," said he, referring to a well known PET software house's sales literature.

"Yes, about 150,000 items appears OK."

"WHAT!" says I, "on an 8K PET?"

"Oh yes, I don't see why not. You see it has a tape recorder built in, and you can store an incredible amount of information on just one ordinary tape."

I know this is true, but 150,000 items on a tape is just a little ridiculous. Anyway to cut a long story short, he said if I really had a stock control problem, an 8K PET with no extras would have suited me fine for up to 150,000 items. I was never offered a demonstration of anything running on the system, yet I was expected to believe this bunkum.

That man is a menace to me, you and anybody else who may have anything to do with computers. He needs to stick to selling rubbers and pencils, not high technology electronics.

Example 2 — I attended an exhibition in a provincial city not long ago, and a would-be competitor of ours was exhibiting in another area of the show. He handles two low to medium priced products, and was having delivered, for the show, his first pukka business system. It is, in fact, a very reasonably priced, high specification S100 bus machine using CP/M. I don't fear it as competition, but it does have its features.

On the second day of the exhibition, along comes this competitor, asking to see our gear, including CP/M. Why not! Being a suspicious fellow, I showed him the operation, but said one thing while doing another. He didn't notice. An hour later a customer comes on to the stand.

"That fellow round the corner has a system that he says is better than this one", says the customer, "only thing is he can't make it work!"

It turned out the competitor couldn't even read the manuals supplied with his new system, which I knew explained in some detail how to run it. His knowledge was abysmal, and his lack of honesty lost him a sale. But it could have meant a system sold to an unsuspecting customer without any form of technical support at all. That customer could have been you — yet another menace.

Example 3 — this time on the dangers of buying computers from discount suppliers. Please note that buying from a discount supplier is a perfectly reasonable decision if, and only if, you've got the technical experience to provide your own support and service.

Local Government decides to purchase machine X. Tenders invited from suppliers A, B, C. Supplier A is 150 miles away, while B and C are local. Supplier A discounts the machine to obtain the order. He does so. Machine X then breaks down. When contacted, supplier A is quite willing to fix it, but...

"Oh yes, we'll fix it. Trouble is we've got a bit of a backlog at the moment, could be two months before it's ready."

In other words, get lost! You got your discount, you can't expect to get it fixed as well.

In the end one of the local suppliers fixed it for a reasonable fee, but it cost more in total than it would have if bought from nearby; they would have fixed it for nothing. . .under warranty. For every pound saved by buying discount, you're losing a pound in support and service from your supplier. He has a fixed margin to work on. He can't make more profit by any devious means. Therefore your purchase at a discount psychologically puts up a barrier between you and him — you've reduced his working profit. Why should he treat you like a normal customer!

In conclusion, tread very warily on the plains of the new computer revolution. Them there varmint cowboys are on the loose and they'll take you for a ride if given the opportunity. Buy from suppliers who can show:

a) satisfied customers
b) membership of the computer retailers association
c) relevantly experienced staff on their payroll
d) reasonable trading standards in terms of warranty, service etc.

Finally, don't give 100% cash up front on order. A deposit of 25% and the balance for clearance before collection or dispatch is quite reasonable for any bone-fide retailer.

Good luck!

Hawkeye

The hardware they come, the software they fall

'Cowboys' exist in every part of the commercial world, and it now seems that the microcomputer field is no exception. Hardware has become very good value and its technology is advanced enough to give us high reliability. Beware, however, the software, or you may well discover that programs of sufficient standard for your particular

application are very hard to find!

At one time or another most businesses and private micro owners find themselves purchasing a piece of commercial software. For many this provides an unpleasant surprise, especially when they are used to the kind of support available for 'mainframe' commercial software.

Although some of the programs available in the microcomputer market are both clever and well founded, sadly, my experience is that the majority of software is poorly documented and badly written. Many people fail to realise that a commercial programmer for mainframe systems can spend two-thirds of his time on documentation and only one-third on programming! Surely at the very least every copy of a program should include a heavily commented, self-explanatory listing, plus a 'manual' that outlines the purpose of the program and its method of use, and that also gives a full description of all error messages together with the procedure for recovery from non-fatal errors. Finally the program should be described module by module with details of areas for expansion, plus (for high-level languages) a description of the use of each variable and function.

I am not really surprised that the one-man, amateur 'software-house' does not provide such a service. Possibly many of them are new to the game and they don't really know what adequate standards of documentation are? What does surprise me is the lack of support and coherent documentation from major system manufacturers. I know of one purchaser of a very expensive American system who found he was unable to use the graphics facilities on his machine — due to the total lack of information on the subject. Also, neither of the two supplied (compiled) graphics programs would load, due to errors.

Another point worth noting is the number of systems that are sold without full error detecting diagnostics. A friend and I recently spent several hours trying to debug a rogue system that very nearly succeeded in convincing us we were incapable of programming the thing. Although the culprit was eventually found (a dud Tuart board), our task was not made any easier by (a) the notable lack of diagnostic software, and (b) the fact that the only sample tuart-handling assembly code routine given in the user manual could never have functioned. Before you purchase a system ask the salesman what programs he has available to demonstrate that the whole thing works *this* side of the Atlantic.

Manufacturers . . . may I state the obvious? Support must be a vital part of sales, unless of course you wish to promote the Jekyll and Hyde image. Although my comments may well stem from the few bad apples that make the whole barrel taste nasty (no dig at Apple intended), just think where the 16 bit microcomputer would be today if Texas had provided software at the time the TMS9900 was produced!

To the amateur user much of this may seem like nit-picking; however, whereas he might enjoy the challenge of a duff piece of code, the small business user cannot afford the time and effort of debugging — not to mention the possible losses in production.

It could be too, that some of the fault for low standards might well rest with the purchaser. Is software too cheap compared to hardware? Perhaps a two-tier market should exist with proper software and support being provided at the upper end. That said, however, I am not totally convinced that doing things properly would cost very much more, especially if we all insisted on higher standards.

To any friends I may have left in the commercial field perhaps I can end on a more hopeful note. Even the best written program can have the odd bug. Non-serious idiosyncrasies are usually tolerated for their character, others can be patched up by the owner. The third possibility I suppose is that the software repair man may become as common as the household plumber!

Paul Dorey
Southampton, Hants.

Let not the right hand...

What do computers, caviar, fur coats and cigarettes all have in common? Give up? . . .well I'll tell you. According to H.M.G., they are all luxuries, and as such they are all subject to 15% VAT. That means when you scrape together enough geldt to buy your computer — say at £500 — you will need another £75 to pay to H.M.G. I'll tell you something else. If your home computer breaks down and you need a couple of I.C. s to get it going again, you'll pay 15% VAT on them, too, and on your software, mains plug and all.

Now if you're a business man in a small way and can set off the capital expenditure as part of your enterprise, then you're laughing, because H.M.G. will benevolently pay you your 15% back again. If you're in education, the local education authority will — in return for a signed statement handing over ownership of the said computer to the authority — give you back the 15% VAT and in turn claim it off the government. Don't laugh — this is serious.

Ready for the next twist in the tale? If you want to train as a computer technician or programmer, lo and behold, you can go along to your local Employment Exchange (sorry — Job Centre) and get a government course of training in which they not only pay for the tuition, but pay you for attending! Crazy, innit?

Not only that, but the outgoing Labour Government allotted 'x' million specifically for the encouragement of research and training in the use of the microprocessor and microcomputer in industry and commerce. The present Government have added more millions of pounds and included some for training in schools and colleges.

You see, I wouldn't mind too much if only the government was behaving consistently, but on the one hand it is yelping that the country urgently needs more programmers, technicians and so on, while on the other it imposes a swingeing 15% tax to actively discourage self-reliance.

"Ah," they say, "but the home computer IS a luxury — it's not doing anything useful."

Oh yeah? Who says so? What about the chap who buys a home computer in order to gain first-hand experience, or to teach his kids or his neighbours' kids? Isn't that a useful and worthwhile job?

If we look back at history for a moment, we can see that universal education came into being partly as a result of the realisation that in an industrialised society a fully-literate workforce was an absolute necessity. For someone to operate a machine successfully, he/she had to be able to read instructions, warning notices and so on, as well as to be able to make out worksheets. That was the narrow view. Later it came to be realised that not only the workforce but the whole population ought to be literate if production was to be increased.

It seems to me that we are in a parallel situation now. If we are to survive the current technological revolution as a competitive trading nation, then we need an entire population that is computer and microprocessor-minded. No, I don't mean that we shall all have to be programmers! I mean that the entire population should at the least be familiar with computers, at ease with them and aware of their possibilities and shortcomings.

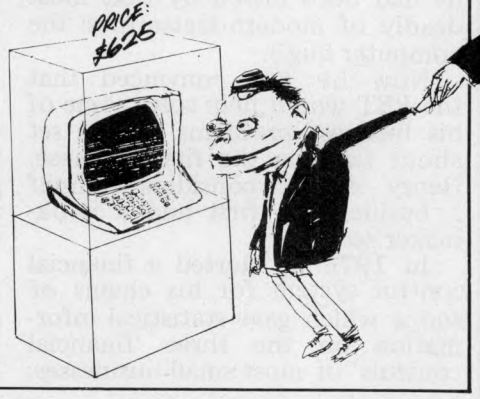
It would be a start if H.M.G. removed the 15% VAT on all computers and computer equipment. It wouldn't be so bad if ALL nightschools, colleges, dayschools, state schools, libraries and the like were already equipped with ranks of computers for use by the public — at least then there would be no need for anyone to go-it-alone. But right now, the schools in my county that are equipped with computers can be counted on the fingers of one hand and the numbers of people receiving instruction counted only in hundreds, rather than the hundreds of thousands that it should be.

In computer terms, we are back in the days when the few books were in the care of monks and chained to the library walls. A book in the hands of the hoi poloi was looked upon as heresy.

I know several people who are seriously considering the purchase of a computer for their children but who are deterred by the cost. If VAT was removed, that would be an encouragement. If only one child grew up to be a programmer in professional terms, it would still be a whole lot cheaper than the state paying for his training, while as a spin-off we would have several more families aux fait with the machine.

That tax has got to go — now!

Derrick Daines
Sutton-in-Ashfield, Notts.



BETTING ON PET

A STORY OF SMALL-BUSINESS SUCCESS; TOLD BY MIKE KNIGHT

In the spring of 1978 a bookmaker's fancy turned to thoughts of. . . microcomputers. Henry Barnett, the owner of two small chains of betting shops, used at one time to work in the electronics industry. (He was involved with one of the first electronic thermometers.) He had kept up his interest in this field in two ways — he regularly subscribed to Electronics magazines, and was something of an expert in Hi Fi.

RICK KEMP

He felt sure that a microcomputer could help him in his business so he looked at the products available and eventually chose a standard 8K PET, plus a free-standing cassette recorder. He 'bet' on PET for two main reasons. Firstly, it had the COMMODORE name which he knew well from his electronics past, and, secondly he liked its looks and general marketing oriented image. 'A decent product doesn't have a multitude of wires trailing out of the back, nor connections that can go wrong!'

Having bought his PET he sat down and read the documentation; then he switched it on, sat down and read the documentation again (a story probably familiar to those of you who bought early PETS and remember how 'clear?' the documentation was.)

He pressed on regardless and having just returned from a motoring holiday in France, wrote a small program to determine his miles per gallon for the trip. The program worked and the results appeared on the screen — this of course was fatal. His wife, quietly preparing the evening meal, was suddenly dragged from the kitchen by a wildly gesticulating being who bore only passing resemblance to her previously 'sane' husband. (Older and wiser readers will know he had been bitten by that most deadly of modern tsetse flies 'the computer bug').

Now he *was* convinced that the PET would help solve some of his business problems and he set about tackling the first of these. Henry always considers himself a businessman first and a bookmaker second.

In 1976 he started a financial control system for his chains of shops which gave statistical information on the three 'financial controls' of most small businesses; turnover, profitability and product 'sales'. In his case 'products' were betting slips, so he calls these figures 'SLIPPAGE' (not to be confused with the more ominous meaning that'll be known by those in the manufacturing industries).

One of Henry's staff was taking a day per week (15%-20% of their effort) to produce this financial report for just the larger of his two chains of betting shops, and even then it didn't contain all the information Henry needed. It wasn't difficult, therefore, for him to make an exact 'specification' of his requirements for the 'statistics' program. By early summer of 1978 he had found, however, that converting this specification into a working program was going to be more difficult than he had thought.

By this time he knew the fundamentals of the PET and the basics of programming; what he wanted was some professional training and guidance to help him convert good ideas into practical solutions.

He happened to mention this problem to a great friend of his (a director of Ladbrokes) who suggested that he meet a certain Chris Ryan; by chance, Chris lived at West Drayton, just down the road from Henry's head office in Southall.

This was his 'lucky break', for Chris not only had exactly what he wanted, but was prepared to give up his spare time at weekends and in the evenings to help a very enthusiastic 'amateur'.

Chris is Group Services Division Manager of Mills and Allen Communications Ltd and a director of Ross Computer Services Ltd (an IBM 360 bureau in South Wales). His experience of 13 years in the computer industry includes knowledge of the bookmaking business, gained from 2 years as a business analyst with Ladbroke's Lucky Seven Entertainment Ltd. He had implemented three PET installations for the Mills and Allen group. (The first implementation, incidently, on the Valuation of Secondary Certificates of deposit, probably recovers more than the cost of the equipment daily.) His part time interests include being treasurer of MICUS, the Institute of Data Processing Management microcomputer subgroup for businessmen and the professions.

Henry and Chris soon established a good working relationship and Chris was able to design three programs which satisfied all Henry's 'statistics' needs.

In the meantime Henry had come up with another business problem. He wanted to expand his operation and this meant the purchase of additional betting shops ie, it was a standard capital expenditure problem for a small business. He had three sites in mind, one of which was doubtful.

With Chris' guidance he wrote a Shop Valuation program. The specification was written based not only on his day to day activities as the controller of two chains of betting shops, but also his experience gained as SE England property manager for Ladbrokes.

The results were spectacular, the third 'doubtful' site was shown to be overpriced and the program had taken only ten minutes to run whereas, manually, the job would have taken half a day. In fact this one program had

paid for the machine in a single run.

Chris meanwhile was implementing the 'statistics' suite. Yes, the original program envisaged by Henry had expanded to four.

Program one analysed slippage and stakes and gave gross profits per shop. Program two matched stakes (ie. turnover) to budgets on a week by week and cumulative basis per shop. Program three matched the gross profits to budgets on a week by week and cumulative basis per shop. Program four handled update data for the files.

Although the 'statistics' programs were written by November 78, Henry chose January 79 as the actual "go live" date for its obvious advantage of zero year to date cumulative figures.

By this time of course Henry, with suggestions from Chris, was looking for further application areas. Obviously there was accounting which, in the case of Henry's bookmaking business, was primarily the General Ledger. They, therefore, sat down and designed an accounting pack consisting of a general ledger with a flexible chart of accounts and all the controls necessary to satisfy audit requirements. (They were surprised to find that many of the "standard" packages available didn't have audit trail facilities.) Chris has now completed the programming for this and Henry hopes to go "live" in September.

Other application areas seemed to come quite naturally out of general conversations between Henry and Chris. One such conversation took place in February; Henry was explaining to Chris about "Laying Off" on big races. (This is the system where a small bookmaker makes a bet with one of the large bookmakers because he'd lose money if the "wrong" horse won.) Since bets are being placed right up to the time of the "off" it is quite difficult for the small bookmaker to judge exactly when and how much to "lay off". Chris was immediately interested and said he could write a program which would make this judgement easy. Two weekends later the program was completed and they decided to try it out on Grand National day.

The night before the race Henry entered the names of all the runners into the 'field sheet' program. At the start of the big day Henry got all his shops to ring in with the amounts of money already staked on each horse and the odds given; from then on half-hourly phone calls were made. He entered all this data into the program and at the same time had one of his top staff do the same operation manually. After two hours the "parallel run" was abandoned because the computer was continually beating the manual system. From then on the latter dealt only with the smaller of the two chains and the computer handled the larger (over twice the size).

The latest bets were rung in right up to ten minutes before the start of the race. Throughout this time the computer beat the manual system on every occasion by at least ten minutes.

The operation was so successful that Henry re-ran it on Derby day with the PET handling both his chains of shops. He wouldn't tell me how much the program made for him but he did remark that the initial installation, together with the upgrades he has made since, of a printer and discs, was all paid for by these two days.

Throughout the year that Henry and Chris have been working together Henry has grown more confident and competent in programming. An example of this is his Bank Reconciliation program.

Each shop reports details of its bank transactions to Henry; the bank, however, treats the business as one account. Henry was, therefore, finding it took him some time to reconcile what his shops were saying with what the bank was saying. So he sat down and wrote a program to list all his shop's transactions in the same sequence as the bank statement. This of course made reconciliation a very simple process, but he didn't stop there.

Henry has now added standing orders and direct debits to his program so as to give an almost exact replica of his bank statement.

You will probably have noticed that all the programs described so far concentrate on the control side of Henry's business. His staff haven't been completely forgotten, however, because Chris has written a Settler's Aid program. This program settles bets — that is, it calculates the amount to be paid to winning "punters". Most settlers can calculate normal single, double and treble bets faster than a computer, but when it comes to the more exotic bets such as:

YANKEE (4 horses in doubles, trebles and accumulators)
CANADIAN (5 horses in doubles, trebles and accumulators)
HEINZ (6 horses in doubles, trebles and accumulators)
SUPERHEINZ (7 horses in doubles, trebles and accumulators)
GOLIATH (8 horses in doubles, trebles and accumulators)...

particularly if the bets are each way (or place only), or there are dead heats, it can take quite a while to work out.

Chris's program covers all of these different bets and allows for dead heats, different place proportions and also calculates the betting tax.

In looking back over the past year or so both Chris and Henry agree that it has been very exciting. There have been problems. . .for example, Henry ordered a printer on six weeks delivery in December, and two and a half months later it had still not turned up. And there were some initial operating difficulties with the statistics suite. It was originally designed on a shop by shop basis but this meant that someone had to be around to enter the next shop's transactions when the last one had finished. This has now been changed so that all the data is entered in one go.

Chris offers the following words of wisdom for anyone else trying the same thing.

Allow plenty of time to evaluate the equipment. There are too many quirks in each of the different manufacturers' products and in some cases their delivery timescales are optimistic.
Try and plan for the financing of a programmer — to work full time on the project rather than part-time.
Do as they did, have a ready built customer for the "product", even though there may eventually be many others.

On this last piece of advice, one of Henry and Chris' achievements in the past year has been the formation of Busy Chips Ltd to market their complete "package" to the bookmaking industry. This came about mainly as a result of the interest shown at the Bookmakers Exhibition last year where they outlined all that they had achieved up to that date. (Incidently, if you'd like to see their "package" they are exhibiting again this year at the Bookmakers Exhibition in November.)

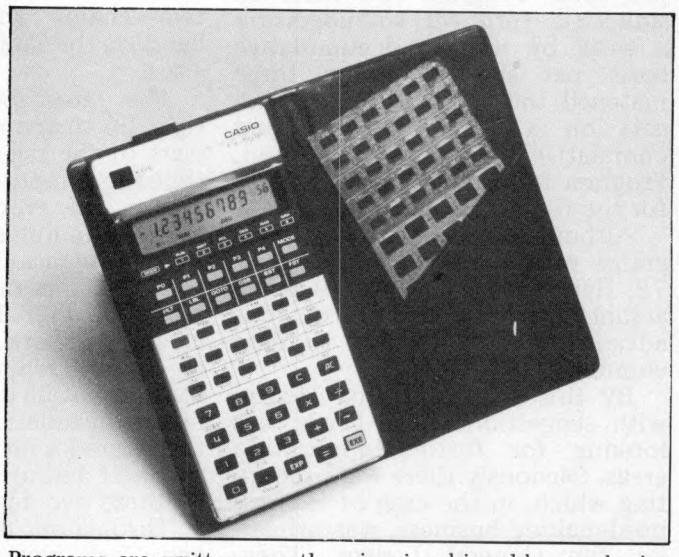
Henry states quite simply that the programs have done far more than he ever either expected or anticipated. In addition he has found a way of satisfying his previous interest in electronics, having as he says had: "One of the most exciting and satisfying years of my life". I think this enthusiasm can best be shown by my repeating a comment made by one of his staff — "Oh, you're using the computer — I'll come back in three hours!".

In the microelectronic hardware world, to start off a product test with a discussion of its appearance is probably to invite ridicule. You can't judge a book by its cover; you can't judge a calculator by its packaging. Nevertheless, when I first opened the box containing the Casio FX-501P my initial and overwhelming reaction was "Want it, want it!". Casio have produced a package so slick and tasteful that it destroys ones preconceptions of what a programmable calculator should look like, while inducing an almost indecent desire to own it. Not for them a lump of plastic the size of a ½lb. of butter, inscribed with all the symbols of the Zodiac. Instead an elegant sliver of anodized metal in a folding wallet which slips easily into a shirt pocket and positively disappears in a jacket pocket.

SUPERCALC

A QUICK LOOK AT THE CASIO FX-501P

DICK POUNTAIN



In fact the 501P is so damned pretty that one's second reaction is suspicion; such devotion to cosmetics must be at the expense of function.

This impression soon proved erroneous. The FX-501P is a serious instrument. Vastly more powerful a computing tool than the FX-201P which it replaces, it compares well with all but those battleships of the calculator world, the TI59 and the Hewlett-Packard card programmables. Its sister machine the FX-502P has twice the memory capacity and is roughly the calculating equivalent of an HP-67.

The compact package is made possible by the rare adoption of an LCD display — rare, that is, on programmables. The low power requirement allows the use of tiny silver oxide batteries, and though mains operation is not provided, at 1300 hours continuous operation per set, who cares?

More importantly it allows the use of non-volatile memories. Switch off and all is not lost! Your programs and data stay safety stored for weeks or months.

But suppose you wish to store more than the 10 programs memories can hold. A discreet socket at the top provides a way. Using the optional FA-1 adapter (which we weren't supplied with. . . test on that to follow) the contents of all the registers may be Saved onto an ordinary domestic cassette recorder, and Loaded again at any time. Just like a micro in fact.

The basic specification as a scientific calculator is excellent; all the now usual arithmetic, trig, hyperbolic, power, root log and exponential functions are there plus several very useful and less common ones such as factorial, absolute value, remove integer and remove fractional part, polar to cartesian coordinates and even a random number generator. Statistics are provided on the keyboard, with standard deviation, mean, square sum, sum and number of data available on single keys and entry for unlimited strings of statistics data. It's not necessary to assign data memories and all these functions are useable in programs.

The arithmetic operations are true algebraic with five levels of parenthesis or implicit priority of functions over multiplication and addition.

The 501P display is the best I've seen anywhere. The normal format is ten digit fixed point which automatically goes to scientific floating point for values over 10^{10}. Scientific may also be keyed in as ten digits plus a two digit exponent plus negative signs, and the exponent is actually displayed as a superscript for clarity. Another key converts scientific to engineering notation, and the third and fourth formats available round to any chosen number of significant figures and sexagesimal (ie. hours/degrees, minutes and seconds). The display also contains alpha character 'tell tales' for mode of operation (RUN, WRT, HLT, PCL) angular mode (DEG, RAD, GRAD) plus halt, constant and INV. Program instructions are displayed in alphanumeric form and so cannot be confused with data or program addresses.

All of this adds up to a very powerful scientific calculator, but it is in the program mode that Casio have made great strides in ease of use and learning.

Program memory is divided into 10 registers, each with its own key, P0 to P9. These keys thus effectively become user defined keys; each can store and run a separate program or subroutine, (the total number of steps must of course not exceed the capacity of 128). Programs are written exactly as they would be performed as keyboard operations. The editing functions put others to shame; obvious and natural, their use is a real pleasure.

Firstly the display always shows the most recently entered instruction and program step (unlike the annoying TI system which shows the next blank location). Secondly insertion is automatic; key in an instruction at any point and the program 'opens up', renumbering succeeding steps. Deletion, performed by the Clear Key, similarly closes up and renumbers. Back and forward step keys go into fast stepping if held down for 1 second, so any point may be reached in a trice.

Debugging is catered for by a trace mode which lets you single step through a program, with data entered, displaying program step number and intermediate results. There is also an automatic error status flag which displays E and the step number for most common error conditions when a program takes a dive.

As for the instructions themselves, Casio have abandoned their unique Fortran based 'language' for a more orthodox assembler based one like TI's and HP's. In fact most commands are interchangeable with TI's except for their names, eg. Min is STO, MR is RCL. This system is far more concise; a typical program occupies half the space it would have done on the FX-201P. Further concision is achieved by employing memory arithmetic; M+ and M- add and subtract from stores directly (unfortunately memory multiplication/division is not possible).

The 201P's single IF conditional jump statement is replaced by six conditional jump tests ($x = 0$, $x \geqslant 0$, $x = F$, $x \geqslant F$, ISZ, DSZ). This I almost regret because although less economical of steps, the old IF instruction was superbly flexible, covering all possible tests and branching three ways on the outcome from a single statement. The increment/decrement-and-skip commands, however, had no single equivalent on the old system.

Other features which contribute to the power of the 501 are indirect addressing on all memory jump commands and subroutine calls; subroutines are nestable up to four levels and can be run, edited and debugged independently of the main routine by pressing their Program Key. A nice touch is the Pause which when inserted in a program displays an intermediate result for 1 second each time. This allows 'dynamic' displays which change, flash, countdown etc, all adding a touch of class, especially to games and simulations.

What then separates the 501P (and the 502 which just has twice as much of everything) from the real big boys? Well, for one thing total memory capacity is modest and it is not user partitionable between program and data.

Continued on page 63.

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DEXTEROUS DISPLAYS

A TYRONE CRUDIS GUIDE TO BETTER GAMES GRAPHICS

A tutorial on methods of building up complex graphic patterns for PET, Sorcerer, or any other computer which provides a large vocabulary of graphic symbols.

Teletypwritis

How many commercially-offered PET programs can you think of which turn out to make no real use of PET's truly fantastic graphics capability? Quite a few, I suspect! The typical symptom of 'teletypewritis' is a display which scrolls upwards for 'fresh paper' and redraws the entire game board on every move. The only cure when this dread malady is detected is to scrap the display altogether and return to fundamentals. Let us tackle the problem of designing a display for HEX (or for any board game) from this point of view.

The game of Hex

HEX, also known as HEXPAWN and HEXAPAWN, is a simple game using chess pawns and their moves on a 3 x 3 board. Non-chess players should know that the pawn moves only forward towards the enemy, never backward, and can advance one step directly forward into an empty cell or one step diagonally forward into a cell containing an opponent's piece, which is then captured and removed. In HEX, one side wins when it has captured all three of the opponent's pieces, when it is the opponent's turn but he has no legal move, or when one of the player's pieces reaches the opposite edge. HEX is of interest to the microcomputer enthusiast because of its applicability to simple AI techniques. That's 'Artificial Intelligence', in case some of you cattle farmers out there were wondering what computers won't be into next.

In an historical article in Scientific American[1] Martin Gardner showed how a mechanism consisting of matchboxes containing coloured beads could be manipulated to play a series of games against a human opponent in such a way that it would learn from its mistakes and shortly become unbeatable. The game was soon programmed for computer. A well-known version appears in '101 BASIC Computer Games'[2]. There are weaknesses in this program: for example, it ignores certain types of blatant cheating, and it needs to store all possible positions which the game can undergo, as well as all possible moves from each position, in a pair of arrays which the computer must refer to on each move. These are not the reasons for choosing HEX as a subject, however, and they will have to be resolved in another article. I have chosen HEX to illustrate certain techniques for building up graphics patterns because it is simple and because the graphic display provided for present versions of the program cries out for improvement. What I have to say will equally well apply to other board games and to displays in general.

Designing the board

Crudis' Compendium of Games-Writing Standards consists of all the items in italics.

The first step in designing any board game is to analyse the space available in terms of the displays required. The requirements for HEX (Fig. 1.) are for a square array *as large as possible*, for a line of text prompting the human to insert his move and commenting on errors, for a cumulative game scoreboard to be displayed at the end of each game, and perhaps for another line of text for 'in process' comments by the computer. With PET's 25 x 40 element screen, the largest possible square display is 25 x 25, but we want to reserve at least one line for text, and *double-spaced lines* are an essential for easy reading. Also we had best *avoid writing on the bottom-most line* if possible, as it is too easy to generate inadvertent scroll-ups from this position. This leads us to the next consideration which is that, unless unavoidable, one should *keep the board and the pieces separate.* That is, the process of drawing a piece should not obliterate any detail of the board. Otherwise removal of a piece will necessitate redrawing portions of the board, which will slow things down, detract from available memory, and make it difficult to implement another concept; that it is desirable to *make the pieces appear to move.* (More on that later!)

Now there are several ways of building up a matrix or net of lines graphically. (It was Ben Jonson in his dictionary who defined a net as a 'set of reticulated interstices'!). One way is to draw all the horizontals and then all the verticals, as we would do with pencil and paper. This won't do on PET, since two symbols can't occupy the same pixel. One would have to insert the shifted left bracket or crossed line symbol at all the interstices. This would be all very well if a thin, narrow line were desired, but we want *bold, heavy lines* to strengthen and add *vitality* to our display. Another way (Fig. 2A) is to draw the bottom and one side of each cell in such a way that all the cells fit together with the bottom of one serving as the top of another. Then the missing top and side of the board must be added. Thirdly, we can draw a complete outline for each cell and butt them all together (passing blessing on the name of the designer who gave us a contiguous 8 x 8 dot matrix). As shown at Fig. 2B, this calls for an additional border all round to equalize the line widths at the edge or to provide a decorative frame. You will notice that Fig. 2A in this instance gives a 5 x 5 field for the playing piece with a 19 x 19 board, or could be drawn to give a 6 x 6 piece with a 22 x 22 board, while Fig. 2B gives only 4 x 4 in 20 x 20.

Consideration should always be given to the *use of a reverse field* with dark lines on a white background, and a decision made as to whether it is applicable in the circumstances being analysed. In general, reverse field tends to be restful on the eyes and they also give a crisper appearance to lines and symbols. It will not 'slow things down to write all that white', as one observer suggested to me. Not all VDUs provide character-by-character reverse field, and some that do are unable to display it well. PET, however, is exemplary in this respect.

Designing the pieces

A new consideration now enters our deliberations. The pieces are in all likelihood expected to be symmetrical about their vertical axes. One might think that making the width of the piece an odd number of squares with its concomitant centre column would

make it easier to design such pieces. I don't find it to be so. Try designing a piece to fit in 4 x 4, 5 x 5, and 6 x 6 and see if you don't agree. Tastes differ, however, and what I finally selected (Fig. 3) may not be what you find enchanting. Whatever your choice, try for *good visibility at a distance* and a *balance* so that neither board outline nor piece seems too heavy in respect to the other. Above all, don't be restricted in your thinking by unreal barriers. In games such as HEX, Checkers, Othello, and Tic-Tac-Toe the pieces serve only to indicate that a square is occupied and by which player. Colours are relative: in such games it is only necessary to distinguish the two players and the null condition. A solution which looks very nice in the game of Othello is to use black, white, and the shifted '&' pattern filling the entire piece space. (See Fig. 4.) You might prefer to try this for HEX as well.

The astute reader will have noticed that the 'squares' on the PET screen are not exactly square. This is inherent in most VDUs and is no cause for alarm, although the precisionist can correct it over a limited area of the screen by going to a 7 x 6 array if desired. I am put in mind of the board for the Japanese game of GO, which is 19 x 19 and on which the cells are not square but are 29/32" x 27/32", a point which many of us may have missed, but which is significant to the cultured Oriental who is opposed to the monotony entailed in excessive regularity.

Drawing the board

The easiest way to have the program draw a fixed board which will remain unchanged during the game is by a brute-force series of PRINT instructions proceeding line by line from the top down. When writing such a program for Fig. 2B, observe that two nested loops can be used to advantage, and remember PET's labour-saving characteristic that similar but not identical lines can be generated by overwriting a line number and making only the desired changes. The resulting routine will be of the form:

```
110 PRINT... (top edge of board)
120 :FOR J = 1 TO 3
130 :PRINT . . . (top line of cells)
140 ::FOR K = 1 TO 4
150 ::PRINT . . . (edges of board
      and sides of cells)
160 ::NEXT K
170 :NEXT J
180 PRINT . . . (bottom line of
      lowest cells)
190 PRINT . . . (bottom edge of
      board)
```

all of which can be compressed to a few actual lines. It is neither necessary nor desirable at this stage to use string variables, since the routine is so simple.

Poke vs cursor string techniques for positioning

When we come to drawing the pieces, which must be erased and redrawn many times, different techniques should be considered. The two major approaches which can be used are the POKE technique and the cursor technique. The BASIC command, POKE, followed by the address of the desired spot and the code of the desired symbol, allows us to force any symbol on any spot on the screen. Knowing that the decimal address of the upper left corner of the screen is 32678, we can use an expression like POKE 32678 + 40*Y + X, Z to place character Z at the position X,Y. This is excellent for such games as Battleships where each move involves only one pixel, but it is slow and becomes clumsy where, as in HEX, we have elected to draw a super-symbol consisting of 16 pixels. Hence, we will discuss only the cursor string technique in this article.

Analysis vs synthesis

There are two varieties of the cursor string technique, an analysis or breakdown approach and a synthesis or buildup approach. While the former has been described a number of times and is seen in quite a few game programs, I believe that the latter is original with me. What I will here call the analysis technique is that of writing a general-purpose string and then selecting a desired portion of it using MID$, LEFT$, or RIGHT$. One might, for example, select one of three graphic symbols A, B, or C depending on the variable X by writing PRINT MID$("ABC", X,1) or one might position a symbol A at X spaces to the right with PRINT LEFT$("[39CR],x") + "A" where [39CR] means 39 cursor right symbols in accordance with the proposed conventions printed in my ESP feature, published last month. As useful as the analytical technique may be in many applications, the synthesis technique which is about to be described has advantages over it when the application is one of generating relatively complex patterns, while, as we shall see, the two used together form an exceedingly powerful tool. Here is what I mean by 'synthesis'. For the HEX board, each piece symbol, irrespective of position, can be generated by a string such as B$ = "[SP SL] + UI + [SP 4CR CD SP] + JK + [SP 4CR CD] + UIUI + [4CR CD] + JKJK + [2CL 3CU]". Note (Fig. 5) how this string writes the symbol starting at its upper left corner (arbitrarily) and scanning to the right over four pixels, then flying back to the left end of the next line, scanning it, and so on to the lower right corner, ending with a fly-up to the starting position for the next adjacent piece to the right. (The cursor will automatically step one place to the right after writing the last command.) Now, by calling for PRINT B$ + B$ + B$ we can write a row of three contiguous black pieces without further ado. The concatenation sign "+" can be omitted from print statements without ill effect on PET, but I will continue to include it for clarity. The white piece is simply W$ = "[RE]" + B$ + "[RO]" (reverse plus black string plus reverse off), and to erase any piece, we can cover its area with the background symbol: E$ = "[RE 4SP 4CL CD 4SP 4CL CD 4SP 4CL CD 4SP 2CR 3CU RO]". Let us devise a positioning string to place the cursor in position to write in the upper left cell of the board, which we can now dimension as in Fig. 6: P$ = "[HO 18CR]"

Board nomenclature

Now, before we continue with the synthesis process (and you will have noted that there is at least one element missing) we must digress to cover two other subjects. The first is board nomenclature. Up to this point we have avoided naming the cells of the board, but they *must* be named so that the player can indicate his play. "They wouldn't have to have names if I had a light pen and could point at them!", I hear you cry. True enough, but light pens and their application are a subject for another lecture. See me after class for advanced reading!

Fig. 7A is the one good way to name the cells on the HEX board. This is because the numerical keypad has that orientation and is the means by which we are going to enter our instructions. While an X,Y coordinate system (Fig. 7B) has many advantages to the computer, it is too much to require the human to use it for a board this simple. What are some of the advantages to the computer? Illegal moves are easy to identify by examining left digit differences and right digit differences. Computer moves always change the left digit by -1: human moves always change it by +1. The direction of diagonal moves can be

sensed from right digit differences. There are so many such advantages to the computer that it will be worthwhile going to the trouble of accepting the human input in keypad form and converting it to X,Y form, as we may do in a subsequent article.

Illusion of motion

So much for board nomenclature at present. The second digression concerns a matter of realism. I like to think that *the computer is moving the pieces*, and this illusion is shattered if the update program simply scrolls the display or if it erases all the pieces and then rewrites them or if it erases the piece in question and then rewrites it with a noticeable time delay or, which is worst of all, if it rewrites a piece before it has been erased. (Makes me shudder to think of it!) You may feel that I am splitting hairs and that this is all too much trouble over trifles. If so, this article has little more to offer you, Philistine! If you agree with me, however, that these are the details by which we approach perfection, then we can continue hand-in-hand with the concept that the piece should be erased and be 'immediately' rewritten in its new position with such speed that our persistence of vision makes it appear to have moved across the intervening space.

Move synthesis

The computer's moves on the board all contain a 'down-one-space' component and either no move to the left or right or a 'right-one-space' or a 'left-one-space' component. Similarly the human's moves are structured about an 'up-one-space' move. We can therefore simply generate all relative moves from combinations of the following: D$ = "[6CD]":U$ = [6CU]" :R$ = "[6CR]":L$ = "[7CL]". L$ has seven, not six cursor lefts because of the cursor's habit of stepping one space to the right after printing. The three possible relative moves for the computer are D$, D$ + L$, and D$ + R$, while for the human they are U$, U$ + L$, and U$ + R$. A complete move from a given starting position therefore consists of the erase of the old position, the relative move to the new position, and the rewriting of the symbol. Such a move is E$ + D$ + R$ + B$ (erase, move down, move right, print Black piece.) The fact that the entire symbol cell is rewritten means, of course, that any symbol previously there is effectively erased. It is to be remembered that all these exercises are purely for display purposes and make no record for the computer to refer to. That must be done in a 3 x 3 array specified for the purpose. (Had we elected to use POKE writing techniques, we could conceivably have used the screen memory or part of it as a board memory and utilized PEEK to read the memory, but the equivalent expressions would be weighty and complex in comparison.)

A certain philosophical approach now becomes evident: I choose to build up complex movements from simple, easily-understood, easily-modified elements. In doing so, I don't hesitate to *be profligate with memory use.* After all, there are 7167 bytes of memory available for each game and (who knows?) they may atrophy if they're not exercised regularly!

Positioning the computer's pieces

It remains to decide how to position the cursor to start each move. In the case of the computer this is taken care of automatically because the computer will have to step from cell to cell examining the possibilities at each cell until it selects a move. If, as I have suggested, it works in X,Y coordinates, the computer might scan the board when it is its turn as follows:

```
FOR Y = 3 TO 1 STEP -1
FOR X = 1 TO 3
FOR W = 1 TO 3
(examine the three possible moves)
IF ..... GOTO .....
(drop out of loops when a desirable move is found)
NEXT W,X,Y
```

The initial position consists of the values held by the variables X and Y when the drop-out occurred. The relative move to be made (this is rather nice) is coded in the value of W: a value of 1 means down and to the left, 2 means down, and 3 means down and to the right.

Now the moves L$ for left and R$ for right which we had defined previously don't entirely take care of our requirements. Did any reader catch this point? The reason is that when the piece, B$ or W$, has been written, the cursor is not positioned to rewrite the same piece, but is actually and intentionally in position to write the next piece to the right. As you can and should confirm from Fig. 5, we don't need any R$; L$ should be "[12CL]", and D$ standing alone needs to have 6CL added to it for this reason. Bear with me while I redefine L$ as "[CR 19CL]" and operate on it with analytic MID$ to provide all the necessary functions. MID$ (L$,A,B), as we know, writes B characters of L$ starting with the Ath character. If A = 1 and B = 2, the result will be [CR CL], cancelling itself out. We must 'cheat' like this since neither A nor B can be zero in a MID$ statement. If A = 2 and B = 6, the result will be [6CL], and if A = 3 and B = 12, the result will be [12 CL]. Therefore we can write the general positioning expression for Black as PRINT E$ + D$ + MID$(L$,A,B) + B$, if A and B are given the proper values. These are determined by the value of W. In fact, A = W and by a circumstance too delightful to be coincidental, an expression for B can be found which generates the desired numbers, viz: $B = W^2 + W$, and the general positioning expression reaches its final form as PRINT E$ + D$ + MID$(L$,W, W↑2 + W) + B$. Some insufferably prescient reader may guess why I have made the new L$ contain 19 cursor lefts instead of the 13 which seem at this point to be all that are required. The rest of you will have to wait until I say 'Aha!'.

Positioning the white pieces

The human will enter his desired move under the control of an INPUT command. Let us assume that the computer converts it from keypad form to X, Y form. For example, the move 2, 5 (from cell 2 to cell 5) will become 12, 22 (see Fig. 7). By examining right digit differences the computer will generate a value for W of 1, 2, or 3. The same scan in X, Y which the computer uses can also be applied to find the start position for updating the display on the human's turn. The general expression for writing White's move, similar to that derived for Black, is of course PRINT E$ + U$ + MID$(L$,W,W↑2 + W) + W$.

The complete display up-date

To keep things sorted, let's have a variable TU which flags whose turn it is; TU = 0 for computer, TU = 1 for human. Putting this together with everything discussed to date, the complete display update routine now becomes:

```
600 PRINT P$;
610 :FOR YD = 3 TO 1 STEP -1
620 ::FOR XD = 1 TO 3
630 ::IF TU = 1 THEN W = XI —
      XF + 2
640 ::IF TU = 0 THEN U$ = D$
      :W$ = B$
650 ::IF XD <> XI OR YD <> YI
      THEN PRINT R$:GOTO
      670
660 ::PRINT E$ + U$ + MID$
      (L$,W,W↑2 + W) + W$:
```

```
        GOTO 700
670 ::NEXT XD
680 :PRINT D$ + L$;
690 :NEXT YD
```

COMMENT

600: P$ positions the cursor to the upper left of the board to start.

610: XD, YD are the X,Y co-ordinates of the display.

630: XI, YI are the initial X,Y co-ordinates of either the human's or the computer's move. XF, YF are the final X,Y coordinates.

650: R$ moves the cursor to the right to the next cell if the cell being scanned is not the initial cell of a move.

680: D$ + L$ (aha!) moves the cursor down and left to the beginning of the next line of cells.

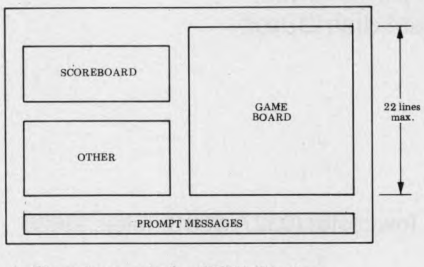
What to do until the doctor comes

For the present you may want to experiment with making this up into a two-person computer-display game, or you can try incorporating it in your current HEX program. In a subsequent article I hope to show how the computer can be made to teach itself unbeatable HEX strategy knowing only how to make or recognize a legal move and recognize a win; I will reproduce a complete program.

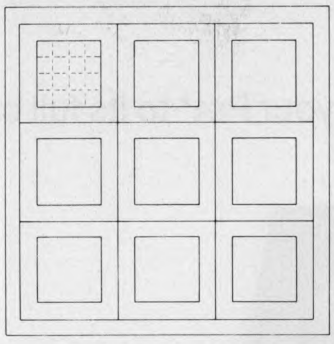
References

1 *Scientific American* Vol. 206 No. 3 p. 138; also reprinted in *The Unexpected Hanging and Other Diversions*, Martin Gardner, Simon & Schuster 1969.

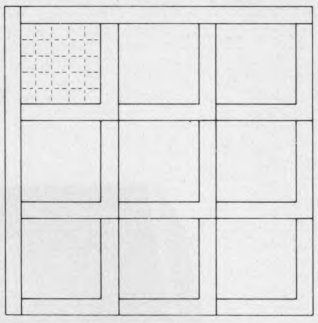
2 *101 BASIC Computer Games*, David H. Ahl, Digital Equipment Corp. Another source of background on the game of HEX is an article entitled "HEXPAWN" in *The Best of Byte Vol. 1*, Ahl & Helmers, Creative Computing Press 1977.



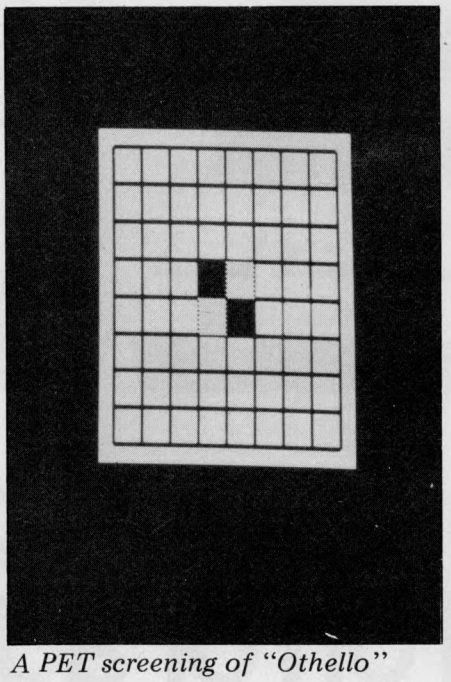
1. Requirements for HEX Display



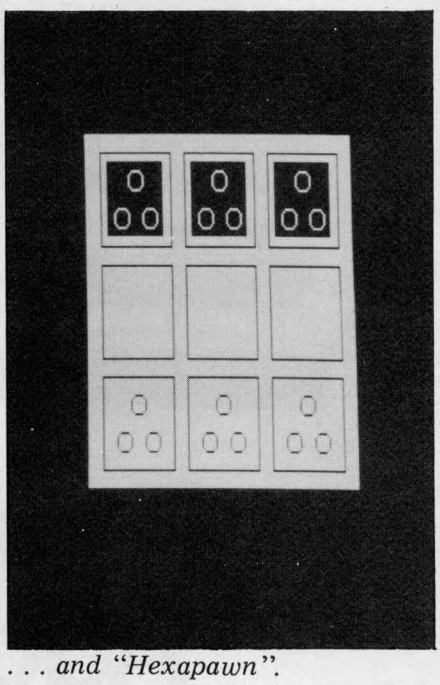
2A. 5 x 5 Cell in 19 x 19 Board



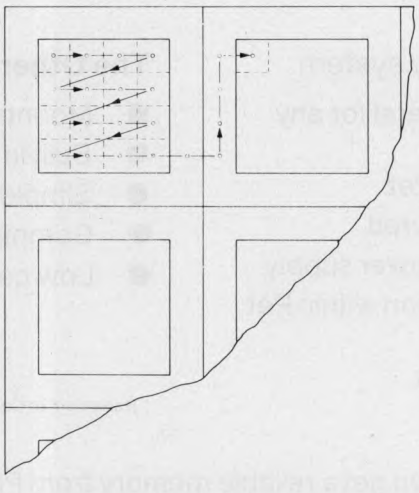
2B. 4 x 4 Cell in 20 x 20 Board



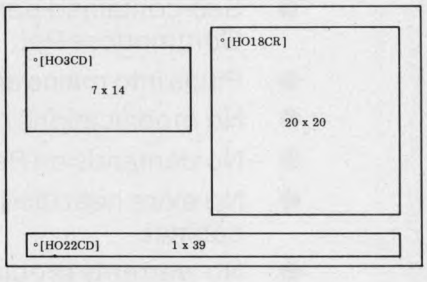
A PET screening of "Othello"



. . . and "Hexapawn".



5. Drawing One Piece on the Board



6. Final Dimensions for HEX Display

7	8	9
4	5	6
1	2	3

7A. Naming the Cells of the HEX Board in Keypad Orientation

31	32	33
21	22	23
11	12	13

7B. Naming the Cells of the HEX Board in X,Y Coordinates

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ON THE LINE

The increasingly widespread use of personal computers in the home and in the office makes for an exciting prospect. Equally, today's advances in telecommunications technology will soon be landing a significant impact on our way of life. The symbiosis of the two could well be the realisation of McLuhan's concept of the 'Global Village'. David Hebditch, owner of an International D.P. consultancy continues in "On the Line" to discuss the practical technicalities of such a concept.

Data link controls Part 2

If you have ever wondered what some of those funny non-graphic characters in the ASCII table mean, now is your big chance. In last month's column we discussed the basic requirements of a data link control for getting data from one computer system to another over a telephone line. Such protocols are implemented using the control characters provided in the ASCII set (see figure 1). These are all in column 1 of the table. Not every one is required in our simple link control so I shall just describe the essentials.

ENQ(5) is used to solicit a response from the other station; the exact meaning will depend upon the context

ACK(6) is the positive acknowledgement, yes, OK. . .

NAK(21) is negative acknowledgement, nyet, not OK etc. . .

SOH(1) is 'start of header' and prefixes control information at the beginning of each message

STX(2) indicates the start of the message text (and implies the end of the header — if there was one)

ETX(3) marks the end of the message text (and is usually the last character in the message, unless we are using a block parity check)

EOT(4) is 'end of transmissions' but can also be used to reset the line to an agreed starting point in the protocol.

Some of the above characters are used to format messages and the rest to control the transmission of those messages. Figure 2 illustrates the standard format for any message. The first character is always SOH and this is followed by a fixed-length header. The format and use of this header will be considered in next month's article.

The first character after the header is STX and this marks the beginning of the data being sent. The very last character is ETX. Unlike the header, the message is variable in length (and may indeed be absent). A common technique for finding the end of an incoming message is to examine each character to see if it is an ETX.

The danger of this is that if you want to send ETX as part of your message (or one occurs by mistake) then the receiving system will lose some of the data.

One way around the problem is for the header to contain a count of the number of text characters, thus avoiding the need to examine them. The ETX can then be used as a check that the count was correct.

So much for the general message format. Figure 3 is a generalized schematic of our simple data link control. (Last month's article described the basic concepts, should you want to refresh your memory).

In figure 3, the sequence is started by Station A but it could just as well have been Station B. In other words, if you write a program to implement the protocol then it should run unmodified in A and B; it will be able to 'talk to itself'.

The sequence is always begun by sending ENQ to determine if the other station is ready to receive a message. If it is, it will reply ACK. If not it will send NAK. (Do not forget the response time-out requirement).

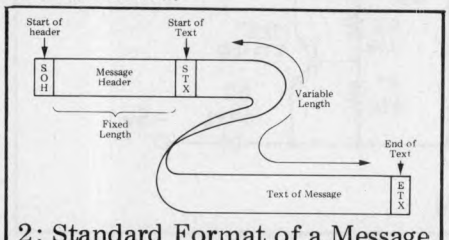
On receipt of ACK, the originating station can go ahead and transmit the message in the format described above. The receiving station will check each incoming character for good or bad parity. If the message is clear it will send back an ACK and the first station can transmit another message if it wishes. A NAK to a message will cause the originating micro to re-transmit. This will continue until the transmission is successful or until an agreed limit on re-transmissions is reached.

When Station A has sent all the messages for a particular exchange it will terminate with an EOT. The EOT character may also be used by the receiving computer to terminate the exchange in case of problems.

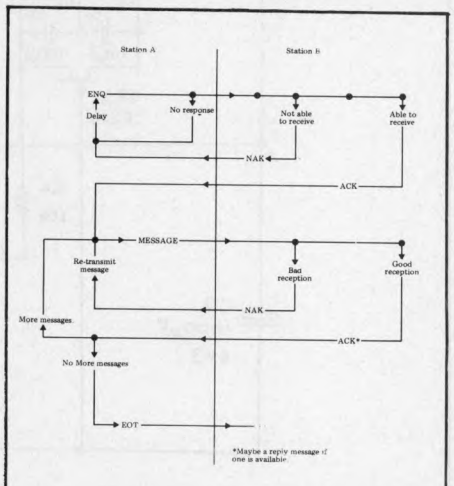
Next month we shall look at a possible format for the header.

FIG 1

Decimal	7 bit octal	Char.	Decimal	7 bit octal	Char.	Decimal	7 bit octal	Char.
0	000	(NUL)	43	053	+	86	126	V
1	001	(SOH)	44	054	,	87	127	W
2	002	(STX)	45	055	—	88	130	X
3	003	(ETX)	46	056	.	89	131	Y
4	004	(EOT)	47	057	/	90	132	Z
5	005	(ENQ)	48	060	ϕ	91	133	[
6	006	(ACK)	49	061	1	92	134	\
7	007	(BEL)	50	062	2	93	135	]
8	010	(BS)	51	063	3	94	136	↑
9	011	(HT)	52	064	4	95	137	←
10	012	(LF)	53	065	5	96	140	^
11	013	(VT)	54	066	6	97	141	a
12	014	(FF)	55	067	7	98	142	b
13	015	(CR)	56	070	8	99	143	c
14	016	(SO)	57	071	9	100	144	d
15	017	(SI)	58	072	:	101	145	e
16	020	(DLE)	59	073	;	102	146	f
17	021	(DC1)	60	074	<	103	147	g
18	022	(DC2)	61	075	=	104	150	h
19	023	(DC3)	62	076	>	105	151	i
20	024	(DC4)	63	077	?	106	152	j
21	025	(NAK)	64	100	@	107	153	k
22	026	(SYN)	65	101	A	108	154	l
23	027	(ETB)	66	102	B	109	155	m
24	030	(CAN)	67	103	C	110	156	n
25	031	(EM)	68	104	D	111	157	o
26	032	(SUB)	69	105	E	112	160	p
27	033	(ESC)	70	106	F	113	161	q
28	034	(FS)	71	107	G	114	162	r
29	035	(GS)	72	110	H	115	163	s
30	036	(RS)	73	111	I	116	164	t
31	037	(US)	74	112	J	117	165	u
32	040	(SP)	75	113	K	118	166	v
33	041	!	76	114	L	119	167	w
34	042	"	77	115	M	120	170	x
35	043	#	78	116	N	121	171	y
36	044	$	79	117	O	122	172	z
37	045	%	80	120	P	123	173	
38	046	&	81	121	Q	124	174	|
39	047	'	82	122	R	125	175	
40	050	(	83	123	S	126	176	~
41	051	)	84	124	T	127	177	(DEL)
42	052	*	85	125	U			



2: Standard Format of a Message



3: Generalized Schematic of the Data Link Control.

SENSE OF REALITY

INTERFACING YOUR PERSONAL COMPUTER TO THE ANALOGUE WORLD

Following John Coll's recent Digital to Analogue Converter design (July PCW), we now look at T. Jones' conversion of analogue input to digital information.

INTERFACE YOUR PERSONAL COMPUTER TO THE ANALOGUE WORLD

The potential of a small computer system can be considerably increased by the addition of an analogue to digital converter; the computer can thus be used to measure, record and operate on analogue parameters such as voltages, temperatures, positions, etc. With a facility such as this the computer may become the heart of a sophisticated control system or data logger.

This article describes a method of constructing an analogue to digital converter using cheap and easily obtained components. Alternatively the system is available in a ready-built form. Examples of system software and ideas for expansion on the basic theme are also given.

The interface is built around a 3 digit converter integrated circuit — the LD130. This versatile device, which has an analogue input range of 0 — 1 volt d.c., is accurate to .1% of full scale. Any parameter which can be transformed into a 0 — 1 volt signal may be interfaced to your processor.

The circuit shown in Figure 1 offers a simple hardware interface for a 4 bit microprocessor. This converter uses two input ports and is not synchronised to the machine clock, thus a significant amount of processor time is needed in order to obtain the required results. However, this method does serve to demonstrate the fundamentals of the system with more refined versions for both 4 bit and 8 bit machines described later.

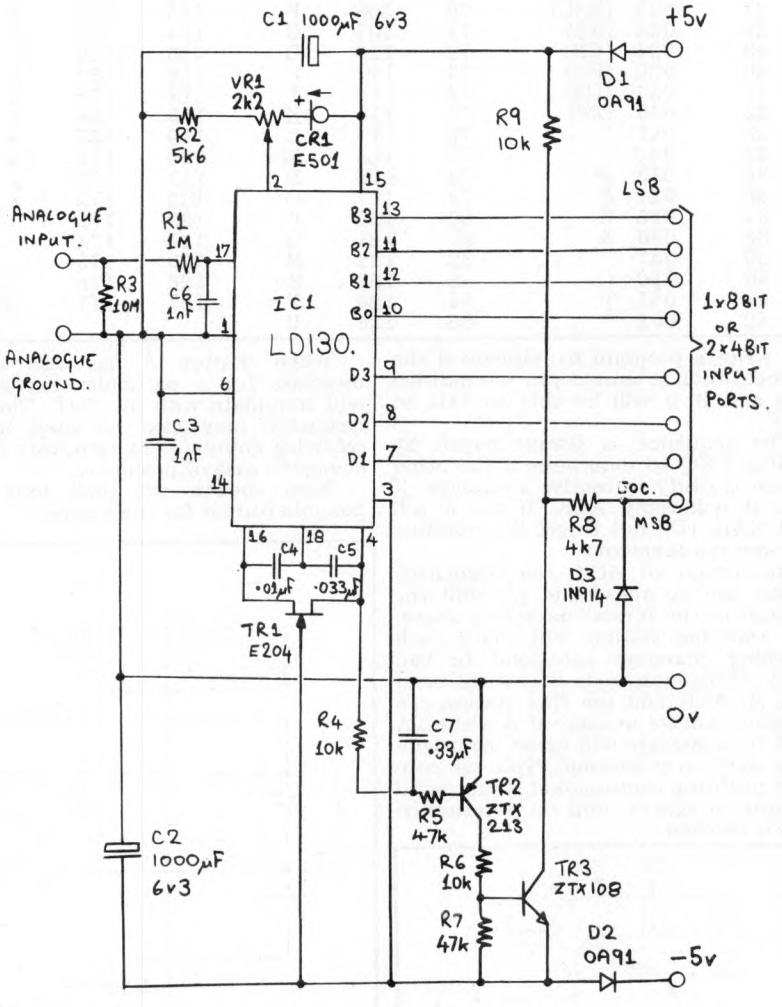


FIG 1. BASIC CIRCUIT DIAGRAM

OPERATION OF THE BASIC CIRCUIT (Figure 1)

The analogue input is applied via a protection resistor (R1) to pin 17 of the LD130. The resistor protects the I.C. against over-voltages up to 1000 volts. Power supplies (±5.0v) are applied to the circuit via diode capacitor smoothing components D1, D2, C1 and C2. A stable reference voltage, which the LSI device requires, is provided by R2, VR1 and CR1. VR1 is adjusted to calibrate the circuit. C3, C4 and C5 are parts of the conversion circuit which cannot be integrated onto the chip. The JFET, TR1, eliminates a power-on lock-up mode which may otherwise manifest itself by a constant output of 007.

The digital output of the device consists of a series of three B.C.D. words per conversion on pins 10 to 13, which are taken to input port 1. Digit strobes are provided on pins 7, 8 and 9. Pin 7 is at logic 1 while the most significant digit is present on the B.C.D. output pins. Similarly, pin 8 is a '1' while the centre digit is present at the output and pin 9 is a '1' while the least significant digit is present. These digit strobes are taken to three of the second input port terminals. The fourth terminal at this port is used to present an 'end of conversion' signal to the computer. This signal (EOC) is developed by TR2, TR3 and associated components. Output data is valid only when EOC is at logic 0.

REFINED SYSTEM FOR FOUR BIT MACHINES

The interface shown in figure 2 uses only one 4 bit input port. It simplifies software and saves machine time by synchronising the LD130 to the system clock and is particularly suitable for Intel 4004 and 4040 microprocessors. The computer system clock is divided by 16 with a CD4024 (IC1) before driving the 'osc' input (Pin 14) of the LD130. Digit strobe D1 (Pin 9) fires a monostable (IC2) the output of which is logically ANDed with the EOC bit. The composite signal thus generated forces an illegal BCD state onto the data bus, indicating to the processor the presence of D1 time. When this illegal state disappears D1 data may be picked

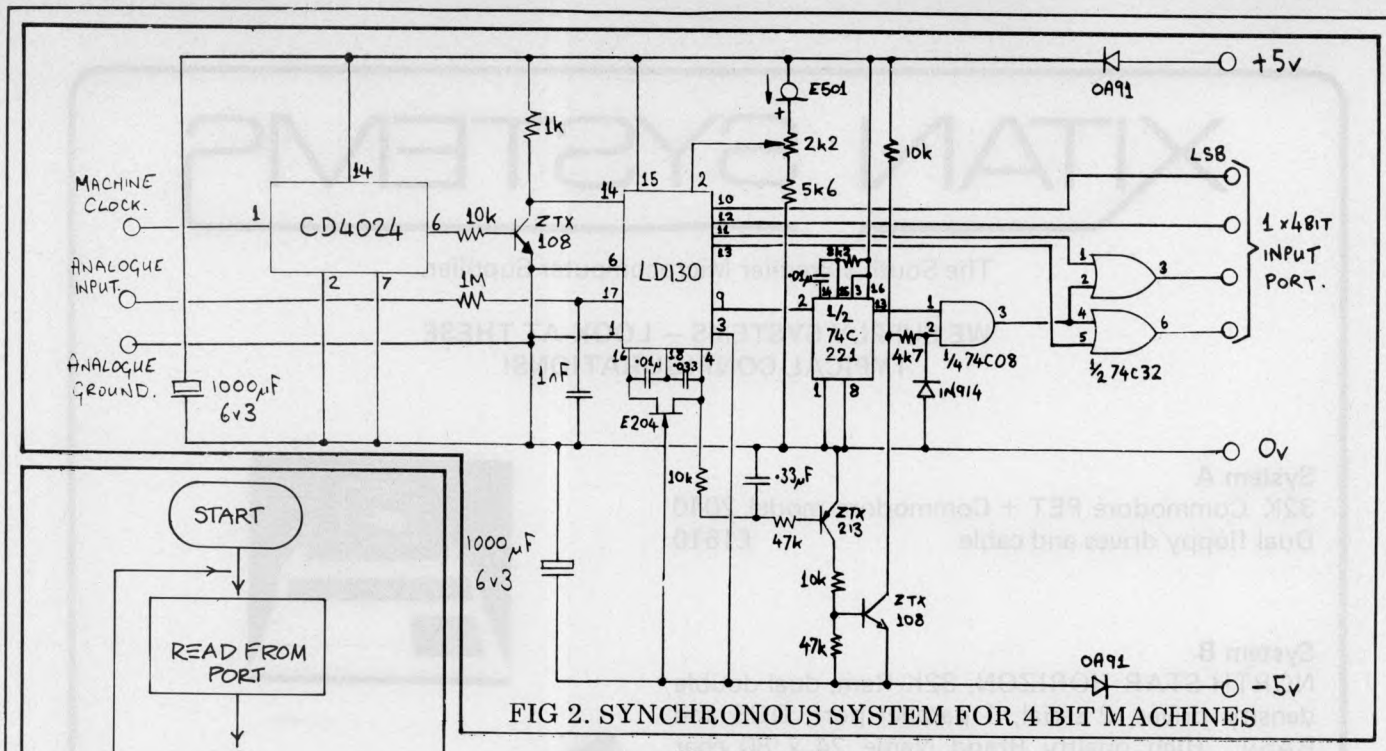


FIG 2. SYNCHRONOUS SYSTEM FOR 4 BIT MACHINES

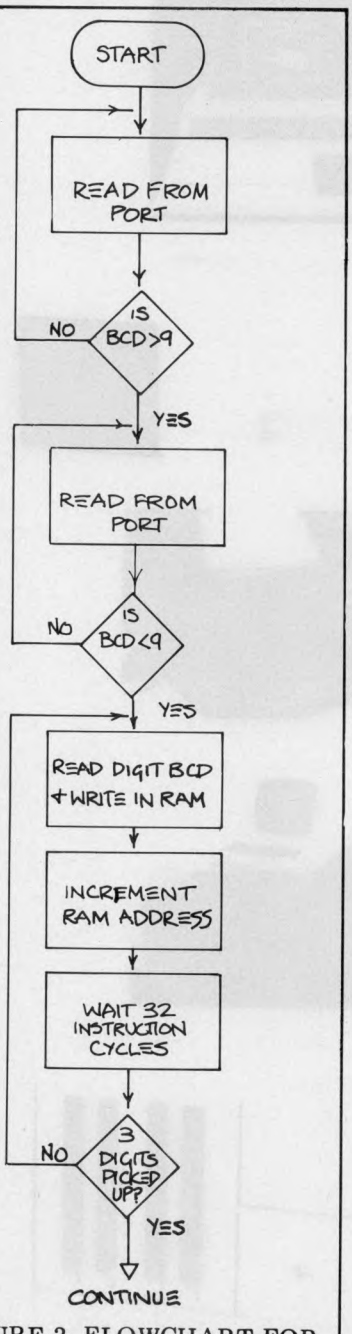


FIGURE 3. FLOWCHART FOR SINGLE PORT 4 BIT SYSTEM

up and stored in memory. D2 and D3 data are picked up 32 and 64 machine cycles later respectively. The flow chart and software for this system are shown in figure 3 and figure 4 respectively.

This information is intended for general practical guidance and while sound in conception has not been run and is therefore not necessarily fully 'debugged' or optimised.

	FIM %, %%H	RAM AND ROM ADDRESS
	FIM 2, 6%H	ADDER CONSTANT
	FIM 4, D%H	TIME CONSTANTS
	SRC %	REGISTER CONTROL
	CLB	CLEAR CARRY AND ACCUMULATOR
READ	RDR	READ ROM PORT %
	ADD 2	ADD CONSTANT (6)
	JNC READ	REPEAT IF D1 HASN'T OCCURRED
CHANGE	CLC	CLEAR CARRY
	RDR	READ ROM PORT %
	ADD 2	ADD CONSTANT (6)
	JC CHANGE	LOOK FOR FALLING EDGE
NEXT	RDR	READ 4 BCD BITS OF D1
	WRM	WRITE TO RAM
	INC 1	INCREMENT RAM ADDRESS
	SRC %	SEND NEW RAM ADDRESS
TIME	ISZ 5, TIME	TIME DELAY
	ISZ 4, NEXT	READ NEXT DIGIT.

FIG 4. PROGRAM INSTRUCTIONS FOR FLOWCHART OF FIG 3.

SYSTEM FOR EIGHT BIT MACHINES

When interfacing to an 8 bit processor the 8 bit bus is taken up with the 4 BCD data bits, 3 digit strobes and the EOC signal. The hardware circuit is again that shown in figure 1.

This data interface requires the computer to occasionally interrogate the input port to determine if EOC is low, ie. is the number less than 80 hexadecimal? When the answer to this question is "yes" the machine successively looks for D1, D2 and D3 times by comparing the input word with the numbers 40H, 20H and 10H. As each time is detected the appropriate digit is written into memory. The basic flowchart for this system is shown in figure 5.

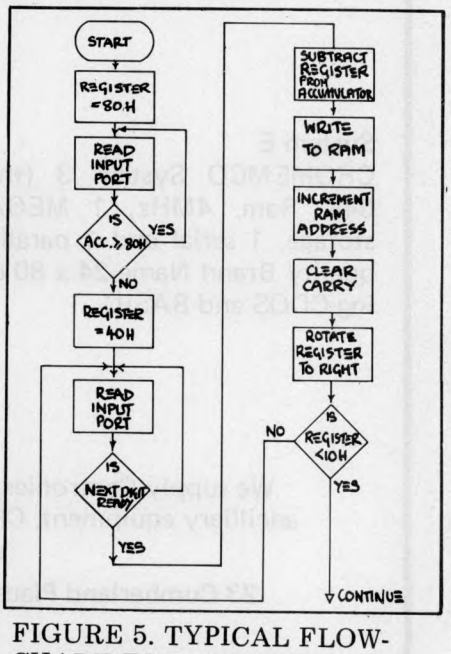


FIGURE 5. TYPICAL FLOWCHART FOR AN 8 BIT MACHINE PROGRAM

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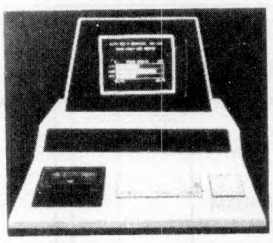

System B
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System C
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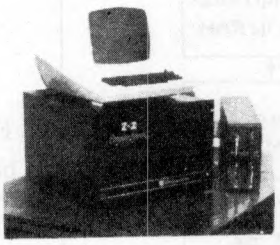

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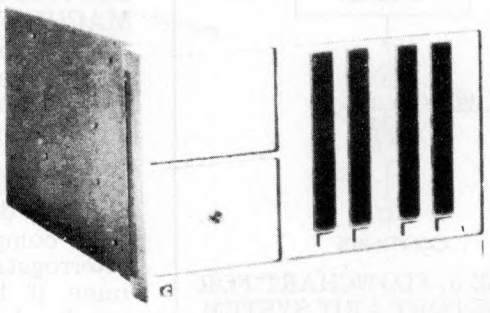

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Programs to accomplish this task will obviously vary from machine to machine and from application to application but typical ones for Intel 8080 and Motorola M6800 based computers are shown in figures 6 and 7 respectively. These, unlike the previous example in figure 4, have been operated successfully. The data storage format is shown in figure 8.

		DATA.							
LOCATION 1	D1	0	0	0	0	B3	B2	B1	B0
LOCATION 2	D2	0	0	0	0	B3	B2	B1	B0
LOCATION 3	D3	0	0	0	0	B3	B2	B1	B0

FIG 8. DATA STORAGE FORMAT FOR 8 BIT COMPUTERS

```
        MVI  B,40H      ;SET DIGIT POINTER TO D1
        LXI  H,DATA     ;DATA: IS BASE ADDRESS OF
                        ;LOCATION IN RAM WHERE D1,D2&D3
                        ;ARE TO BE STORED
READ:   IN   LD130P     ;READ INPUT PORT
        MOV  C,A        ;TEMP STORE INPUT
        ANI  0F0H       ;REMOVE LOWER 4 BITS IN A
        CMP  B          ;CHECK IF 'DATA VALID' BIT
        JNZ  READ       ;LOW & CORRECT DATA READ IN
        MOV  A,C        ;VALID INPUT RESTORED TO A
        SUB  B          ;MASK DIGIT POINTER
        MOV  M,A        ;STORE DATA IN RAM
        INX  H          ;INCREMENT RAM ADDRESS
        MOV  A,B        ;MOVE DIGIT POINTER TO A FOR
                        ;UPDATE
        RRC             ;UPDATE DIGIT POINTER
        MOV  B,A        ;RESTORE DIGIT POINTER TO REG B
        CPI  10H        ;CHECK STATUS OF DIGIT POINTER
        JNC  READ       ;JMP IF DIGIT POINTER = D2 OR D3
```

FIG 6. TYPICAL WORKING PROGRAM FOR AN 'INTEL 8080' BASED COMPUTER

```
0120-> B6  LDA A  FBC6   LOAD ACCUMULATOR 'A' WITH 'PIA' DATA
0123-> 2B  BMI     0120  BRANCH TO 0120 IF NEGATIVE ie. MSB = '1'
0125-> CE  LDX    #0083  LOAD INDEX REG. WITH MEMORY LOCATION
0128-> 86  LDA A  #40    LOAD ACCUMULATOR 'A' WITH 40H
012A-> B5  BIT A  FBC6   LOGICAL'AND''A' WITH 'PIA' (NO CHANGE TO ACC.)
012D-> 27  BEQ     012A  BRANCH TO 012A IF RESULT EQUAL TO 0
012F-> F6  LDA B  FBC6   LOAD ACCUMULATOR 'B' WITH 'PIA'
0132-> C4  AND B  #0F    'AND' 'B' WITH 00001111 PUT RESULT IN ACC 'B'
0134-> E7  STA B  00,X   STORE 'B' IN ADDRESS SHOWN IN INDEX REGISTER
0136-> 09  DEX           DECREMENT INDEX REGISTER
0137-> 44  LSR A         SHIFT RIGHT ACCUMULATOR 'A'
0138-> 81  CMP A  #08    COMPARE 'A' WITH 00001000
013A-> 26  BNE     012A  BRANCH TO 012A IF NOT EQUAL (MORE DIGITS TO GO)
013C-> 39  RTS           RETURN FROM SUB-ROUTINE
013D
```

FIG 7. TYPICAL WORKING PROGRAM FOR A 'MOTOROLA M6800' BASED COMPUTER

CONSTRUCTION

A converter such as has been described is not an expensive item and may be purchased as a ready built and tested device. However, many computer hobbyists have come up through the ranks of electronics and may thus prefer to make a small saving by purchasing individual components to carry out their own construction. A brief description is now given to assist this section of readers.

The best method of construction for this device is undoubtedly on a printed circuit board. Figure 9 shows a suitable layout. Correct orientation of all semiconductors and electrolytic capacitors is an absolute necessity and careful soldering will go a long way towards avoiding disappointing results. The pin of the E501 current regulator diode (CR1) denoted + is the one nearest to the flat on the body of the device. The LD130 should be connected via an 18 pin socket soldered into the board but must not be plugged in until all other components have been fitted to the board. Variable resistor (VR1) is a cermet track device, which, although slightly more expensive than a carbon track component, is vastly superior from a stability point of view and is recommended to achieve good results.

The board may be mounted either in its own case or in the computer mainframe and outputs from it may be direct wired or taken via any suitable multiway connector. Power supplies of ±5v are normally obtainable from the computer itself and may be taken to the converter board through the same connector as the data lines. It should be stressed that the lines connecting this device to a processor be kept as short as practical, as the outputs are unbuffered. Line drivers could be added if the converter is to be installed remotely from the computer. Output buffers may be necessary to drive certain types of bipolar input ports.

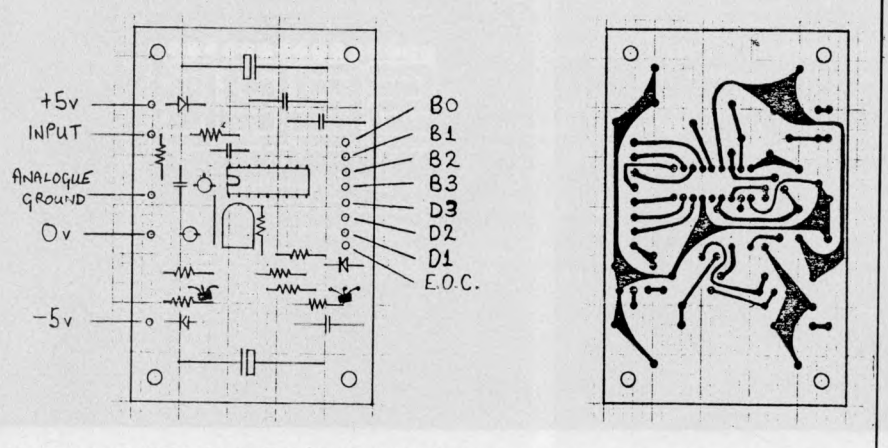


FIG 9. PRINTED CIRCUIT BOARD LAYOUT (BASIC CIRCUIT).

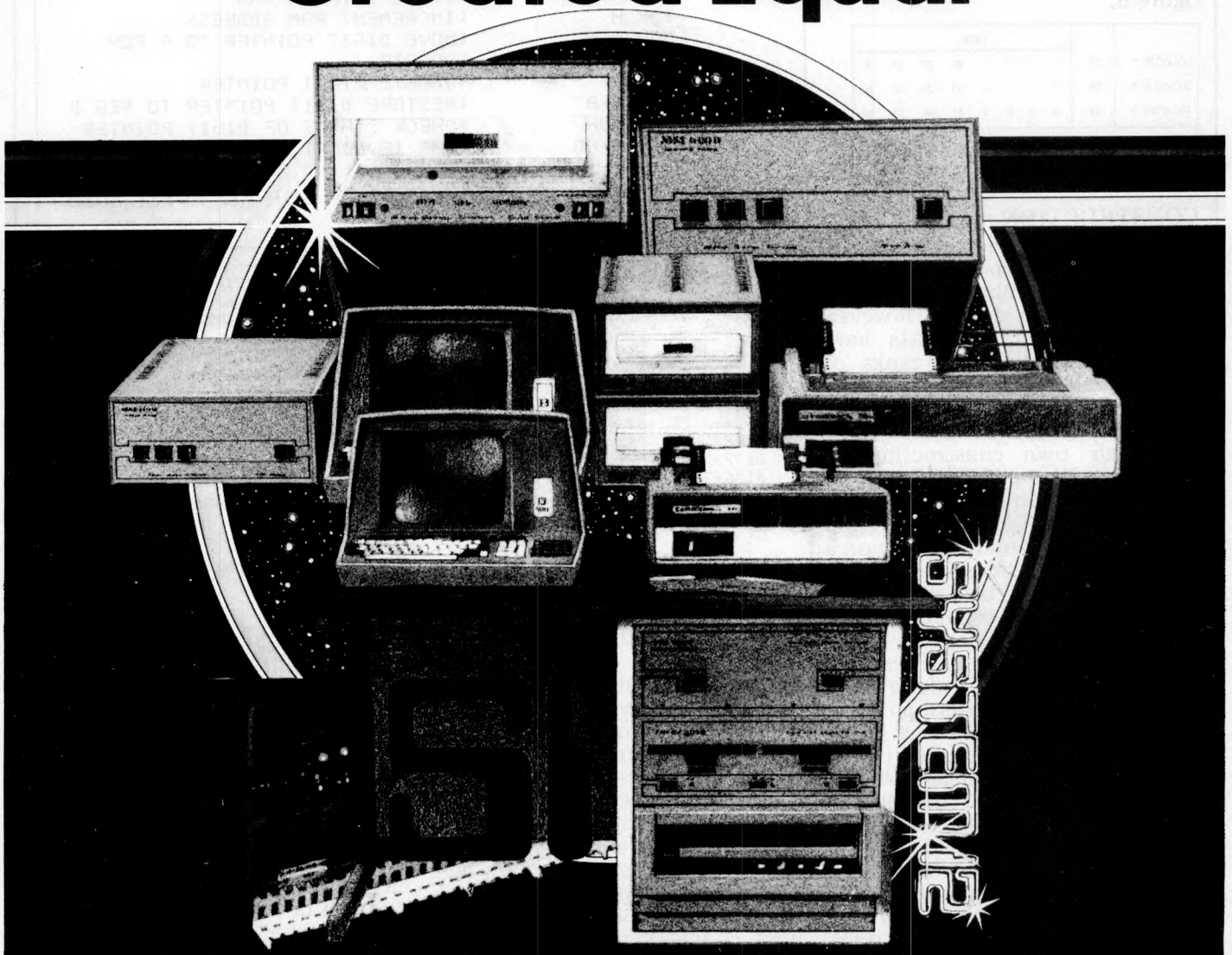
TYPICAL APPLICATIONS OF THE DEVICE

It was stated earlier in the article that the analogue full scale of this circuit is 1 volt — it is actually .999volt or 999mV. This is because the converter is a three digit device and the maximum digital output is therefore 999 (BCD). Furthermore this statement assumes that the reference voltage (Vref) on pin 2 of the LD130 has been suitably set by VR1. Variation of Vref will alter the analogue full scale although the maximum digital output will always be 999. The equation for the actual output count in terms of the input and reference voltages is given below.

$$\text{COUNT} = 2000 \frac{\text{Vin}}{\text{Vref}}$$

Proper application of the LD130 is dependent on this equation, which may be utilised to enable the converter to perform many types of measurement. Readers ingenuity will offer some ideas, which may be applied in a similar manner to the examples given below.

All Systems Are Not Created Equal



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1. POSITION DETECTOR

A simple application of the ratio measurement feature of the LD130 would be as an angular or linear position measuring instrument. The linear potentiometer and two resistors, shown in figure 10, are the only additional components needed for this measurement and serve to provide both the position to voltage conversion and the reference voltage. Output will be 0 to 99.9%. The voltage divisions from these resistors are applied to the equation below.

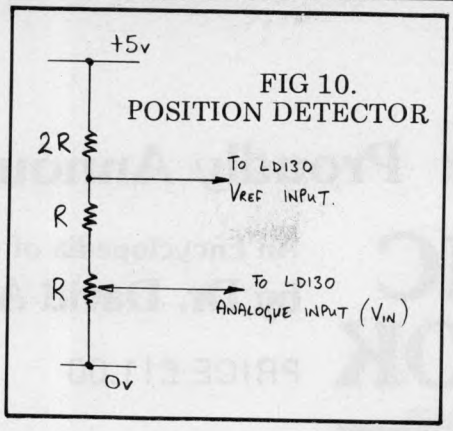

FIG 10. POSITION DETECTOR

$$Vref = +5 \times \frac{2R}{4R} \text{ volts} = 2.5 \text{ volts.}$$

$$Vin = +5 \times \frac{R}{4R} \text{ . (Pot Coefficient) volts.}$$

$$Count = 2000 \frac{\left(\frac{5R}{4R} \text{ Pot Coefficient}\right)}{\left(5 \times \frac{2R}{4R}\right)} = 1000 \text{ X Pot Coefficient}$$

Scaling to degrees, centimetres or any specific unit involves solving the equation for the appropriate divider resistors.

2. TEMPERATURE INDICATOR

A digital thermometer, reading in either degrees F or degrees C x 0.1, can be constructed by adding the circuit shown in figure 11 to the basic circuit. Figure 11 converts temperature to a voltage by using the temperature dependent forward voltage of a PN junction as the sensing element. The change in this voltage is typically −2.3mV/ Degree C at room temperature and can be suitably linear if the junction is biased with a constant current much greater than the reverse saturation current.

Since the diode will have a finite voltage at either a Celsius or Fahrenheit Zero this voltage component must be subtracted out. Figure 11 shows the temperature sensing diode (Base-Emitter of a 2N2222) biased with a 0 T.C. current regulator diode CR033). Zeroing is achieved by summing the currents from the CR033 and CR140 diodes at the wiper of a potentiometer.

The scaling for either degrees C or degrees F is achieved according to the equation.

$$\Delta Count = 2000 \frac{\Delta Vin}{Vref}$$

for $\Delta T = 100°C$ $\Delta Vin = -230mV$.

$\Delta T = 1000°F$ $\Delta Vin = -1.278V$

Thus Vref = 0.46V for °C

= 2.5V for °F.

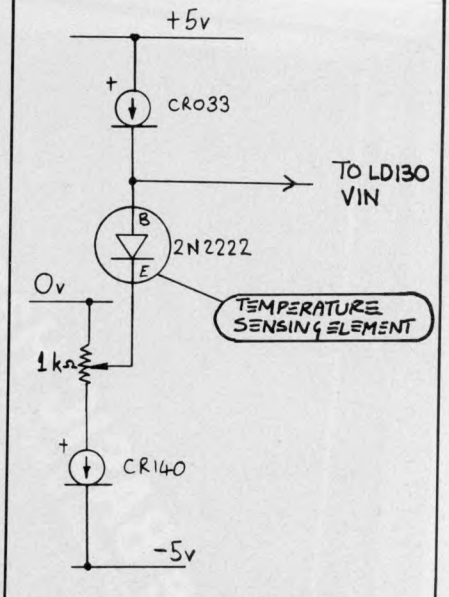

FIG 11. TEMPERATURE TO VOLTAGE CONVERTER.

From page 50.

There are no user settable flags, and no absolute addresses. All addressing must be labelled and only 10 labels are available.

For most people outside of research laboratories these limitations will be far outweighed by the low price, ease of use and fine portability.

No printer is offered yet, though perhaps one may be introduced later, operating through the cassette 1/0 port.

The calculator is supplied with a program library containing Engineering, Physics, Statistics, Finance, Maths and Surveying Routines plus some rather trivial games and a few bizarre music synthesis programs for recording kitsch tunes onto cassette! The instruction manual is, unfortunately, well down to the lowest Japanese standards and barely adequate to operate the calculator. A newcomer to programming would have difficulty learning from this wretched blurb. Please copy TI and Hewlett-Packard in this respect, Casio, the machine deserves better!

To sum up, Casio have produced an attractive and powerful instrument at a very keen price which should eat up the market for calculators just below the 'almost-a-micro' class.

In particular the FX-502P is an interesting comparison to the Texas 58 which is slightly more powerful but has volatile memories and no form of magnetic storage. If you regularly run long programs, the strength of your index finger could be the deciding factor.

A final speculation; if Casio combined this operating system with 1000 steps of user partitionable memory, 60 labels and a printer, then look out for fireworks at the top of the market.

(Thanks to Tempus of Cambridge for the loan of the test model Casio FX-501P.)

Price: The manufacturers recommended prices are as follows:

FX-501P	£84.95
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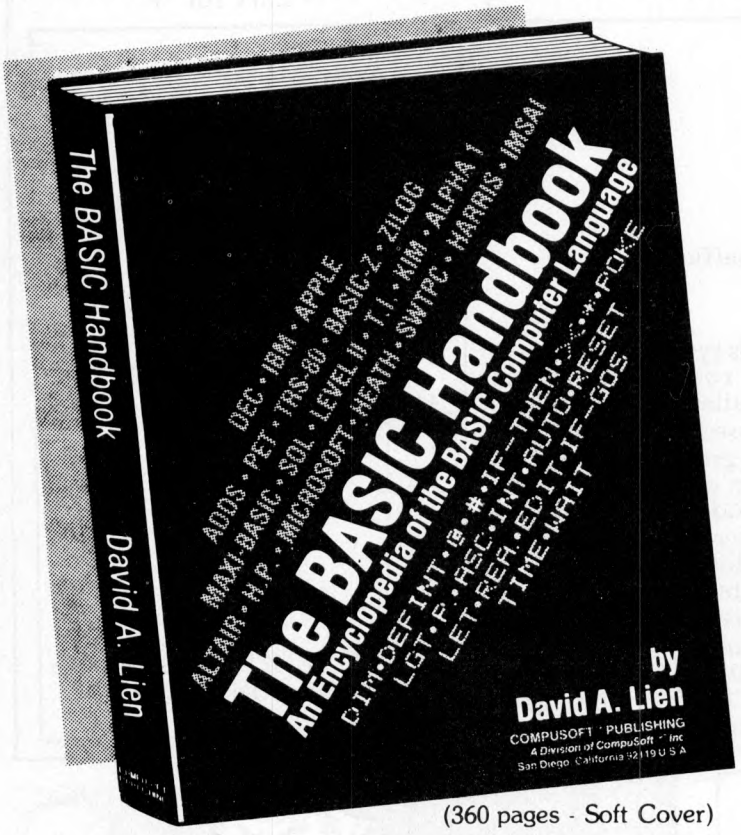

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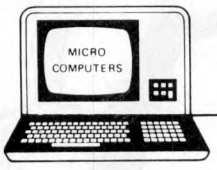

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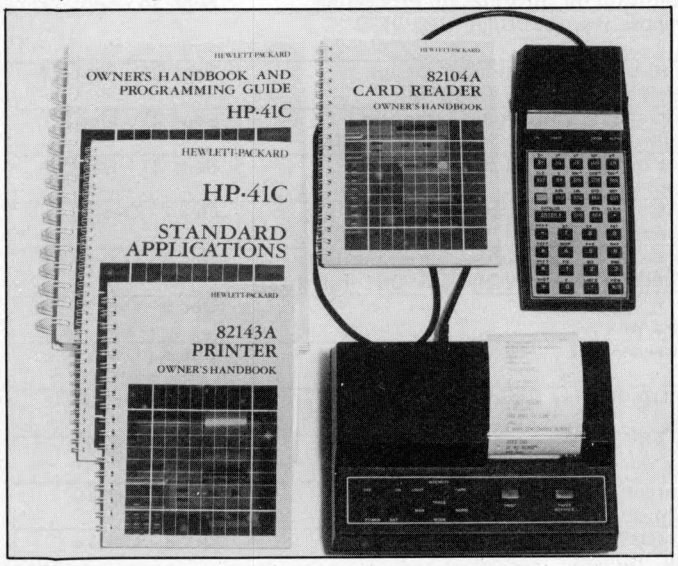
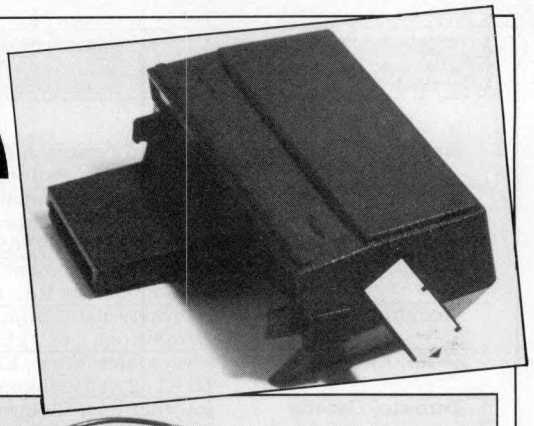
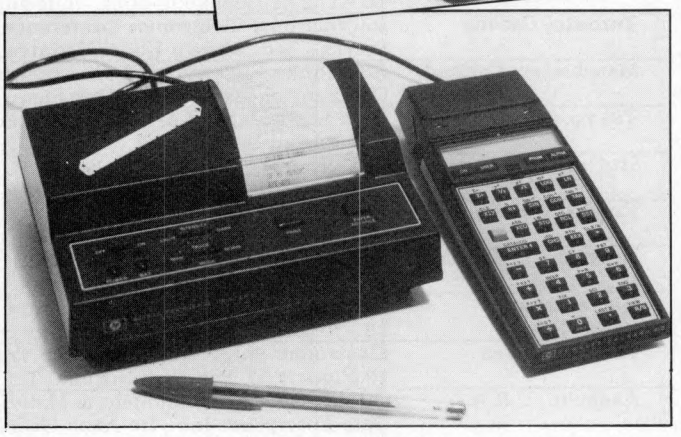
Osaka, Japan	Electronics Show. Japan Convention Bureau, 167 Regent St., London W1. Tel: 01-734 9638.	Oct 5 - Oct 10
Tai Pei, Taiwan	Electronics Show, China External Trade Development Council, 10 Floor, 201 Tun Hwa N Road, Tai Pei, Taiwan.	Oct 8 - Oct 14
Anaheim, U.S.A.	COMPUSIGN — Equipment & Materials for Computers Exhibition. Golden Gate Enterprises Inc., De Anzo Office Center, 1307 So. Mary Ave., Suite 210, Sunnyvale, CA 94087, U.S.A.	Oct 9 - Oct 11
Dortmund, W. Germany	ELEKTROTECHNIK — Electrotechnical Trade Exhibition. Westfalenhalle GmbH Ausstellungen, Rheinlanddamm 200, 4600 Dortmund, W. Germany.	Oct 10 - Oct 13
Berlin, W. Germany	BURO DATA — Office Equipment Exhibition, Westbourne Marketing Services Ltd., Crown House, Morden, Surrey. Tel: 01-540 1101.	Oct 10 - Oct 13
New York, U.S.A.	Information & Management Systems Exhibition, ECL 11 Manchester Square, London W1M 5AB. Tel: 01-486 1951.	Oct 15 - Oct 18
Zagreb, Yugoslavia	INTERBIRO EDUCA. — International Exhibition for Data Processing, Office Equipment, Teaching and Training Equipment, ECL, 11 Manchester Square, London W1M 5AB. Tel: 01-486 1951.	Oct 15 - Oct 20
Roseville, Australia	CETIA. — International Computers, Electrical Technology & Communications Exhibition, Convention & Exhibition Administration, PO Box 259, Roseville, NSW 2069, Australia	Oct 16 - Oct 19
Brimingham, England	International Business Show. BETA, 109 Kingsway, London WC2B 6PU; Tel: 01-405 6233	Oct 23 - Nov 1
Harrogate, England	Management Services & Equipment Exhibition. Peter Mirrington Exhibitions, 1 The Coppice, School Rd., Kelvedon Hatch, Brentwood, Essex CM15 6DL. Tel: 0277 74290.	Oct 25 - Oct 26
Frankfurt, W. Germany	Office Equipment Exhibition. Collins & Endress, 36 Sackville St., London W1X 1DB.	Oct 30 - Nov 2
London, England	Personal Computer World Show, Montbuild Exhibitions Ltd., 11 Manchester Square, London W1M 5AB. Tel: 01-486 1951.	Nov 1 - Nov 3
Los Angeles, U.S.A.	5th West Coast Computer Faire (tentative). Jim Warren, The Computer Faire, PO Box 1579, Palo Alto, CA 94302, U.S.A.	Nov 2 - Nov 4
Cardiff, Wales	BEX — Business Equipment Exhibition, Douglas Temple Studios Ltd., 1046 Old Christchurch Rd., Bournemouth, BH1 1LR, Hants. Tel: 0202 20533	Nov 5 - Nov 6
London, England	COMPEC — Computer Peripheral & Small Computer Systems, Iliffe Promotions Ltd., Dorset House, Stamford St., London SE1 9LU.	Nov 6 - Nov 8
Dublin, Ireland	ITRON — Irish Electronics Exhibition, SDL Exhibitions Ltd., 68 Fitzwilliam Sq., Dublin 2, Ireland. Tel: Dublin 763871.	Nov 6 - Nov 8
Helsinki, Finland	FENNTEC 79/ELKOM 79. — Electrical Technology & Professional Electronics Fair. ECL Ltd., 11 Manchester Sq., London W1M 5AB Tel: 01-486 1951.	Nov 6 - Nov 10
Munich, W. Germany	PRODUCTRONICA — International Exhibition for Electronics Production, ECL Ltd., 11 Manchester Square, London W1M 5AB. Tel: 01-486 1951.	Nov 6 - Nov 10
Hamburg, W. Germany	Office Equipment Exhibition, Hamburg Fairs & Congress Co., 238 High Street, Poole, Dorset BH15 1DY. Tel: 02013 4450.	Nov 13 - Nov 17
Madrid, Spain	SIMO — International Office Equipment & Computers Exhibition, CITEMA, Plaza de Conde de Valle Suchil 8, Madrid 15, Spain.	Nov 15 - Nov 23
Manchester, England	Minicomputers, Word Processors & Copying Machines Exhibition. Groundrule Exhibition Co., 7 Market St., Altrincham, Cheshire, WA14 2QW. Tel: 061-928 2227.	Nov 20 - Nov 21
London, England	Electronics '79 Show. Industrial & Trade Fairs Ltd., Radcliffe House, Blenheim Court, Solihull B91 2BG. Tel: 021-705 6707.	Nov 20 - Nov 23
Brussels, Belgium	International Electronics Exhibition, Brussels International Trade Fair, Palais du Centenaire, Parc des Expositions, B-1020 Brussels, Belgium.	Nov 26 - Dec 1
Tokyo, Japan	Semicon Japan, Golden Gate Enterprises Inc., De Anza Office Center, 1307, So. Mary Ave., Suite 210, Sunnyvale, CA 94087, U.S.A.	Nov 28 - Nov 30
Bucharest, W. Germany	SYSTEM TECHNIK — International Electronics Exhibition & Trade Fair, Glahe International GmbH & Co., Herler Strasse 91-109. PO Box 800349, D-400 Cologne 80, W. Germany.	Dec 3 - Dec 8
London, England	Breadboard Exhibition (Home Electronics). Trident International Exhibitions Ltd., 23a Plymouth Rd., Tavistock, Devon, PL19 8AU. Tel: 0822 4671.	Dec 4 - Dec 8
Birmingham, England	TV MEX — Montbuild Ltd., 11 Manchester Sq. London W1M 5AB. Tel: 01-486 1951.	Jan 15 - Jan 17

CHECKOUT

Below: Basic machine, printer and literature, Far Right: HP-41c Card Reader.







HEWLETT-PACKARD-41C

Of course, micros are quite different to programmable calculators, aren't they? They're. . .well, how could *you* describe a micro's unique features? Perhaps something like this:

- Memory is addressable
- Alphabetic and numeric data can be handled with equal ease
- Memory allocation between data and programs is under user control
- Input/output devices may be attached
- Programs are simple to write
- Operation may be directed by a series of prompts

Guess what? — the HP-41C, Hewlett-Packard's 'hand held' *calculator*, has all of these facilities!

Memory

This is divided into registers, each of which can hold a numeric value up to $9.999999999 \times 10^{99}$ or 6 alphabetic characters.

The basic machine comes with 63 registers and it's possible to add a further 4 memory modules, each containing 64. If you're feeling lazy this gives a total of 319. Each register can be individually addressed and the user can dynamically allocate memory between data and instructions.

Input/output

The HP-41C comes with 4 I/O ports. Hewlett-Packard already have a number of neat peripherals which clip together nicely. They include the following:

- A magnetic card reader. Each card contains 32 registers of data or program.
- A thermal printer which has a print width of 24 characters, each of which can be numeric, upper or lower case alphabetic or a 7 x 7 point graphic matrix. It also has an extremely useful automatic trace facility.
- A set of standard application modules covering areas like: business, mathematics, engineering and finance. . .each of which can contain up to 4000 program steps.

An optical bar code reader will be available early in the new year.

Programming

Programming is very simple — the user selects program mode and then enters the steps that would be taken manually. These are automatically stored in program registers. Any number of programs can be in store at the same time, the limiting factor being memory size.

Logical comparisons, labelling and GO TO are available as standard. Each program can be named and user prompts can be built in as required. These will appear on the calculator display and on the printer, if attached. If the prompt exceeds the display capacity (12 characters — Liquid Crystal) it will automatically 'scroll' from right to left to give a maximum message of 24 characters.

Operating

One of the nicest facilities of the machine is its user mode. The HP-41C has only 35 function keys, although it has 130 functions available. User mode allows the user to define which of these functions he would like assigned to each key. This facility can also be used to allocate a *program* to a key. This means, in order to run a particular named program, all the user need do is touch one key!

Dimensions/Prices

Basic HP-41C (includes batteries): £185 — 3" x 5½" x 1¼"
Memory Expansion Module: £28.95 — Flush fit *into* an I/O port.
Card Reader: £125 — 3" x 2" x 1¼"
Printer (includes PSU): £225 — 6¾" x 5" x 2½"
Application Modules: £28.95 — As memory expansion
All prices include V.A.T.

Conclusion

Well, if you agreed with the earlier definition of a microcomputer, it's hard to see how The HP-41C doesn't qualify! Maybe the limited display and the assembler-like programming will give micros a little extra lease of life — *but for how long?*

PETSOFT PROGRAMMERS TOOLKIT

Would you like to have ten new commands at your disposal on your PET? The Programmers Toolkit is a new PET add on from Palo Alto ICs (distributed in the UK by Petsoft) which gives you just that.

The Kit is a machine code program in 2K of ROM on a card which, on old PETs (like ours!), plugs into the memory expansion port and the 2nd cassette port.

Installation took us 5 minutes using only grubby fingers. Of course, as long as the Toolkit is in place you can't use a memory expansion board or a 2nd cassette unit. What do you get for your money? Ten commands which facilitate program entry and debugging. Punch in the code SYS 45056 and the Toolkit is on as long as the PET is under power. The following new commands are now available:

AUTO n,m — This command, followed by a pair of numbers (eg. 50, 10), provides automatic line numbers starting at any chosen point (50 in this case) and increasing in any chosen intervals (here 10). This facility works very well indeed. After hitting 'Return', up pops the next number.

Two RETURNS cancel the feature allowing RUN or manual insertion of lines, but when you recall AUTO you will find the line numbers continue where you left off. The start and interval will be remembered until either you change them or the PET is switched off. AUTO without following numbers will assume 100, 10. Not perhaps an essential command but a real luxury.

RENUMBER n,m — This command changes all line numbers to a chosen first number and interval. If no n and m are entered RENUMBER, like AUTO, assumes you mean 100, 10. Destinations of jumps and subroutine calls are changed to their proper new line numbers and any unreferenced destinations in an incomplete program will be assigned no. 63999, which can be changed later. A tremendously useful feature this one. Old programs may be used as subroutines or merged with new programs in seconds rather than hours.

One limitation of RENUMBER is that it won't find line numbers included in quoted strings or in REM statements; these you must go back and change manually.

APPEND "PROGRAM NAME" — This command takes a program saved on tape and appends it (ie. tacks it on) to the end of the program in PET memory. This it does regardless of line numbers; it places material at the end of an existing program without overwriting it or interleaving in numerical order (and no amount of LISTing will interleave the lines). If the line numbers of the APPENDed material are not higher than those of the main program, the apparent contradiction is easily resolved by RENUMBERing which puts the new numbers in proper order. By using both these commands, any program may be taken from cassette and used as a subroutine in a new program. Also, programs

CHECKOUT

may be built up piecemeal from previously fabricated parts. APPEND behaves just like LOAD, searching for a taped program by name and announcing FOUND, APPENDING, READY.

DELETE — This works exactly like LIST but removes the lines rather than displaying them. So DELETE 100 - 253 removes all the lines from 100 to 253. It's useful for removing large chunks of program, but not worth the trouble for single lines. As a safety feature DELETE, without any line numbers does nothing, rather than wiping out the whole program!

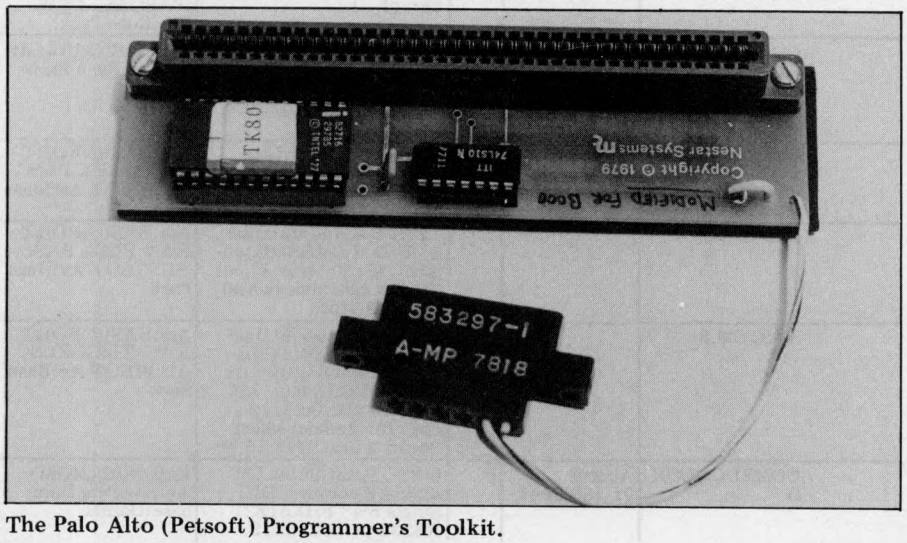
FIND — This is perhaps the most useful command of all; it revolutionises PET program editing. The command locates and lists all lines which contain a specified code, or fragment of code or a quoted string or part of such a string. So FIND ↑ would list every line containing ↑. FIND "A" would list lines containing "THAT" or "ABC" etc. Its only limitation is that FIND "something" will only look in quoted strings; it will not not find x = something outside of quotes. And conversely, FIND x will not look in quoted strings and so will not find a line with "x = 10". If you need to alter, say, a variable name in a large program, this command could save you hours of time and maybe even your sanity.

DUMP — This useful command prints the values of all variables in a program in the order in which they were defined. It will not DUMP array variables and it operates only when execution is at a halt. It's very useful in debugging, since dumped variables may be altered by the screen editor and then execution resumed.

HELP — When your program crashes and an error message is displayed, punch in this command; the line containing the error is listed and a non flashing "cursor" pinpoints the wrong code. HELP doesn't always work in this ideal way. Often the cursor is positioned over the character preceding the mistake. For some types of error the cursor remains at the end of the line or is absent; for a few types of error, HELP will not display anything. Nevertheless, for common errors such as syntax, FOR without NEXT, and the like, HELP pinpoints the problem very effectively. Even if the cursor is not positioned exactly over the source of the error, the line itself is usually enough to tell you what's up.

STEP, TRACE and OFF complete the list. TRACE displays the changing line numbers of a running program in a reverse field window at the top right of the screen. STEP does the same but executes one line at a time; pressing SHIFT advances to the next step. OFF is necessary to get out of the TRACE or STEP mode and remove the window. TRACE slows down program execution very considerably which makes tracing a large program rather tedious. The use of TRACE, STEP and DUMP together adds a lot of debugging power to your elbow.

The Programmers Toolkit gives your PET ten well thought out and useful commands found only on far more expensive machines. It comes with an unusually good instruction document, which gives full explanations of the uses of the commands and a candid appraisal of their limitations and cases where they may fail. We think it's good value for money, especially if you own the "new" PET. In this case the £55 Toolkit chip pops into a spare ROM socket on the main board and becomes an integral part of the machine. For "old" PETs the cost is £75, the extra cost being the edge connector and additional circuits on the card.



The Palo Alto (Petsoft) Programmer's Toolkit.

IN STORE

BRITAIN'S MOST COMPREHENSIVE BUYER'S GUIDE FOR MICROCOMPUTERS

Compiled by Richard Olney of Heuristic Consultants

Month by month, every effort will be made to keep In Store *up-to-date and accurate. And that means PCW will always be happy to hear from its readers of any errors, and additions that seem worthy of inclusion.*

LIST OF ABBREVIATIONS

Ass *Assembler*
Av *Available*
B *BASIC*
Busn Pack *Business Package*
Cd *Card*
D/A *Digital to Analogue*
Ed *Editor*
Exp *Expandable*
Ext *Extensive*
F/D *Floppy Disc*
H/D *Hard Disc*
H *Hardware*
Index Seq *Indexed Sequential*
Int *Interface* **OR** *Introductory Manual*
Lim *Limited*
M.Ass *Macro Assembler*
Num pad *Numeric Pad*
Op Syst *Operating System*
OPT *Option*
Par Pt *Parallel Port*
Pers *Personal*
Prnt *Printer*
Pt *Port*
R/M *Rack Mounting*
S *Software*
S/A *Stand Alone*
Ser pt *Serial Port*
Tex Ed *Text Editor*
Text Pro *Text Processor*
Util *Utility*
Wd *Word length (in bits)*
W.Pro *Word Processor*

Name of Machine	Main Distributor & Phone No	No Dlrs	Hardware	Software	Doc	Price	Comments
ALPHA MICRO	Alpha Micro Systems UK Ltd. 01-930 1991	TBA	64K-16M RAM:WD16: Dual 8" F/D,1.2MB:6x Ser Pt:modular	Multi User Op Syst: BASIC:M.Ass:PAS CAL: Text Ed:Util Av: Busn Pack	Ext	£5700	Expandable to 1200 MB, 32 Terminal Syst. Average 10MB H/D syst costs £11000
APPLE II	Microsense 0442-63561	80+	16-48K RAM:6502:8I/O slots:15x18x5 OPT:single 5¼" F/D, 116K,£425: Cass £33:RS232 int £110 :16K RAM £110	Op Syst:BASIC AV :PASCAL:Games	S	£810	280x192 high resolution graphics. Integer BASIC in 6K ROM
ATTACHE	Moncoland 01-839 3661	5	48-64K RAM:8080:Dual 8" F/D,616K:1xser, 1x par pt:two units. OPT: 9",16x64 B/W VDU £250	Ex BASIC Av:FOR TRAN	S	£4381	Interfaces to Centronics 702 printer.
CHALLENGER	Mutek 0225 743289:Byte Shop 01-518 1414:CTS 0706 79332: MILLBANK 01-549 7262	5	4-8K RAM:6502:RS232 pt:15x16x4. OPT:Dual 5¼" F/D,160K £550	Op syst:BASIC: Games Av:ExBAS IC:Data Man:Lim Busn Pack.	S	£350	D/A conv. Colour capability. 8K Microsoft BASIC in ROM
CHALLENGER C3			32-56K RAM:6502,6800 Z-80:Dual 8" F/D,1.15 MB;2-16 ser pt:17x22x 12	OS65 U Op syst, Av: CP/M:BASIC:COBO L:FORTRAN:Data Man:Busn Pack	S+H	£2450	Also C3B & C3P H/D mods avail. 74MB about £10000
COMMA VO3	COMMA 0277 811131	N/A	32K RAM:LSI11:Dual 8" F/D,512K:4xser DLU 11S pt:Modular	Av:RP11 Op Syst (£750):BASIC:COB OL:FORTRAN:Lim Busn Pack	H	£4200	Many configs poss. Max 20 MB,H/D about £27000
COMPELEC SERIES	COMPELEC 01-636 1392		64K RAM:Z-80:Dual 8" F/D,512K:2xRS232, 1x par. pt.	CP/M;Ass:CBASIC: COBOL:FORTRAN :PASCAL. Av:W. Pro:Busn Pack.	S	£2400	Also with double dens F/D, 1MB £2900. 1K EPROM.
COMPUCORP 625	COMPU-CORP 01-952 7860	15	60K RAM:Z-80:Dual 5¼" F/D 700K:9",16x 80 B/W VDU:40cps prnt:RS232 pt:20x28x 10	Ass:BASIC:Util. Av :W.Pro:Busn Pack	B	£6000	Also avail 655 model with 315K F/D capacity & 12", 20x80 VDU £3750
COMP WORKSHOP SYSTEM 1	Comp Workshop 01-491 7507	N/A	32K RAM:6800:Dual 5¼" F/D 170K:9", 16x 64 B/W VDU:modular	Ass:BASIC:FORT RAN:FLEX:PASC AL:PILOT Av:Busn Pack	Ext	£1600	These systems are example configurations from a fully compatible modular range.
SYSTEM 2			128K RAM:6809:Dual 8" F/D, 1.2MB:3xintelligent 20x80 term:80 col, 125cps prnt:daisywheel Sprint 3 prnt..	Ass:BASIC:FORT RAN:FLEX PASC AL:PILOT Av:Busn Pack		£11000	
SYSTEM 3			768K RAM:6809:Dual 8" F/D, 1.2MB:64MB H/D:10xintelligent 20x 80 term:2x132col, 120 cps prnt:2x80col, 125 cps prnt:2xdaisywheel Sprint 3 prnt:Max 16 pt	Ass:BASIC:FORT RAN:FLEX:PASC AL:PILOT Av:Busn Pack		£36000	
COMPUCOLOR II	Abacus 01-580 8841	6	8-32K RAM:8080:13" 32x64 8 colour VDU: Single 5¼" F/D 51K: RS232 pt:18x15x13	ExBASIC (ROM) Av:Ass:Pers Database:Games	Int	£1058	16K Mod - £1134, 32K £1137 Maintenance & Programming manual available.

IN STORE

Name of Machine	Main Distributor & Phone No	No Dlrs	Hardware	Software	Doc	Price	Comments
CROMEMCO SYSTEM 2	Comart 0480 215005 Datron 0742 585490 Microcentre 031 225 2022	20	64K RAM:Z-80:Dual 5¼" F/D 180K,OPT: Dual 8" F/D 512K £1370:11MB H/D £3495:22MB H/D £5999	CDOS Av:BASIC: COBOL:FORTRAN (£55) Multi user BASIC	Ext	£1995	Expandable to multi user system for 2-7 users £3455-6400
CROMEMCO SYSTEM 3			32-64K RAM:Z-80:Dual 8" F/D 512K OPT:As above:Extra dual F/D £1200	CDOS Av:BASIC: COBOL:FORTRAN :Multi user BASIC	Ext	£2995 64K - £3293	
DIGITAL MICROSYST DSC-2	Modata 0892 39591		64K RAM:Z-80:Dual 8" F/D, 2.28MB:4xRS232 pt:EIA pt:17x21x7	CP/M:BASIC-E Av: CBASIC:COBOL: FORTRAN:PASCA L:CAP Busn Pack	H	£5395	Up to 6 additional F/D units possible.
DURANGO	Comp. Ancillaries 07843 6455	12	48K RAM:8085x3:Dual 5¼" F/D 1MB:9" 16x64 green VDU:132col, 165 cps prnt:Numeric pad. OPT:Add F/D £1753: Aux VDU £875	Op syst Av: DBASIC :Busn Pack	S	£7750	Can take up to 4 workstations. Fully integrated syst 15x30 x24
DYNABYTE DB8/1	Dynabyte UK/Europe Ltd 0723 65559	6	32-64K RAM:Z-80:S100 Bus:2xRS232, 1xpar pt: 20x18x7. OPT:Dual 8" F/D 1MB £2000	CP/M Av:BASIC:CO BOL:FORTRAN: PASCAL:W.Pro:Busn Pack	H	£1500	Expandable to multi user syst. Also DB8/2 with dual 5¼" F/D, 400K £3000.
EQUINOX 300	Equinox 01-739 2387	N/A	64-256K RAM:WD16: 2MB H/D:15" 24x80 B/W VDU:150cps prnt 6xser pt.	Op Syst:BASIC:COB OL:M.Ass:PASCAL: Text Pro:Multi User. Av:Busn Pack	S	£11750	Up to 1200MB stor-age poss. (4x300MB Calcomp Tridents)
EUROC	Eurocalc Ltd 01 405 3113	TBA	64K RAM:8080A:Dual 8" F/D, 1MB:15" 25x 80 B/W VDU:132col, 140cps, prnt.	CP/M:CBASIC:Ass: Util:Account Syst. Av:Busn Pack	S	£7995	1 Year maintenance & Stationery supply inc.
EXIDY SORCERER	Factor One 0736 66565	10	8-32K RAM:Z-80:RS 232, 1xpar pt:S100 connector:30x64 VDU I/O:OPT:Dual 5¼" F/D 630K £1200:12" 30x64 green VDU £240:S100 Chassis £210	Op Syst:ExBASIC (ROM) Av:W.Pro: Ed:Ass:Games	Int	£650 16K - £760 32K - £859	High resolution graph-ics capability.
IMF 5000	Equinox 01 739 2387	20	32-256K RAM:Z-80: Dual 5¼" F/D, 320K: 15" 24x80 B/W VDU: 150cps prnt:2xser, 1x par pt:18x24x3	CP/M:BASIC:COB OL:FORTRAN Av: PASCAL:W.Pro: CAP Busn Pack	S&H	48K, Desk top £5100	Also avail. IMF 8000 c/w dual 8" F/D, IMB £6500 desk top or S/A models
IMSAI VDP 42	Computer-mart 0603 615089 Corner Comp 01 784 1101	2	32-64K RAM: 8085: Dual 5¼" F/D 400K: 9" 24x80 B/W VDU: 1xser. 1xpar pt: 18x 27x12	IMDOS (CP/M comp) :Ass:ExBASIC:Util Av:CBASIC:COBOL FORTRAN.	H	£3900	Can support 8 add F/D drives. Also Avail VDP44 with 780K F/D £4400
IMSAI VDP 80			32-64K RAM:8085:Dual 8" F/D 1.2MB:12" 24x 80 B/W VDU:1xser 1x par pt:25x15x25	IMDOS:Ass:ExBAS IC:Util Av:CBASIC COBOL:FORTRAN: CAP Busn Pack	H	£6200	
ITT 2020	ITT 0268 3040	15	16-48K RAM:2020:15x 18x4 OPT:single 5¼" F/D 116K £425:Cass £33:60cps prnt £825 16K RAM £110:RS232 pt £110	Monitor:Ass:BASIC Dis Ass Av:Games	B	£867 32K - £916 48K - £995	High resolution graph-ics capability. Integer BASIC in 6K ROM.
LUXOR ABC 80	CCS Micro-sales 01-444 7739	TBA	16-40K RAM:Z-80A: Cass:12" 16x40 B/W VDU:4680 bus:IEEE 488, RS232 pt. OPT: Dual 5¼" F/D 160K (own DOS) £895	DOS:BASIC:Games Av:W.Pro:Database: Engineering + const-truction prog.	S	£790	Graphics Loudspeaker with 128 effects Viewdata compatible
MEGAMICRO	Bytronics 0252 726814	5	256K:8080A:Dual 8" F/D 1MB:12" 20x80 B/W VDU: 120cps prnt:2xser, 2xpar pt: OPT:prnt stand £100	CP/M:Util:Av:Busn Pack	H&B	£6080	
MICRONOVA	Digitus 01-636 0101	3	64-1128K RAM:N601: 10MB H/D (5fix, 5 rem): 12" 24x80 VDU:132col 60cps prnt:4xser, 1xpar pt	DOS:M.Ass:Util:text Ed:Index Seq:Debug: FORTRAN IV Av: BASIC:PASCAL:W. Pro:Busn Pack	Ext	£12000	Larger configs usual. Bus syst for multi user Also smaller syst poss. with F/D
MICROSTAR 45 PLUS	Data Efficiency 0442 57137	TBA	64K RAM:8085:Dual 8" F/D 1.2MB:3xser, RS232 pt:17x26x8	STARDOS:CP/M BASIC:COBOL:FO RTRAN:UPDATE (database). Av: Busn Pack	Ext	£4950	
NORTH STAR HORIZON	Comart 0480 215005 Comma 0277 811131 Equinox 01-739 2387	20	24-56K RAM:Z-80A: Dual 5¼" F/D 360K: 15", 24x80 B/W VDU 150cps prnt:2xser, 1x par pt.	DOS:BASIC Av: CP/M:COBOL:FOR TRAN:PASCAL: Busn Pack	Ext	£4650 for 48K	
PET 2001-8	Commodore 01 388 5702	150	8K RAM:6502:Cass:9" 25x40 VDU:IEEE488 (Non standard) pt. OPT Dual 5¼" F/D 353K £795:80col 93cps prnt £645:Exp to 32K RAM: £249	Op Syst:BASIC:Ass Av: FORTH:PILOT :GAMES	Int	£550	Graphics facility. BASIC in 8K ROM Also avail. dual 5¼" F/D 800K £995 + £30 for operating ROM

IN STORE

Name of Machine	Main Distributor & Phone No	No Dlrs	Hardware	Software	Doc	Price	Comments
PET 2001-16/32			16-32K RAM:6502:Cass: 9" 25x40 green VDU: IEEE488 (Non stnd) pt. OPT:Dual 5¼" F/D 353K £795:80col, 93cps prnt £645.	Op Syst:BASIC:Ass Av: FORTH:PILOT :Games	Int	£675 32K - £795	As above but disc op ROM inc.
POWERHOUSE II	Powerhouse Micros 0442 48422	TBA	16-32K RAM:Z-80A: 5" 27x96 B/W VDU: 1xser 1xpar pt:17x11x7 OPT:IEEE488 int £95 :cass £150 graphics cd £250	FDOS:BOS:BASIC Av:Games:commercial Pack:ExBASIC: (in 14K EPROM) £350	Int	£1650	
RAIR BLACK BOX	Rair 01-836 4663	N/A	32-64K RAM:8085:Dual 5¼" F/D 160K:2xRS232 pt 20x16x5 OPT:Dual 5¼" F/D 520K £1000	CP/M:BASIC:CQBOL:FORTRAN:M.Ass :Text Ed. Av:Busn Pack	H	£2300	16K RAM expansion £250
RESEARCH MACHINES 380-Z	Research Machines 0865 49791	N/A	16-56K RAM:Z-80A: Cass:RS232 pt:19x16x6 OPT:Dual 5¼" F/D 168K £895:Dual 8" F/D 1MB £1695 (fitted in machine)	Tiny BASIC:Games: Graphics Av:Ass. Ex BASIC:CBASIC:COBOL:FORTRAN: ALGOL:CP/M:Util	S	£1048 56K - £1654	Designed for education. High res graphics being developed.
SDS 100	Airamco 0294 57755	5	64K RAM:Z-80:Dual 8" F/D 1MB:12" 24x80 VDU:S100 Bus:RS232 pt:num pad	CP/M:Ass:ExBASIC Av:COBOL:FORTRAN:CAP Busn Pack	Ext	£4290	Facility for 8K PROM
SHARP MZ-80K	Sharp UK 01-571 2157	TBA	6K-34K RAM:Z-80:Cass: 10" 24x40 B/W VDU	BASIC:Ass. Av: Games	B	£520 - £740	Graphics. Loudspeaker. BASIC in 14K RAM
SMOKE SIGNAL CHIEFTAIN 1	Winrush Micro Des 069 24 5189	TBA	32-64K RAM:6800:Dual 5¼" F/D 160K:12" 24x 80 VDU: 112cps prnt: RS232C pt: OPT:16K RAM exp £500	DOS:BASIC. Av:DBASIC:RBASIC:Ass:FORTRAN:Util:Text Ed:Busn Pack	Ext	£3050	Also avail. Chieftain 3 with Dual 8" F/D 1MB £3950
SOLITAIRE/ WP	SOLITAIRE/ KPG 04252 71448	TBA	64K RAM:8085:Dual 5¼" F/D, 700K:14" VDU (with own cpu) 45cps prnt:CPU pt.	DOS:W.Pro. Av: BASIC	S	£6750	All Solitaire systems are compatible. Graphics on 11x13 dot matrix
SOLITAIRE/ BS200			64K RAM:8085:Dual 8" F/D 960K:14" VDU (with own cpu):45cps prnt:cpu pt.	DOS:BASIC:W.Pro Av:Specialised Busn Pack	S	£7950	As above.
SOLITAIRE/ HBS100			64K RAM:8085:10MB Fix H/D:14" VDU (with own cpu):200cps prnt: cpu pt. OPT:up to 40MB H/D	DOS:BASIC:W.Pro Av:Specialised Busn Pack	S	£9500	Up to 8 int term can be used. Also avail. HBS200 with 20-80 MB H/D
SORD M100 ACE	Dectrade 0602 861774	TBA	48K RAM:Z-80:Single 5¼" F/D 143K:12" 24x 64 colour VDU:RS232 pt OPT:single 5¼" F/D £300	Op Syst:BASIC	Int	£2650	With colour graphics. 8K ROM
SORD M223			64K RAM:Z-80:Single 5¼" F/D 350K:12" 24x 80 B/W VDU:S100 bus: RS232 pt. OPT:extra F/D £450	Op Syst:BASIC Av: CAP Busn Pack	Int	£3500	Other configs poss.
TANDY TRS 80 LEVEL 1	Tandy 021 556 6101	200	4-16K RAM:Z-80:Cass: 12" 16x64 B/W VDU	BASIC:Games Av: Ass	Int	£380	BASIC in 4K ROM. Upgradable to level 2.
TANDY TRS 80 LEVEL 2			4-48K RAM:Z-80:Cass 12" 16x64 B/W VDU: RS232 int:1xpar pt. OPT:single 5¼" F/D 78K £478 (Max 4)	BASIC:Games Av: M.Ass: FORTRAN Busn Pack	Int	£515 - £1005	16K machines inc numeric pad. 4-16K upgrade £120, without num pad £85.
TEI 208	Abacus 01-580 8841	5	32-60K RAM:8080/80 85:Dual 5¼" F/D 320K 9" 24x80 green VDU:3x ser, 3xpar pt:17x18x10. OPT:150cps prnt £1250	CP/M Av:BASIC: COBOL:FORTRAN PASCAL:ALGOL: Busn Pack.	H&S	£4400	
TEI 212			32-60K RAM:8080/80 85:Dual 8" F/D 1MB: 15" 24x80 green VDU: 3xser, 3xpar pt:17x20 x17 OPT:150cps prnt £1250	CP/M Av:BASIC: COBOL:FORTRAN PASCAL:ALGOL: Busn Pack	H&S	£5067	
VECTOR GRAPHICS MZ	Almarc 0602 248565	5	48K RAM:Z-80:Dual 5¼" F/D 630K:1xser, 2xpar pt:20x17x8	DOS:BASIC:Ass:Av: CP/M:CBASIC:COBOL:FORTRAN:PASCAL	Ext	£2300	4K PROM
VECTOR GRAPHICS SYSTEM B			48K RAM:Z-80:Dual 5¼" F/D 630K:12" 24x80 B/W VDU:1xser, 2xpar pt:20x17x8	DOS:BASIC:Ass:Av: CP/M:CBASIC:COBOL:FORTRAN:PASCAL	Ext	£2850	With graphics and numeric pad
ZILOG MCZ1/05	Micropower 0256 54121 Memec 084421 5471	N/A	64K RAM:Z-80:Dual 8" F/D 600K:RS232 pt.	RIO Op Syst:M.Ass: Util Text Ed. Av:BASIC:COBOL:FORTRAN:PASCAL:Busn Pack	H&S	£4200 - portable	Debug in 3K PROM Also avail as desk top unit or R/M model both £4800
ZILOG MC21/35			64K RAM:Z-80:10MB H/D (5 fix, 5 rem):RS 232 pt.	RIO Op Syst:M.Ass: Util:Text Ed. Av:BASIC:COBOL:FORTRAN:PASCAL:Busn Pack.	H&S	£12000	Int disc control with own Z-80
Z—PLUS	Rostronics 01-874 3665	TBA	32-64K RAM:Z-80:Dual 8" F/D 1MB:2xser, 2x par pt:10x29x11.	CP/M:Ass:Util. Av: BASIC:COBOL:FORTRAN:PASCAL: Database:Busn Pack.	H&S	£4000	

JAPAN MUSCLES INTO MICROS

UK'S FIRST-EVER LOOK AT THE SHARP MZ-80K

The first Japanese personal computer to arrive in the U.K. marketplace, the Sharp MZ-80K, will be publicly unveiled at the Birmingham International Business Show in the third week of October. Because of the Japanese reputation in other electronic fields, their arrival is being awaited with anticipation — or trepidation — depending on your point of view. In a field where being first is extremely important, it will be interesting to see if the Japanese can make up the year and a half lead of their competitors.

LAURENCE MYNOTT

When considering a machine that has been around for some time, the potential buyer is able to consult a wide variety of opinion as to its make-up and performance, as well as choose from an expanding range of hardware and software enhancements. On the other hand, early machines have all too often suffered marketing problems and design faults; if the Japanese can learn from these past mistakes, perhaps they'll be successful.

The Sharp MZ-80K (which is available in Japan as a hobby machine in kit form) is aimed directly at the largest personal computer market in the U.K. — the PET market. One of the problems that PET dealers have experienced is endless delays in the distribution of peripherals (eg. disc drives and printers). Sharp U.K. have decided to have peripherals and interfaces designed and produced in Britain (by 3D Digital Design and Development). The advantage of this is that they ought to become available more rapidly and be better tailored to the British market.

Unfortunately there will be no "goodies", specially made for MZ-80K, coming from America. Sharp manufacture the Z80 chip under licence and have an agreement with Zilog not to sell any Z80 product in the U.S.A.

HARDWARE

The Sharp MZ-80K looks quite attractive with its two-tone metal case (I saw a beige and red machine, but was told the production model would be beige and brown). It is a compact and very portable machine, weighing only 13Kg.

It's based on a Z80 CPU with a 4K Monitor System in ROM and from 20K to 48K RAM. Because the BASIC takes up 14K of the RAM, the minimum system is called 6K.

The cassette is a reasonably fast 1200 b.p.s. that uses normal audio cassettes; as standard there is a tape counter — extremely useful for locating individual programs.

The VDU is a 10 inch, black and white CRT (there are plans for colour) with a 40 characters by 25 lines or 80 by 50 pixel display.

There is a loud speaker that can be programmed as an output device (pitch and tempo) through both BASIC and machine code. The volume of this output can be controlled, as can the CRT tuning, by knobs located inside the box, directly under the CRT.

Sharp haven't learned from Commodore's experience with keyboards and have produced a non standard version. The keys are full size, but made of flat, hard plastic. As a result, they don't make as good a contact (both tactile and electrical) as standard keys; this is particularly apparent when touch typing. There is enough room on the front of the MZ-80K for a standard keyboard and I hope that Sharp can provide one in less time than it took Commodore (although to be fair, the problem is nowhere near as bad as it was on the PET).

There are 78 keys, all located in one block. The righthand side is reserved for graphics keys, while the rest is similar to a QWERTY keyboard, with additional graphics characters available on a shift key. The graphics are of the PET type, but far more extensive; they include sufficient anatomical features to enable a full face to be drawn. There are apparently 208 keyboard characters (including lower case) which can be accessed using two shift keys. (I say apparently" because you can access others by pressing "illegal" key combinations). Both Space and CR are double size keys on the bottom row. I would have preferred a separate graphics pad and the CR in its more traditional place. As it is, it's possible to hit CR for Space, or vice-versa.

SOFTWARE

The BASIC has to be loaded from cassette. Sharp's justification for this is. . .1) they keep improving the BASIC and hence don't want it in ROM, and 2) they want to give users the full 48K address space when using discs (I don't know why this Z80 can't access 64K yet). The BASIC takes about 1 minute 45 seconds to load after it has been found (25 seconds). If you have a bad BASIC tape (I had two BASIC tapes, one of which didn't always load) then it will take several minutes before you discover that the load is abortive.

A machine code utility is available on cassette. This uses some of the BASIC area, so before loading it, the monitor must be rebooted, otherwise you'll get an OVERLAY error message.

Turning to the BASIC, it can be seen from the Benchmarks that it is reasonably fast, and from the list of reserved words, that it is fairly standard. It *feels* like a typical "8K BASIC" with the addition of plotting and music instructions. I was told that some of the 14K was being reserved for future developments. The points I noticed particularly about it were:

1 LIST will list to and/or from a line number.

2 /P is for a line printer and /T is for tape.

3 There are two music instructions, MUSIC and TEMPO. Music to be played is placed in strings and executed whenever a MUSIC statement is reached. TEMPO increases or decreases the amount of time a note is played. People who understand music will have a lot of fun with this feature.

4 SET X,Y and RESET X,Y sets up a pixel in the 80 x 50 field add-

ressed by X and Y. SET lights up the pixel and RESET darkens it.
5 TI$ is a special string variable to hold the time.
6 Arrays can be dimensioned with a variable.
7 LIMIT is used to specify a memory limit for BASIC programs.
8 π is on the keyboard and can be used as a constant.
9 Variable names can be of any length.
10 The mathematical functions are exceptionally accurate.

There are only six error messages, and being sufficiently vague to cover all difficulties (eg. SYNTAX) they are not always very helpful.

I enjoyed using the screen editing — a feature that more expensive computers frequently cannot provide. I didn't have the opportunity to play with the monitor, but did have a demonstration of the machine code tape which contains a variety of useful commands for examining, writing, debugging, loading and storing machine code programs.

POTENTIAL USE

To judge a machine suitable for business and/or education use tends to imply that the necessary software is available. At the time of writing, there was very little . . . just games, machine code and BASIC.

One type of application that comes to mind when using the Sharp is process control. An error condition could be signalled aurally, thus eliminating the need for screen-watching during processing.

The games programs reminded me very much of the arcade or TV-type — they fully utilise both sound and animation. I got quite involved in 'stamp out' and worked hard to shoot down all my enemies before time ran out! The graphics characters are most suitable for this sort of thing.

EXPANDABILITY

Bearing in mind that, at the time of writing, there are still several weeks to go to the launch of this machine, I can only give you some idea of what *might* be available to the future Sharp owner. 3D, who say interfacing a Sharp is much simpler than interfacing a PET (and they handle both) are in the process of developing the following:

1 a serial interface
2 a parallel interface
3 a disc sub-system which will run CP/M and have up to four drives (any combination of mini and full size)
4 an interface to a Sharp cash register

The Sharp MZ-80K, attractive in its two-tone metal case.

IAN DOBBIE

5 A to D converter
6 D to A converter

Items 1, 2 and 3 are planned to be available at the launch, in which case any lack of current software will be unimportant (since the Sharp and CP/M sub-system should provide access to existing professional software). In consequence, the degree of success of the MZ-80K probably depends on the availability and pricing of item 3.

DOCUMENTATION

The English BASIC manual did not exist at the time I used the machine, but the Japanese version looked quite entertaining and thorough. As all the examples are in BASIC, it's even reasonably understandable. There is a BASIC primer (96 A4 pages illustrated with cartoons), a full listing of all the BASIC reserved words with examples and (I assume) definitions, a list and description of error messages, the MZ-80K character set, memory map, the bus, Z-80 instruction set, a glossary of computer terms and construction information.

I'm told that the translated, English version of the manual will be included in the purchase price of a machine. For the purposes of the test, I was also given a ten page summary of BASIC COMMANDS which should prove sufficient for someone who already knows the language.

PRICES

Model	Price (ex VAT)
6K	£520
10K	£540
18K	£620
22K	£640
34K	£740

The Sharp is slightly more expensive than the PET, throughout its range.

CONCLUSION

If, in November 1979, I want to

spend £600 on a personal computer, my choice will be between PET, TRS-80 and MZ-80K. Without question, the MZ-80K has the smartest packaging, the fastest BASIC and marginally better system software.

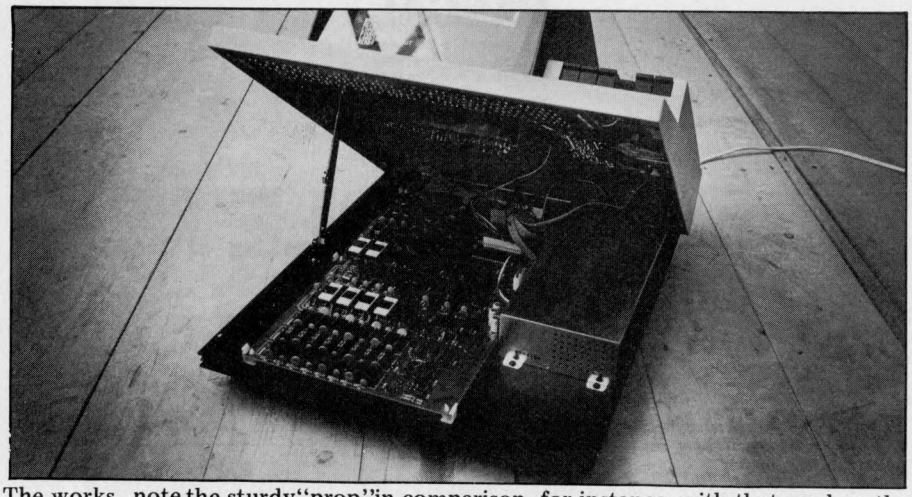
Sharp, in common with other micro manufacturers, require additional interface devices to drive peripherals such as printers, monitors, etc. These interfaces are being produced for Sharp by a British company who, incidentally, have further Sharp interfaces on the drawing board.

There are plenty of software packages available on cassette for the PET and TRS-80 whereas, if you buy the basic MZ-80K, only the games package is available at the moment. A British software house is currently developing business and home finance packages for Sharp, and these will be ready for the launch. This, of course, shouldn't stop you keying in (with slight modifications) begged, borrowed or stolen BASIC programs.

Disc users will be blessed with CP/M and therefore they'll have access to (almost) unlimited software. This, together with the interfacing arrangements, should enable Sharp to overcome the availability problems usually associated with a new machine launch.

At the time of writing, a country-wide dealer network is being set up. The plan is to have 15-20 dealers by the end of October. Further information is available from Paul Streeter of Sharp U.K. on 01-571 2157.

Finally, PCW would like to thank Sharp U.K. and 3D Digital Design and Development for their help in making possible this special, pre-launch, Benchtest.



IAN DOBBIE

The works...note the sturdy"prop"in comparison, for instance, with that used on the PET.

STOP PRESS

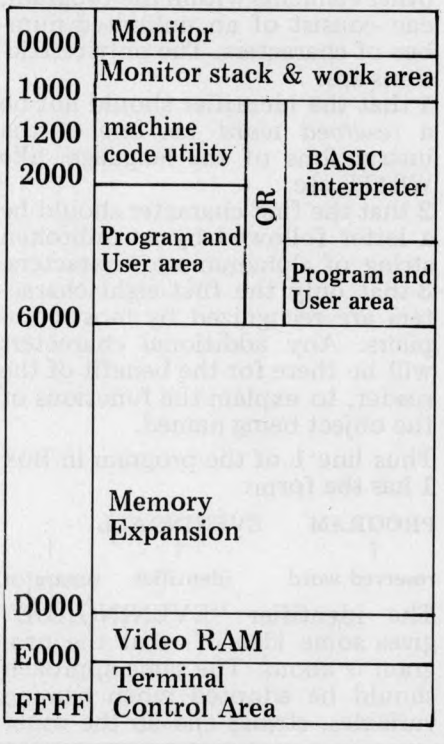
Latest news from Japan — Sharp are making plain paper and discharge printers, to become available in the near future.

AT A GLANCE

FIRST IMPRESSIONS	
Looks	****
Setting up	*****
Ease of use	***
HIGH LEVEL LANGUAGES	
BASIC	****
COBOL	Under development
FORTRAN	Under development
PASCAL	N/A
Other	Assembler due this December
System Software	CP/M (and all that implies)
PACKAGES	
Business	Some packages to be available at launch
Education	Under development
Home	Some packages to be available at launch
Games	****
PERFORMANCE	
Processor	****
Cassette	****
Discs	Available at launch
Bus	***
COMPATABILITY	
Hardware	***
Software	***
DOCUMENTATION	
Seems sufficient — no English version available until launch	
VALUE FOR MONEY	****

*****	excellent	**	fair
****	very good	*	poor
***	good		

Memory Map



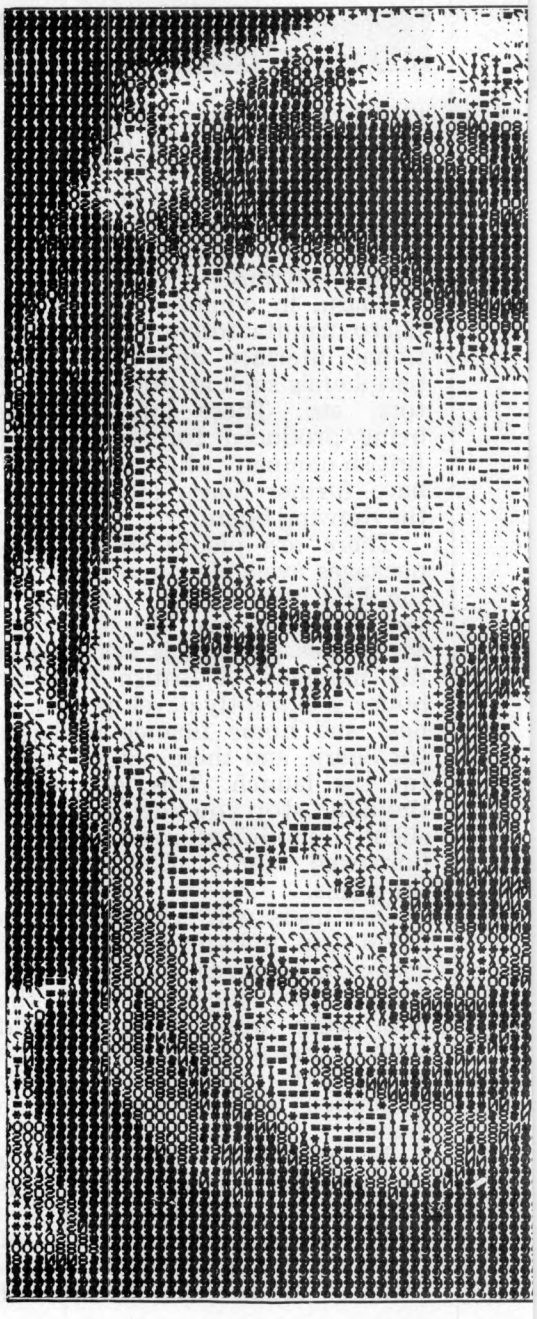
BASIC					
Statements:	GOTO	RESTORE	END	LIMIT	LIMIT MAX
	GOSUB	GET	REM	MUSIC	ON. .GOTO
	RETURN	PRINT	PEEK	TEMPO	ON. .GOSUB
	READ	PRINTP	POKE	SET	IF. .THEN
	DATA	STOP	USR	RESET	IF. .GOTO
	IF. .GOSUB		FOR. .NEXT. .STEP		
Commands:	LOAD	SAVE	VERIFY	CLR	RUN
	NEW	CONT	BYE	LIST	LIST/P
	PRINT	PRINT/P			
Mathematics:	ABS	SGN	INT	SIN	COS
	TAN	ATN	SQR	EXP	LOG
	LN	RND	DEF	FN	
String handling:	LEFT$	RIGHT$	MID$	LEN	ASC
	CHR$	VAL			
File handling:	WOPEN	ROPEN	CLOSE	INPUT/T	PRINT/T

Technical Data	
CPU:	Z80 2MHz
Memory:	20K-48K dynamic RAM
Keyboard:	78 keys
Screen:	10" B & W, 25 lines of 40 char. or 80 x 50 pixels
Cassette:	1200 b.p.s. audio
Disc drives:	Shugart-based, promised for October launch
Printer:	Serial and parallel interfaces will be available (see text)
Bus:	Sharp's Z80 bus
System Software:	Monitor SP-1002
Language:	14k BASIC, machine code

10 PART PASCAL SERIES

THE COMPLETE PASCAL

BY SUE EISENBACH AND CHRIS SADLER



CHAPTER 2 FUNDAMENTALS: ACTION AND DATA

The British Standards Institute (BSI) has produced a draft definition for a standard PASCAL language which the American National Standard Institute (ANSI) and the International Standards Organisation (ISO) are currently examining. Everyone is working to avoid the sort of situation BASIC finds itself in where a large number of the statements for one machine either won't execute or give total rubbish on another.

Niklaus Wirth, author of PASCAL, was very firm on the idea of standardization, and we shall use his book *PASCAL User Manual and Report* (Kathleen Jensen and Niklaus Wirth, Springer-Verlag) as the ultimate reference work for this series.

However, the team at the Institute for Information Systems at the University of California in San Diego, like most other compiler writers, could not resist 'improving' the language slightly for their version. Since this version is currently the most widely available on personal computers, we shall be pointing out the occasional differences between 'Wirth PASCAL' and 'UCSD PASCAL' as they arise.

In any case, until ISO and ANSI publish their final report, we don't know which of these will be closer to the ultimate PASCAL.

Every language (computer or human) has rules of grammar. However it is very difficult to achieve fluency just from a list of rules; examples bring individual points to life. On the other hand an example cannot illustrate all the possible applications of a new rule. In this series we will present sample programs to illustrate points and then, more formally, provide the rules so that the new constructions can be used in a variety of ways and checked for 'legality'.

Format of a program

A good programming language is one that can achieve an acceptable compromise between the following conflicting goals. First, it should provide the programmer with sufficient flexibility to allow programs to be written in a natural, logical way, and second, the programs should have a highly predictable structure so that the *compiler* (the program that translates the source program into a machine-code object program) can be fast and efficient.

In some languages, each statement must appear on its own line. This is equivalent to saying that the *statement separator* is ⟨CR⟩ ⟨LF⟩ (i.e. the code transmitted when you press RETURN). This limits the maximum length of a statement to some fixed amount (usually 80 characters); it also makes a program with lots of short statements very stilted and space-wasting. In PASCAL the statement separator is a semi-colon which allows several short statements to be compressed onto one line, or a single statement to overflow onto several lines. Even so, the compiler can still rapidly sort out one statement from another

It has become accepted that every language must include some means of documenting a program within the text itself. This provides the reader with additional explanations beyond the bare lines of essential code. In PASCAL the primary method of documentation comes about through the use of a very flexible naming convention. Every name (or identifier), whether it is the name of the program itself or that of one of the variables or other elements within the program, can consist of an unlimited number of characters. The only restrictions are:

1 that the identifier should not be a *reserved word* i.e. one of the instructions of the language, like WRITE etc.

2 that the first character should be a letter followed by an unbroken string of alphanumeric characters.

3 that only the first eight characters are recognized by most compilers. Any additional characters will be there for the benefit of the reader, to explain the functions of the object being named.

Thus line 1 of the program in Box 1 has the form:

```
PROGRAM    EVENINGALL    ;
   ↑           ↑          ↑
reserved word  identifier  separator
```

The identifier "EVENINGALL" gives some idea of what the program is about. The same approach should be adopted when naming variables, strings and all the other

program elements, although care should be exercised to ensure that the first eight characters are unique, for the sake of the compiler. For instance it would probably treat identifiers ACCOUNTSPAYABLE and ACCOUNTSRECEIVABLE as being identical.

The second method of documentation is the *comment*. In PASCAL this consists of a string of explanatory text enclosed by the character pairs (* and *) as shown on line 5 in Box 1. (* You can use [and] if you can find them on your keyboard *). When the compiler encounters the left-hand *delimiter*, "(*", it ignores everything until the right hand delimiter, so that the message contained therein is for the human reader only.

Good programmers always use a lot of documentation in their programs, whatever language they are writing in. However, in PASCAL they would probably concentrate their documentary efforts on the various identifiers chosen and use correspondingly fewer comments than they would include in (say) BASIC or FORTRAN, which have more restricted naming conventions.

The program in Box 1 illustrates the general format of a PASCAL program. The box is divided into three sections. Apart from the section containing the PASCAL code there is a section with line numbers down the left hand side.

```
 1 PROGRAM EVENINGALL ;
 2 BEGIN
 3   WRITE('HELLO') ;
 4   WRITE(' ', 'HELLO HELLO') ;
 5   WRITELN ; (*MOVES TO A NEW LINE*)
 6   WRITELN('AND WHAT DO WE HAVE HERE?')
 7   WRITELN('HELLO HELLO HELLO')
 8 END.
-----------------------------------
 9 HELLO HELLO HELLO
10 AND WHAT DO WE HAVE HERE?
11 HELLO HELLO HELLO
```

BOX 1 PROGRAM EVENINGALL

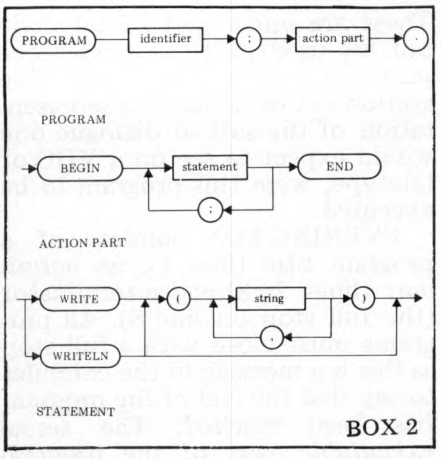
These are *not* a part of the code but are used purely for reference purposes within the text. The section below contains a representation of the sort of dialogue one would expect to see on a VDU or teletype, were this program to be executed.

EVENINGALL consists of a program title (line 1), an *action part* (lines 2—8) and a terminator (the full stop on line 8). All programs must close with a full stop as this is a message to the compiler to say that the end of the program has been reached. The actual *executable* part of the program stretches from line 3 to 7 and the results of execution appear on lines 9 to 11. The instruction WRITE causes whatever follows it in brackets to be output. WRITELN will have the same effect except that ⟨CR⟩ ⟨LF⟩ are appended to the end of the text. If there is no text after a WRITELN, the type head is simply moved to the beginning of the next line. Thus lines 3 to 5 in Box 1 have the same effect as line 7 (see lines 9 and 11). The brackets which enclose the output are 'output delimiters', while the single quotes surrounding each item are 'string delimiters'. In line 4 there are two output items separated by a comma.

The structure of the program and various subsections are illustrated, by means of syntax diagrams, in Box 2. These syntax diagrams show what a program looks like, *from the point of view of the compiler*, and as such are worth taking a bit of trouble over. If one knows how the compiler will view a program, then code can always be written which will *compile* even though it may still misbehave when it executes.

Look at the first diagram in Box 2. When the compiler encounters the word PROGRAM (a reserved word), it looks for a ";". Anything between these is the identifier or program name (provided it obeys the rules). Likewise, everything between the ";" and the "." is the action part which, looking at the second diagram, starts with the reserved word BEGIN and finishes with the reserved word END. Between these are *statements*, separated by ";"s and they are defined in the succeeding diagram. Check each statement from 3 to 7 in Box 1 against the definition of a statement in Box 2 to ensure that each one is 'legal' — this is exactly what the compiler has to do.

As this series proceeds, the elementary definitions will be expanded and enhanced to include all the PASCAL facilities. In the meantime, below are some rules for interpreting a syntax diagram. 1 Symbols in *circles* are PASCAL



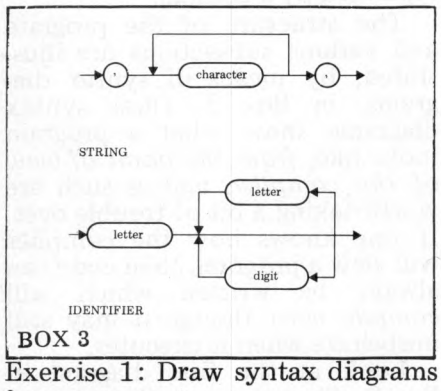
BOX 2

punctuation marks — ie. separators, delimiters and terminators etc.

2 *Sausages* contain either the reserved words (in capitals) or one of 'letter', 'digit' or 'character' — which includes anything on a keyboard.

3 *Rectangles* enclose names of elements which are defined in other diagrams (eg. 'action part' in the first diagram is defined in the second). They can be considered therefore as symbols for other complete diagrams.

In Box 3, two diagrams are presented to complete the set of definitions begun in Box 2 and stated earlier in the text.



BOX 3

Exercise 1: Draw syntax diagrams for a comment.

Programs that do things

Every part of PASCAL, each concept, method and programming trick, has its accompanying syntax diagram which, although perhaps acceptable for compilers, is rather heavy going for the potential PASCAL devotee. At the same time, nobody could be expected to stay satisfied with little Noddy-programs that simulate policemen. Therefore, pausing only to promise that in no future chapter will there be so many (or such complex) syntax diagrams, we proceed to develop more PASCAL features, widening the range of problems with programmable solutions.

Almost every program functions by obtaining some data (input), manipulating or processing this data and presenting its results (output). In PASCAL, this functional aspect of the program (the action part of the previous section) is separated from the more organisational task of deciding how the information is to be stored and used at each stage of the operation. These decisions must be made and announced in a 'declaration part' immediately before the action part is begun.

In program PAY, Box 4, lines 2 & 3 form the declaration part while lines 4 (ie. BEGIN) and onwards constitute the action part. Looking first at the action part, lines 5 & 6, together with line 14, show how a dialogue can be constructed within a program. WRITE outputs text but allows the response to be typed on the same line. READLN requires a ⟨CR⟩ to terminate the input. Finally, line 11 is a typical assignment statement. The values of the variables HOURS, RATE and OVERHOURS are arithmetically manipulated, together with the value 1.5 (from OVER), to produce a numeric value which is assigned to the variable WAGE. The *assignment operator* ":=" is used to emphasize that this activity occurs in the action part, and indicates that the contents of a memory location (referenced by WAGE) is to be altered. The final diagram in Box 6 defines all the new statements introduced in program PAY.

Although the action part of this program must seem straightforward for a BASIC programmer, the declaration part probably looks rather peculiar. At machine-code level, all data is represented by sequences of ones and zeroes at specific locations in memory. Higher level languages must provide a means of accessing and interpreting this data in a more readable form — numbers and characters, arrays and words. Generally, memory locations are accessed by means of variable names (or identifiers) and some languages use restrictions in the naming convention to help the compiler to interpret the data stored at the named location. So FORTRAN distinguishes between names for REALS and those used for INTEGERS, while BASIC has REALS and STRINGS (of characters).

These restrictions are inefficient in two ways — first, program readability is hindered and second, the programmer has to *force* his data into the rigid data types provided. Thus, in most versions of BASIC, a flag (taking values 1 or Ø) which need only occupy one bit will, in fact, occupy 32 bits in the guise of a REAL variable. In PASCAL, variable identifiers have no such restrictions so one function of the declaration part is to give the programmer the opportunity to name variables and state what type they are. So Box 4, line 3 reads:

```
VAR  HOURS, RATE, OVERHOURS, WAGE:   REAL
 ↑              ↑                     ↑
reserved word   identifiers           type
```

This enables the compiler to set up all the necesaary memory locations at one go (before starting on the action part). Clearly this is more efficient than the alternative, where memory allocation must occur in conjunction with other compilation activities.

Moving from efficient compilation to efficient execution, another PASCAL feature, the declared *constant*, comes into its own. When a computer executes an arithmetic assignment, all the relevant numbers have to be extracted (via the variable identifiers) from memory. Because this activity uses a significant fraction of the execution time required for the operation, the facility exists to incorporate actual values into an arithmetic statement. Hence PASCAL allows for the declaration of constants (line 2, Box 4). When the program is compiled, every occurence of the specified identifier (OVER) is replaced by the value indicated (1.5). No location in memory is associated with constant identifiers.

Constants can also be used in the more traditional way. For example line 11 in Box 4 could have '1.5' instead of 'OVER'. But if union negotiations managed to push up overtime rates to double-time, someone (imagine a larger

```
 1  PROGRAM PAY ;
 2  CONST OVER=1.5 ;
 3  VAR HOURS, RATE, OVERHOURS, WAGE:REAL ;
 4  BEGIN
 5    WRITE('NORMAL HOURS WORKED? ') ;
 6    READLN(HOURS) ;
 7    WRITE('RATE OF PAY? ') ;
 8    READLN(RATE) ;
 9    WRITE('OVERTIME HOURS— TYPE Ø IF NONE' ) ;
10    READLN(OVERHOURS) ;
11    WAGE:=HOURS*RATE + OVER*RATE*OVERHOURS ;
12    WRITE('WAGES=' , WAGE, 'POUNDS')
13  END.
-------------------------------------------
14  NORMAL HOURS WORKED? 4Ø
15  RATE OF PAY? 2
16  OVERTIME HOURS— TYPE Ø IF NONE 3
17  WAGES=89 POUNDS
```

BOX 4 PROGRAM PAY

```
 1  PROGRAM TEMPERATURECONVERSION ;
 2  CONST FREEZING=32 ;
 3        LINE='                                ' ;
 4  VAR CENTDEGREE, IFAHRENHEIT : INTEGER ;
 5      RFAHRENHEIT : REAL ;
 6  BEGIN
 7    WRITE('PLEASE TYPE IN A TEMPERATURE IN DEGREES CENTIGRADE:—') ;
 8    READLN(CENTDEGREE) ;
 9    RFAHRENHEIT:=CENTDEGREE*9/5 + FREEZING ;
10    IFAHRENHEIT:=CENTDEGREE*9 DIV 5 + FREEZING ;
11    WRITELN(LINE) ;
12    WRITELN(CENTDEGREE, ' C = ', RFAHRENHEIT, 'F OR APPROX ';
13              IFAHRENHEIT, ' F' ;
14    WRITELN(LINE)
15  END.
```

```
16  PLEASE TYPE IN A TEMPERATURE IN DEGREES CENTIGRADE:—21
17                 ----------
18  21 C = 69.8 F OR APPROX 69 F
19                 ----------
```

BOX 5 PROGRAM TEMPERATURECONVERSION

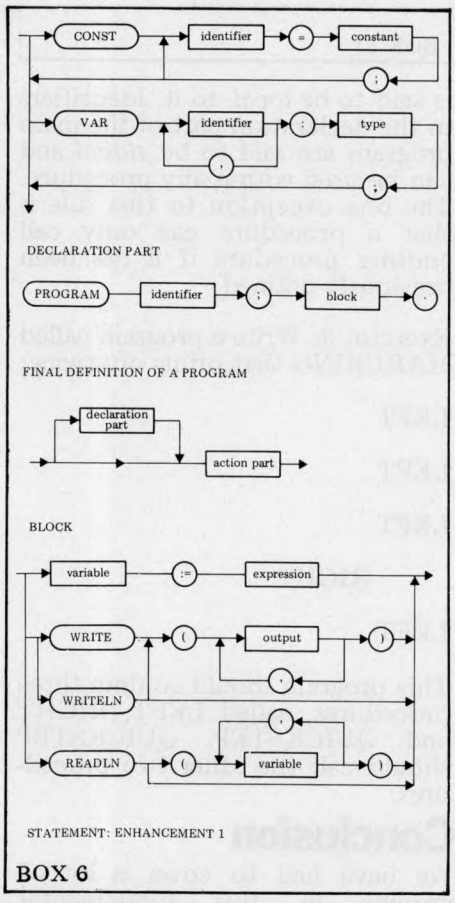
program with tax and NI calculations, etc) would have to look through the entire program to adjust it.

The role of the declaration part is therefore to allocate memory locations and to assign constant values for use by the action part. The first three diagrams in Box 6 cover the descriptions of the last few paragraphs. The third diagram in particular shows the exact format of constant and variable declarations. In Box 8 the words 'constant identifier' and 'variable identifier' occur. By these we mean a legal identifier that has been previously declared in a constant or variable declaration.

TEMPERATURECONVERSION in Box 5 contains a wider range of data types. On line 3 there is an example of a string constant. This facility will be familiar to most programmers. In line 4 CENTDEGREE and IFAHRENHEIT are declared as INTEGERS. This means that they can only take whole number values (and in machine terms take up less storage space than REALS).

If the left hand side of an assignment statement is a variable of type INTEGER, then all terms on the right hand side must also be INTEGERS. When adding, subtracting and multiplying two integers, the result will always be an integer. However, when dividing two integers the result may be a real. PASCAL provides two division operators. '/' (as in line 9, Box 5) is the division operator for reals and it always produces a real result. It can be used between integers but the result must be assigned to an identifier that has been declared as REAL. The operator DIV (as in line 10 in Box 5) is used between two integers when an integer result is required. Any fractional part is chopped off (that is truncation rather than rounding occurs). So 11/4 gives 2.75 while 11 DIV 4 gives 2.

The syntax diagrams in Box 7 and 8 deal with the fine points of PASCAL language grammar that



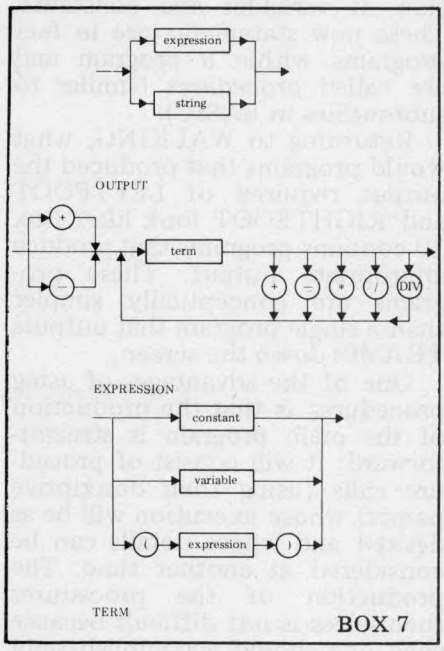
BOX 6

have been illustrated in programs PAY and TEMPERATURECONVERSION. Unfortunately the syntax diagrams fail to show that reals cannot be assigned to integers explicitly.

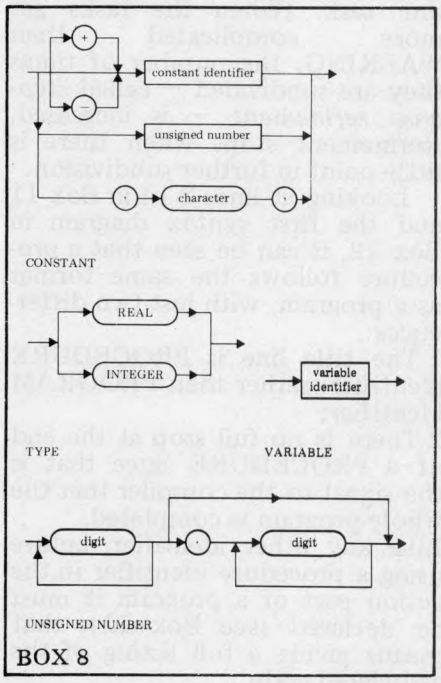
Exercise 2: Write a program called PAYPACKET that (like PAY) asks for hours worked, rate of pay and overtime hours and which displays as well as the wage, the number of five pound notes and one pound notes required to make up the wage packet. Use integer rather than real variables and an overtime rate of 2.

Refining a problem

Look at the action part in Box 9. Is it possible that Niklaus Wirth would have incorporated instructions for walking down a VDU screen? It's highly unlikely so the question arises, how do the statements LEFTFOOT and RIGHTFOOT produce the indicated output.



BOX 7



BOX 8

```
 1  PROGRAM WALKING ;

    DECLARATION PART

15  BEGIN
16    LEFTFOOT ; RIGHTFOOT ;
17    LEFTFOOT ; RIGHTFOOT ;
18    LEFTFOOT
19  END.
    ----------------------

20  TRAMP
21
22
23                TRAMP
24
25
26  TRAMP
27
28
29                TRAMP
30
31
32  TRAMP
```

BOX 9

PASCAL provides the facility to add new instructions for the duration of an individual program just as it allows for the introduction of variables and constants. These new statements are in fact programs within a program and are called *procedures* (similar to subroutines in BASIC).

Returning to WALKING, what would programs that produced the output required of LEFTFOOT and RIGHTFOOT look like? Box 10 contains programs that produce appropriate output. These programs are conceptually simpler than a single program that outputs TRAMPs down the screen.

One of the advantages of using procedures is that the production of the main program is straightforward: it will consist of procedure calls (using their descriptive names) whose execution will be as desired and whose details can be considered at another time. The production of the procedures themselves is not difficult because each one should accomplish only one task. (When the tasks get more complicated than WALKING, the number of times they are subdivided — called *stepwise refinement* — is increased. Refinement stops when there is little point in further subdivision.

Looking at lines 2-14 in Box 11 and the first syntax diagram in Box 12, it can be seen that a procedure follows the same format as a program, with just two differences:

1 The title line is PROCEDURE identifier; rather than PROGRAM identifier;

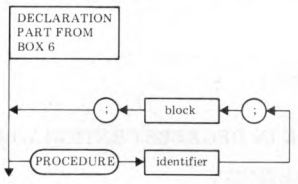
2 There is no full stop at the end of a PROCEDURE since that is the signal to the compiler that the whole program is completed.

Like any other identifier, before using a procedure identifier in the action part of a program it must be declared (see Box 11); that means giving a full listing of the associated code.

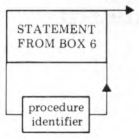
Since procedures are very much like programs they too can have declaration parts (see Box 9 line 9). And like whole programs, upon exit from a procedure, the items declared in it become available, because their memory locations are released. Any identifier declared within a procedure

```
 2  PROCEDURE LEFTFOOT ;
 3  BEGIN
 4    WRITELN('TRAMP') ;
 5    WRITELN ;
 6    WRITELN
 7  END ; (*LEFTFOOT*)
 8  PROCEDURE RIGHTFOOT ;
 9  CONST SPACE='      ';
10  BEGIN
11    WRITELN(SPACE, 'TRAMP') ;
12    WRITELN ;
13    WRITELN
14  END.; (*RIGHTFOOT*)
```

BOX 10 PROCEDURES



DECLARATION PART: ENHANCEMENT 1



STATEMENT: ENHANCEMENT 2

BOX 11

is said to be *local* to it. Identifiers in the declaration part of the main program are said to be *global* and can be used within any procedure. The one exception to this rule is that a procedure can only call another procedure if it has been previously defined.

Exercise 3: Write a program called MARCHING that prints out twice:

LEFT

LEFT

LEFT

RIGHT

LEFT

This program should contain three procedures, called LEFT, RIGHT and QUICKSTEP. QUICKSTEP should call the other two procedures.

Conclusion

We have had to cover a lot of ground in this fundamental section. Although future chapters may be concerned with more sophisticated ideas, there will never again be the need to absorb so much new material. Drawing all the various lines together, there emerge three significant points:

1 PASCAL is a language which gives flexibility to the programmer without interfering with the predictable format required for an efficient compiler.

2 The major means of achieving this in PASCAL is through the separation of a program into declaration and action parts.

3 Programmer control over the declaration part offers freedom of specification of both variable names and types as well as giving powerful operational procedures that enable the straightforward coding of (often repetitive) tasks.

Anyone looking over the program examples would be forgiven for wondering — why all the fuss over PASCAL flexibility and structure?. It is certainly true that small, simple programming tasks can be solved with fairly similar efficiency in any language. And each problem could have been solved with fewer lines of code, without constants, integers or procedures to produce the given output — even in PASCAL. It's in large programs that these features really come into their own.

In our next chapter we will look at another method for coding repetitive tasks — loops and, as well, we shall expand the range of data types that can be used in a program.

Some of the programs included in the text were tested on an Ithaca DPS/1. Thanks go to Alan Toffel of Codified Computer Systems.

Look up table

Chapter 2: JARGON

Compiler
Identifier
Syntax diagrams — Circles
— Sausages
— Rectangles
Punctuation — Separators
— Delimiters
— Terminators
Reserved Words
Variable — Type — Real
— Integer
Scope — Local
— Global
Constant
Statement
Block
Stepwise Refinement.

UCSD DEVIATION

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PASCAL Reserved Words
PROGRAM
BEGIN
END
WRITE
WRITELN
CONST
VAR
REAL
INTEGER
READLN
DIV
PROCEDURE

Exercise Summary
1 Syntax Diagram for comment line
2 Pay program with wages in bank notes
3 Marching

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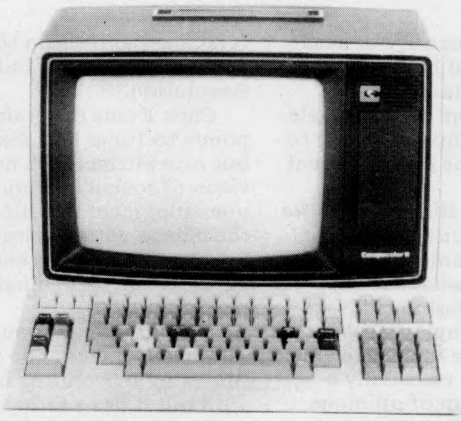

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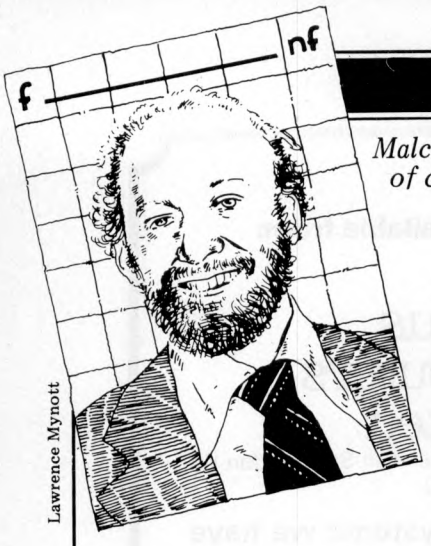
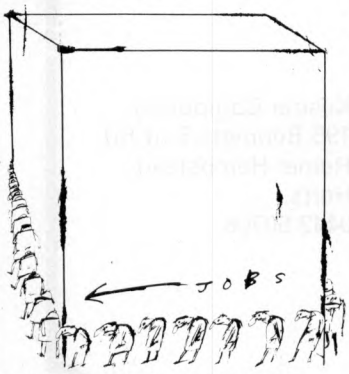


Lawrence Mynott

Malcolm Peltu has made his name writing and lecturing about the nature and impact of computer-related technologies.

Tomorrow the World



At the end of a mid-1930s film of H.G. Wells' *Things To Come*, a group of people watch Earth's first space ship going where no Man had gone before.

Is there no rest for Man from the unrelenting quest for knowledge, no peace until the entire universe is his, asks one character? No, replies another, there can be no rest because once Man has taken the first step down the path of knowledge and understanding, he must take all those that follow. The alternative is to do nothing, to live "with the insects in the dust".

It is with this challenging vision of Man's ceaseless drive towards new knowledge and the exploitation of that knowledge that *Dr Christopher Evans*, psychologist, computer scientist and technological populariser extraordinaire, concludes his optimistic and entertaining book, *The Mighty Micro (Gollancz, £5.50)*.

When opening the first British DIY computer show in 1977, Dr Evans said he believed the micro could represent the greatest ever liberation of human intelligence and ingenuity because it took computing power out of the hands of large corporations and into the homes and pockets of masses of individuals.

In *The Mighty Micro* he elaborates on this belief, taking it even further by suggesting that the micro could help to bring about the creation of Ultra Intelligence Machines (UIMs) which will be more "intelligent" than humans. He believes they'd open up whole new vistas of exciting adventures for both Man and machine.

A more pessimistic and, in the short-term at least, probably more realistic view of our micro-infested future is contained in *Automatic Unemployment* by *Colin Hines and Graham Searle (Earth Resources Research Ltd, 40 James St. London W1, £1.75)*.

Their pessimism is rooted primarily in their analysis of the possible patterns of employment and unemployment in the future, with microelectronics being a likely accelerator of the latter. Hines and Searle conclude. . . given the fact that the UK's rivals are likely to adopt micros as quickly — perhaps even more quickly — Britain is unlikely to improve its international trading position through the exploitation of the new technology.

Throughout the world they see low economic growth coupled with the working through of a "baby bulge" as pouring out an increasing number of young people onto the job market each year.

They suggest, "It is unlikely in the Western democracies that unemployment can continue to grow without an unidentifiable threshold level of joblessness being reached at which social disruption and unrest will threaten the stability of national economies." Then they quote an unusually vivid comment from an EEC official, "Everyone knows that youth unemployment is the biggest powder keg in European politics. What we are all wondering is how long is the safety fuse."

Earth Resources Research is associated with the environmental pressure group, Friends of the Earth, and Colin Hines first encountered the micro when he was investigating the problems of inner city decay, to see if new employment could be created in derelict warehouses, etc.

Like a spaceman stumbling into a black hole, Hines began to learn about the potential for micros in changing the nature and quantity of available work and he could see a deep, dark chasm of high unemployment making irrelevant his attempts at trying to patch up some of the current problems.

Last year Hines wrote *The Chips Are Down . . .* one of the first documents in the UK to highlight what has now become the fashionable subject of the employment impact of the "micro revolution". It was essentially a brief round-up of opinions and the few facts that had begun to emerge. *Automatic Unemployment* is a far more substantial work.

Its uniqueness lies not in any new information that it brings to light but the fact that it is attempting to draw together the work of the environmental movement, trade union concerns and technological change.

As a work of reference, it is an excellent summary of the actions, views and opinions which have surrounded the public debate over the impact of micros — with a few hundred references to assist in any further research.

Hines and Searle examine the general scale of the unemployment problem and methods of reducing it. In their most optimistic sections they explore ways of using the technology and of creating labour-intensive jobs in areas of accepted social need; their ideas include new forms of energy and medical aids. They look into the alternative plans for financing new employment put forward by Labour and the Tories and at ways of re-allocating available work through labour sharing and early retirement schemes.

Their concluding pessimism is based on a general view of slow worldwide economic growth, much of which has little to do with micros. They stress at the end of their report that they believe some of the measures they have analysed for creating new and socially desirable fields of employment, coupled with the implementation of work sharing schemes, could provide temporary relief, allowing "time for the formulation of policies appropriate to a longer term future in which our present attitudes to work and to management of the economy will have undergone a more fundamental revision than in any period since the Industrial Revolution."

Chris Evans raises similar points to Hines and Searle but overwhelms such negative views of socially disruptive unemployment resulting from the micros with a cascade of bright opportunities enamating from the technological revolution.

Dr. Evans' infectious enthusiasm makes *The Mighty Micro* an invigorating book to read but it has a serious flaw in the way it rather briefly and superficially dismisses some genuine fears about the social and employment aspects of micros and information technology. For example, he raises the question of the potential misuse of highly intelligent computers in invading personal privacy (by the police and security forces) under the heading "Bizarre issues"; elsewhere he brings up some of the possible objections to the progress of the micro revolution, and then quickly knocks them down again without ever really fleshing out the substance of the objections.

But then Dr Evans believes that there is no alternative but to aim for the "whole universe".

His idea for *The Mighty Micro* grew from a talk he gave in 1976 to a weekend conference organised by a British Computer Society group and Computer Weekly under the title "Can Computers save Britain?". As Ian Dury has said in a different context, that's another silly question.

But the response Dr Evans got from that meeting, one which was composed largely of hard-bitten people from the computer industry, made him think about developing his futuristic outlines into something more substantial.

The Mighty Micro — which may soon be transformed into a six-part TV series once the ITV industrial relations kerfuffle is eventually overcome — is the fruits of his efforts.

The book is like an inverted sandwich with bread in the middle and some juicy meat on the outsides. The bread in the centre, though wholemealy and tasty, is still essentially the staple "Tomorrow's World" diet. It explains the wide variety of potential applications of micros and related technologies, such as

computer assisted teaching, viewdata, medical aids, electronic funds transfer, etc, etc. For someone new to the subject there is no more readable description of these applications.

The meat on the outsides is much fresher. The book starts with an enjoyable look at the history of computing and contains some fascinating stories about the poeple who made the whole thing possible.

For example, there is the story about how King Kong nearly won the war for Germany. One of the pioneers of computing, Konrad Zuse, was in a stage production of the horror movie shortly before the war but the role of Kong, which he had wanted, was taken by an electronics engineer, Helmut Schreyer. Despite their theatrical rivalry, Zuse and Schreyer became friends and worked together in 1940 to put forward a proposal for the creating of an electronic code cracking machine which, but for Hitler's unwillingness, could have led to a fully electronic, general purpose computer.

Part 1 of *The Mighty Micro* is packed with relevant anecdotes and insights which bring to life what is often elsewhere presented as the dry history of computing. Dr Evans has conducted a series of taped interviews with some of the pioneers of computing — it is a sign of the youth of the technology that many of its pioneers are still alive. These tapes can be obtained from the Science Museum.

The last two parts of the book take us on a trip into the unexplored territory of artificial intelligence and other computer-related religions.

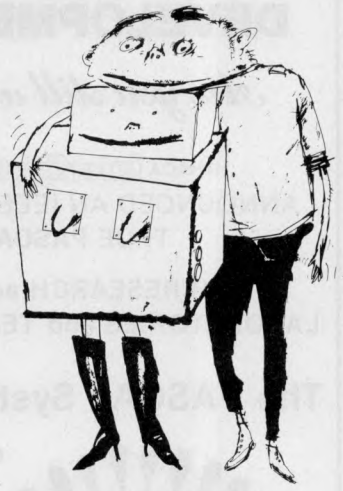
It is a fascinating journey with Dr Evans adopting a strong, partisan line on the side of the possibility that computers will grow from their current IQ level — which he puts at somewhere between that of a tapeworm and an earwig — into something greater than Man. He even holds out the vision of Ultra Intelligent Machines ruling the world and helping to advise Man against pursuing the futility of war.

He suggests that new religions might appear in the 80s and 90s in which computers appear either in a Satanic role, representing "evil technological forces", or as some kind of deity.

Although he is clearly a strong believer in machine intelligence potential, he provides a convincing argument, including analyses of the major objections, to show why it is just a matter of time before there are genuine "thinking" machines.

The Mighty Micro and *Automated Unemployment* are both books with strong editorial biases, and that's what makes them so invigorating and thought-provoking. They both, however, have enough objectivity to give the reader a fair idea of the cons to their pros, even if their arguments are heavily biased. Together they probably provide the best contemporary views of our Micro Things To Come.

Chips Robots etc.



The Boomtown Rat's hit "I Don't like Mondays' begins with the line, "Silicon chip inside her head."

Imagine silicon chips inside the minds and heads of many people; not just inert chips but chips that grow, expand, ooze because of experiments that lead to an electronic cancer which threatens to engulf the world in a silicon crystal mosaic of slimy evil.

That surrealistic image is the startling basis of *The Think Tank That Leaked (United Writers Publications, £5.20)*, the latest novel by Christopher Hodder-Williams, a science-fiction writer who has frequently concerned himself with the impact of computer technology.

The Think Tank expresses a revulsion and disgust with the dangerous potential of technological developments, culminating in a climax which touches subconscious pools of terror. The technological chance which leads to the electronic cancer are sufficiently unlikely and remote to remove these "living chips" from the realm of the Ultra Intelligent Machines discussed in realistic terms by Chris Evans in *The Might Micro* (see review on these pages).

The theme of Man creating machines and monsters which then threaten to destroy their creator is a common one in science fiction and is explored in a new paperback *Xanthe and the Robots by Sheila Macleod (Penguin 95p)*. Like *The Think Tank*, Sheila Macleod views the future with some alarm. Her tale, which has strong Freudian overtones, takes a familiar semi-satirical line about robots becoming too clever for their creators and therefore deciding to rule the world.

The Hodder-Williams book, however, is the one with the more disturbing and long lasting images because he breaks through the bounds of probability, into the depths of the subconscious. His belief is summarised in a quote by the book's hero, "Surely our real opponent is not the physical expression of technology gone wrong but the state of the technology itself, as an idea. Information processing became a rat-race and was bound to threaten civilisation in one form or another."

And he adds, "Our job is to remould the technology, take the power away from the military and the bureaucrats and re-invest it in people."

The book is best enjoyed at this level, regarding the technological mutations as the mutations of ideas, rather than getting too concerned with the mechanics of what is happening.

Despite its futuristic purpose, the book is laced with a strong period flavour of the days when Biggles reigned supreme. The hero and heroine get involved in some hair raising and improbable escapades, including a burning computer room, an out of control Jumbo and a dying-swan Concord. These encounters are of the "and in one bound he was free" cliff-hanger ilk and provide an anachronistic counter-point of relative light relief to the growing horror of chip virus — a disease spread by any human contact with someone infected by the dreaded crystal mosaics.

The leaking think tank, by the way, is not a reference to a group of incontinent Whitehall boffins but to an experiment which triggered the electronic cancer. A psychologist siphons off the "hate" emotion from patients into a computerised thought drain — and it is these hate thoughts which motivate the growing chips.

Xanthe and the Robot involves more conventional forms of psychological analysis. Its technological counterpoint, equivalent to the Think Tank's Biggles adventures, is a Woman's Own romance in which Xanthe's emotions are torn between Man and machine. At first it is the no-complications love with a sexless robot which attracts Xanthe, a research worker concerned with giving hearts and other human characteristics to the Philophrenics (these are upper class robots programmed with the brains of poets and philosophers — the main Robot is programmed with the "I think therefore I am" brain of Descartes.)

But in the end, true (human) love wins out and Xanthe and her love disappear off into the sunset to procreate in a countryside of human despair. Meanwhile, the Philophrenics rule the cities despite strikes by the working class robots, the Pragmapractors. The Philophrenics could be seen as examples of Ultra Intelligent Machines. In fact, they decide to take over because they are more "perfect" than the humans who made them.

Sheila Macleod, who incidentally is married to actor and singer Paul Jones, strives to mix psychological insights with social comment. But the style is heavy handed and the observations on the impact of technology, rather old hat.

Her belief is summed up by a quote from Thomas S. Szasz which is given at the beginning of the book: "Whereas primitive man personifies things (anthromorphism), modern man 'thingifies' persons. We call this machanomorphism: modern man tries to understand man as if 'it' were a machine,"

Set in a familiar sci-fi "post-catastrophe" world, Xanthe chooses the rough and tumble of humanity rather than suffer the soul-less robot society which begins to mirror the human divisions between the haves and the have-nots.

But if you want to explore the important consequences of Szasz's observation, *The Mighty Micro* offers a more considered and entertaining view, although it lacks the Freudian romance.

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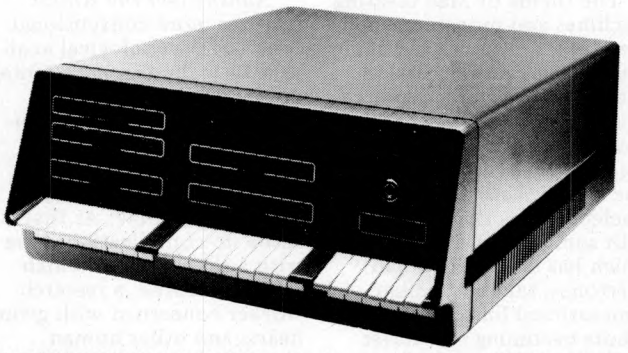

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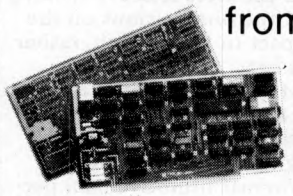

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ALTER-APPLE

Since writing my program for personalising Apple II DOS commands (Letters, August 1979), version 3.2 of the operating system has been released. There are significant differences between this and earlier versions: in particular the command table now starts at location 43140 (in a 48K system), and is 131 bytes long. A revised version of the personalisation program is shown below:

```
10  LOC=43140
20  FOR I=1 TO 28
30  READ CO$
40  IF LEN (CO$)=1 THEN
    85
50  FOR J=1 TO LEN (CO$)
    -1
60  POKE LOC,ASC(MID$
    (CO$,J,1) )
70  LOC=LOC+1
80  NEXT J
85  POKE LOC,ASC(RIGHT
    $(CO$,1))+128
90  LOC=LOC+1
100 NEXT I
110 END
120 DATA INIT,LOAD
    SAVE,RUN,CHAIN,DE
    LETE,LOCK
130 DATA UNLOCK,CLOSE,
    READ,EXEC,WRITE,
    POSITION
140 DATA OPEN,APPEND,
    RENAME,CATALOG,
    MON,NOMON
150 DATA PR#,IN#,MAXFI
    LES,FP,INT,BSAVE,
    BLOAD
160 DATA BRUN,VERIFY
```

S.J. Withers,
Coventry, Warks.

LIBRARY PLEA

We are beginning research into possible applications for microcomputers in special libraries and information units. First we would like to establish the exact 'state of the art' of such applications in this country. We are interested in contacting any librarian, information scientist, or anyone else, who is using or planning to use, a microcomputer in this field. If you could publish this letter it would help us tremendously.
R.P. Winfield, ASLIB Research and Development Department, 36 Bedford Row, London, WC1R 4JH (01-242 4264)

MEMORY PLUS

Will you please inform your readers of the following addition to my recent article, "The Memory Lingers On": Further development and analysis of this programmer has brought to light a problem when programming 2716s. This is caused by the 74121 mistriggering if used with a fast system clock, causing the monostable to produce pulses approximately 5ms long, instead of 50. To prevent this the program requires the addition of a short delay in the loop, and must be altered from line 0F41 (SC/MP code):

```
0F41  8F  08  DLY '08'
0F43  B8  DC
0F45  9C  F6
0F47  B8  D9
0F49  9C  DF
0F4B  C4  00
0F4D  07
0F4E  3F
```

The problem was only discovered when experimenting to speed up the circuit, and it has been found that reducing the monostable period to as low as 5ms still produces valid data in a 2708. I hope to bring you further details and a copier add-on (if the editor is kind enough) in a future issue.
John Stephenson,
Welling, kent.

BUZZ "OFF"?

In your list of buzzwords — August issue — you have defined the word Heuristics as: "Achieving a solution by deliberate trial and error."

May I inform you that in the first instance the word is Heuristic not Heuristics. Secondly, any classical scholar could inform you that Heuristic comes from heurisco meaning to discover — the past participle being eureka — and means enabling one to find out things for oneself eg. research.
N.D. Adenwalla
(Managing Director, Heuristic Consultants Ltd), London.
Pardon me for saying, but doesn't "finding out things for oneself" often involve a "solution by deliberate trial and error"? Ed.

WINNING STRATEGY

I wish I'd been as smart as the entrepreneur who disinterred Lewis Waterman's 1888 game, "Reversi" (see any edition of Hoyle previous to 1962), renamed it "Othello", repackaged it, and made his million in the first year.

My reason for writing is to comment that the commercial "Othello" programs derived from the article in BYTE magazine for October '77 play a very poor game. *I believe that a winning strategy exists and that I have discovered it.* I certainly have not been beaten by man, woman, child, or machine in the last few hundred games I have played. If any reader would care to test this claim for himself, he may have a one-page typed description of my method (*not* a program) by writing to me enclosing a cheque or international money order for £2.50 and an unstamped self-addressed envelope.
Francis T. Chambers,
Rock House, Ballycroy,
Westport, Co. Mayo, Ireland.

TOO BASIC?

I wonder if anyone will be bothered to use Dr. Samson's algorithm for QUICKSORT listed in his article (Personal Computer World, August, 1979)? To incorporate this into one's own program would require a great deal of effort including, possibly, renumbering of lines and the corresponding jumps and checking that there was no clash of variable names between the sorting routine and the main program.

The trouble is that BASIC conceals the essentially recursive nature of QUICKSORTS and a programming language which allows recursion produces a far simpler and more elegant program. I have been using a subset of PASCAL on an SWTP 6800 system. This is marketed by Lucidata of Oosteinde 223, Voorburg 2271 EG (ZH), Netherlands and the QUICKSORT procedure listed below was supplied by them as a demonstration program. The only global variable involved is the array called LIST and this might have to be edited into some other name to use it in a different program. Apart from that the procedure is totally portable. It will sort 100 integers in under four seconds.

```
PROCEDURE QUICKSORT
  (LOW,HIGH : INTEGER) ;
  (* RECURSIVE *)
VAR
  I,J,MID,SWOP : INTEGER;
BEGIN
  I:=LOW; J:=HIGH;
  MID:=LIST[(I+J) DIV 2];
  REPEAT
    WHILE LIST[I] < MID
    DO I:=I+1;
    WHILE LIST[J] > MID
    DO J:=J-1;
    IF I <= J THEN
    BEGIN
      SWOP:=LIST[I];
      LIST[I]:=LIST[J];
      LIST[J]:=SWOP;
      I:=I+1;
      J:=J-1;
    END;
  UNTIL I > J;
  IF LOW < J THEN QUICK
  SORT (LOW,J);
  IF I < HIGH THEN QUICK
  SORT (I,HIGH);
END;
```

It seems to me that to discuss algorithms of this kind using BASIC as a programming language does a dis-service to the art and the sooner you publish some articles illustrating the use of more appropriate programming languages the better for everybody.
P.J. Barker, Edinburgh.
We note your last remark — please see our PASCAL series and also please remember that BASIC is probably the most commonly used high level language among our readers. Ed.

COUNTER MOVE

Readers may be interested in some SC/MP instructions that are not listed in any National Semiconductor manuals. These instructions result from the fact that pointer register 0 is the program counter:
XPCL (exchange PC low and AC) opcode = 30
XPCH (exchange PC high and AC) opcode = 34
A use for these instructions is as an alternative to a jump. An extremely useful instruction (?!) is XPPC (0), opcode = 3C, which exchanges the program counter for the program counter!
N.D. Sheldon,
High Wycombe, Bucks.
Thank you and good night. Ed.

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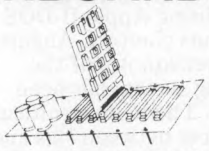

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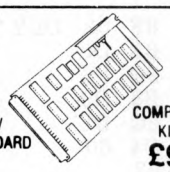

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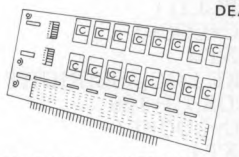

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16×21141 only £79				LM741CN-14	0.35	7915	1.10	10MHZ	2.70	40DIL	0.95
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TRITON DOCUMENTATION

available separately as follows, prices include p & p

Triton manual — detailed circuit description and constructional details + user documentation on level 4.1 monitor & basic	£5.70
L4.1 listing — listing of 1K monitor & 2K tiny basic	£4.20
L5.1 user documentation on level 5.1 firmware	£1.20
L5.1 listing — listing of 1.5K monitor & 2.5K basic	£5.20
L6.1 user documentation on 7K basic interpreter	£1.80
Motherboard, 8K RAM & 8K EPROM constructional details	£5.00

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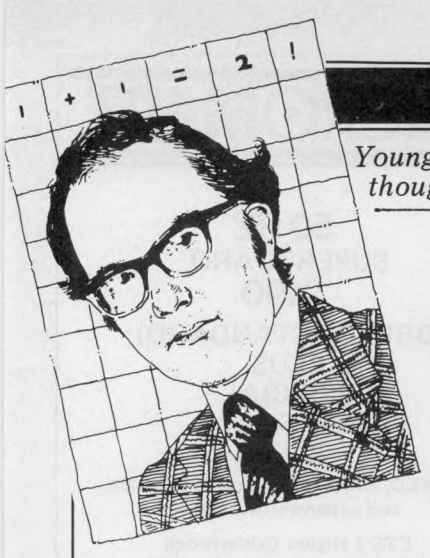
YOUNG COMPUTER WORLD

Young Computer World is the place where, each month, John Coll highlights the thoughts, ideas and contributions of PCW's younger readers.



Because of the 6 week lead time for printing PCW I am writing this in mid-August, before receiving any reaction to the idea of a Young Computer World page. However I have heard from two companies who are looking for school leavers to work on micro-computer projects for a year or so, perhaps before going to University, or just for experience. If you are interested then write to me giving brief details of your experience and I will pass the information on.

These two companies are in fact seeking full time staff but I hope that the YCW page will also provide contacts for people at school. If you are not so young (!) but have a problem that can be solved on a computer then let me know. There is much more satisfaction in writing a program to solve a 'real' problem than in just writing one for the sake of it. It also seems to me to be vital that people at school should have the opportunity of working with outside industry before they leave. In the total absence of any lead from the Department of Education and Science we must look to Industry and Business in general for ideas and help.

As promised last month here is Ian O'Neill's GRAPH program. If you read his introduction carefully you will see that a lot of thought has gone into it — the result is very good. Personally, though, I would much prefer to use the full version with instructions. I think it is vital that the computer always prompts the user when necessary. There should be no need for a crib sheet! Thus, when a program is waiting for INPUT, a null input (just Return) should *always* produce a helpful instruction for the user.

I strongly believe that programs should be segmented, so that, for example, all plotting routines occur in one area. It not only helps one to understand how the program works, it makes it a lot easier to modify. I am glad to see that Ian has done that.

My main critisism of the program is that it would be difficult to convert to run on another machine. Ian's elegant method of getting the equation into the program is specific to the TRS-80 and that can, clearly, be defended.

A prize worthy problem

Is there a *general* way of getting an equation into a program once the program is running? For example if the computer prompted:
WHAT IS THE EQUATION TO BE PLOTTED?
the user should be able to reply:
Y = 4*X
rather than:
500 LET Y = 4*X
RUN

Ideally I am looking for a general method that will run on all computers (or almost all). . .I'm not sure if there is one. If there isn't, then at least we need one good method for each machine. If least we need one good method for each machine. If you have any ideas, general or specific, let me know. Ian has a version for the Tandy, can you do better?

Ideas to: John A Coll, Laxton House, Oundle, Peterborough.

Graph by Ian O'Neill

This is a program written for the TRS-80 (with Level II BASIC), which allows the user to plot any function y of x, which is expressible in the form y = f(x), eg. y = x*x + 2*x - 3. Unlike many other programs, however, this program asks the user for the equation of the curve during the run.

The program listed here is the most recent, Mark IV version of the GRAPH programs I have written. It is also a specially 'shrunk' version, so that users with 4K of RAM can also implement it on their systems, with no adaptation. Earlier versions, did contain full instructions within the program, which could be accessed at any time — if you have 16K (or more!) memory.

As well as defining any function (in 'Cartesian' explicit form), the user may also choose his own x-axis and y-axis limits, or choose his x-axis limits and then type 'AUTO', which then causes the computer to calculate upper and lower limits for y. These values, are not, however, guaranteed; they are based on values taken between the two x-limits at thrice the normal interval. They may also be inaccurate if the function is discontinuous at the lower x limit (eg. y = 1/x at x = 0).

The Program

Like Mr. Addinsell (PCW, May 1979, pp.54-57), I also managed to work out how the TRS-80's Level II BASIC interpreter stores programs. It does so by searching each line as it is ENTERed, and converting any 'key words' into a single character, in the range 128—255 (ASCII code). Since these are characters which cannot be typed at the keyboard, they are 'free' for this use, and any key word, such as PRINT, or RETURN, or CLEAR, can be stored as just one byte, instead of 5, 6 or 5 respectively. The codes for certain functions can be seen in line 40.

By examining the function that the user types (stored in string T), and converting the key words into their respective codes, the program produces a version of the formula which, if it were stored as a line of the program, the computer could use. The next step is to put this converted formula into a (purposefully) vacant line, line 500, which is full of '@' characters before the program is run. The computer looks through its memory starting at byte number 19000 (since this is convenient), and using the BASIC function PEEK, examines each byte until it comes across one with an '@' in it. Then, if the following four bytes are also '@' (character 64), the computer has located the dummy line, and stores the address of the first byte of the line in the integer variable L. Later, using the command POKE, it can store the translated version of the formula in line 500, followed by a :REM, so that the rest of the line (still full of '@'s) is ignored.

The program itself is composed as follows:
Lines 10—30 finds dummy line 500;
40 stores functions and their Level II codes in arrays V & R;
50—100 gets function from user, converts, and pokes into 500;
110 asks if function is symmetric about y = 0, eg. circle;
120—140 inputs limits, and checks their validity;
150—180 calculates automatic y limits (if requested);
190—270 control centre of program, which will process and act on a variety of single-character commands from the user;
280—340 plots graph of current function within current x and y limits;
350—360 error routine, for checking validity of formula, and location of discontinuities;
370 end of program — re-initializes line 500;
500—510 subroutine to calculate y given x — function stored in line 500 by program.

The program itself, in this 'compressed' form, occupies under 2400 bytes of memory; a further 400 bytes are reserved for string storage, and this leaves sufficient room for the storage of numeric variables, even on a 4K system.

Using the Program

When you run the program, the computer, after a slight pause while it locates line 500, will ask you to type the function, y, in terms of x. You may use any of the 5 arithmetic functions +, —, *, / and ↑, also parentheses,), (, any numeric constants, eg. 5, 3.141593, 1.41421E-06, (or function thereof), and any of the standard BASIC library functions, ie. SGN, INT, ABS, RND, SQR, LOG, EXP, SIN, COS, TAN and ATN. The function should be typed in such a form that, were it typed as a line of a BASIC program, it would be valid. Spaces may not be typed if the program is used as it stands without adaptation, nor any other characters not appearing above.

Once you have typed the function, you will be asked whether or not you wish the function to be symmetrical about the x-axis, to which you should answer "YES" or "NO" ("Y" or "N" will suffice). This allows, for example, for the plotting of conic sections. Incidentally, to plot a circle which looks like a circle requires a bit of 'fiddling' with the limits, or you end up with an ellipse!

The next stage is to type the limits. You must first type the lower and upper x limits, and then you will be asked for the lower y limit. You may either type one, or you may type "AUTO"; if you do the latter, the computer will calculate its own y limits, and after a slight pause (whose length depends upon the complexity of the function), it will display these. If you type anything but "AUTO", however, the computer will take the value of whatever you type; so if you type "A", or any non-number, the computer assumes the value zero. If you do not request AUTO y limits, the computer will also ask for an upper y limit, of course.

Once you have typed limits, a flashing cursor will appear, indicating that you may now issue any of the following commands, simply by pressing the appropriate letter:
D Display limits (displays limits on top line of screen);
F display Function (again, on top line of screen);
L insert new Limits;
N New function (allows you to plot a different function);
P Plot (plots current function within current limits);
End program.
The last character is a top line shift character, so that it cannot be pressed accidentally. Depression of any other key will cause the computer to display a question mark (?) for a short time, to indicate that you have pressed a 'wrong' key.

Whenever you wish to cease using the program, you should terminate your usage via the "#"-key, as this way the computer pokes "@"s into line 500 again, so that

continued over

from previous page

the program can be run again straight away. If you leave the program by pressing the "break" key, however, the last function you used will remain resident in line 500, and if you attempt to run the program again, either the computer will miss line 500 altogether, or instead it will poke your new function into line 500 after the REM statement poked into line 500 by the previous run, and you will instead get graphs of the last function you typed on the previous run.

If you do break out of the program, you can change line 500 to its initial condition again manually, by editing line 500 and changing the first 5 or more characters into "@" characters, or by retyping line 500 altogether.

Note that, whenever you plot the function you are currently using, if either or both of the axes occur within the limits set, they will be plotted — this is done on lines 290 and 300, which can be removed if you do not want axes (or you could adapt the program to ask whether or not axes are required).

Finally, here are some graphs to try, if you're at a loss for ideas:

Y=SQR(X*X−1) (hperbola) Yes to symmetry;
Y=SQR(1−X*X) (circle/ellipse) Yes to symmetry;
Y=SQR(X) (parabola) Yes to symmetry
Y=SIN(X), Y=COS(X), Y=TAN(X), Y=ATN(X),
Y=1/SIN(X), etc. Y=1/X, Y=X↑3, Y=EXP(X), Y=LOG(X)
Y=EXP(−.1*X)*SIN(X) try limits of x=0 to 19, y = -1 to 1
Y=(X−1)*(X−2)*(X−3)*(X−4) try x = .8 to 4.2, y AUTO.
and so on.

I. O'Neill

```
10 CLEAR400:CLS:PRINT@474,"PLEASE WAIT.":DEFINTA-P:DEFSTRQ-W:ONERRORGO
   TO350:FORL=19000TO20000:IFPEEK(L)=64THEN30
20 NEXTL:PRINT@471,"NO DUMMY LINE 500.":END
30 FORJ=LTOL+4:IFPEEK(J)=64THENNEXTELSE20

40 DIMV(20),R(20):FORJ=0TO20:READV(J),I:R(J)=CHR$(I):NEXT:DATA+,205,-,
   206,*,207,/,208,↑,209,(,40,),41,.,46,EXP,224,X,88,SGN,215,INT,216,A
   BS,217,SQR,221,RND,222,LOG,223,COS,225,SIN,226,TAN,227,ATN,228,E,69

50 CLS:PRINT:PRINTTAB(25)"GRAPH PLOTTER":PRINTTAB(24)STRING$(15,61):PR
   INT:PRINT:PRINT"TYPE THE FUNCTION IN TERMS OF X:":PRINT
60 INPUT"Y=";T:J=1:U="":IFT=""THEN50
70 IFMID$(T,J,1)>"/"ANDMID$(T,J,1)<":"THENU=U+MID$(T,J,1):J=J+1:GOTO100
80 FORI=0TO20:IFMID$(T,J,LEN(V(I)))=V(I)THENU=U+R(I):J=J+LEN(V(I)):GOTO
   100ELSENEXT
90 PRINT"ILLEGAL REFERENCE:  Y="LEFT$(T,J)"?"RIGHT$(T,LEN(T)-J):PRINT"
   RETYPE FUNCTION.":GOTO60
100 IFJ<=LEN(T)THEN70ELSEU="Y"+CHR$(213)+U+":"+CHR$(147):FORJ=1TOLEN(U
    ):POKEL+J-1,ASC(MID$(U,J,1)):NEXT:H=0:GOSUB500:IFH=2THEN50

110 PRINT:INPUT"IS FUNCTION SYMMETRICAL ABOUT X-AXIS (Y/N)";S:S=LEFT$(
    S,1):IFS<>"Y"ANDS<>"N"THEN110
120 CLS:PRINT:PRINT"LIMITS":PRINT"======":PRINT:M=0
130 PRINT"PREVIOUS LIMITS:   X ="XL"TO"XUCHR$(8)", Y ="YL"TO"YU:PRINT@
    384,"";:INPUT"X-AXIS:  LOWER LIMIT";XL:INPUT"         UPPER LIMIT"
    ;XU:XS=(XU-XL)/128:PRINT:INPUT"Y-AXIS:  LOWER LIMIT";Q
140 IFQ="AUTO"THEN150ELSEYL=VAL(Q):INPUT"           UPPER LIMIT";YU:YS=(
    YU-YL)/48:IFXS=0ORYS=0THENPRINT"  ILLEGAL LIMITS:  AXIS-LENGTH ZE
    RO.":FORI=1TO900:NEXT:GOTO120ELSEM=1:GOTO190
150 M=0:X=XL:GOSUB500:YL=Y:YU=Y:FORX=XL+XSTOXUSTEP3*XS:GOSUB500:IFY>YU
    THENYU=YELSEIFY<YLTHENYL=Y
160 NEXT:IFYU<>YLTHENM=1:Y=YU-YL:YU=YU+.04*Y:YL=YL-.04*Y:YS=Y/48
170 IFS="Y"ANDM=1THENYU=ABS((YU+YL+ABS(Y))/2):YL=-YU:YS=YU/24
180 PRINT@576,CHR$(30)"Y-AXIS:  AUTO LIMITS ="YL"TO"YU:Q=STR$(YL)

190 AT=16040:IFW="P"THENAT=15360
200 POKEAT,143:FORI=1TO40:W=INKEY$:IFW=""THENNEXT:POKEAT,32:FORI=1TO32
    :W=INKEY$:IFW=""THENNEXT:GOTO200
210 POKEAT,ASC(W):FORI=1TO250:NEXT:IFW="#"THEN370
220 IFW="P"THEN280
230 IFW="L"THEN120
240 IFW="N"THEN50
250 IFW="F"THENPRINT@5,CHR$(30)"Y="T;:GOTO200
260 IFW="D"THENPRINT@5,"LIMITS: X ="XL"TO"XUCHR$(8)", Y ="YL"TO"YU;:GO
    TO200
270 POKEAT,63:FORI=1TO300:NEXT:GOTO200

280 IFM=0THENCLS:PRINT:PRINT"ILLEGAL LIMITS:  AXIS-LENGTH ZERO.":FORI=
    1TO900:NEXT:GOTO120ELSECLS
290 A=INT(.5-XL/XS):IF0<=AANDA<=127THENFORI=0TO47:SET(A,I):NEXT
300 A=47-INT(.5-YL/YS):IF0<=AANDA<=47THENFORI=0TO127:SET(I,A):NEXT
310 FORN=0TO127:X=XL+N*XS:H=0:GOSUB500:IFH=1THEN340
320 P=47-INT((Y-YL)/YS+.5):IFP>=0ANDP<=47THENSET(N,P)
330 IFS="Y"THENP=47-INT(.5-(Y+YL)/YS):IFP>=0ANDP<=47THENSET(N,P)
340 NEXT:GOTO190

350 IFERR=2ORERR=40THENCLS:PRINT"  Y="T:PRINT:PRINT"ERROR IN FUNCTION.
    RETYPE CORRECTLY.":FORI=0TO2000:NEXT:H=2:RESUMENEXT
360 H=1:RESUMENEXT


370 FORI=LTOL+10:POKEI,64:NEXT:CLS:PRINT"RUN COMPLETE.":END
500 @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
    @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
    @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
    @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
510 RETURN
```

PROGRAMS

FUN & GAMES

PET BREAKOUT

by N.S. Fuller.

Here is a program for an 8K PET. It is rather like the amusement aracde "Breakout" program in which you have to demolish brick walls.

```
1 GOSUB10000:PRINT"3";
2 C=33077+(INT(RND(1)*5))
3 TI$="000000"
5 K=33707:S=33708:T=33709:U=33710
6 POKEK,226:POKES,226:POKET,226:POKEU,226
7 PP=0
8 J=1
10 FORA=32768TO32807
20 POKEA,227
30 NEXTA
31 FORA=32889TO32927
32 POKEA,102
33 NEXTA
34 FORA=32929TO32967
35 POKEA,170
36 NEXTA
37 FORA=32969TO33007
38 POKEA,218
39 NEXTA
40 FORA=32881TO33728STEP40
50 POKEA,229
55 POKE A+39,231
60 NEXTA
100 PRINT" BALL NO.2";J;"1"
101 PRINT"                ";"SCORE";PP;"1"
102 A=INT(RND(1)*1.9)
110 IF A=0 THEN B=41
120 IF A=1 THEN 100
130 IF A=2 THEN B=39
140 REM
141 POKEC,81
145 IF PEEK(C-B)=81THENPOKE(C-B),32
150 C=C+B
151 IFC<>32768THEN153
152 C=32809:B=41:GOTO140
153 IFC<>32807THEN160
154 C=32846:B=39:GOTO140
160 IFPP=760THEN7200
161 IFINT(400-(TI/60))<>KKTHEN165
162 KK=INT(400-(TI/60))
163 IF PEEK(C)=227THEN990
164 GOTO167
165 PRINTTAB(34);"    ";"1"
166 GOTO162
167 PRINT"                              ";"TIME TO GO2";KK;"1"
168 IFVAL(TI$)>=640THEN7000
170 IF PEEK(C)=229THEN1040
180 IF PEEK(C)=231THEN1090
190 IF C>33728THEN1140
195 IFPEEK(C)=226THEN1200
196 IFPEEK(C)<>32THEN5000
200 GETA$
210 IFVAL(A$)=4THEND=-1
220 IFVAL(A$)=6THEND=1
230 IFVAL(A$)=5THEND=0
240 IFPEEK(K+D)=229THEND=0
250 IFPEEK(U+D)=231THEND=0
260 IFD=-1THENPOKEU,32
270 IFD=-1THENPOKEK-1,226
280 IFD=1THENPOKEK,32
290 IFD=1THENPOKEU+1,226
300 K=K+D:S=S+D:T=T+D:U=U+D
310 GOTO141
990 IF PEEK(C-B)=81THENPOKE(C-B),32
995 C=C-B
1000 IF B=-41 THEN B=39
1010 IF B=-39 THEN B=41
1015 C=C+B
1020 GOTO160
1040 IF PEEK(C-B)=81THENPOKE(C-B),32
1045 C=C-B
1050 IF B=-41 THEN B=-39
1060 IF B=39 THEN B=41
1065 C=C+B
1070 GOTO160
```

```
1090 IF PEEK(C-B)=81THENPOKE(C-B),32
1095 C=C-B
1100 IF B=41 THEN B=39
1110 IF B=-39 THEN B=-41
1115 C=C+B
1120 GOTO160
1140 REM
1150 IF PEEK(C-B)=81THENPOKE(C-B),32
1160 FOR Z=1TO500:NEXTZ
1165 J=J+1
1167 C=33077+(INT(RND(1)*5))
1170 GOTO 100
1200 IF PEEK(C-B)=81THENPOKE(C-B),32
1201 IFB=39THENB=-41
1210 IFB=41THENB=-39
1220 GOTO150
5000 IFPEEK(C)=102THEN6000
5010 IFPEEK(C-B)=81THENPOKE(C-B),32
5015 POKEC,81
5016 PP=PP+5
5017 PRINT"                    ";"SCORE2";PP;"1"
5020 IFB=-41THENB=39
5030 IFB=-39THENB=41
5040 C=C+B
5050 GOTO160
6000 IF PEEK(C-B)=81THENPOKE(C-B),32
6001 IFB<>39THEN6003
6002 B=-41:GOTO6010
6003 IFB<>41THEN6005
6004 B=-39:GOTO6010
6005 IFB<>-41THEN6008
6006 B=39
6007 GOTO6010
6008 B=41
6010 PP=PP+10
6011 POKEC,81
6015 PRINT"                    ";"SCORE2";PP;"1"
6020 C=C+B
6030 GOTO160
7000 LL=VAL(TI$)
7001 FORA=32768TO33767
7010 POKEA,127
7020 NEXTA
7070 PRINT"3"
7080 PRINT"BALLS USED";J
7090 PRINT"TIME TAKEN";LL;"SECONDS"
7100 PRINT"SCORE IS";PP
7101 PP=(INT(((PP+LL)/J)*10)/10)
7102 PRINT"YOUR BREAKTHRU' FACTOR IS";PP
7105 IF PP>100THEN7200
7110 INPUT"DO YOU REQUIRE A REPLAY";A$
7120 IF LEFT$(A$,1)="Y"THEN 1
7130 END
7200 PRINT"3YOU WIN A REPLAY"
7205 FORRR=1TO1000:NEXTRR
7210 GOTO1
10000 POKE59468,14
10004 IFDDD=1THEN10120
10005 DDD=1
10010 PRINT"3THIS GAME IS BREAKTHRU'?."
10015 PRINT
10020 PRINT"THE OBJECT OF THE GAME IS TO KNOCK"
10030 PRINT"AS MANY 'BRICKS' OUT OF THE THREE"
10040 PRINT"'WALLS' AS POSSIBLE ."
10041 PRINT
10042 PRINT"THIS HAPPENS WHEN THE BALL HITS THE WALL"
10050 PRINT"THERE IS A TIME LIMIT OF 6.6 MINUTES."
10055 PRINT
10060 PRINT"TO MOVE THE 'BAT' TO THE LEFT THE"
10070 PRINT"PLAYER PRESSES NUMBER 4."
10075 PRINT
10080 PRINT"TO MOVE THE 'BAT' TO THE RIGHT THE"
10090 PRINT"PLAYER PRESSES NUMBER 6."
10095 PRINT
10100 PRINT"TO STOP THE 'BAT' MOVING THE PLAYER"
10110 PRINT"PRESSES NUMBER 5."
10111 PRINT
10112 PRINT"HIT ANY KEY TO BEGIN."
10115 GETA$:IFA$=""THEN10115
10120 POKE59468,12
10130 RETURN
READY.
```

PROGRAMS

POWER BOAT

by Derrick R. Daines

Power Boat is a computer game of skill for one person, although since a score is printed out, players can compete against each other. The idea is that the player has to steer a power boat around a lake on which a number of buoys are randomly placed. Figure 1 gives a typical printout. You will notice that the lake is represented by a 14 x 12 matrix. Zeroes are buoys and the line of asterisks is the wake of the boat. In this example the boat has run aground at 1,3 and so ended the game.

The starting condition is shown in Figure 2, where B represents the position of the boat. It always starts at 1,1 on a course of 3 (southeast) but the number and disposition of the buoys is different every game. The game ends after 100 moves, or when the boat runs aground. Points are gained for each successful move, but deducted for striking a buoy, running aground or requesting a map print.

The following commands are recognised:

0 —Do nothing. Allow the boat to continue one move with present helm. 10 points bonus.
1 —Print map showing all buoys and course to date. Penalty 15.
2 —Change helm. The computer responds with 'Helm Change?'. Typing 1 puts the helm to starboard; 0 centres it; -1 puts it to port. It also moves the boat.
3 —Print score to date. 5 points penalty.
4 —Stop game at current position. No penalty.

It will be noted that at no time may the boat be stopped, slowed or put into reverse. The player must always think ahead and plot his future course. Bumping a buoy costs a penalty of 50 points but does not stop the boat. Running aground incurs a penalty of 100 points as well as ending the game.

The particular interest of the game involves the method of changing course. Rather than spinning on the spot, a change of course involves movement round the arc of a circle 4 points across, with a 45 degree turn every move. This can be seen in Figures 1 and 3. Turning in complete cirlcles is not permitted by the program, for obvious reasons.

Turning now to the program listing, line 20 is inserted to prevent worries on the part of newcomers to computing. It takes the computer 10-15 seconds to set up the buoys and sometimes people start thinking that the machine has gone wrong. Lines 80 to 160 set the position of buoys and if desired the number could be adjusted by some fine tuning of line 110.

FIGURE 1

```
    1 2 3 4 5 6 7 8 9 0 1 2 3 4
1   * . *
2   . * * . . . . . 0 . . . .
3   . . * . . . . 0 . . . . . .
4   . . * * . . . . . 0 . . . .
5   . . * 0 * . 0 0 . 0 . . 0 .
6   . . * . . * 0 . . . . . . .
7   . . * . . . * . . . . 0 0 .
8   . . . * * * * * * * * * . .
9   . . . . . . . 0 * . . 0 * .
10  . . . . . 0 . . . * . . * .
11  . . . . . . . . . . * * 0 .
12  . . 0 0 . . . . 0 . . . . .
COURSE: 1
```

A typical map printout showing buoys and course of boat.

Line 170 places the starting position of the boat and gives an initial free printout at 210. The Command loop is then entered at 230, with appropriate branching at 270. The bulk of the remaining program is self-explanatory until 560, which is the data listing for adjustment of the boat co-ordinates. The data is read at line 610 and at 640 and 650 adjusts the co-ordinates of position. The map printout of lines 1020 to 1130 might well be changed by those with string handling facilities.

For such a short program, the game is really a very good one. The boat handling must be mastered early on, particularly remembering that typing '0' with the helm over will cause a further swing of course. When the desired heading is reached, the helm must be centred by first requesting a helm change and then typing '0'.

For information purposes, headings are given as per Figure 4.

The steering method is of course capable of very wide application and is well worth

FIGURE 2

```
    1 2 3 4 5 6 7 8 9 0 1 2 3 4
1   B . . . . . . . . . . . . .
2   . . . . . . . . . 0 . . . .
3   . . . . . . . 0 . 0 . . . 0
4   . . . . . . . . . . . . . .
5   0 . . 0 . . . . . . . . 0 0
6   . . . . . . . . . . . . . .
7   . . . 0 . . . 0 . . . . . .
8   . . . . . . . . . 0 . . . .
9   . . . . . 0 . . . 0 0 . . .
10  . . . . . . . . . . . . . .
11  . . . . . . . . . . . . . .
12  . . . 0 0 . 0 . . . . . 0 .
COURSE: 3
```

Starting position. Boat is shown as 'B' at top left, commencing run on Southeast course. 'Ø's are buoys.

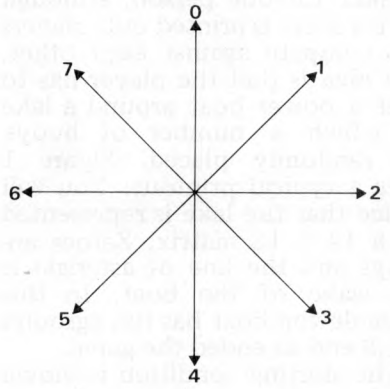
incorporating in many graphic games.

FIGURE 3

```
    1 2 3 4 5 6 7 8 9 0 1 2 3 4
1   * . . . . . . . . . . . . .
2   . *. . . . . . . . 0 . . .
3   . . *. . . . 0 . 0 . . . 0
4   . . . *. . . . . . . . . .
5   0 . . 0 *. . . . . . . 0 0
6   . . . . . *. . . . . . . .
7   . . . 0 . . * 0 . . . B . .
8   . . . . . . . *. . 0 * . .
9   . . . . . 0 . . * 0 0 * . .
10  . . . . . . . . * * . . .
11  . . . . . . . . . . . . . .
12  . . . 0 0 . 0 . . . . . . 0
COURSE: 0
```

The game of Figure 2 after 14 moves.

FIG. 4 HEADINGS.



LIST OF VARIABLES

D1	Vectors of current position of boat	Z	Flag for placing buoy
D2		T	Total points earned
D3	Course 0 — 7	M	Total number of moves to date. 100 to finish course.
D4	Helm 1 = starboard; 0 = amidships; -1 = port.		
A(12,14)	Matrix of lake. Ø = empty; 1 = wake; 3 = buoy	H1	Count of moves with current helm.

```
0010 PRINT "POWER BOAT"
0020 PRINT "WORKING ....."
0030  D1=1
0040  D2=1
0050  D3=3
0060  D4=0
0070 DIM A(12,14)
0080 FOR X=1 TO 12
0090 FOR Y=1 TO 14
0100  Z=RND(0)*10
0110 IF Z<9 THEN 140
0120  A(X,Y)=3
0130 GOTO 150
0140  A(X,Y)=0
0150 NEXT Y
0160 NEXT X
0170  A(1,1)=1
0180  T=0
0190  M=0
0200 GOSUB 1000
0220  H1=0
0230 PRINT "COMMAND ";
0235  A(D1,D2)=1
0240 INPUT C
0250  C=INT(RES(C))
0260 IF C>4 THEN 230
0270 ON C+1 GOTO 550,280,320,430,530
0280 REM MAP
0290  T=T-15
0300 GOSUB 1000
0310 GOTO 230
0320 REM HELM
0330 PRINT "HELM CHANGE ";
0340 INPUT H
0350 IF H<>H1 THEN 400
0360  H1=H1+1
0370 IF H1<=7 THEN 400
0380 PRINT "TURNING IN CIRCLES IS NOT"
0385 PRINT "PERMITTED."
0390 GOTO 330
0400  H1=1
0410  D4=H
0420 GOTO 550
0430 REM INFO
0440  T=T-5
0450 PRINT "POSITION: ";D1;",";D2
0460 PRINT "COURSE: ";D3
0470 PRINT "HELM: ";
0480 IF D4=-1 THEN PRINT "PORT"
0490 IF D4=0 THEN  PRINT "MIDSHIPS"
0500 IF D4=1 THEN PRINT "STARBOARD"
0510 PRINT "SCORE: ";T
0520 GOTO 230
0530 PRINT "STOPPED AT ";D1;",";D2
0540 GOTO 740
0550 REM MOVE
0560 DATA -1,0,-1,1,0,1,1,1,1,0,1,-1,0,-
1,-1,-1
0570  D3=D3+D4
0580 IF D3>7 THEN LET D3=0
0590 IF D3<0 THEN LET D3=7
0600 FOR I=1 TO D3+1
0610 READ E,F
0620 NEXT I
0625 RESTORE
0630  A(D1,D2)=2
0640  D1=D1+E
0650  D2=D2+F
0652 IF D1<1 THEN 720
0654 IF D1>12 THEN 720
0656 IF D2<1 THEN 720
0658 IF D2>14 THEN 720
0660 IF A(D1,D2)=3 THEN 690
0670  T=T+10
0674  M=M+1
0676 IF M>=100 THEN 800
0680 GOTO 230
0690 PRINT "BUMP AT ";D1;",";D2
0700  T=T-50
0704  D1=D1-E
0708  D2=D2-F
0710 GOTO 230
0720 PRINT "RUN AGROUND!"
0730  T=T-100
0740 PRINT "YOUR SCORE WAS ";T
0750 PRINT
0760 PRINT "TYPE RUN TO PLAY AGAIN";
0770 END
0800 PRINT "GREAT! YOU GOT ROUND THE COU
RSE"
0810 PRINT
0820  T=T+100
0830 GOTO 740
1000 REM MAP  PRINT
1010 PRINT
1020 PRINT "   1 2 3 4 5 6 7 8 9 0 1 2
3 4 "
1030 FOR X=1 TO 12
1040 PRINT X;
1050 IF X<10 THEN PRINT " ";
1060 FOR Y=1 TO 14
1070 IF A(X,Y)=0 THEN PRINT " .";
1080 IF A(X,Y)=1 THEN PRINT " B";
1090 IF A(X,Y)=3 THEN PRINT " 0";
1100 IF A(X,Y)=2 THEN PRINT " *";
1110 NEXT Y
1120 PRINT
1130 NEXT X
1140 PRINT "COURSE: ";D3
1150 RETURN
```


PCW is always on the lookout for original programs

PUZZLES

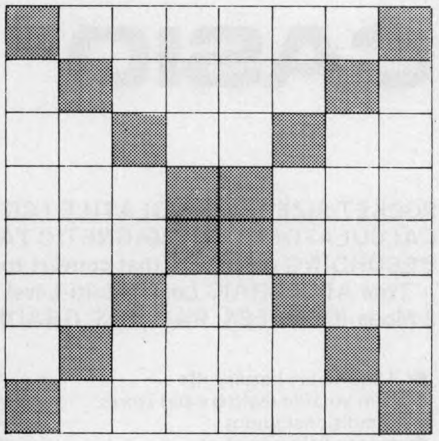
LEISURE LINES

Well, you've had a month's recuperation period since the last issue, so I hope you're all fit and fresh and ready for October's edition of Leisure Lines. First of all it's time for a 'quickie'. . .that means no answers, no prizes.

Three men in a restaurant. The bill came to £30, so each man gave a £10 note to the waiter. The waiter took the bill and delivered the payment to the manager — who decided he'd overcharged. He gave the waiter £5 to return to the men. On the way back to the table the waiter dishonestly pocketed £2 of the £5 for himself, and therefore he gave £1 back to each of the men. That means that each man had paid £9 — making a total of £27. The waiter had taken £2, the men had paid £27. . .that comes to £29. What happened to the missing £1?

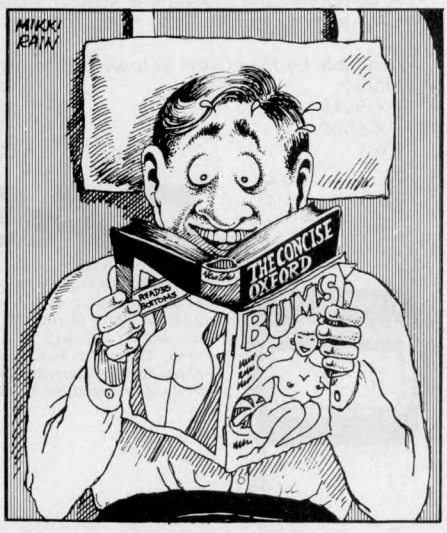
So much for the 'kid's stuff', time now for this month's prize puzzle.

Place 8 coins on the squares of a standard chess board so that no two coins are in line horizontally, vertically or diagonally. In addition, no coin may occupy a square on either main diagonal of the board. In other words, only the unshaded square in the diagram shown may be used. Solutions (including coins?) on postcards addressed to: *Puzzle No. 2, Personal Computer World, 14 Rathbone place, London W1P 1DE.*



Once again, please remember to write clearly and include your name and address. Entries should arrive not later than October 31st, 1979. The winner will be notified by post and the result, plus solution, will be published in our next-but-one edition of PCW. The Editor reserves the right to make final decisions on all matters — no correspondence will be entered into.

PRIZE
After last month's gluttony with the chocolate bars, what better way to follow than with food for the mind? Yes, our 'Silly (?) Prize' for the October issue is an unabridged version of the Concise Oxford Dictionary. It contains all the dirty words (bar two) that were used in 'Lady Chatterley's Lover'!



Continued from page 45

Teletype KSR33. . .good condition — £200. A.E. Scott, 78 Morley Avenue, Wood Green, London N22. Phone (01) 888 7841.

Wanted

HP-19C or HP-29C Programmable Calculator. . .in good order complete with manuals. Write to Mr. B.M. Compston, 22 Blue Bell Close, Malvern, Worcs. WR14 3QR.

Used Daisy Wheel Printer. . .with proportional spacing, must be good condition; serial interface. Phone Richard Mortimore on 01-979 4546.

PET 2001-8K. . .service information wanted. Local dealer claims mine already beyond repair! Will pay for gen of use to experienced electronics engineer with oscilloscope. Would consider cash offer for the offending PET plus IBM terminal (no interface) plus Petsoft tapes. Contact Jim Wilkie, Grickstone, Horton, Bristol, BS17 6QY. Phone Chipping Sodbury (0454) 313305.

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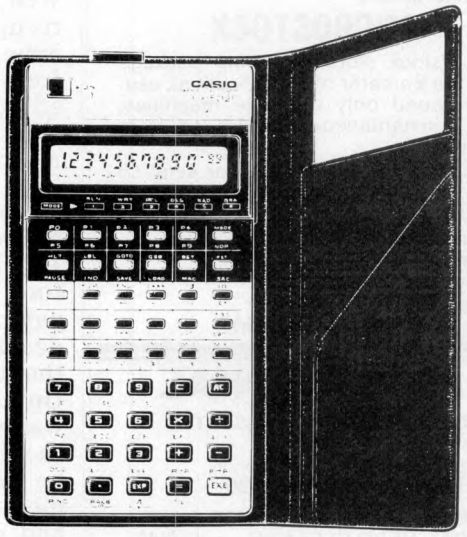

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USER GROUPS INDEX

User Group Index is Britain's major, up-to-date listing of clubs, user groups and societies. The information published here has been checked correct as of going to press; if YOUR group hasn't been included, then please let us have all relevant information. Send it to: PCW, 14 Rathbone Place, London W1P 1DE. Updates on changes would also be appreciated.

AVON

Bristol Computing Club. £3.00 p.a. Meetings 3rd Wednesday, monthly. Contact: Leo Wallis, 6 Kilbirnie Rd., Bridge Farm Estate, Bristol, BS14 0HY. Tel: Bristol 832453.

Brunel Technical College Computing Club. The club divides into two sections . . .the "skilled" and the "not skilled". They share alternate Wednesdays at the College. Contact S.W. Rabona at 18 Castle Road, Worle, Weston-Super-Mare, Avon, BS22 9JW (0934 513068).

BEDFORDSHIRE

UK Intel MDS Users Group. Contact: Lewis Hard, 29 Chaucer Rd., Bedford.

Cosmac Users Club (proposed) For People using the RCA 1802, Cosmac ELF, ELFII, Super Elf etc. Those interested contact James Cunningham at 7 Harrowden Court, Harrowden Road, Luton LU2 0SR (enclose sae, please).

The 6502 Users Club. Hoping soon to hold regional and national meetings, they offer "support, encouragement and fellowship". Contact: Walter Wallenborn, 21 Argyll Ave., Luton, Beds LU3 1EG.

BERKSHIRE

77/68 User Group. Quarterly Newsletter. Free membership for 1st year if you buy the 77/68 instruction manual, £1.50 thereafter. Contact: Newbear Computing Store, 40 Bartholomew St., Newbury, Berkshire.

The Thames Valley Amateur Computer Club. Meetings are on the first Thursday of every month and from November on, that will be at "The Southcote", Southcote Lane, off the Bath Road, Reading, Berks. Starting time, 7.00pm. Contact Brian Quarm (Camberley 22186) OR Brian Steer (Slough 20034).

BUCKINGHAMSHIRE

TRS-80 Users Group. Contact: Brian Pain, 40a High St., Stony Stratford, Bucks.

CHESHIRE

Anyone interested in starting a Chester club please contact: Mr. W. Collins, 37 Garden Lane, Chester, Cheshire.

DERBYSHIRE

The Independant PET Users Group. IPUG. Secretary is Mike Lake of 9 Littleover Lane, Derby (Derby 23127).

DEVONSHIRE

Exeter and District Amateur Computer Club. General meetings 2nd Tuesday monthly, specialist meetings 3rd or 4th Tuesday. £5.00 p.a. Contact: Doug Bates, 3 Station Road, Pinhoe, Exeter, Devon.

DURHAM

Northeast PETS. Contact: Jim Cocallis, 20 Worcester Road, Newton Hall Estate, Durham. The group meets on the 3rd Monday of each month (at 7.30 pm.) in: Room A102, Ellison Bldgs, Newcastle Polytechnic, Newcastle-upon-Tyne.

ESSEX

TRS80 User Club (Chelmsford). Now part of the National TRS80 User Club. Contact Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.

Amateur Computer Club. Membership now costs £3.50. Contact D. Ellis (the Membership Secretary), c/o 118 Cambridge Avenue, Gidea Park, Romford, Essex RM2 6RA.

GLOUCESTERSHIRE

Cheltenham Amateur Computer Club. Meetings, 4th Wednesday monthly, 7.30pm start. Microprocessor workshop starting October 2nd. Contact: Mr. M. Pullin, 45 Merestones Drive, The Park, Cheltenham, GL50 2SU (Cheltenham 25617).

9900 Users Group, TI

9900 Users Group, TIMUG Contact: Chris Cadogan, 21 Thistle Downs, Northway Farm, Tewkesbury, Glos.

HAMPSHIRE

Southampton Amateur Computer Club. Meetings 1st Wednesday monthly (not July, Aug. or Sept.). Contact: Paul Dorey, Department of Physiology, University of Southampton, Southampton, SO2 3SU or Tel: Paul Maddison on Winchester 4433 Ext. 6955.

HERTFORDSHIRE

'11s Users Group. A sort of help service only. No meetings no newsletter. Contact: Pete Harris, 119 Carpenter Way, Potters Bar, Herts., EN6 5QB. Tel: 0707 52091 or 01-248 8000 Ext. 7065.

KENT

Medway Amateur Computer and Robotics Organisation. Contact: Tony Aylward, 194 Balmoral Rd., Gillingham, Kent. Tel: Medway 56830.

North Kent Amateur Computer Club. Meetings, the second Tuesday of each month — usually at the Charles Darwin School, Jail Lane, Biggin Hill, Kent. The sub is £2.50 per annum (£1 for students). More members are needed . . .contact: Barry Biddles at 3 Acer Road, Biggin Hill, Kent (09594 71742).

LANCASHIRE

Merseyside Microcomputer Group. Several sub-groups . . .Contact: J.S. Stout, Department of Architecture, Liverpool Polytechnic, 53 Victoria St., Liverpool L1 6EY or Tel: 051 236 0598 or STEM Ltd., 19/23 Abercrombie Sq., PO Box 147, Liverpool University, Liverpool L69 3BX.

LEICESTERSHIRE

The Leicestershire Personal Computer Club. Meetings held the 2nd Monday in each month, at Leicester University and Loughborough University alternately. They start 7pm. Membership is £2 per annum (£1 for under 16s). Contact Miss Jill Olorenshaw (Club Secretary) c/o Arden Data Processing, Municipal Buildings, Charles Street, Leicester (0533 22255) OR Mr Dick Foden (Club Chairman) at 11 Gaddesby Lane, Rearsby, Leicester.

LINCOLNSHIRE

Lincolnshire Microprocessor Society. Various meeting-places. For up-to-date information, contact the Hon. Sec., Mr Eric Booth, Senior Common Room, Bishop Grosseteste College, Newport Lincoln.

LONDON

MK14 Club. Bi-monthly magazine called "Complement and Add". Contact: Geoff Phillips, 8 Podsford Rd., London NW9 6HP.

Southgate Computer Club. Meetings 1st Wednesday and 3rd Thursday monthly during term time. Newsletter. Contact: Paul Woolley, Southgate Technical College, High Street, London N14 6BS. Tel: 01-888 6521.

UK Pet Users Club. Contact: Commodore Systems Division, 360 Euston Road, London, NW1 3BL.

East London Amateur Computer Club. Meetings 3rd Tuesday monthly. £2.50 p.a. (½ price to school students). Contact: Jim Turner, 63 Millais Rd., London E11.

The North London Hobby Computer Club. General meetings held on a Wednesday evening, once a month — specialised topics on three evenings each week. Location: The Polytechnic of North London. Contact: Robin Bradbeer (Chairman) at the Dept, of Electronic and Communications Engineering, Polytechnic of N. London, Holloway, N7 8DB (01-607 2789).

MIDDLESEX

Harrow Computer Group. Meetings (term time) at the Harrow College of Higher Education and (other time) the "Traveller's Rest" Public House, in Kenton, Middlesex — on alternate Wednesdays at 7pm. Contact: Bazyle Butcher, 16 St. Peter's Close, Bushey Heath, Watford (01-950 7068) or P. Lecker, 23 Moss Lane, Pinner, Middx.

NOTTINGHAMSHIRE

UK Apple Users Group, Contact: Andy Witterick (Keen Computers), 5 The Poultry, Nottingham. Tel: 0602 583254/5/6.

OXFORDSHIRE

Research Machines Ltd. National User Group. Inaugural meeting 5th October. Contact: M.D. Fischer, PO Box 75, Oxford, OX4 1EY, for a registration form.

Oxfordshire Microcomputer Club. £5.00 p.a. Contact: S. C. Bird, 139 The Moors, Kidlington, Oxford OX5 2AF Tel: Kidlington (08675) 6703

STAFFORDSHIRE

Central Program Exchange. Full membership £25 Europe, £40 overseas), provides 30 free programs p.a. Small User Serivce £10 Europe, £20 overseas) provides 10 free programs p.a. Contact: Mrs Judith Brown, The Polytechnic, Wilfruma St., Wolverhampton, WV1 1LY.

SURREY

Exidy Sorcerer Users Group. Newly formed, and a division of the U.S. User Group. Fee is £5 p.a. Write, stating what hardware you own, to: Andy Marshall (Micro44), 44 Arthurs Bridge Road, Woking GU21 4NT (04862 66084).

SUSSEX

Independent PET Users Group — South. Free membership — meetings the first Wednesday of every month. £1.50 to receive monthly newsletter. Contact: John C Nuttall, 56 West Street, Shoreham-by-Sea, Sussex BN4 5WG.

WEST MIDLANDS

West Midlands Amateur Computer Club. Newsletter . . . meetings 2nd Tuesday monthly. £2 p.a., or £1 if under 18, or a full time student. Contact: John Tracey, 100 Booth Close, Crestwood Park, Kingswinford, West Mids DY6 8SP. Phone Brierley Hill 70097.

YORKSHIRE

South Yorkshire Personal Computing Group. (Please note, another publication has listed, incorrectly, a South Yorkshire Amateur Computer Club. It does not exist). For details of the SYPCG, contact Tony Rycroft, 88 Spinneyfield, Moorgate, Rotherham, S. Yorks, (Tel: Rotherham 74889, eve).

IRELAND

Computer Education Society of Ireland. A voluntary organisation that consists of a national body and an expanding number of local branches. Their brief is to monitor computer education in Ireland. *National CESI* (£3 p.a.) — Diarmuid McCarthy, 7 St. Kevin's Park, Kilmacud, Blackrock, Co. Dublin. *Cork branch* (£1 extra) — Michael Moynihan, Colaiste an Spioraid Naomh, Bishopstown, Cork. *Dublin branch* (£1.50 extra) — Jim Walsh, C.B.S. Naas, Co. Kildare. *Limerick branch* (£1 extra) — Sr. Lourda Keane, Convent F.C.J., Laurel Hill, Limerick. *Waterford branch* (£1 extra) — Mr. Hugh Dobbs, Newtown School, Waterford. *Kilkenny branch* (£1 extra) — Sr. Helen Lenehan, Presentation Secondary School, Kilkenny.

SCOTLAND

Ithaca Audio S100 bus UK User Group. Contact Dave Weaver, 16 Etive Place, Cumbernauld, Glasgow G67 4JE. Phone 02367 36570.

WALES

Gwent Amateur Computer Club. Covering the Gwent and Cardiff areas, the club has its own computer room and technical library. Meetings held once a week, Wednesdays, starting 7.30pm, at Room 149, Civic Centre, Newport. Contact: Peter Hesketh on Shirenewton 596.

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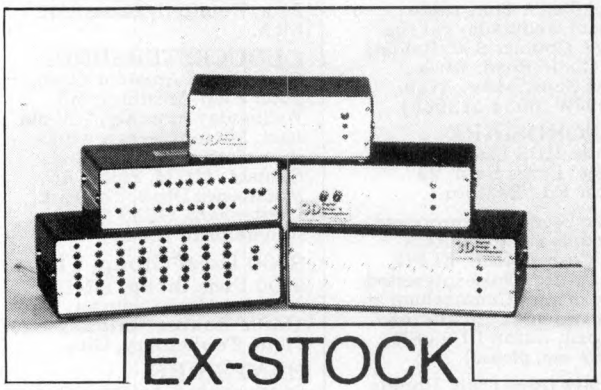

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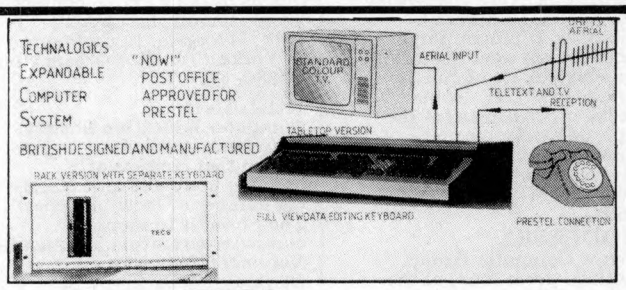

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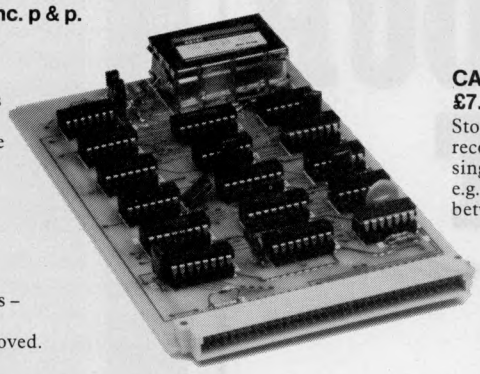

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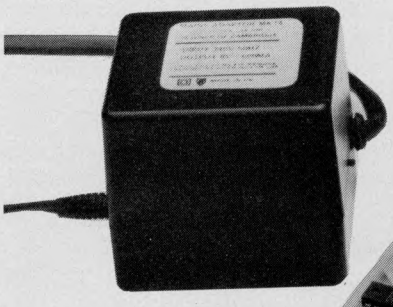

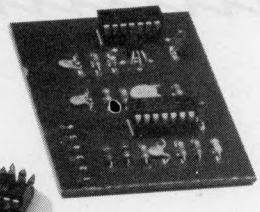

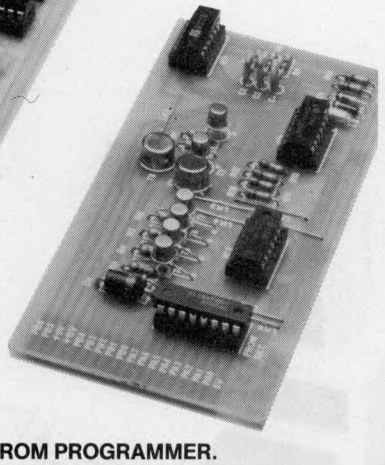

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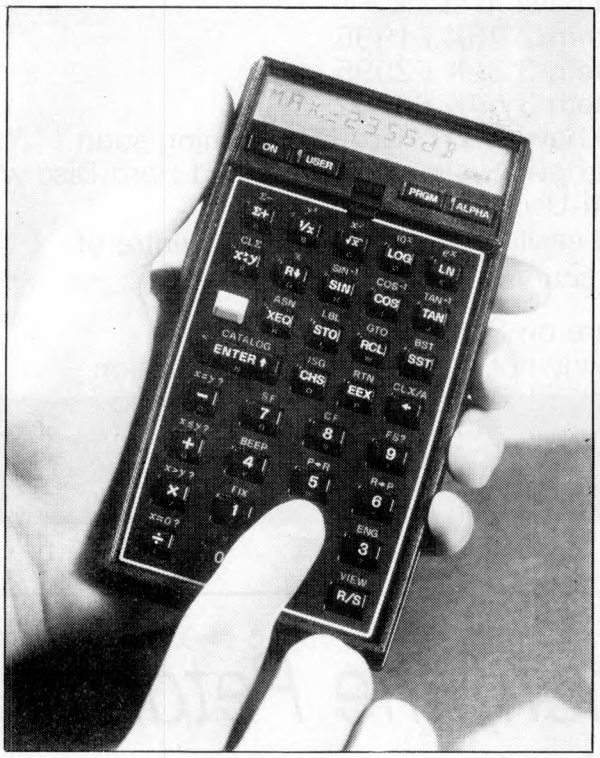

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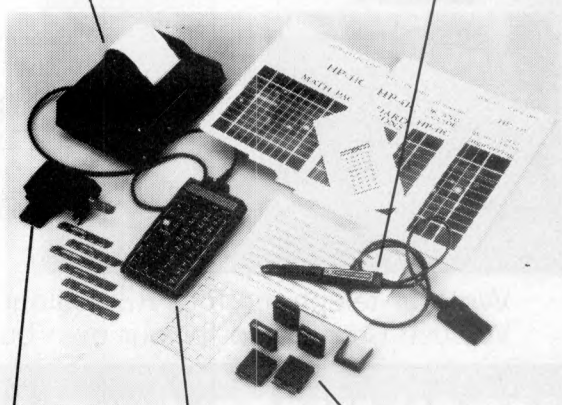

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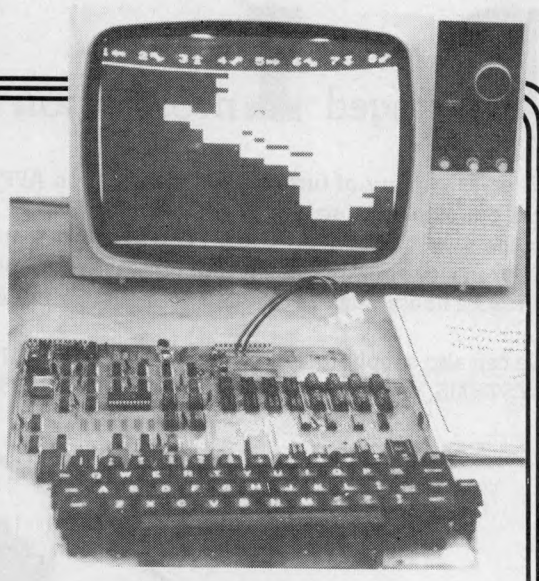

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Extras

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- Assembler/editor and extended machine code monitor available.

Commands

CONT	LIST	NEW	NULL	RUN	

Statements

CLEAR	DATA	DEF	DIM	END	FOR
GOTO	GOSUB	IF...GOTO	IF...THEN	INPUT	LET
NEXT	ON...GOTO	ON...GOSUB	POKE	PRINT	READ
REM	RESTORE	RETURN	STOP		

Expressions

Operators

$-, +, *, /, \uparrow$, NOT, AND, OR, $>, <, <>, >=, <=, =$

RANGE 10^{-32} to 10^{+32}

Functions

ABS(X)	ATN(X)	COS(X)	EXP(X)	FRE(X)	INT(X)
LOG(X)	PEEK(I)	POS(I)	RND(X)	SGN(X)	SIN(X)
SPC(I)	SQR(X)	TAB(I)	TAN(X)	USR(I)	

String Functions

ASC(X$)	CHR$(I)	FRE(X$)	LEFT$(X$,I)	LEN(X$)	MID$ (X$,I,J). VAL(X$)
RIGHT$(X$,I)			STR$(X)		

Plus variables, arrays and editing facilities.

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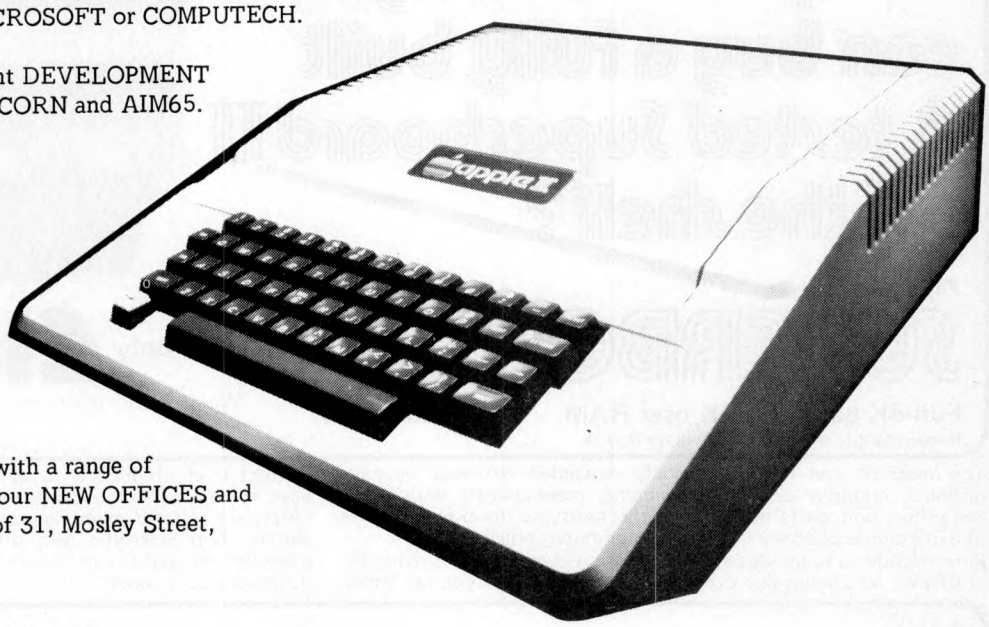

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03= *ENTER PURCHASES
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05= *ENTER A/C PAYABLES
06= ENTER/UPDATE STOCKS REC'D
07= ENTER ORDERS REC'D
08= EXAMINE/UPDATE BANK BALANCE
09= EXAMINE SALES LEDGER
10= EXAMINE PURCHASE LEDGER
11= EXAMINE ORDER BOOK
12= EXAMINE PRODUCT SALES

SELECT FUNCTION BY NUMBER

13= PRINT CUSTOMER STATEMENTS
14= PRINT SUPPLIER STATEMENTS
15= PRINT AGENTS STATEMENTS
16= PRINT VAT STATEMENTS
17= PRINT WEEK/MONTH SALES
18= PRINT WEEK/MONTH PURCHASES
19= PRINT YEAR AUDIT
20= PRINT PROFIT/LOSS ACCOUNT
21= UPDATE ENDMONTH FILES
22= PRINT CASHFLOW ANALYSIS
23= ENTER PAYROLL
24= RETURN TO BASIC

EACH PROGRAM GOES IN DEPTH TO FURTHER EXPRESS YOUR REQUIREMENTS.
FOR EXAMPLE (9) ALLOWS: a. list all sales; b. monitor sales by stock code; c. invoice search; d. amend ledger files; e. total all sales.

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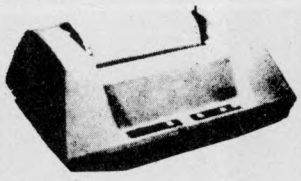
WORD PROCESSOR complete with printer for £1195



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THE RESEARCH MACHINES 380Z COMPUTER SYSTEM

THE RESEARCH MACHINES 380Z
A UNIQUE TOOL FOR RESEARCH AND EDUCATION

Microcomputers are extremely good value. The outright purchase price of a 380Z installation with dual mini floppy disk drives, digital I/O and a real-time clock, is about the same as the annual maintenance cost of a typical laboratory minicomputer. It is worth thinking about!

The **RESEARCH MACHINES 380Z** is an excellent microcomputer for on-line data logging and control. In university departments in general, it is also a very attractive alternative to a central mainframe. Having your own 380Z means an end to fighting the central operating system, immediate feedback of program bugs, no more queuing and a virtually unlimited computing budget. You can program in interactive BASIC or, using our unique Text Editor, run very large programs with a 380Z FORTRAN Compiler. If you already have a minicomputer, you can use your 380Z with a floppy disk system for data capture.

What about Schools and Colleges? You can purchase a 380Z for your Computer Science or Computer Studies department at about the same cost as a terminal. A 380Z has a performance equal to many minicomputers and is ideal for teaching BASIC and Cesil. For A Level machine language instruction, the 380Z has the best software front panel of any computer. This enables a teacher to single-step through programs and observe the effects on registers and memory, using a single keystroke.

WHAT OTHER FEATURES SET THE 380Z APART?

The 380Z with its professional keyboard is a robust, hardwearing piece of equipment that will endure continual handling for years. It has an integral VDU interface – you only have to plug a black and white television into the system in order to provide a display unit – you do not need to buy a separate terminal. The integral VDU interface gives you upper and *lower* case characters and low resolution graphics. Text and graphics can be mixed *anywhere* on the screen. The 380Z has an integral cassette interface, software and hardware, which uses *named* cassette files for both program and data storage. This means that it is easy to store more than one program per cassette.

Owners of a 380Z microcomputer can upgrade their system to include floppy (standard or mini) disk storage and take full advantage of a unique occurence in the history of computing – the CP/M™* industry standard disk operating system. The 380Z uses an 8080 family microprocessor – the Z80 – and this has enabled us to use CP/M. This means that the 380Z user has access to a growing body of CP/M based software, supplied from many independent sources.

380Z mini floppy disk systems are available with the drives mounted in the computer case itself, presenting a compact and tidy installation. The FDS-2 standard floppy disk system uses double-sided disk drives, providing 1 Megabyte of on-line storage.

**Trademark, Digital Research.*

Versions of BASIC are available with the 380Z which automatically provide controlled cassette data files, allow programs to be loaded from paper tape, mark sense card readers or from a mainframe. A disk BASIC is also available with serial and random access to disk files. Most BASICs are available in erasable ROM which will allow for periodic updating.

If you already have a teletype, the 380Z can use this for hard copy or for paper tape input. Alternatively, you can purchase a low cost 380Z compatible printer for under £300, or choose from a range of higher performance printers.

380Z/56K complete with DUAL FULL FLOPPY DISK SYSTEM FDS-2

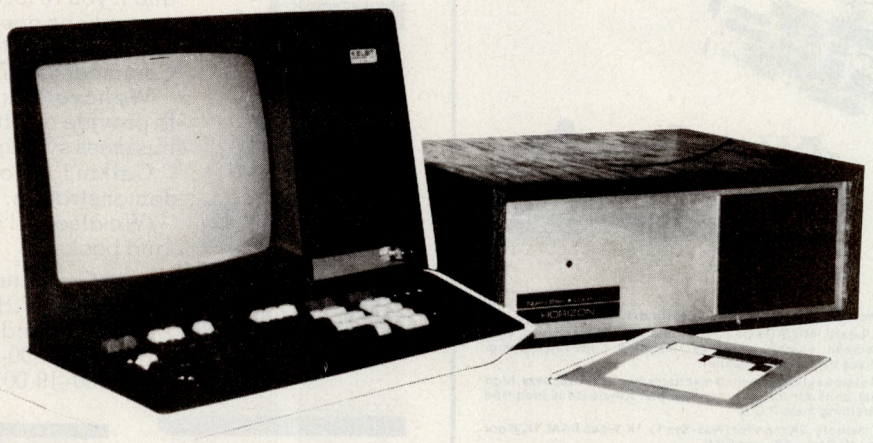
£3266.00

380Z/16K System with Keyboard

£965.00

RESEARCH MACHINES Computer Systems are distributed by RESEARCH MACHINES LTD., P.O. Box 75, Chapel Street, Oxford. Telephone: OXFORD (0865) 49792. Please send for the 380Z Information Leaflet. Prices do not include Carriage or VAT @ 15%.

HORIZON



For Business, Scientific and Educational Uses.

PROFESSIONAL HARDWARE

Use of the North Star Horizon for a short period will enable you to appreciate the professionalism in the product. There's a solid well-built chassis, a good power supply, a quiet fan and an attractive wooden case. There's a Z80A processor running at 4MHz with the 250ns static RAM boards.

There are dual integral Shugart minifloppy drives (capacity of about 360 KB on line, with an option for a further two drives), enabling easy and quick handling and copying of programs and data files.

And of course, there's the 12 slot S-100 bus which enables you to plug in many types of peripheral boards, including a hardware floating point board for increased "number crunching" performance.

PROFESSIONAL SOFTWARE

North Star Computers built their professional reputation around their powerful, but simple, Disc Operating System and Disc Extended BASIC Interpreter.

The latter contains, in addition to the usual BASIC commands, random and sequential access disc files, strings, string operators, multiple dimensioned arrays, formatted output, machine language CALL, memory EXAMine and FILL, line editor, program chaining and more.

The CP/M operating system is also available as an option and provides access to a Macro Assembler, C BASIC Compiler and FORTRAN-80 and COBOL-80 Compilers. A standard UCSD PASCAL has now been implemented.

TYPICAL APPLICATIONS SOFTWARE

- Financial
- Mathematical
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- Purchase Ledger
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- Payroll
- General Ledger
- Estate Agents Package
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- Employment Agents

HORIZON with dual drives, 32K RAM, 2 serial + 1 parallel ports:- Dynamic RAM – £1545, Static RAM – £1905.

COMPLETE HORIZON BUSINESS SYSTEMS (hardware) with 32K RAM, dual mini-floppy drives, VDU and 8" printer – £3295; 48K RAM, dual mini-floppy drives, VDU and 150cps printer £4658.

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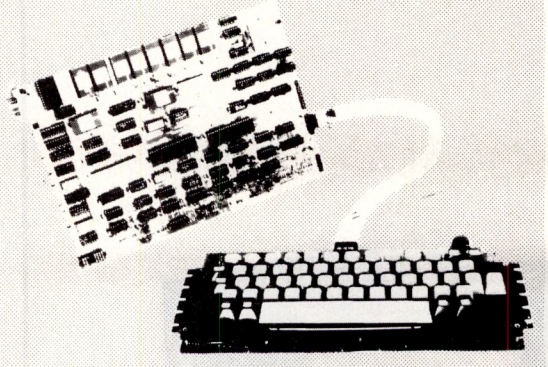
Just a little bit more... NASCOM-2



Compare its features:

- Z-80A 4MHZ. CPU: The most powerful 8-bit processor on the market.
- 8K Basic: resident on board, MICROSOFT Basic, the industry standard, with extensions for on-screen editing, graphics, machine code interfacing. Optimised for speed (see benchmarks below).
- Full 57 Key Licon solid state keyboard: switch mechanisms are contactless, high reliability professional units for long trouble free life. Keyboard is mounted separately to avoid straining main P.C.B.
- Total of 20K on-board memory: 2K monitor (Nas-Sys 1), 1K Video RAM, 1K Work space RAM, 8K Microsoft Basic, 8K user RAM.
- Kansas City cassette interface: for reliable storage of programs and data at 300 or 1200 baud, with full checksum error detection.
- Nas-sys monitor: A powerful 2K machine code monitor provides an ideal environment for learning about and developing machine code programs. Nas-sys uses a blinking non destructive cursor, with 22 commands. ASCII terminals are fully supported via the serial interface; users can add their own I/O drivers via the system I/O vector table to support other devices.

Nas-sys commands are:

A—Hex arithmetic	N—return to normal
B—set breakpoint	O—Output to P.I.O.
C—Copy	Q—Query input port
E—Execute	R—Read tape
G—Generate	S—Single step
H—Operate as half duplex, terminal.	T—Tabulate memory
I—Intelligent copy	U—activate user I/O drivers
J—Execute at FFA	V—Verify tape
K—set keyboard options	W—Write tape
L—load from tape	X—set external device
M—Memory modify	Z—execute at FFD

- On board P.I.O. — An uncommited P.I.O. (MK 3881) giving 16 programmable I/O lines with handshake.
- On board RS-232-Will interface directly into any standard teletype — allowing use of BASIC or Nas-sys from the teletype.
- Full on-screen editing: a complete screen editor with cursor movement (UP, DOWN, LEFT, RIGHT), insert and delete, backspace etc.

Screen display of 16 lines x 48 characters: Stable, clear display to British television standards. Full 128 ASCII character set: option for further 128 graphics characters.

- Fully buffered NASBUS compatible: Well defined bus structure with a range of expansion cards; including (shortly) a floppy disc system with CP/m — the industry standard operating system.

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Nascom-2	295.00	44.25	339.25
Power supply	24.50	3.68	28.18

PERSONAL COMPUTER WORLD BENCHMARK TESTS

	Nett	Vat	Total
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Z-80 Microcomputer handbook			6.95
Practical microcomputer programming the Z-80			20.00
Sargon-8K Z-80 Chess program (book)			9.50

PERSONAL COMPUTER WORLD BENCHMARK TESTS

	APPLE II	NASCOM 2	RM 380Z	PET
BM 1	1.5	1.1	1.4	1.7
BM 2	3.2	5.4	6.5	9.9
BM 3	7.3	11.1	13.2	18.4
BM 4	7.2	11.6	13.9	20.4
BM 5	8.9	12.6	15.0	21.7
BM 6	18.6	19.3	22.3	12.5
BM 7	28.2	27.6	31.6	50.9
BM 8		5.2	6.2	12.3

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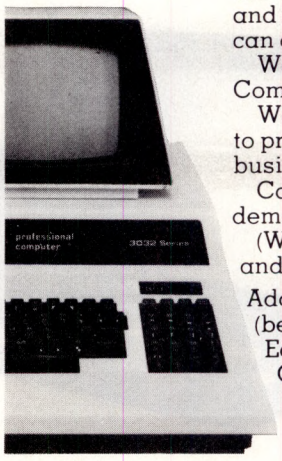

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AND	IF	ON/GOSUB	RND
ASC	INPUT	OR	RUN
CALL	LEFT$	PEEK	SAVE
CHR$	LEN	POKE	SGN
DATA	LET	POS	SIZE
DIM	LIST	PRINT	STEP
EXOR	LOAD	PUT	STOP
FOR	MID$	READ	TAB
GET	NEW	REM	TO
GOSUB	NEXT	RESTORE	TRACE
GOTO	NOT	RETURN	

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7460	.40	74196	.95	74LS05	.45	74S112	.60
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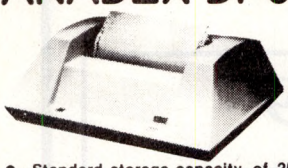

The DP 8000 prints the 96-character ASCII set in single or double width at 84 lines per minute. ● The unit operates bi-directionally to print a 9 x 7 matrix on multiple copy, pin-feed plain paper. ● This model accepts RS-232C or current loop serial data at baud rates switchable from 110 to 9600 and Parallel Bit data input at over 1000 characters per second. ● Standard storage capacity of 256 characters ● Other features include Out of Paper Detector, Top of Form Programming and Skip Over Perforation Control.

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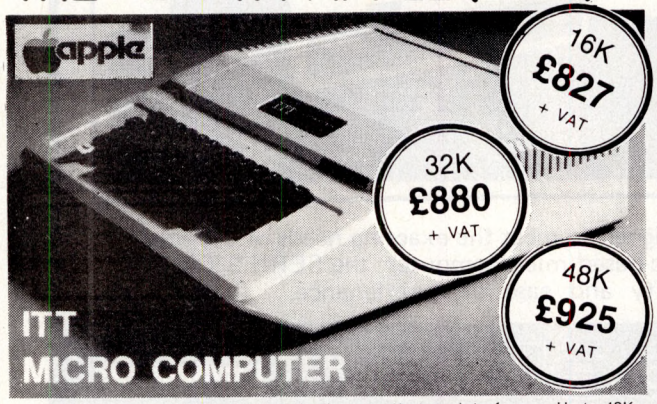

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video 100

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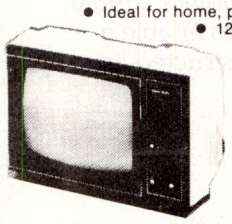

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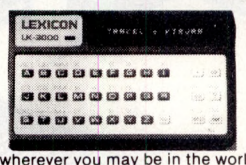

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COMMANDS

CONT	LIST	NEW	NULL	RUN

STATEMENTS

CLEAR	DATA	DEF	DIM	END FOR
GOTO	GOSUB	IF..GOTO	IF..THEN	INPUT LET
NEXT	ON..GOTO	ON..GOSUB	POKE	PRINT READ
REM	RESTORE	RETURN	STOP	

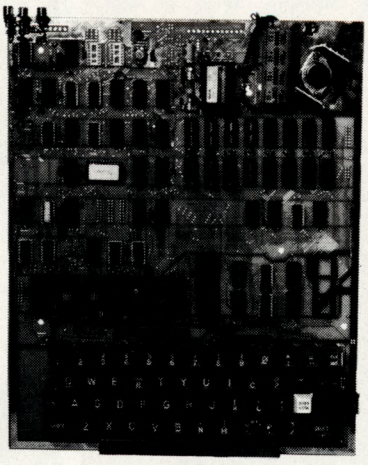
EXPRESSIONS

OPERATORS

+ - * / ↑ NOT.AND.OR. > < <> > = < = RANGE 10^{-32} to 10^{+32}

VARIABLES

A.B.C. ....Z and two letter variables
The above can all be subscripted when used in an array. String variables use above names plus $.e.g.A$



*8K Microsoft Basic means conversion to and from Pet, Apple and Sorcerer easy. Many compatible programs already in print.

SPECIAL CHARACTERS
@ Erases line being typed, then provides carriage return, line feed.
Erases last character typed.
CR Carriage Return — must be at the end of each line.
: Separates statements on a line.
CONTROL/C Execution or printing of a list is interrupted at the end of a line.
"BREAK IN LINE XXXX" is printed, indicating line number of next statement to be executed or printed.
CONTROL/O No outputs occur until return made to command mode. If an Input statement is encountered. either another CONTROL/O is typed, or an error occurs.
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FUNCTIONS

ABS(X)	ATN(X)	COS(X)	EXP(X)
LOG(X)	PEEK(I)	POS(I)	RND(X)
SPC(I)	SQR(X)	TAB(I)	TAN(X)
FRE(X)	INT(X)		
SGN(X)	SIN(X)		
USR(I)			

STRING FUNCTIONS

ASC(X$)	CHR$S(I)	FRE(X$)	LEFT$(XS.I)
RIGHT$(X$.I)		STR$(X)	
LEN(X$)	MID$(X$.I.J)		
VAL(X$)			

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One lineprinter will be awarded to the winner of each category.
Send or bring along to the address shown below the following:
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2) Any documentation that you have for the program (source listing not necessary)
3) This coupon signed by you accepting the rules and conditions of the competition.

RULES:
1) Entries, including documentation, must be printed by computer or typed double spaced, with your name on every page.
2) Send or bring your entries to the address shown below.
3) Entries must be received by midnight on 29/2/80, any received after this time are void.
Winners will be notified by post before 31/3/80.
4) You warrant by your signature that all programs and documentation material included is entirely your own creation, and that no rights to it have been given or sold to any other party, and you agree to allow **COMPUKIT LTD.** to use, publish, distribute, modify, and edit it as it sees fit.
5) All entries become the property of **COMPUKIT LTD.** No entries will be returned nor any questions answered regarding individual entries.
6) Judging will be by a selected panel chosen by, and including representatives of COMPUKIT LTD. Judges may assign programs to any of the categories as they see fit. Decision of the judges is final.
7) Employees of **COMPUKIT LTD,** its dealers, distributors, advertising agencies and media are not eligible to enter.

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I agree to abide by the above mentioned rules.

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